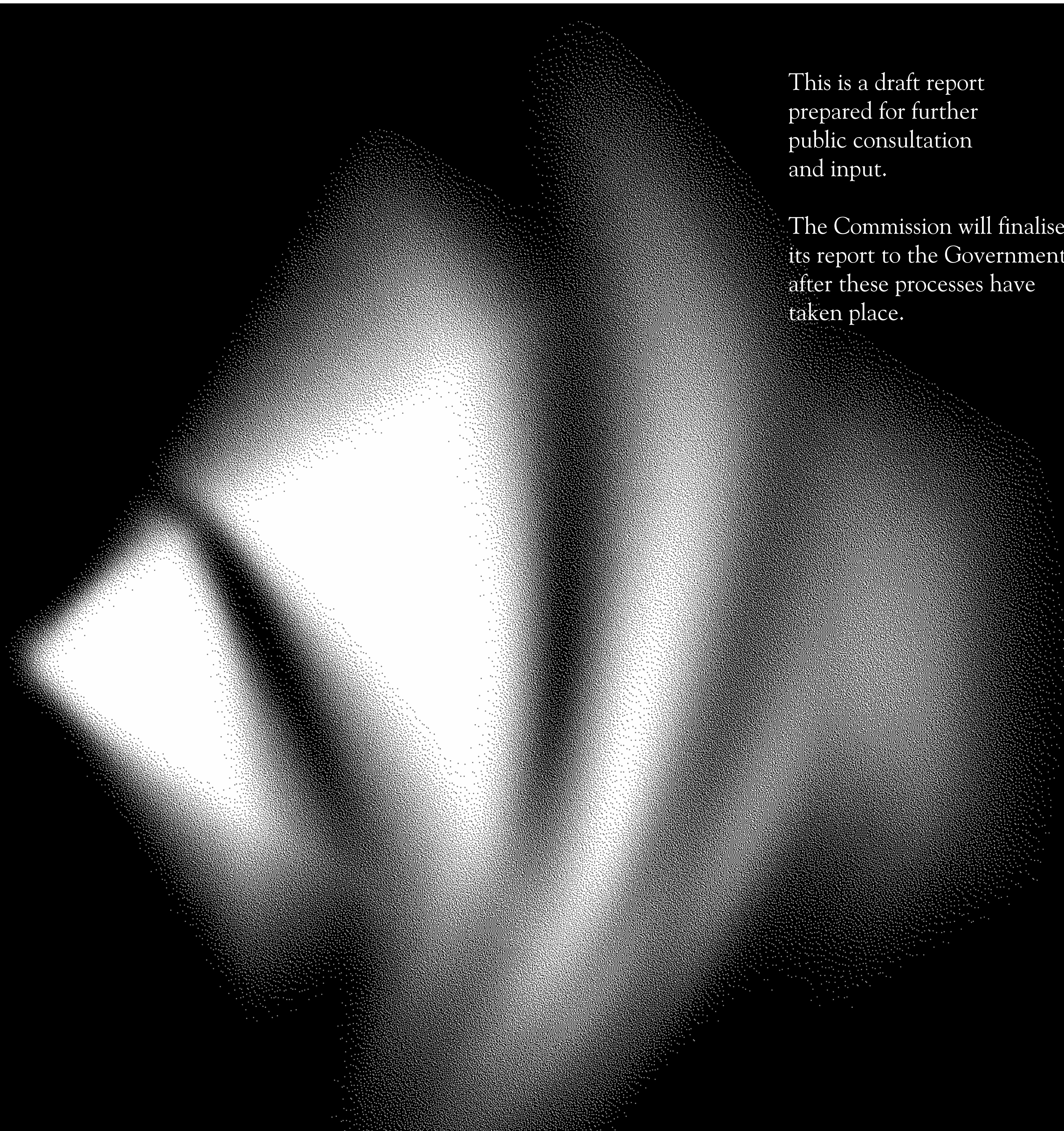
Australian Government
Productivity Commission

Energy Efficiency

Productivity Commission Draft Report



This is a draft report prepared for further public consultation and input.

The Commission will finalise its report to the Government after these processes have taken place.

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The Productivity Commission

The Productivity Commission, an independent agency, is the Australian Government's principal review and advisory body on microeconomic policy and regulation. It conducts public inquiries and research into a broad range of economic and social issues affecting the welfare of Australians.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

Information on the Productivity Commission, its publications and its current work program can be found on the World Wide Web at www.pc.gov.au or by contacting Media and Publications on (03) 9653 2244.

Opportunity for further comment

You are invited to examine this draft report and comment on it within the Commission's public inquiry process.

Written responses should be received by the Commission on, or before, Friday, 27 May 2005. The Commission would appreciate receiving submissions to be presented at the public hearings at least three business days prior to the relevant hearings. After submissions have been received the final report will be prepared. Public hearing dates and locations are listed below. Please note that locations and times may change. Therefore, you are advised to register your interest so that final details can be confirmed.

Public hearing dates and locations

Location	Date	Venue
Brisbane	Commencing 9.00am Monday, 30 May 2005	Mercure Hotel Brisbane 85-87 North Quay
Sydney	Commencing 9.00am Tuesday, 31 May 2005	Radisson Hotel and Suites Sydney 72 Liverpool Street, Darling Harbour
Canberra	Commencing 9.00am Friday, 3 June 2005	Rydges Capital Hill Cnr Canberra Ave and National Circuit
Melbourne	Commencing 9.00am Monday, 6 June 2005 Tuesday, 7 June 2005	Productivity Commission Rattigan Room L28, 35 Collins Street

Commissioners

For the purposes of this inquiry and draft report, in accordance with section 40 of the *Productivity Commission Act 1998* the powers of the Productivity Commission have been exercised by:

Dr Neil Byron	Presiding Commissioner
Mike Woods	Commissioner

Terms of reference

INQUIRY INTO THE ECONOMIC AND ENVIRONMENTAL POTENTIAL OFFERED BY ENERGY EFFICIENCY

Productivity Commission Act 1998

I, ROSS CAMERON, Parliamentary Secretary to the Treasurer, pursuant to Parts 2 and 3 of the *Productivity Commission Act 1998*, hereby request that the Productivity Commission undertake an inquiry into the economic and environmental potential offered by energy efficiency and report within 12 months of receipt of this reference. The Commission is to hold hearings for the purpose of the inquiry.

Background

Australia's access to low cost, reliable energy is a source of competitive advantage for Australia. However, Australia's historic energy efficiency performance has been weak in comparison with other OECD countries. In this context, improvements in energy use which are cost-effective for individual producers and consumers have the potential to enhance Australia's economic prosperity and at the same time lower Australia's greenhouse signature.

Energy efficiency in this context refers to maintaining or increasing the level of useful output or outcome delivered, while reducing energy consumption, and encompasses both supply side and demand side efficiency.

Scope of the Inquiry

The Commission is to examine and report on the economic and environmental potential offered by energy efficiency improvements which are cost-effective for individual producers and consumers, including through consideration of:

1. the economic and environmental costs and benefits arising from energy efficiency improvements, including, but not limited to, research undertaken in the context of the National Framework for Energy Efficiency and international studies;
2. existing and recent Australian and state government energy efficiency programmes, including consideration of the level of coordination between these programmes and comparison with international experiences;
3. barriers and impediments to improved energy efficiency, including, but not limited to, information asymmetries and implementation costs;
4. the potential for energy efficiency improvements which are cost-effective for individual producers and consumers arising from actions including:
    - energy market reform to facilitate improved demand and supply management, including, but not limited to, more efficient cost-reflective price signalling in the market, particularly at peak times;

- improved financial information on energy efficiency, including, but not limited to, provision of additional financial information on energy efficiency to firms' internal and external investors and decision makers;
- improved energy efficiency information, including, but not limited to, provision of additional energy efficiency information in relation to plant and equipment, appliances, vehicles and fuels, and residential and non-residential buildings;
- minimum energy efficiency standards, including, but not limited to, minimum standards for plant and equipment, appliances, vehicles and fuels, and residential and non-residential buildings;
- new and improved technologies and equipment, including, but not limited to, improved technologies in relation to plant and equipment, appliances, vehicles and fuels, and residential and non-residential buildings;
- financial incentives for improving energy efficiency, including, but not limited to subsidies, private sector rebates or discounts and levies on energy use; and
- improved operational practices at the level of consumers and households, governments, and the industrial and commercial sectors.

5. policy options for energy efficiency improvements which are cost-effective for individual producers and consumers, including:
   - improving industrial and commercial energy efficiency, including, but not limited to, energy efficiency agreements, and increased disclosure through public energy efficiency reporting;
   - improving consumer and household energy efficiency;
   - improving the efficiency of government energy use;
   - improving transport related energy efficiency, including, but not limited to, urban planning, congestion pricing, intelligent transport systems, travel demand management, and increased efficiencies in the business and freight sectors (including opportunities for better matching of transport choices with transport tasks undertaken); and
   - introducing a national energy efficiency target, including, but not limited to, the establishment of an annual requirement for major users of stationary energy to generate, or otherwise acquire, a target level of efficiency related energy savings.

The Commission is to provide both a draft and a final report. The Government will consider the Commission's recommendations, and its response will be announced as soon as possible after the receipt of the Commission's report.

ROSS CAMERON
31 August 2004

Contents

BOXES

FIGURES

TABLES

Abbreviations and Explanations

Abbreviations

ABARE	Australian Bureau of Agricultural and Resource Economics
ABCB	Australian Building Codes Board
ABGR	Australian Building Greenhouse Rating
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ACTHERS	ACT House Energy Rating Scheme
AER	Australian Energy Regulator
AEMC	Australian Energy Marketing Commission
AGA	Australian Gas Association
AGO	Australian Greenhouse Office
BASIX	NSW Building Sustainability Index
Building Code	Building Code of Australia
BERS	Building Energy Rating Scheme
BTRE	Bureau of Transport and Regional Economics
CEFG	Clean Energy Future Group
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEH	Australian Government Department of the Environment and Heritage
DEUS	NSW Department of Energy, Utilities and Sustainability
EEAP	Enterprise Energy Audit Program
EEBP	Energy Efficiency Best Practice Program
EEWG	Energy Efficiency Working Group

EEOA	Energy Efficiency Opportunities Assessment
EPC	energy performance contract
ESCO	energy services company
IC	Industry Commission
ITS	Intelligent Transport Systems
kWh	kilowatt hour
MCE	Ministerial Council on Energy
MEPS	minimum energy performance standard(s)
NAEEEC	National Appliance and Equipment Energy Efficiency Committee
NAEEEP	National Appliance and Equipment Energy Efficiency Program
NATA	National Association of Testing Authorities
NatHERS	Nationwide House Energy Rating Scheme
NCP	National Competition Policy
NEET	national energy efficiency target
NEM	National Electricity Market
NFEE	National Framework for Energy Efficiency
NGO	non-government organisation
NGS	National Greenhouse Strategy
NTC	National Transport Commission
OECD	Organisation for Economic Cooperation and Development
PC	Productivity Commission
PVA	product verification audit
R&D	research and development
RIS	regulatory impact statement
SEAV	Sustainable Energy Authority of Victoria
TWh	Terawatt hour
US EPA	United States Environmental Protection Agency

Explanations

Draft Findings	*Draft findings in the body of the report are paragraphs highlighted using italics, as this is.*
Draft Recommendations	***Draft recommendations in the body of the report are highlighted using bold italics, as this is.***
Requests for further information	*Information requests are paragraphs highlighted using italics, as this is.*

EXECUTIVE SUMMARIES

Key points

- Firms and households generally implement energy efficiency improvements that are cost effective for them — most do not deliberately waste energy. But energy has been cheap and is only a small percentage of total outlays for most Australian firms and households.
- Australian circumstances contrast with the relatively higher energy prices and/or harsher winters of the major overseas economies. Australia must achieve the right level of energy efficiency for its own context.
- Many governments see energy efficiency improvements as a low-cost means of reducing emissions of greenhouse gases, and thereby slowing global climate change. But increasing energy efficiency is only one of the possible ways to address global climate change.
- Current levels of energy efficiency are below the levels that might appear (to an outsider) to be privately cost effective. But the benefits of energy efficiency improvements may be overstated and the costs of adoption underestimated. The real gap is likely to be much smaller than it appears.
- The most important barriers to improving energy efficiency appear to be:
  – a failure in the provision of information; and
  – the different incentives facing those who take decisions about installing energy-efficient products (heaters, air conditioners, etc) and those who might benefit from using them.
- Some regulatory responses to these problems are appropriate. But the Commission favours light-handed responses and information provision wherever possible, rather than overly prescriptive and intrusive approaches.
- Mandatory measures — such as minimum performance standards — override consumer and producer sovereignty, and are inconsistent with the proposition that the energy efficiency improvements they promote are privately cost effective.
- A sufficient case has not been made for the imposition of a national energy efficiency target and tradeable obligations. There would be many practical difficulties in defining and administering the scheme and complying with the obligations placed on regulated entities.
- The nine point National Framework for Energy Efficiency (Stage One) measures, recently endorsed by the Ministerial Council on Energy, should be deferred until independent evaluations of existing energy efficiency programs have been undertaken.
- Whatever the merit of the various educative, suasive and regulatory approaches to encourage or mandate greater energy efficiency, they continue to conflict with the signals given to energy users by Australia’s relatively low energy prices.
- Some energy efficiency measures may not be privately cost effective, and yet may generate net public benefits because of their environmental outcomes. Those measures may prove to be sound public policy, but they should also be considered against other means of achieving the environmental objectives more directly.

Overview

Energy efficiency has long been a policy issue, first because of concerns about energy scarcity and depletion of energy reserves, exacerbated by the oil shocks of the 1970s, and more recently, because of links between fossil-fuel use and climate change. Policy interest has been heightened by the diverse positions of governments over the ratification of the Kyoto Protocol, emissions trading and carbon taxes. Governments around the world have been seeking low-cost opportunities to reduce greenhouse gas emissions. Since most greenhouse gas emissions come from the combustion of fossil fuels, reducing their consumption (or of electricity derived from them) seems like an obvious focus.

Energy efficiency measures, unlike energy conservation, aim to reduce energy consumption while at the same time maintaining or increasing the level of useful output or outcome delivered. Put simply, on hot days, electricity consumption could be reduced through:

- an *efficiency* measure, for example, installing insulation (which reduces the amount (and cost) of electricity used to maintain a cool home); or
- a *conservation* measure, for example, turning up the thermostat (and tolerating a hotter house) or by turning off the air conditioner and going to the pool or the movies.

Energy efficiency in most countries has been steadily improving. In Australia, (primary) energy consumption per unit of output declined by 18 per cent between 1973-74 and 2000-01.

Achieving greater energy efficiency is understandably attractive to many governments and environmental organisations concerned about climate change. It offers the prospect of significant reductions in emissions — at low or negligible costs to energy users — it may even save considerable amounts of money.

The pursuit of energy efficiency should also be in the interests of any rational producer or consumer, firm or household. And yet the issue at the heart of this inquiry is why producers and consumers don’t always react in this manner, even when it seems cost effective for them to do so. Why isn’t the market working — or is it? Answering these questions is important in framing a policy response that will provide net benefits for the community. In part, the answer is one of perspective —

individual producers and consumers seek to economise on the use of all inputs, not just energy.

Scope of inquiry

The core issue of this inquiry is ‘the economic and environmental potential offered by energy efficiency improvements which are cost-effective for individual producers and consumers’ (inquiry terms of reference). It has both narrow and broad perspectives.

The narrower focus has been on identifying energy efficiency improvements where the private benefits exceed the costs to individual producers or consumers, and the barriers and impediments to their adoption. Policy options have been canvassed for various sectors of the economy: commercial and industrial; consumers and householders; government (as a user); and transport. Different policy instruments and government programs have been examined: labelling and the provision of other information; standard setting; financial incentives; energy market reforms, such as the regulation of electricity prices; and the introduction of a national energy efficiency target.

Private cost effectiveness is a much narrower focus than the more commonly adopted public perspective that underpins the Commission’s economywide charter. However, in this latter respect, the inquiry terms of reference directs the Commission to examine and report on the broader economic and environmental costs and benefits arising from the energy efficiency improvements that meet the private cost effectiveness criterion.

Additionally, energy efficiency programs have often been proposed (explicitly or implicitly) because of their wider environmental benefits (including greenhouse gas abatement), rather than on how they encourage the (privately-profitable) adoption of energy efficiency improvements. If it is difficult to overcome the barriers to the adoption of privately cost-effective improvements in energy efficiency, then it will be even more difficult to drive the adoption of measures that will require private sacrifices for the greater public good; that is, measures that are not privately cost effective but whose social and environmental benefits outweigh the private costs.

The policy principles which the Commission has articulated in this report are intended to provide a framework for evaluating the overall community benefit of all energy efficiency improvements, whatever their underlying rationale. But the first task is to examine the nonadoption of measures that appear to be privately cost effective. Examination of measures that generate net public benefits despite not being privately cost effective, is beyond the scope of this inquiry.

Policy interest in energy efficiency

All levels of government in Australia are involved in various, and changing, energy efficiency programs. Some effort is being devoted to developing a more coordinated approach as a means of adopting best practice nationally, of achieving economies of scale in the development of programs and of reducing costs of compliance for national firms. However, there can also be benefits from so-called ‘regulatory competition’, where different approaches by different governments provide opportunities for exploring and piloting innovative policies. These tradeoffs come into play at various points in this report.

In June 2001, the Council of Australian Governments (COAG) established the Ministerial Council on Energy (MCE) to oversee energy market reform and related issues. The MCE subsequently established the Energy Efficiency Working Group (EEWG) to develop a National Framework for Energy Efficiency (NFEE). Following public consultation through EEWG, the MCE has adopted an extensive nine point plan for promoting energy efficiency (NFEE Stage One). It involves:

- tightening *residential* building energy efficiency regulation;
- introducing *commercial* building energy efficiency regulation;
- extending *labelling and standards* for electrical appliances and applying the same approach to gas appliances;
- various awareness raising programs targeted at *consumers*, the *financial sector* and the *private sector* (the latter including through mandatory audits for large energy users);
- developing *commercial and industrial sector capability* (for example, through establishing best-practice networks);
- imposing additional reporting requirements on *governments*; and
- trade and professional *training and accreditation*.

In its August 2004 White Paper, *Securing Australia’s Energy Future*, the Australian Government announced its commitment to ‘energy prosperity, security and sustainability’. Measures which were endorsed included: mandatory audits for large energy users; the extension of minimum energy performance standards for appliances and buildings (both as set out in NFEE Stage One); and a ‘solar cities’ demonstration trial.

Other more ambitious initiatives proposed during the drafting of the White Paper, such as a national energy efficiency target (NEET), were not included. However, it was agreed that these would be referred to the Commission for inquiry. This led to the perception among some people that this inquiry would be constrained to only consider policies additional to the NFEE Stage One policies. However, the terms of reference quite clearly stipulate that the Commission should look at all *existing and recent* policy considerations, including a NEET.

The size of the energy efficiency gap

Throughout these processes, much has been made of the magnitude of the 'energy efficiency gap', defined as the gap between actual energy efficiency and the level of energy efficiency believed to be achievable and affordable.

For some, evidence that Australia's technical energy efficiency, or rate of improvement in technical energy efficiency, is below OECD norms is taken as evidence that there is a problem that needs to be fixed by government action. The terms of reference for this inquiry include this notion. But for each country the economically efficient level of energy use, intensity or efficiency depends on factors, such as the price of energy, the climate, and the cost of other inputs. The costs of making the necessary changes and other options for investment must also be considered.

Using a bottoms-up approach, modelling undertaken for the NFEE has estimated that there are energy efficiency gaps of 5 to 14 per cent of current energy usage, depending on the industry sector. It was estimated that this represents a potential opportunity to increase GDP by 0.09 per cent in 2016. The Commission has assessed the underlying assumptions and come back to the basic issue — if energy efficiency improvements are so financially worthwhile, what are the barriers and impediments to them being implemented already?

Barriers and impediments

Inquiry participants identified different reasons for the behaviour of individual producers and consumers where investing in energy efficiency improvements is concerned (box 1). This behaviour reveals that many different barriers and impediments can be at work. This report has grouped these into three broad categories: market failures; organisational failures, and behavioural and cultural norms; and other barriers and impediments.

Market failures

There are well known circumstances in which markets will not achieve the best returns for the community. The market failures of most policy relevance are caused by information failures. *Lack of information* may account for many energy efficiency opportunities being forgone, including those that would be privately cost effective. Some information may not be provided at all, or will be underprovided, if firms and households can *free-ride* on the efforts of others. And *information asymmetries* can put buyers of energy-using products at a disadvantage to sellers.

Box 1 **Some attitudes to energy efficiency**

The attitudes of a number of producers and consumers to improving their levels of energy efficiency can be summarised as follows:

- *My production decisions are driven by the combined costs of all inputs, and not just the most efficient use of energy* — energy efficiency does not fully equate with market place economic efficiency.
- *I'm not across all of the options* — there are information gaps, asymmetries and costs.
- *I can't afford the extra costs of the latest or most efficient machinery or appliance* — producers and consumers are generally capital constrained.
- *For the savings it will give me, it's not worth my effort* — satisficing behaviour is a fact of business and household life.
- *What might be cost effective for some people is not cost effective for me* — producers and consumers are heterogeneous, and the potential costs and benefits of one individual's actions to increase energy efficiency will be different from the benefits and costs in a 'model' energy-efficient business or household.
- *From my experience, making the changes won't be straightforward* — there are implementation costs and risks, some of which may be uncertain.

Split incentives might also be important. Split incentives can exist where, for example, the incentives facing a builder (to choose a technology with low capital costs) diverge from the incentives facing the user (to choose the technology with lower running costs). While these problems may be worse where information asymmetries are present, they may exist even where both parties have the same information. For example, both landlord and tenant would benefit from installing insulation or a solar hot water system, if they could agree on a rent adjustment that makes both better off. Yet frequently this does not happen because of difficulties and risks in negotiating the rental adjustment. However, the importance of split incentives as a market failure needs to be kept in perspective. To the extent that energy costs become more important, incentives will tend to converge and it will become worthwhile to both parties to overcome the transaction costs and sort out a new contract.

The presence of market failure does not of itself warrant government intervention. Government intervention can be costly and introduces its own distortions, especially if the intervention is poorly targeted to achieving the relevant objective. Government intervention is only warranted when it produces net economic, social or environmental benefits to the community.

Organisational failures and behavioural norms

A second set of barriers and impediments include behavioural norms and organisational constraints. The difficulties faced by individuals in obtaining and processing complex information can lead to *satisficing* ('close enough is good enough') rather than *optimising* behaviour. However, to the extent that this leads to lower information costs (including cognitive effort), it might itself be a realistic, cost-effective outcome.

Constrained or defective internal communications within organisations might also account for some of the energy efficiency gap. Even within households there are communications gaps ('Turn the lights off, kids!'). But the extent to which this set of barriers should influence policy is doubtful. For business, encouraging a competitive environment is a better approach, as this will exert pressure on firms to be as efficient as possible, in all areas, including their use of energy.

Other barriers and impediments

A final set of barriers and impediments are associated with a range of costs that are difficult to capture in the 'engineering–accounting' models typically used to estimate the cost effectiveness of energy efficiency improvements. The limited resources of management, the costs of implementing new technologies, risk and uncertainty, access to (and the cost of) capital, and the sunk nature of many investments provide a reminder that many energy-efficient technologies may not be sufficiently cost effective, once all of the costs are considered.

Furthermore, energy costs are often quite a small component of total costs. In the face of competing demands, households and firms may not consider that it is worth the time or effort to obtain information about energy used and then undertake the consequent investment, for relatively small (private) benefit. For example, at current prices (and flat tariffs), households only spend on average around $21 per week on non-transport energy. Thus, even a 10 per cent saving would amount to little over $2 per week.

Generally speaking, these are not barriers that warrant policy intervention.

The influence of energy prices

The Commission, in its analysis of barriers, has separately considered the price of energy. Changes in energy prices would clearly influence what energy efficiency measures individual consumers or producers would be prepared to adopt. Higher prices would encourage more investment in energy-efficient technologies as people and firms think of creative new ways for economising on the input that has become more expensive. Higher prices do not, however, change the intrinsic nature of the barriers and impediments in the market for energy-efficient technologies, just their relative importance. Even in Europe, where energy prices are much higher than in Australia (and energy efficiency appears also to be somewhat higher as a result), the same sorts of barriers and impediments still persist.

Responding to barriers and impediments

The Commission has summarised how governments have typically responded in their attempts to overcome the various barriers and impediments (table 1). Many existing policies and programs do not address market failures, but rather impose mandatory measures where government agencies have concluded that householders and firms have consistently made 'wrong' decisions, even after they have been provided with the relevant information. Many of these may be quite effective in increasing energy efficiency and/or reducing emissions of greenhouse gases, but they are unlikely to be privately cost effective for producers and consumers.

Table 1 **Governments' responses to identified barriers and impediments to adopting energy efficiency improvements**

Barrier and impediment	*Typical government responses*	*Australian examples*
Market failure		
Asymmetric information	Help buyer discover relevant information or require seller to disclose	Labelling appliances ACT house energy efficiency rating scheme
Split incentives	Mandate installation of chosen technology	Minimum energy performance standards for appliances; Building Code of Aust; Building star ratings
Public good information	Provide or subsidise provision of relevant information	AGO Green Vehicle Guide; TravelSmart; Smart Housing; brochures; energy efficiency shopfronts.
Positive externalities	Provide or subsidise research and development and demonstration projects Encourage business networks	General support currently available through R&D tax concessions and grants; cooperative research centres Energy Efficiency Best Practice program
Behavioural and cultural		
Bounded rationality	Reduce choice; eliminate 'inferior' products; mandate certain equipment	Minimum energy performance standards for appliances; Building Code of Aust; Building star ratings
Organisational barriers	Mandatory audits & disclosure	Energy Efficiency Opportunity Assessments; Victorian EPA licensing requirements
Other barriers and impediments		
Implementation costs	Subsidies for audits, consultancies and equipment	SEAV/DEUS programs
Risk and uncertainty	Subsidise use of energy service consultants	NSW Energy Smart Business program
Capital constraints	Special funds for energy efficiency	Energy Efficiency Program for Low Income Households (SA)
Asset replacement costs	Accelerated depreciation schedules Subsidies	Greenhouse Gas Abatement program (DEH); subsidies for solar hot water systems and renewables

Policy issues

The degree to which particular barriers and impediments occur in different sectors in the economy varies. The market failures of most policy relevance are more profound in the residential/consumer segment than elsewhere, typically relating to information asymmetries and split incentives. In the commercial and industrial area, information problems are less important, particularly for larger firms, and especially for those who face large energy bills and/or have strong links to like firms around the world. However, for many small businesses, the issues are similar to those confronting householders.

The preliminary policy positions reached by the Commission, presented according to the type of policy instrument that governments might (or do) use, are addressed below. They are presented in an order of increasing intrusion:

- providing information directly to buyers;
- voluntary partnership programs (for example, Greenhouse Challenge Plus);
- subsidies and other financial incentives;
- requiring disclosure of information by sellers/producers;
- preventing access to less energy-efficient products (for example, minimum energy performance standards (MEPS) and the energy efficiency standards in the Building Code of Australia);
- setting a national energy efficiency target (NEET); and
- mandating investment in more energy-efficient equipment, appliances and technologies.

Providing information

Information programs are provided by all jurisdictions and are pitched mostly at the householder level. For example, the Queensland Government provides a general energy efficiency advisory service and a more specific Smart Housing service that provides information on how to build homes that are more energy efficient.

Governments have a role to play in providing such information directly where the information has public good characteristics (or positive spillovers) that would result in it being otherwise underprovided. Government provision might also achieve economies of scale and scope, and thus lower costs to users; and it might be justified for social reasons if it aids accessibility or provides credibility by deriving from a neutral source.

However, it can be difficult to judge how much governments should attempt to provide information on energy efficiency directly. For example, the Australian Greenhouse Office's Green Vehicle Guide provides fuel consumption information that largely replicates what is available from private sources. And some advice on home energy efficiency options can be obtained from commercial or non-government sources. To some extent, the most productive role for government is to be the facilitator that draws together this information and packages it in a form that ensures that relevant and trusted information gets to those who would otherwise not get it.

The case for governments providing general information is weakest where the users are larger commercial and industrial organisations. The information needs of such firms are usually very specific and, to the extent that energy costs are significant, firms have strong incentives to obtain that information.

Market forces are already operating to address information needs. Producers of energy-efficient goods and services (for example, insulation, solar hot water systems, and more efficient motors) vigorously advertise the merits of their products. Energy services companies (ESCOs) are widespread in North America and are rapidly emerging in Australia, with business propositions that guarantee energy savings for their clients.

Governments very clearly have a role to provide information on energy efficiency regulations where they exist. In the interests of maximising regulatory compliance, no fees should be charged for access to the regulations themselves. In this respect, the Commission reiterates its concern over the high costs of accessing the Building Code of Australia (Building Code) and affiliated standards.

Voluntary partnership programs

Most jurisdictions operate partnership programs in which participating firms voluntarily commit to invest in agreed measures, usually targeted at achieving greenhouse objectives. In return, the firm receives some assistance (though not usually cash subsidies) and the right to promote itself as an ‘eco friendly’ company. The most prominent of these is the *Challenge Plus — Enhanced Industry Partnerships* program operated by the Australian Government. This program has attracted the participation of a large proportion of manufacturing industry, particularly the larger firms.

The Commission considers that voluntary agreement programs can be effective policy tools for promoting energy efficiency improvements as a means of achieving greenhouse gas abatement objectives. Voluntary agreements give organisations the flexibility to self-select as well as to choose the level and nature of their undertaking. There is, therefore, a lower risk of firms being forced into adopting practices which are not privately cost effective for them.

However, at least in the case of Greenhouse Challenge Plus, it is likely that firms are motivated partly to prove their green credentials and as a precaution against the possibility of more intrusive measures being adopted. Furthermore, despite their neutral overtones, a certain amount of financial coercion or incentive is present in these schemes. The Commission notes that from 1 July 2006 participation in the Challenge Plus program will be a requirement for Australian companies receiving fuel excise credits of more than $3 million. The presence of financial incentives (or sanctions) may increase the probability of such companies undertaking projects that are not privately cost effective (even though they may have net social benefits overall).

Subsidies and other financial incentives

Subsidies and rebates are used by governments to encourage energy efficiency improvements in various ways. Most jurisdictions have provided or currently provide subsidies to encourage firms to undertake audits, invest in research and development or participate in demonstration projects. Residential users may also receive rebates to take up energy-efficient practices, technologies and/or appliances (such as solar hot water heating), and subsidised house energy audits.

There may be good public policy reasons for using financial incentives in some or all of these cases. An incentive to encourage the uptake of energy-efficient practices may be justifiable on the grounds of reducing environmental damage associated with energy use, or because the practices generate positive spillover effects, like demonstration effects. But in the absence of these spillovers, the role of financial incentives is questionable.

Financial incentives do not address directly the market failures preventing the uptake of privately cost-effective energy efficiency improvements. They might make cost effective what is not otherwise, and they might help address internal organisational issues within firms (for example, by inducing involvement of different managers within the firm), but the Commission considers that these are not sufficient reasons for policy intervention.

Levies

The Commission was also asked to consider the role of levies, and has presumed this to mean a way of raising revenue for subsidising the uptake of energy efficiency improvements. That is, the income of the levy is hypothecated to a particular purpose. Levies have been used in some overseas countries in this way. Levies can be an important revenue-raising tool where there is some connection between the payment and the services received, and are sometimes likened to benefit taxes. The use of the fuel excise paid by truck operators to fund road damages is an example.

A levy on energy users to pay for energy efficiency improvements has some appeal on equity and environmental grounds — all users of energy derived from fossil fuels contribute to environmental externalities and hence might be asked to contribute to their amelioration. However, such a levy would have some serious drawbacks because:

- levies would unduly penalise those who are already achieving high levels of energy efficiency; and
- there is no necessary nexus between the appropriate level of taxes and funding needs.

The risk is that such levies would be more distortionary and have higher administration and compliance costs than existing broad-based taxes. The Commission considers that the case for government subsidies for promoting energy efficiency should be separated from the means of funding those subsidies.

Requiring disclosure of information

Governments can pass regulations that require information to be provided. Examples include compulsory labelling schemes (such as applies to electrical appliances), requiring that energy efficiency ratings be provided when selling or leasing a house, and compulsory auditing and reporting for large energy users. Governments typically also require that their own agencies provide information on energy consumption or intensity.

Appliance and vehicle labelling

Labelling is used to indicate the energy efficiency of electrical and gas appliances and cars. Labelling directly addresses a source of market failure — the asymmetry of information between buyers and sellers of energy-using products. By providing information in a readily accessible and easily understandable format, labelling can help consumers to make better-informed choices about energy efficiency.

Research suggests that energy efficiency labels are not a prime consideration in choosing appliances or motor vehicles, but may come into play once consumers have short listed products on the basis of price, performance, capacity and style. A positive characteristic of labelling is that it does not directly limit consumer choice. Suppliers might chose to withdraw low ranking appliances from sale, but that is essentially a commercial decision on their part.

However, labelling involves both administration and compliance costs, such as those incurred by suppliers in having their products tested. Even so, the

Commission has concluded that, at least in the case of electrical and gas appliances, labelling has probably produced net social benefits. The Commission has also concluded that labelling should be more actively considered as an alternative to minimum performance standards. Other forms of labelling, such as disendorsement labels (for example, 'This product is not recommended for frequent usage'), might also be considered.

This is not to say that labelling should extend to all appliances or necessarily be government run. Labelling is most suited where there is a wide spread in the range of energy efficiency performances of comparable appliances, where energy-rating tests bear some resemblance to the way appliances are used, and where information failures are most pronounced. Government-run labelling schemes are arguably more credible and sustainable than private schemes, but many highly credible voluntary labelling schemes exist and are valued.

House energy performance rating

The ACT Government currently requires anyone selling or leasing a house to obtain an energy-performance rating that must be disclosed in advertisements and in the contract of sale. The NFEE Stage One proposals include the extension of this scheme to all other States and Territories. This scheme addresses market failures arising from information asymmetry and split incentives between vendors and purchasers.

However, the Commission is not convinced it produces net social benefits. It adds to transaction costs, and since energy costs are a small proportion of household expenditure, the rating is unlikely to be a significant selling point. If it were, owners of energy-efficient houses would have an incentive to voluntarily commission such a rating, and purchasers would have an incentive to demand it. Furthermore, unlike appliances, no two houses are the same and this report canvasses a debate on whether energy performance can be measured accurately.

It would seem prudent for a full and independent evaluation of the scheme to be undertaken before it is extended to other jurisdictions. The evaluation should assess how well house ratings predict actual energy performance, and the costs, benefits and effectiveness of the scheme.

Mandated audits for large energy users

The recently announced Energy Efficiency Opportunity Assessment (EEOA) program will make it mandatory for the 200 companies in Australia that use most energy, to undertake energy audits and report the results publicly. The program is the culmination of a long history of governments trying to persuade firms to invest in energy efficiency improvements that external auditors consider to be cost effective but which are not being adopted. The public reporting requirement is a significant development that is presumably intended to encourage management to adopt cost-saving opportunities that others (both within and outside the firm) might identify. The features of the EEOA suggest that it is designed to address perceived organisational and behavioural weaknesses within firms.

The proposition that large energy users are forgoing cost-effective energy efficiency improvements is questionable. These users, particularly those who use energy intensively, have strong incentives to use energy prudently within the total mix of all inputs. Unnecessarily wasting energy will cost them money, and damage their competitiveness.

It is also questionable whether mandatory assessments and reporting will lead to changed behaviour. Publicly-listed firms are already answerable to shareholders and the capital market generally. And as has been seen with earlier audit programs, many energy efficiency opportunities are not taken up by management because they are perceived to be uneconomic when all costs of implementation are considered. Any changes in behaviour may reflect managers investing in projects that are not as cost effective as other competing uses of capital.

As noted previously, the Commission considers that organisational and behavioural limitations/barriers are not a sufficient reason for government intervention. Governments' attention would be better focused on continuing to promote a competitive environment within which firms focus on cost control as part of maximising shareholder value.

It is doubtful too that the EEOA scheme could be justified on environmental grounds. It contains no incentives to address environmental objectives other than to avoid the possible embarrassment associated with publishing audit results. On the basis of the evidence currently before it, the Commission is not able to support this program.

Preventing access to energy-inefficient products

Governments can prevent the sale of energy-inefficient products by using minimum standards. These standards apply to gas and electrical products through the minimum energy performance standards program (MEPS), and for houses (and shortly, other buildings) through the Building Code (and State and Territory-specific standards).

Minimum Energy Performance Standards

MEPS apply to many appliances that are also covered by labelling. MEPS eliminate the worst energy performers, and labelling rewards better performance.

Appliance standards have most relevance where products are purchased infrequently, consumers rarely inspect the appliances in the showroom, and split incentive problems are significant. These conditions may apply for appliances, such as water heaters (where householders may have little influence on choice), but are less relevant for most other household appliances, such as refrigerators and freezers, and equipment used by commercial and industrial consumers.

MEPS deny consumers choice and add to costs. Higher levels of energy efficiency may only be achieved through trading off other features, which consumers might value, or through an increase in price. Many of these effects will go unnoticed because most consumers will be unaware of the (unavailable) options. But that does not decrease their importance.

MEPS may also have adverse distributional effects. Many consumers are capital constrained and may prefer to purchase a less efficient but cheaper appliance even if it would cost them more to operate over its lifetime. Others may find it more privately cost effective to have such products if they use them less than average. For example, for those who might only occasionally use an air conditioner, the operating cost savings might not justify the higher up-front purchase costs of a more efficient model.

One of the problems with MEPS, and with labelling, is in relating measures of energy efficiency to actual use. For ‘set and forget’ appliances (such as freezers and refrigerators), laboratory measurements of energy consumption are likely to relate reasonably closely to actual use. But where energy consumption is influenced more by the user than by the design of the appliance, this connection is more tenuous. While it is difficult to incorporate the many different circumstances in which appliances might be used in *ex ante* analyses of cost effectiveness, it is equally important not to overlook these differences in evaluating the case for introducing MEPS. Consumer and producer sovereignty should not be overridden lightly.

The Commission has reservations about the use of minimum standards. Standards restrict choices and, while appropriate to ban goods that are dangerous or defective, in the case of energy efficiency standards, may reduce the welfare of some consumers. They can be blunt instruments for addressing the inherent nature of market failures caused by information asymmetries and split incentives. And they do not appear to result in cost-effective options for individual producers and consumers. Benefit-cost analyses of such proposals have tended to use unrealistically low discount rates (around 5 per cent) that bear little resemblance to the rates that firms and consumers appear to apply (often in the 10 to 20 per cent range or higher).

The Commission therefore considers that future decisions to apply MEPS need more rigorous analysis, and greater consideration needs to be given to other policy instruments, including labelling. The practice of always selecting standards on the basis of world's best practice also needs to be reconsidered as it can lead to over-engineered standards that reduce private cost effectiveness.

Building energy efficiency regulations

The explicit objective of the energy efficiency regulations in the Building Code (and variations on these adopted by particular states) is to achieve greenhouse gas abatement. But they have also been promoted as cost effective for householders and building owners to implement. In the Commission's view, these regulations suffer from many of the same problems as appliance standards: they limit consumer choice (and innovation in design); add to costs; and may have adverse distributional effects.

In addition, there appear to be serious doubts about the effectiveness of these regulations in improving energy efficiency in a systematic way. Buildings are heterogeneous in nature and, other things being the same, no two households will use energy, or their buildings, in the same way. However, the energy efficiency standards are based on computer simulation models, such as the Nationwide House Energy Rating Scheme (NatHERS), that exclude many of the determinants of a building's actual energy consumption. They may therefore give biased outcomes. This might not be such a problem if the results were consistently biased in the same direction (though it might lead to the benchmark being set too high or too low), as this would allow consistent rankings of building designs. But there are doubts that even this is the case. The Commission has received evidence that the simulations may award low or zero star ratings to buildings that subsequently have very good energy efficiency performance. The software may need further refinement and testing.

In a recent research study on the Building Code, the Commission noted the problems of the different jurisdictions taking different approaches to energy efficiency regulation (and other aspects), and called for a more consistent national approach (PC 2004b). Different approaches add to the costs of administration and (for firms operating nationally) compliance, and hence need to be justified by incremental gains. The Commission also called for rigorous application of benefit-cost analysis to any future extension of these regulations and closer consideration of other options such as information provision.

Having now had the opportunity to examine the energy efficiency aspects of the Building Code in greater detail, the Commission is concerned that the analytical basis for these regulations (computer simulations of energy loads within buildings in each climatic zone) may be flawed. It therefore considers existing standards should be fully evaluated before new or more stringent energy efficiency standards for residential and other buildings are introduced.

A national energy efficiency target

Another proposal to promote energy efficiency is to implement a national energy efficiency target (NEET). While no firm policy proposal is available yet, this idea is generally associated with large energy users having to achieve efficiency-related energy savings (compared to projected energy use under 'business-as-usual' assumptions). While such targets could be voluntary, current proposals are that they be mandatory, to ensure wide coverage. A firm that failed to meet its mandatory target would be penalised, or in a more sophisticated version of a NEET, would be able to purchase credits in a market for energy efficiency certificates (sometimes called white certificates).

A NEET would not directly address the market failures that may account for the energy efficiency gap and hence lacks a clear focus. It is also unclear how it would interact with (or be a substitute for) an emissions trading scheme and tradeable mandatory renewable energy target certificates. Notwithstanding European experiments with trade in energy efficiency (white), renewable energy (green) and greenhouse emissions (black) certificates, it is unclear whether the white or green certificates are necessary or desirable if the black certificate trade exists and is active.

There would also seem to be many practical difficulties:

- A 'business-as-usual' baseline for each regulated entity would have to be established, against which improvements in energy efficiency would then be measured. It could be very difficult to allow for variations in energy consumption due to market and technological changes. Measuring how much of an output is not produced is always difficult, and is likely to encourage gaming by firms.
- Energy efficiency is not a tangible, readily measurable entity. Accordingly, it would be difficult to translate energy efficiency improvements into marketable instruments. If white certificates were not of equal value under all contexts, and

hence not fully interchangeable with each other, the secondary market would not allocate certificates efficiently.

- To address some of these problems a regulator would be required to decide which measures are eligible, and in doing so would create winners and losers. There is a risk that many activities that would have occurred anyway would be deemed eligible.
- Allocating obligations would create equity problems by penalising efficient and inefficient energy users alike.
- The problems of verifying white certificates would be likely to result in high administrative and compliance costs.

The Commission has major reservations about the principle and practical difficulties of such a scheme.

Mandating investment

At its most interventionist, government policy might involve compulsory investment in technologies to achieve greater energy efficiency. This is a feature of the regulatory framework covering Victorian firms licensed by the Environmental Protection Authority. Under that scheme, firms seeking works approval for proposals involving energy use of 500 gigajoules per annum or more, must undertake an audit, and are required to invest in projects that meet specified investment criteria (a three-year payback is the norm).

Such requirements could distort firms' investment decisions. Even if the audit assessment is accurate — and the proposed investment passes normal profitability criteria — the regulator is unlikely to know if the firm has access to the capital required or if the project represents the best use of that capital.

Although justified primarily for its environmental objectives, this scheme also illustrates the preparedness of governments to force firms to supposedly 'help themselves'. The Commission does not support such schemes. A better approach might be to attach (explicitly justified) environmental performance conditions to the licences of such firms and allow them to choose the means of achieving those objectives.

Energy market reform and transport

The Commission has been asked to examine energy efficiency in the context of other important reform agendas: the influence of energy market reforms; and transport. In both cases, there appear to be compelling economic reasons for building on the pro-competitive reforms introduced in these areas in the past. The direction of those reforms is fundamentally about getting the prices of energy and transport right, so that producers and consumers face appropriate signals that will lead to better resource allocation in the economy. This will influence energy efficiency, but energy efficiency is *not* the prime policy objective. Indeed, while many reforms in these areas will enhance overall community welfare, their impacts on energy efficiency may be small, zero or even negative.

Energy market reforms

Significant microeconomic reforms of electricity and gas markets have occurred under the aegis of COAG and various State Governments. Of most interest in this inquiry is the electricity industry, and the potential for achieving even more cost-reflective pricing in the future. Past reforms have driven down costs but little attention has been given to demand-side measures. A number of obstacles to more cost-reflective pricing of electricity remain.

Retail price regulation

Retail electricity prices are regulated in one form or another in all States and Territories (typically through price or revenue caps on tariffs for residential and small business users or though price equalisation schemes). Without a price mechanism to moderate demand during periods of congestion and high wholesale prices for electricity, many consumers have little or no incentive to conserve electricity or invest in energy efficiency, or reschedule their use to off-peak times. The result is the overinvestment in infrastructure needed to meet the needs of the community for those relatively few hours in the year when demand peaks, and an undue dependence on nonprice means of rationing demand.

Many participants advocated the deregulation of retail pricing to allow more cost-reflective tariff arrangements to be introduced. There was a great deal of interest in time-of-use pricing and variations on this theme. While consumer demand is likely to be quite inelastic to increases (and decreases) in prices in the short term, there is potential for more significant medium to longer-term adjustment as behaviour changes.

Some participants were concerned that competition might not yet be sufficiently robust to contain price rises. Others were concerned that adverse distributional effects would follow from unravelling the cross subsidies that exist in current tariff structures (for example, between small and large users and between urban and rural users). Distributional issues are clearly a concern for governments but, where hardship occurs, may be better addressed by more direct policy intervention, such as through explicitly funded community service obligations.

The Commission strongly supports the deregulation of retail pricing of electricity, as soon as there is effective competition in retail and generation markets.

However, the Commission notes that it will then largely be up to network operators and electricity retailers to decide how to translate wholesale prices into retail tariffs. To put time-of-day pricing into practice will require a substantial investment in interval meters, and it is by no means clear that installing such meters for all small customers will be worthwhile. Ordinarily, this might seem to be a commercial decision for network operators, retailers and their customers to contemplate. However, it might be difficult for any one party to capture sufficient benefits to warrant making the investment unilaterally. There may be a case for government intervention to speed up the rate of adoption and address free rider problems. Regulatory initiatives are already occurring in some States. For example, Victoria has mandated the roll out of interval meters in all new dwellings.

Disincentives to invest in demand-side management measures

Some participants were concerned about regulatory disincentives for network operators to invest in demand-side management (for example, voluntary cuts in energy consumption, greater energy efficiency, or peak-load shifting) as an alternative to expanding their networks. There can be more incentive to invest in poles and wires than there is to invest the time and effort in demand-side measures that will lose them sales revenue, particularly if the regulated prices make allowances for such capital expenditures. The Commission supports the actions of some regulators to address this bias through measures that attempt to recognise revenues forgone as a result of demand-side management measures. Peak-load congestion in the distribution systems might be more cost effectively addressed through demand-side management than through expanding the network, especially where the new capacity will only be utilised for a few hours per year.

‘Postage-stamp pricing’ of networks discourages location-based pricing

Price regulation of distribution and transmission networks generally involves cost averaging over classes of customers, including ‘postage-stamp’ pricing where the price is the same irrespective of the distance the electricity is transported. This can mean that users do not face the full (location-based) costs of delivering electricity to them. This may encourage the inefficient consumption of energy in some areas, while also discouraging distributed generation (that is, smaller-scale generators located close to local users). It may be having mixed effects on energy efficiency. There could be tradeoffs between energy lost in transmission and the potentially lower generation efficiencies of the smaller generators involved, and possible localised pollution impacts.

Transport

Most important energy efficiency improvements in transport flow from policies which have major objectives other than energy efficiency. For example, the primary rationale for congestion pricing is that it will achieve valuable time savings, but it will also have some fuel efficiency benefits. Similarly, improved regulatory environments for road freight and the rail industry offer significant productivity gains and are also likely to provide energy efficiency improvements within each sector as well.

Efficient road pricing to alleviate congestion, at least in some cities at some times could deliver significant net benefits (including improved fuel efficiency). Analysis by the Bureau of Transport and Regional Economics suggests that substantial net social benefits could be achieved from implementing congestion pricing in Sydney, Melbourne and Brisbane. Continued reform and improvements in passenger public transport should accompany any road pricing initiatives.

There is scope for further regulatory improvements in road transport, although the road agenda has progressed much further than rail (PC 2004a). These additional reforms may permit the use of larger trucks (B-doubles and triples), which would increase the average fuel efficiency of road freight. But whether such changes should be made will depend on many other factors as well (road safety, road damage, noise, etc) — energy efficiency is but one consideration.

Improvements in the economic efficiency of the rail sector would improve energy efficiency directly and, by shifting demand from road to rail, is likely to increase national energy efficiency even further. But again, there are other considerations that would need to be considered in addition to energy efficiency.

The existing voluntary fuel target for the Australian vehicle fleet seems a fairly innocuous policy. And the compulsory fuel and greenhouse gas label scheme gives consumers low-cost information which might not have been provided so extensively or in such a reliable, comparable and easy-to-access form by the market. As these schemes do not compel consumers and producers to move to more energy-efficient vehicles, any improvements they encourage should be privately cost effective. Both schemes are part of the environmental strategy for the motor vehicle industry and hence have broader objectives than consumer wellbeing.

The way the fringe benefits tax on company cars and parking is calculated provides encouragement to travel extra kilometres. However, any change to this arrangement would require balancing any reductions in the administrative efficiency of the tax system against the benefits of increased energy efficiency, and greenhouse gas and air pollution abatement.

The influence of urban planning on transport-related energy efficiency is included in the terms of reference for the inquiry. Planning is a very broad and complex process that should be focused on optimising outcomes (including transport) for individuals and firms (within the constraints of the private and social costs of meeting desired locational decisions). Energy-efficient transport solutions should not be the only driver of urban planning.

Greater use of 'intelligent transport systems' (for example, coordinating traffic lights on major roads, traffic lights responding to traffic flows, more sophisticated scheduling of public transport etc) might offer some energy efficiency gains as well as other vehicle cost savings and reduced travel times. However, where government funding is involved, these investments need to meet benefit–cost criteria.

Concluding comments

This report attempts to address three main questions:

- To what extent are energy efficiency improvements that are individually cost effective being overlooked by producers and consumers, and why?
- Is government intervention warranted to increase the take-up of improvements in energy efficiency that are believed to be cost effective for producers and consumers?
- How large are the economic and environmental gains offered by such intervention?

The short answers to these are: some energy efficiency opportunities are being forgone but not as many as some people might think; there is a (limited) case for government intervention to address market failures but not many of the other barriers and impediments; and the economic and environmental gains of government intervention are probably quite modest, especially after taking account of the cost of interventions.

Energy efficiency improvements that are privately cost effective are true 'no regrets' measures — the individual producer or consumer concerned saves costs and the (global) community benefits from reduced pollution, including greenhouse gas abatement. There is no doubt that such opportunities exist. But the potential for making such improvements, and the scope for governments to efficiently intervene to address barriers and impediments preventing their uptake, appears to have been overstated. In many cases, the improvements are not as cost effective for individual producers and consumers as they might seem. And few of the many perceived barriers and impediments are areas where government intervention is justified.

There is nevertheless a reasonable case to be made for governments to address information failures of one sort or another. Supplying information directly, or requiring market participants to provide information indirectly, is warranted in some cases. But it is more contentious to argue that mandatory measures (such as the Energy Efficiency Opportunity Assessments) should be introduced to force producers and consumers to take up opportunities that are ostensibly in their own interests. Mandatory measures not only override consumer and producer sovereignty but are inconsistent with the proposition that energy efficiency improvements are privately cost effective. They should be used with some caution and only where broader benefits are clearly demonstrable.

None of this is to deny that firms and individuals are sometimes not acting as rationally as they might. Energy efficiency opportunities are sometimes overlooked, but so too are other income or cost-saving measures. There is nothing intrinsically different about energy in this regard, nor does failure to take up such opportunities necessarily warrant policy intervention.

In a policy environment where other greenhouse gas abatement options have — for the time being — been ruled out, energy efficiency policies and programs have been pursued with some vigour. Building on the presumption that many energy efficiency improvements are cost effective and that the many existing programs are well founded, the MCE and the various Australian jurisdictions have been pushing ahead with new policy proposals. The nine point plan endorsed by the MCE as NFEE Stage One would appear to be just the beginning. While some existing and proposed programs appear to be well founded, others do not.

If there are net financial costs to individual producers and consumers, then governments are obliged to confirm that the net social, environmental and economic benefits do indeed exceed the private costs.

The Commission considers that what is needed most in the policy environment now is to take a pause to evaluate existing and proposed programs and other options more closely. The NFEE is a promising framework for developing a sound, coordinated approach to energy efficiency policy. However, neither the MCE nor the jurisdictions involved appear to have an adequate information or analytical base on which to make good policy choices at present. An example is the strong support for extending the ACT home energy efficiency rating regulations to all jurisdictions before an *ex post* evaluation of the effectiveness and net benefits of that scheme had been undertaken. Indeed, few programs in this area seem to have been rigorously evaluated.

Formal, independent evaluation of key programs would help establish the knowledge base needed for considering the way ahead. These should all be made publicly available. The Commission recommends that the suite of programs currently being progressed under the NFEE Stage One banner should not be implemented until these evaluations have been undertaken.

An alternative perspective can be brought to bear on energy efficiency policy — namely that government intervention might be warranted for its pollution abatement benefits. Even if some measures are not cost effective for individual producers and consumers, they might result in a net social benefit (after considering the costs of government intervention) and hence warrant action by governments. However, it is not clear that directly targeting energy efficiency is the best, or only, response that should be made to address greenhouse gas externalities. A consideration of other approaches is outside the scope of this inquiry.

What is apparent from this inquiry, however, is that the objectives of energy efficiency policy need to be clarified and private cost effectiveness placed in a more realistic light. The temptation has been to overstate the private cost-effectiveness aspect of energy efficiency programs when public benefits from greenhouse gas abatement often seem to be the real policy target. Clarifying objectives will also influence the instruments that are chosen. As the Commission has argued in this report and elsewhere, piecemeal responses to greenhouse gas externalities have the potential to be costly and ineffective. A coherent, soundly-based national response is required.

Findings and recommendations

General

DRAFT FINDING 5.1

Behavioural and organisational limitations on the adoption of energy efficiency improvements do not of themselves warrant government intervention. Understanding these limitations may, however, be helpful in designing efficiency programs that address environmental externalities, information failures and other sources of market failure.

DRAFT FINDING 5.2

Other barriers and impediments that are not market failures (for example, high transaction costs, risk and uncertainty in implementation) may provide rational reasons for the nonadoption of energy efficiency improvements that appear (to an outsider) to be privately cost effective. The role of governments in addressing these issues may be quite small.

DRAFT FINDING 6.1

Numerous case studies have found that producers and consumers fail to adopt some energy efficiency improvements that appear to be cost effective for them. These case studies, however, are based on many debatable assumptions, including:

- *the criterion for cost effectiveness*
- *business-as-usual improvements in energy efficiency*
- *extrapolation of audit and best-practice study results to a whole sector*
- *representativeness of simulated producers and consumers.*

DRAFT FINDING 11.1

National uniformity has been achieved in the regulation of energy labelling and minimum energy performance standards (MEPS) for electrical appliances and this is appropriate. If a revised scheme for energy labelling and MEPS for gas appliances is to be introduced, a similar approach to coordination would be desirable.

DRAFT FINDING 11.2

The current state and territory based variations in energy efficiency standards for new houses increase costs for the building and building products industries. The case for such variations appears to be weak.

DRAFT RECOMMENDATION 11.1

The Australian Building Codes Board should examine ways to reduce the scope for local governments to erode the uniformity of minimum energy efficiency standards for new houses.

DRAFT FINDING 11.3

The National Framework for Energy Efficiency has the potential to improve national coordination and guide the development of energy efficiency programs. At present, however, there is insufficient clarity on the rationale for, and the objectives of, government intervention. There has also been insufficient evaluation of past policies and programs.

DRAFT RECOMMENDATION 11.2

National Framework for Energy Efficiency Stage One proposals (that are not directly affected by other recommendations) should be deferred until independent evaluations of existing energy efficiency programs have been undertaken. The evaluations should determine the effectiveness of these programs in promoting the uptake of cost-effective energy efficiency improvements.

DRAFT FINDING 12.1

A national energy efficiency target is a poorly focused policy instrument that would be very difficult and costly to implement in an effective manner. It can not be justified on the grounds of privately cost-effective energy efficiency. It may help to drive investment in energy efficiency, but this would be at the expense of economic efficiency. As a measure to address greenhouse gas abatement, it has serious disadvantages compared to other options such as an emissions trading scheme.

Residential

DRAFT FINDING 7.1

Appliance energy-performance labels are not a major determinant of which appliances householders buy. But the labels do have some influence on consumers after they have short listed products on the basis of characteristics such as price, performance, capacity and style. While the benefits of energy-performance labelling may have been overstated in regulatory impact assessments, labelling is likely to have produced net benefits for consumers.

DRAFT RECOMMENDATION 7.1

The National Appliance and Equipment Energy Efficiency Committee should adopt procedures to ensure that future regulatory impact assessments of appliance minimum energy performance standards (MEPS) include a more comprehensive analysis of:

- ***why consumers — with guidance from an energy-performance label — are not best placed to judge what is in their best interests;***
- ***whether a voluntary standard, such as the Energy Star program, would be more cost effective;***
- ***what proportion of consumers would be prevented from buying appliances that are more cost effective for them;***
- ***the extent to which consumers would be forced to forgo product features that they value more highly than greater energy efficiency;***
- ***the distributional impacts, including the extent to which MEPS are regressive;***
- ***whether MEPS would reduce competition and how this would affect prices and service quality; and***
- ***whether a disendorsement label would achieve a more cost-effective result.***

DRAFT RECOMMENDATION 7.2

Before the States and the Northern Territory mandate energy-performance ratings for existing dwellings at the time of sale or lease, the Ministerial Council on Energy should commission an independent evaluation of the ACT rating scheme that has operated since 1999. The evaluation should include an assessment of:

- ***the accuracy of home energy ratings in predicting the actual energy performance achieved by home buyers and tenants; and***
- ***the costs, benefits and effectiveness of the scheme, taking account of the diverse preferences and financial circumstances of individual home buyers.***

DRAFT FINDING 7.2

Energy efficiency standards for residential buildings are based on computer simulation models — such as the Nationwide House Energy Rating Scheme energy-rating software — that exclude many of the determinants of a building's actual energy efficiency.

DRAFT FINDING 7.3

A ranking of residential buildings by star rating (using energy-rating software such as Nationwide House Energy Rating Scheme) may be very different from a subsequent ranking based on actual energy consumption or efficiency.

DRAFT RECOMMENDATION 7.3

New or more stringent energy efficiency standards for residential buildings should not be introduced until existing standards have been fully evaluated. The evaluation should be commissioned by the Australian Building Codes Board to:

- ***consider whether defining building standards in terms of simulated heating and cooling loads is an effective way to raise actual energy efficiency;***
- ***investigate whether weaknesses in energy-rating software distort the housing market in favour of particular building designs that are not necessarily the most cost effective, particularly over the longer term as innovations are made in building design;***
- ***evaluate costs and benefits in a way that takes account of the diverse preferences and financial circumstances of individual home buyers;***
- ***assess how effectiveness and compliance costs differ between the deemed-to-satisfy and performance-based standards;***
- ***analyse the distributional impacts of standards on different socioeconomic groups, including first-home buyers and less-affluent groups; and***
- ***examine the process used to set the stringency of standards in the Building Code of Australia, including the impact of any increase in stringency by individual States and Territories.***

Commercial and industrial

DRAFT FINDING 8.1

There are many reasons why firms might choose not to adopt energy efficiency improvements that appear to be privately cost-effective, but the only two that might warrant government intervention are market failures in regard to information and split incentives.

DRAFT FINDING 8.2

Government should not become involved in accreditation of energy consultants and energy service companies because this function can be adequately performed by an industry or professional association like the Australasian Energy Performance Contracting Association.

DRAFT FINDING 8.3

The costs and benefits of a policy of government facilitation of business transactions with energy service providers should be evaluated against alternative mechanisms which promote the market provision of energy efficiency advice or services.

DRAFT FINDING 8.4

The need for special energy efficiency research and development funds has not been substantiated, given that funds can be sourced from existing more general research and development programs.

DRAFT FINDING 8.5

The Commission does not support provision of direct subsidies to firms to undertake energy efficiency improvements which are privately cost effective for those firms. Subsidies may, however, have a role in encouraging the uptake of improvements that have important spillover effects.

DRAFT FINDING 8.6

The case for government subsidies to encourage energy efficiency improvements should be separated from the means of funding those subsidies, such as by hypothecated levies.

DRAFT RECOMMENDATION 8.1

A policy of mandatory energy efficiency opportunities assessments is not warranted on private cost-effectiveness grounds. There would be no justification for mandating the implementation of Energy Efficiency Opportunities Assessment results.

DRAFT RECOMMENDATION 8.2

Energy efficiency standards for commercial buildings should not be introduced without a more thorough evaluation of the costs and benefits of such a policy and a comprehensive analysis of the other policy options. In such an evaluation, the Australian Building Codes Board should give greater consideration to:

- ***the sensitivity of regulatory impact statement estimates of cost savings to the assumptions used;***
- ***the costs of introducing energy efficiency standards, including administration costs and compliance costs; and***
- ***the effectiveness of standards in achieving higher actual energy efficiency.***

Transport

DRAFT FINDING 9.1

Markets provide extensive information to consumers regarding fuel consumption of motor vehicles. Nonetheless, the Australian Government's Fuel Consumption Labelling Scheme and Green Vehicle Guide provide relatively low cost, accessible and comparable information to consumers, and may be justified as part of the more fundamental objective of encouraging consumers to reduce the adverse environmental impacts of motor vehicle use.

DRAFT FINDING 9.2

Fleet-wide fuel consumption targets for new motor vehicles sold in Australia are likely to have had only a limited impact on the fuel efficiency of the new vehicle fleet. Significantly tightening such targets and making them compulsory would be likely to impose additional costs on consumers.

DRAFT FINDING 9.3

Efficient road congestion pricing would lead to increases in energy efficiency by improving traffic flow and diverting some peak-hour journeys to alternative times or to more energy-efficient means of transport. These increases would be cost effective for the community (if tolls are set appropriately) in that costs to those excluded are more than offset by the gross efficiency benefits to those who continue to travel. However, these energy efficiency gains will not be privately cost effective for all road users. Reductions in fuel consumption and cleaner burning of fuel would also provide significant local environmental benefits and reductions in greenhouse gas emissions.

DRAFT FINDING 9.4

The TravelSmart program improves the energy efficiency of transport by providing consumers with information regarding less fuel-intensive travel options and means to reduce the need to travel. TravelSmart simultaneously addresses several policy issues — greenhouse gases, air pollution, and personal health and fitness — in a way that allows consumers to choose which options are most cost effective for them.

DRAFT FINDING 9.5

There remains some scope for additional regulatory reform in the road and rail sectors, which would improve overall efficiency and would probably lead to some increase in energy efficiency within each sector. Reforms may alter the competitive position of road freight compared to rail, which might change the energy efficiency of the overall freight task, but this would not be an appropriate reason for delaying such reforms. There appear to be few regulatory impediments to a privately efficient modal split in the freight sector that would have any significant impact on energy efficiency.

Governments as energy users

DRAFT FINDING 10.1

The use of energy targets for government operations could result in a deterioration of the overall effectiveness and efficiency of government services. Using energy-intensity performance indicators instead of targets can reduce this risk and help identify opportunities for cost-effective improvements in energy efficiency.

DRAFT FINDING 10.2

Addressing cost-effective energy efficiency in procurement policies, provided there is sufficient flexibility, could lead to environmental benefits and a small increase in the overall efficiency and effectiveness of government operations. There may be some additional benefits through demonstration effects and market development, but these are unlikely to justify procurement decisions which are not cost effective for government operations.

Role of energy market reform

DRAFT FINDING 13.1

More cost-reflective pricing has the potential to improve energy efficiency by influencing both consumer and supplier behaviour, particularly in the longer term when consumers have both more information and opportunity to modify their behaviour, and producers have the opportunity to respond to changed market conditions.

DRAFT RECOMMENDATION 13.1

Any mandated roll out of interval metering devices should be subject to a comprehensive benefit–cost analysis. Mandated roll out of technologies should not preclude choice in the device or competition between service providers.

1 Introduction

Key points

- The Productivity Commission has been asked to hold an inquiry into the economic and environmental potential offered by energy efficiency improvements that are 'cost effective for individual producers and consumers'.
- Energy efficiency improvements have attracted considerable attention because of the perception that they can be win–win options: that is, they potentially achieve both private cost savings for the producers or consumers concerned, improved economic performance, and environmental benefits through pollution abatement.
- The predominant focus of the inquiry is on the policy implications of the various barriers and impediments that are said to be preventing the adoption of these improvements in energy efficiency.
- This is not an inquiry into global climate change or the least-cost options for greenhouse gas abatement.
- The Commission welcomes comment on this draft report and will be holding a further round of public hearings before submitting a final report to the Australian Government on 31 August 2005.

Energy efficiency has long been a policy issue, first because of concerns about the depletion of fossil fuels leading to energy scarcity and, more recently, because of attributed links between fossil-fuel use and climate change. Policy interest has been heightened by the recent ratification of the Kyoto Protocol and attempts to negotiate a more comprehensive longer-term international agreement to reduce greenhouse gas emissions.

Intuitively, improving energy efficiency seems an obviously desirable goal. No one — firm or household — is in favour of wasting energy by using it inefficiently. Yet there is no doubt that virtually every household and firm could use energy more efficiently. Indeed, it is often argued that, even at current (and expected) prices for energy, many energy efficiency improvements are cost effective for individual producers and consumers. If this is the case, they would also amount to low-cost or even negative-cost options for emissions abatement. But despite the perceived private benefits, such improvements are not routinely being taken up, leading to the proposition that various barriers and impediments must be at work.

The scope for policy intervention to encourage the greater uptake of cost-effective energy efficiency improvements is the focus of this inquiry.

1.1 Scope of inquiry

The Australian Government has asked the Productivity Commission (the Commission) to conduct an inquiry into the economic and environmental potential offered by energy efficiency improvements that are ‘cost effective for individual producers and consumers’. The scope of this inquiry is set by the Government’s terms of reference, and the Commission’s approach, as set out in its authorising legislation, the *Productivity Commission Act 1998*.

The terms of reference are extensive and in effect constitute a series of mini inquiries. In summary, the Commission is required to consider:

- the impacts of barriers and impediments to improved energy efficiency;
- a range of different policy instruments including standards, labelling, information provision, financial incentives, energy-market reforms (for example, the development of better price signals) and a national energy efficiency target;
- existing and recent government energy efficiency programs, including the level of coordination between those programs; and
- policy options for improving energy efficiency within different sectors, including the commercial and industrial, consumers and householders, government (as a user), and transport sectors.

Cost-effective energy efficiency improvements

The scope of the inquiry is greatly influenced by the focus of the terms of reference on energy efficiency improvements that are ‘cost effective for individual producers and consumers’. The Commission interprets this to mean that, from the point of view of the person or firm making the improvement, the improvement would not increase the total cost of producing current output (and may in fact reduce total cost). It is also implied that these improvements are cost effective at today’s prices for energy, by which it is meant current expectations about the energy prices likely to be experienced over the relevant investment time frame.

The terms of reference then require the Commission to comment on the economic and environmental cost and benefits of such cost-effective energy efficiency improvements. The Commission's enabling legislation requires it to take an economywide view that considers all costs and benefits, including the costs of government intervention. However, the terms of reference imply that the Commission should apply this economywide framework to only those energy efficiency improvements that appear to be privately worthwhile but are not being taken up because of barriers or impediments facing individual producers or consumers. There may well be a broader set of energy efficiency improvements that would be justified on the grounds of net social benefit (including environmental benefits) but these are not the principle policy focus of this inquiry.

The influence of energy prices

Although the focus is on current price expectations, the inclusion of the role of energy-market reforms allows the Commission to consider the impact of distortions in the pricing of energy on the potential for cost-effective energy efficiency improvements. Distortions can arise where the prices paid by users of energy do not reflect appropriately the costs involved in the production and consumption of that energy. This might include distortions arising from the regulatory frameworks governing the energy industries or unpriced pollution externalities (chapter 13).

While changes to energy prices will influence the economically-efficient amount of investment in energy efficiency, they do not change the underlying nature of the barriers and impediments that are seemingly at work at currently-expected prices. For this reason the predominant focus of the inquiry is on the barriers and impediments to achieving energy efficiency improvements.

Barriers and impediments

Many technical experts perceive a significant gap between current levels of energy efficiency and the levels that are privately cost effective. This energy efficiency gap is usually explained by barriers and impediments but it is plausible that the actual gap is, in reality, much smaller than some of the experts believe — they may have overestimated the benefits or underestimated the costs of the energy efficiency improvements they believe are warranted.

The pursuit of cost-effective energy efficiency improvements would seem to be consistent with the self interest of any rational producer or consumer. And yet the issue at the heart of this inquiry is why producers and consumers do not react in this manner. The presumption that various barriers and impediments must be at work, and that these require government intervention to close the gap, requires careful consideration. Barriers can arise for different reasons, and not all barriers suggest the need for such intervention. Government intervention is not costless and, if inappropriately introduced or poorly implemented, can create unintended distortions in the marketplace.

Some barriers or impediments are attributable to market failures that are for the most part caused by imperfect information.[1] These may warrant intervention provided the benefits outweigh the costs.

Others may amount to individuals or firms overestimating the costs involved in making energy efficiency investments (for example, training and disruptions to material flows) or overweighting risks (albeit, the technical risks can be very high). A range of other perceived barriers can be attributed to behavioural norms and organisational limitations. The case for policy intervention to address these other (non-market failure) barriers and impediments, while worthy of investigation, is not always as clear cut. (Barriers and impediments are discussed in chapter 5 and, where relevant, in the sector-specific chapters of this report.)

This is not an inquiry into climate change policies

This inquiry is occurring at a time of great interest in the environmental implications of greenhouse gas emissions. While decreasing Australia's 'greenhouse signature' is mentioned in the terms of reference, the Commission has not been asked to comment on the Australian Government's policy response to climate change. However, the role of cost-effective energy efficiency improvements in decreasing greenhouse gas emissions as well as other environmental effects, such as reducing urban air pollution, is recognised.

Apart from cost-effective energy efficiency improvements, there are other ways to achieve greenhouse gas abatement, including: reducing land clearing; storing carbon dioxide in geological strata; increasing the use of energy from renewable and/or nuclear sources; and increasing energy conservation and energy efficiency by increasing energy prices. Policies to encourage cost-effective energy efficiency improvements can play a role, but this inquiry does not address the appropriate mix of abatement options or what should be the overall abatement objective.

[1] A market failure arises where a market fails to provide or allocate goods and services efficiently. That is, the allocation of goods and services is not one that maximises overall wellbeing of the community.

1.2 Conduct of the inquiry

The Commission received the terms of reference for this inquiry on 31 August 2004. The inquiry is scheduled to be completed within 12 months, including both a draft and a final report. As required by the terms of reference, and in line with normal inquiry procedures, the Commission encouraged public participation in this inquiry. The Commission:

- advertised the inquiry widely and sent a circular to individuals and organisations thought likely to be interested;
- released an issues paper in September 2004 to assist participants to prepare submissions to the inquiry;
- held informal discussions with a wide range of organisations and individuals;
- encouraged written submissions — 85 submissions were received before the release of the draft report; and
- held a round of public hearings in November 2004 in Sydney, Brisbane, Canberra and Melbourne and by teleconference — 39 participants took part.

The Commission thanks all participants for their contributions to this inquiry. Those who attended informal discussions, made submissions and participated in hearings are listed in appendix A.

Interested parties now have the opportunity to comment on this draft report through further written submissions and by participation in public hearings. The locations, dates and times of those hearings are set out at the front of this report.

2 The Commission’s approach

Key points

- Energy efficiency increases if output per unit of energy input increases, regardless of the change in non-energy inputs. Economic efficiency is achieved when society obtains the highest value from all its resources.
- When markets work well, the value obtained from all resources in aggregate is maximised and, from the view of economic efficiency, the level of energy efficiency is ‘right’.
- When markets do not work well because of market failure (for example, information problems or externalities) or inefficient government interventions (for example, impediments to introducing cost-reflective pricing), the level of energy efficiency may be reduced below or raised above its economically-efficient level. Addressing these problems is economically worthwhile (provided the benefits from doing so exceed the costs) regardless of whether energy efficiency is increased or reduced.
- Policy measures that target energy efficiency are an indirect way of pursuing the objectives of reducing emissions of greenhouse gases and reducing urban air pollution.
- Good energy efficiency policy, like good policy in other areas, is characterised by: clear objectives; objectives targeted as directly as possible; and assessment of the costs and benefits of alternative policy solutions.

Chapter 1 explained that the focus of this inquiry is on the economic and environmental potential offered by energy efficiency improvements that are cost effective for individual producers and consumers. This chapter sets up an economic framework for considering these issues. This requires that the objectives of energy efficiency be clarified, to help focus on the appropriate policy solution to the underlying problems. The chapter also addresses the efficient targeting of policy objectives and it concludes with a checklist for good energy efficiency policy.

2.1 Clarifying objectives

What are the objectives of energy efficiency policy? What are the problems that it seeks to address? As in any area of public policy it pays to be as clear as possible about what policy intervention is meant to achieve. This is because the best policy measure for achieving an objective may be very sensitive to the precise specification of what the objective is. For example, a measure may be efficient for pursuing an objective of reducing aggregate energy use. But it is unlikely to be most efficient for advancing the objective of achieving privately cost-effective energy efficiency.

According to its Energy White Paper issued in June 2004, 'the Australian Government's [energy policy] objective is to ensure that Australians have reliable access to competitively priced energy, the value of energy resources is optimised, and environmental issues are well-managed' (Australian Government 2004, p. 2). In the context of the present inquiry, this objective can be expanded such that policies for promoting energy efficiency should have regard to:

- competition and economic efficiency in the production of energy and its supply to end users;
- maximising returns to the Australian community from using and trading in energy; and
- the impacts of the production and consumption of energy on the environment.

With these overriding objectives in mind, an economic framework for assessing a number of objectives of energy policy is outlined below.

Maximising returns to energy

Energy efficiency is defined in the terms of reference as 'maintaining or increasing the level of useful output or outcome delivered, while reducing energy consumption'.[1] With this definition, changes in non-energy inputs are disregarded. One possible objective, then, would be to maximise the return to energy.

Another way of expressing this objective would be to minimise energy intensity, where energy intensity is defined as the amount of energy used to produce a unit of output (which is most commonly gross domestic product). In other words, energy intensity is the inverse ratio of the returns to energy. Energy intensity is commonly used as a proxy for energy efficiency because other data are unavailable (chapter 3).

1 Strictly, this definition relates to an *increase in energy efficiency*.

These ratios can be useful, but limited, approaches to considering energy efficiency. They can be used in comparing the performance of like products or processes. All other things being equal, energy users would maximise their returns by choosing products that maximise output for a given energy input. Compare, for example, two otherwise virtually indistinguishable space heaters, which might effectively heat the same space to the same temperature (the output). If one does it with less energy input it would be superior to the other. But once the comparisons take in other features, or extend to unlike products, physical ratios of output to energy input become a clumsy and insufficient basis for assessing the relative benefits to the community more generally of different energy using options.

The ABS (2001, p. 102) warned that energy intensity reveals nothing about economic efficiency:

> … differences in energy intensities between economies may simply reflect differences in the mix of more or less energy intensive sectors within each economy. Similarly, energy efficiency so defined tells us nothing about economic efficiency. For example, differences in energy efficiency in a given activity between economies may be due to differences in fuel prices and have no bearing on economic efficiency whatsoever.

Changes in energy intensity may occur without any changes in economic efficiency. This could occur due to structural shifts between sectors or regions of the economy (for example, a shift toward less energy-intensive industries or a migration of population to regions with less extreme climates) or changes in the mix of activities within sectors.

Seeking to maximise such a concept of energy efficiency (or minimise energy intensity) in the economy would be analogous to pursuing an objective of maximising the value of output per unit of another resource — such as labour, capital or land. Focusing on output per unit of just one of the many resources used in an economy implies that only that resource is scarce and valuable, and that there is no need to consider the amount of other resources used with the 'special' one in producing the economy's output.

Maximising economic efficiency

Maximising economic efficiency requires that the best use be made of all inputs, not just energy. Economic efficiency has three components: technical, allocative and dynamic efficiency (box 2.1).

Technical efficiency requires that minimum amounts of inputs are used in the production of goods and services. It recognises that different combinations of energy and other inputs can sometimes be used to produce a given output.

Box 2.1 Components of economic efficiency

Economic efficiency is about maximising community wellbeing. This requires satisfaction of three components.

Technical efficiency (sometimes called 'productive efficiency') refers to the extent to which the minimum required inputs of resources are used to produce goods and services, in accordance with economically-feasible technological and management standards. If waste is avoided in this way, improvements in technical efficiency can generate more income and bring improvements in living standards.

Allocative efficiency, in essence, is about ensuring that the community gets the greatest return (very broadly defined) from its scarce and valuable resources. A nation's resources can be used in many different ways. An allocation of more resources to one production activity will produce more output and income from that activity, but reduce output and income produced from other activities where the resources could have been used. The best or 'most efficient' allocation of resources is the one that contributes most to community wellbeing. This often means an allocation of resources that generates the most national income. But it may also mean, for example, that some environmental assets are 'allocated' to conservation in order to meet community values. Prices received for outputs, and costs paid for inputs, are major factors that guide the allocation of resources (although resources that cannot be properly priced or costed in the marketplace often require some form of government intervention to promote the best possible allocation). Improvements in allocative efficiency bring improvements in living standards because resources are used to generate more income and satisfy more needs and desires, but in ways that also reflect community values.

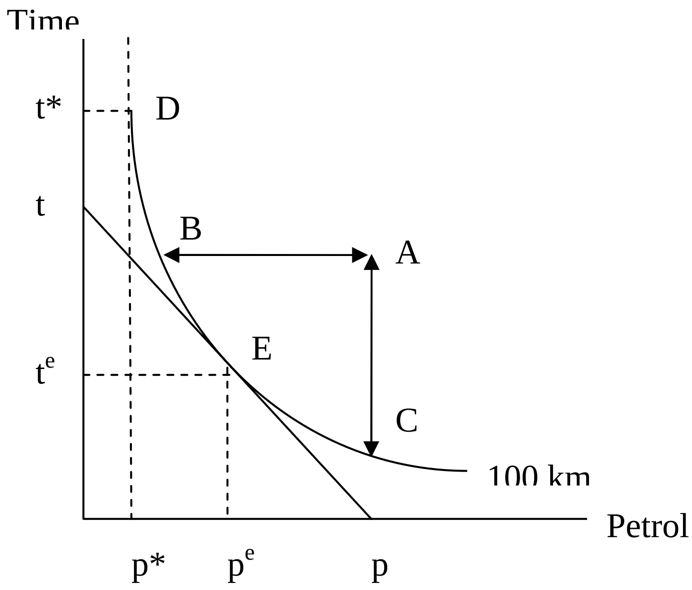
Dynamic efficiency refers to the capacity to improve efficiency and generate the most from resources over time. This can mean finding better products and better ways of producing goods and services. Investments in education, research and innovation can be important in this regard. Dynamic efficiency can also refer to the ability to adapt quickly and at low cost to changed economic conditions and thereby maintain output and productivity performance in the face of economic 'shocks'. Improvements in dynamic efficiency bring growth in living standards over time.

Source: PC (1999).

Allocative efficiency takes this a step further by requiring that the best returns be achieved from the use of all inputs (for example, labour, capital and energy) across the economy. This can be illustrated in a simple example involving driving a car from point A to point B (box 2.2). Different combinations of petrol and time can be used to cover the same trip, but when the prices of both inputs are taken into account a least-cost combination emerges. Unless the driver places zero value on their time because they are indifferent to the time taken to make the trip, this will involve using more petrol than the most energy-efficient combination of inputs.

Box 2.2 **Technical and allocative efficiency**

Different concepts of 'efficiency' can be illustrated by a simplified model, where two inputs (petrol and time) can be used to create an output (distance travelled).



The curved line shows different technically efficient combinations of petrol and time required for a particular car (that is, a given technology) to travel 100 km. By definition, any point on this line is technically efficient — a person can use less petrol, but only by taking more time (and vice versa). Any point above this line is not technically efficient, as a person could save at least one input without using any more of the other. At point A, a person could save AB in petrol and use the same amount of time (for example, by driving more smoothly) or save AC in time using the same amount of petrol (for example, by having the engine tuned).

The existence of many technically efficient combinations of inputs makes it difficult to choose the 'best' combination. Point D represents the combination that uses least energy (p*). However, the trip will take a long time (t*).

Allocative efficiency takes into account the value of both inputs, not just energy. The line tp shows the relationship between the prices of time (for example, a driver's wages) and petrol — how much petrol a person is willing to give up to save a unit of time, and vice versa. The economically efficient combination of inputs is at point E, where the relative prices of time and petrol form a tangent to the technical efficiency curve. Point E is economically efficient, because any other combination of inputs to achieve the same outcome would cost more in total.

Allocative efficiency is useful for thinking about how individual producers and consumers can make tradeoffs between the use of different inputs to maximise income or utility. It can also be used to consider how different sectors or industries compete with each other for the use of resources. Economic efficiency is maximised when resources are allocated among competing ends to achieve the best possible return to the economy. Because of economic differences between countries, there are large international differences in the economically-efficient allocation of resources. For example, in Western Europe and Japan, where energy prices are higher relative to the price of capital than in Australia, it is economically efficient to make investments in energy efficiency technologies that would not be economically efficient in Australia.

Dynamic efficiency involves the idea of adjusting quickly to shifts in the supply and demand factors that determine technical and allocative efficiency. Clearly technology is a crucial influence on energy efficiency. In most areas of the economy technological advances over time mean that the economy is progressively becoming more energy efficient. In the car trip example in box 2.2, one could think of the improvements that have been made in fuel efficiency of like-sized cars over time that would allow the same trip to be taken in the same time but with less fuel. An objective of maximising the economic efficiency with which energy is produced and consumed would also recognise the dynamic efficiency component of economic efficiency.

Economic efficiency is achieved through the profit- and utility-maximising behaviour of individual energy producers and users, provided they face prices that reflect the national economic consequences of their decisions, and they are subject to competition. However, achieving the objective of economic efficiency may require attention to market failures, inefficient interventions and social and environmental objectives.

Accounting for market failures

One of the factors that can prevent the optimum contribution of energy production and consumption to overall economic efficiency is market failure. In considering market failure issues, this report distinguishes between two different markets: *the market for energy* and the *market for energy-efficient technologies* (for example, more energy-efficient washing machines for consumers or better ways of producing process steam for manufacturers):

- There are two main sources of market failure in the market for energy: the influence of natural monopoly in the transmission and distribution of energy (such as gas and electricity), and environmental externalities. These are considered in chapter 13.

- There are a variety of market failures in the market for energy-efficient technologies. These are largely due to the underprovision of information (barriers and impediments are addressed in chapter 5).

Measures that address these market failures in a cost-effective way will enhance economic efficiency. For example, a movement to more energy-efficient appliances as a result of improving consumers' information on the energy requirements of different products would be likely to increase energy efficiency in the economy, after allowing for second-round (rebound) effects (box 2.3).

To many participants, reducing the harmful environmental effects of energy production and use is the major reason for promoting energy efficiency. Increasing national energy efficiency is potentially one way to make progress on this objective — though approaches that focus on energy efficiency do not target either local pollution abatement or the greenhouse emissions objectives most directly. This inquiry focuses on energy efficiency improvements that are cost effective for individual producers and consumers. There are many other energy efficiency improvements that might be optimal from a society wide perspective — taking all costs and benefits into account, including environmental impacts and threats — but which are not privately cost effective. Those improvements are likely to be even more difficult to introduce than the ones that are privately cost effective.

Accounting for inefficient intervention by governments

Inefficient interventions by governments are another cause of economic inefficiency that may also impact on energy efficiency. An inefficient intervention would occur if the costs of government intervention exceed the benefits. The costs of intervention take several forms, including: administration costs to government; compliance costs to regulated businesses, other organisations and households; efficiency costs associated with revenue raising; and the distortionary influence of the regulation.

Two types of inefficient interventions can be considered — those aimed directly at addressing energy efficiency, and those that affect it indirectly. As this report stresses, the case for government intervention to address energy efficiency directly should be based on broad benefit–cost criteria. Whether it is effected by administrative or regulatory means, government intervention is not costless, meaning that policy problems need to be non-trivial before intervention is contemplated.

Box 2.3 The rebound effect

An economic efficiency framework also helps in understanding how the expected effects of energy efficiency improvements on energy consumption can be reduced through so called rebound effects. When an economically-efficient energy efficiency improvement is implemented it might be presumed that the energy saved could somehow be 'quarantined' from further use. But in practice some of this energy 'dividend' will be used by producers and consumers responding to the 'income' and 'substitution' effects of the energy saving.

The income effect comes about because increasing energy efficiency 'frees up' part of the income of the purchaser: they do not have to purchase as much energy to enjoy the same level of output. The purchaser might use all or part of the money they save to buy other goods and services that also use energy.

The substitution effect comes about because increasing energy efficiency makes energy appear cheaper — the same energy services can be purchased for less money. When goods become cheaper, there is a tendency for people to buy a greater quantity of them and substitute them for other goods. For example, after installing a more energy-efficient air conditioner, a residential consumer may choose to set the operating temperature lower or be less diligent in the use of other energy conserving devices such as shades.

Gottron (2001) has estimated that, depending on the device concerned (space heating, space cooling, water heating, residential lighting, home appliances and automobiles), rebound effects of between 10 to 50 per cent might be expected. However, with well-functioning markets, the income and substitution effects that generate the rebound effect result in higher consumer welfare and economic efficiency.

The potential for a rebound effect should be taken into account when calculating the effects of energy efficiency programs. The rebound effect leads to lower energy savings than those projected if its existence is not factored in. This can affect anticipated demand for energy-related infrastructure. The rebound effect can also make it difficult to project the reduction in greenhouse emissions from an improvement in energy efficiency.

Many seemingly inefficient interventions occur as the indirect consequence of policy interventions designed to address other objectives. At face value there would appear to be many examples of such interventions. To illustrate, regulation-induced inefficiencies in energy pricing hold energy prices down in some situations, resulting in a lower level of privately cost-effective energy efficiency (chapter 13). The existence of a lower tariff on imports of four-wheel drive motor vehicles than on conventional motor vehicles induces substitution of four-wheel drive for other vehicles, with the incidental effect of reducing the average fuel economy in Australia's fleet of motor vehicles (chapter 9). However, while these interventions may decrease energy efficiency, they need to be assessed in the context of the other objectives that they are designed to achieve.

A less obvious consequence of inefficient interventions is that they may generate additional uncertainty about future policy regimes. For example, if market participants expect efficient, 'rational' policies to ultimately triumph over inefficient interventions, they will see the timing and the process of moving from the inefficient interventions to the efficient policy state as uncertainties.

Accounting for broader social and environmental objectives

The submissions and discussions for the present inquiry, and the wider debate on energy policy, point to several broader social and environmental objectives being seen as having a role in energy policy. These include:

- conserving non-renewable energy resources;
- increasing self-sufficiency in liquid fuels; and
- reducing adverse distributional impacts such as those that might be associated with the costs for low-income households of adopting energy efficiency improvements.

However, there are significant differences between these broader objectives and the objective of increasing energy efficiency. Different policies would likely be needed to pursue any of them in a cost-effective way.

Conserving non-renewable resources

Conserving non-renewable energy resources might be an objective of energy policy. However, this concept is frequently confused with, and sometimes difficult to separate from, that of energy efficiency. Being more energy efficient implies achieving the same level of outputs using less energy inputs, or achieving more outputs for the same level of energy inputs. Where that can be done cost effectively, there is a gain to householders and/or firms regardless of whether, with rebound effects factored in, there is a reduction in energy use. In contrast, conservation of energy implies giving up something of value in order to save energy. For example, energy is conserved when a device, such as a heater, is switched off, or the thermostat turned down.

Increasing self-sufficiency

Increasing self- sufficiency in liquid fuels is viewed by some as desirable in order to reduce Australia's vulnerability to disruptions in oil supplies from overseas and to economic shocks through world oil prices. For perspective, Australia is more than self-sufficient — it is a net exporter for energy overall, and therefore is likely to gain from rises in world energy prices unless the effects arising from a resulting slowdown in world economic growth outweigh the more direct positive effects. It is also relevant that prices for domestically-sourced oil are determined by world markets, and apart from a likely saving on transport costs, a cost-effective switch in the sourcing of crude oil from imports to domestic sources would not reduce significantly the price of refined petroleum products to Australians. In fact, direct measures to increase self-sufficiency in liquid fuels, such as a tariff on oil imports, would increase the price of petroleum products in Australia.

Distributional effects

Avoiding or reducing regressive distributional impacts is an important consideration in developing public policy for energy efficiency, but it may be best achieved through policy instruments separate from those used to address problems of market failure and inefficient interventions associated with energy efficiency.

2.2 Targeting objectives

In the Commission's view, achieving an economically-efficient allocation of energy, labour, capital, land and other resources is a fundamental objective of economic policy. With efficient markets for energy and energy technology, the voluntary decisions of producers and consumers should result in a level of energy efficiency (and energy intensity) that is 'right' from the view of economic efficiency. Achieving efficient markets requires that any major market failures such as externalities and information gaps are addressed where that yields benefits in excess of the costs. It also requires the removal of distorting interventions in the market. With efficient markets, households, businesses and other organisations will face incentives to make cost-effective improvements in energy efficiency, and in doing so they will enhance economic efficiency. Policies for increasing energy efficiency can be expected to have costs in excess of their benefits if they raise energy efficiency beyond the level that secures an economically-efficient use of the community's resources.

In considering policy responses to market failures, inefficient policy interventions and, when applicable, broader social and environmental objectives, the principle of targeting the objective as directly as possible is fundamental. This principle was drawn on in discussing different policy objectives in section 2.1. In table 2.1 the principle of targeting directly is summarised having regard to the three types of policy problems distinguished in section 2.1 — market failure, inefficient interventions and broader social and environmental objectives. The perspective in the table is whole-of-energy policy, recognising that addressing it will have an influence, sometimes positive, sometimes negative, on energy efficiency.

Table 2.1 **Targeting energy policy objectives**

Class of policy problem	*Issue*	*Directly targeted intervention*
Market failure	Lack of available information on possibilities for saving energy.	Provision of missing information.
	Urban pollution from energy use in factories.	Tax on emission of pollutants; tradeable pollution permits.
	Risk of global climate change due to emissions of greenhouse gases.	Taxes on emissions (worldwide); global tradeable permits scheme.
Inefficient interventions	Absence of cost-reflective pricing in electricity, transport infrastructure.	Removal of institutional impediments to cost-reflective pricing.
	Subsidised electricity for some users.	Removal of subsidies.
Broader social and environmental objectives	Reduce energy use.	Tax energy consumption.
	Increase self-sufficiency in liquid fuels.	Tax on consumption of liquid fuels, and matching subsidy on their production; equivalently, a tariff on imports of liquid fuels.
	Increase energy produced from renewable sources.	Subsidise production of energy from renewable sources, or tax energy from non-renewable sources.

Measures that directly target the desired objective are likely to achieve it at the lowest resource cost, and with the least side-effects. Consider the objective of reducing sulphur dioxide pollution from factories. Direct measures include taxes on emissions of the pollutant and tradeable emission permits. Empirical studies support them as being more cost effective than indirect measures such as regulatory restrictions on the nature of fuel or equipment used (Soskow, Schmalensee and Bailey 1998).

Sometimes the direct targeting of policy objectives is prevented by absence of the required information. When that is so, resort may need to be had to indirect measures. However, because the costs of unwanted side effects are higher with indirect measures, it is less likely that they will yield benefits in excess of the costs.

An increase in energy efficiency beyond the economically-efficient level may be desired, not for its own sake, but because it is a suitable option for achieving another objective. For instance, if more direct and efficient approaches to reducing net greenhouse emissions (such as taxes on emissions or on energy use) were not politically acceptable, or if in the prevailing circumstances the more direct measures could only be applied at a level insufficient to achieve the desired reduction in emissions, there may be a role for policy measures that target energy efficiency. However, in going beyond the privately cost-effective level of energy efficiency, the value of the resulting improvement on the indirectly targeted objective would need to be balanced against the direct economic loss from a privately excessive investment in energy efficiency.

2.3 A checklist for good energy efficiency policy

Drawing on the preceding discussion and the principles for good regulation (box 2.4) some general policy principles emerge:

- *Have clear objectives that allow problems to be identified and addressed.* In this inquiry the overarching problem might be summarised as the perception that barriers and impediments are preventing individual producers and consumers from investing sufficiently in energy efficiency improvements that are cost effective for them. But as chapter 5 demonstrates, this needs to be broken down into its components — not all barriers and impediments warrant attention. The appropriate policy should promote the uptake of energy efficiency investments to the extent that there are net benefits from doing so.
- *Target policy problems as directly as possible.* This will allow the problems to be addressed most fully and at lowest cost, including costs of unwanted side effects.
- *Consider the costs and benefits of alternative policy solutions, including regulatory and non-regulatory alternatives.* This may be especially important if it is difficult to target the problem directly.
- *Have appropriate regard to environmental objectives.* Environmental outcomes are important and should be considered, but it is also necessary to recognise the costs of pursuing environmental objectives indirectly through energy efficiency measures when they are not privately cost effective. Where possible, the extra costs of achieving a given environmental improvement using the indirect measure compared with the direct one should be quantified.
- *Do not use energy efficiency policy for achieving other objectives.* It is appropriate to consider the impacts of energy efficiency policies on other social objectives, but the focus should be on the primary objective. Other objectives might be better achieved through alternative policy instruments, such as Community Service Obligations for addressing impacts on low-income households (IC 1997).

- *Consider the impacts on competition.* If there are such impacts, consider whether objectives can be met in other ways.
- *Establish sound processes for monitoring and reviewing measures intended to address barriers and impediments to cost-effective improvements in energy efficiency.*

Box 2.4 **Regulatory assessment: some general principles**

Objectives

What problem does the regulation seek to address?

Is the problem significant enough to warrant a regulatory response, having regard to the likely costs of intervention? In other words, are the benefits of the regulation to the community as a whole likely to exceed the costs?

General efficacy

Does the regulation target the problem effectively?

Does it have any unintended consequences and costs?

Is it consistent with related regulations?

Can it readily accommodate expected changes to the nature of the regulated activity?

Would changes to the design and implementation of the regulation improve its effectiveness?

Would alternative regulatory approaches provide a superior outcome for the community?

Administrative efficiency and accountability

Are administrative processes timely and transparent?

Are there appropriate and effective monitoring and review provisions?

Are regulators accountable for their decisions?

Is there appropriate separation of policy making and regulatory functions?

Could changes be made to reduce administrative and compliance costs without undermining the regulation's effectiveness?

Source: PC (2001).

3 Energy supply and use in Australia

Key points

- Total primary energy consumption in Australia is dominated by fossil fuels — crude oil, black coal, natural gas and brown coal.
- While some primary fuels can be used directly by end users, many need to be converted to a form which is more convenient for the end user, like electricity or petroleum. Conversion processes consume significant amounts of energy.
- The electricity generation sector is the largest consumer of primary energy in Australia. Around 70 per cent of the primary energy consumed to supply electricity to end users is lost in conversion, transmission and distribution. This represents 30 per cent of total primary energy used.
- Energy is generally a small item of expenditure in the final energy using sectors. It constitutes around 3 per cent of total expenditure in the Australian economy. The share of energy costs varies between 1.6 per cent in the commercial sector and 6.8 per cent in the industrial sector.
- Energy consumption has grown significantly over the last 30 years, because of growth in output. At the same time, primary energy consumption per unit of output has fallen by 18 per cent between 1973-74 and 2000-01.
- Compared to other OECD countries, Australia has a relatively high level of energy consumption per unit of output. However, such comparisons can be misleading because of significant differences between economies, such as the size of energy-intensive industries and price effects.
- Over the last 10 years, Australian electricity prices fell by around 15 per cent in real terms. Real prices for petroleum increased in all states by 9–14 per cent between 1997 and 2004. Real gas prices fell by 1 per cent between 1990 and 1997.
- Energy consumption contributes to greenhouse gas emissions. Around 48 per cent of Australia's greenhouse gas emissions have been attributed to stationary energy users (70 per cent of these are attributable to electricity generation). Around 14 per cent of emissions have been attributed to the transport sector.

Energy is an important input into all the goods and services we consume and underpins many aspects of our high standard of living. Most household activities, such as heating, cooling, cooking, lighting and transport, require energy in some form. Firms also use energy in virtually all of their activities, like processing and manufacturing materials, transporting goods, heating and cooling premises, providing telecommunication services or powering computers.

Over time, the amount of energy used in Australia, the types of energy used and use by individual sectors have changed. This chapter examines these changes, within Australia and in comparison with other countries. It also examines changes in greenhouse gas emissions, many of which are the result of changes in energy consumption.

3.1 Energy availability and use in Australia

Descriptions of the energy system usually refer to energy being consumed. However, in physical terms, energy cannot be 'consumed' — rather, it is converted from one form (such as the chemical energy contained in fossil fuels) to other forms. Ultimately, most energy used by final consumers is dissipated as low-grade heat (Saddler, Diesendorf and Denniss 2004). A summary of the energy system drawn from a study by Energy Strategies for the Clean Energy Future Group is presented in box 3.1.

Box 3.1 **Summary of the energy system**

Primary conversion

The energy system starts with the extraction or harvesting of what are termed primary fuels. These include fossil fuels such as coal, crude oil and natural gas, which are extracted from the earth, and renewable energy sources such as wind, hydro, biomass and solar-thermal energy, which are harvested from the atmosphere, from rivers, from the sea or directly from solar radiation.

Some sources of energy can be used directly by final consumers (for example, burning firewood or coal), but many sources of energy undergo conversion or transformation to end-use fuels, which are more convenient or efficient for final consumers to use. The most important energy conversion processes are thermal electricity generation and oil refining. Each of these processes uses considerable amounts of energy. In addition, some energy is used or lost in the process of delivering energy to final customers.

(Continued next page)

Box 3.1 (continued)

Consumption

The final stage is final consumption by end users of energy (that is, the use of energy for all activities other than the production of energy in another form). As a result of losses in primary conversion and distribution, the total quantity of energy available for use by final consumers is often significantly less than the quantity of primary energy supplied to the economy.

Renewable energy sources

Electricity obtained from renewable sources, such as hydro and wind, is treated as a form of primary energy, which is supplied directly to final consumers with no intermediate conversion step. Therefore, there are no conversion losses, although there are losses in transmission and distribution.

Source: Saddler, Diesendorf and Denniss (2004).

At the primary conversion stage, primary sources of energy (for example, oil, gas and coal) are converted into useable forms of energy (for example, petrol and electricity). The conversion sector comprises mainly electricity generation, electricity and gas transport and distribution, and oil refining and distribution.

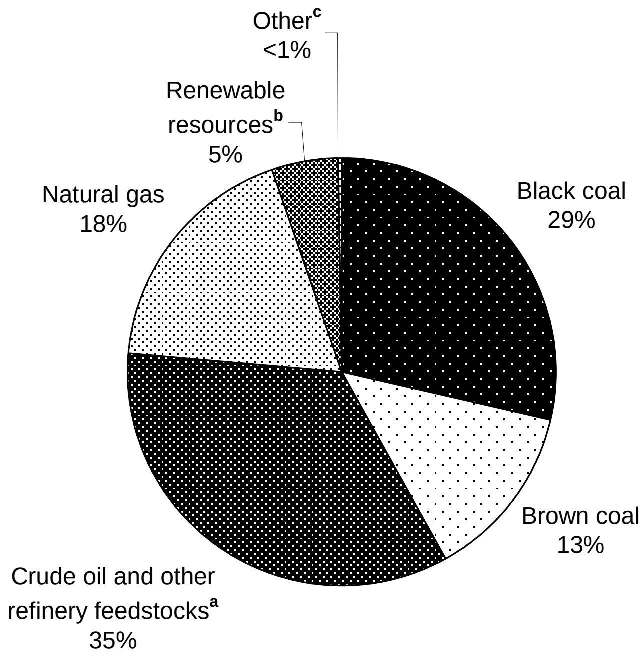
This section examines Australia's energy supply and use in terms of:

- total primary energy consumption (also known as total domestic availability), which comprises domestic production less net exports;
- electricity generation; and
- total final consumption, which comprises total primary energy consumption less energy lost in conversion and distribution.

Primary energy consumption

Total primary energy consumption in Australia is dominated by fossil fuels. For example, crude oil and other refinery feedstocks accounted for 34.8 per cent (or 1747.8 petajoules) of the 5054.7 petajoules of primary energy consumption in 2001-02. This was followed by black coal (comprising 28.9 per cent or 1462.7 petajoules) and natural gas (comprising 18.6 per cent or 941.1 petajoules). Renewables accounted for only small proportions of the total, ranging from 1.8 per cent for wood to 0.1 per cent for solar energy (figure 3.1).

Figure 3.1 Primary energy consumption, by fuel type, 2001-02



[a] Includes petroleum products and liquid petroleum gas. [b] Comprises wood, bagasse, hydro electricity, solar energy and biofuels. [c] Comprises coke, coal byproducts and town gas.

Data source: ABARE (2004).

Total primary energy consumption grew at an average annual rate of 2.4 per cent between 1973-74 and 2001-02[1], almost doubling from 2615.2 petajoules to 5054.7 petajoules.

While black coal made the largest contribution to the absolute change in total primary energy consumption (accounting for 32.8 per cent of the increase), it is notable that natural gas made the second largest contribution at 32.1 per cent of the increase. Consumption of natural gas grew at 6.5 per cent per annum over the period, increasing its share of the total from 6.6 per cent in 1973-74 to 18.6 per cent in 2001-02. Crude oil and brown coal also made significant contributions to the growth in primary consumption over the period (16.6 per cent and 16.7 per cent respectively).

[1] There was a break in the series between 2000-01 and 2001-02. The data indicate that total primary energy consumption grew by 1 per cent over that year. However, this may reflect changes in how data are collected, as well as changes in consumption levels.

Solar energy recorded the strongest annual average growth between 1973-74 and 2001-02 (14.5 per cent per annum on average), but from a very low base. As a consequence, it still comprised only 0.1 per cent of primary energy consumption in 2000-01.

ABARE forecasts suggest that Australia will remain reliant on fossil fuels in the near to mid-term future. Total primary energy consumption is projected to grow by 2.2 per cent each year between 2001-02 and 2019-20 (Akmal et al. 2004). The greatest contribution to this growth is expected to come from natural gas, accounting for 35.6 per cent of the total change. This is followed by oil (30.8 per cent) and black coal (22.6 per cent). The main uses in 2019-20 are expected to be oil (2515 petajoules), black coal (2027 petajoules), and natural gas (1828 petajoules).

Renewable energy resources, such as wind energy and biogas, are projected to record the strongest growth over the period (16.1 per cent and 7.5 per cent each year respectively), but from very low bases. These sources are still expected to account for only very small proportions of total primary energy consumption in 2019-20 (0.2 per cent and 0.4 per cent respectively). Solar energy is projected to grow by 2.6 per cent per year and is still expected to account for only 0.1 per cent of total primary energy consumption in 2019-20.

Electricity generation and transmission

The electricity generation and transmission sector is the largest consumer of primary energy in Australia and makes a larger contribution to greenhouse gas emissions than any other sector.

Fuel sources

Approximately 83 per cent of the energy consumed in producing Australia's electricity is sourced from coal. The overall share of coal in electricity generation has remained relatively constant in the period 1973-74 to 2001-02, although the relative contributions of brown and black coal have changed. The share of black coal has grown from 49 to 53 per cent, while the share of brown coal has fallen from 33 to 29 per cent. Another important development in that period was the growth of the relative importance of natural gas for electricity generation — from 5 per cent in 1973-74 to 11 per cent in 2001-02. The widespread use of coal in Australia reflects the low variable cost associated with coal-fired generators and the proximity of large recoverable coal reserves to electricity consumers (Allen

Consulting Group and McLennan Magasanik Associates 1999). By contrast, gas-fired generators tend to have low capital costs but high fuel costs.

ABARE analysts (Akmal et al. 2004) predicted that Australia's preference for coal-fired generation will continue in the period between 2001-02 and 2019-20. However, natural gas-fired generation is expected to record strong growth, more than doubling its total output over the forecast period (table 3.1).

Table 3.1 **Public electricity generation by fuel**

	Generation			*Annual growth*	
	2001-02	*2008-09*	*2019-20*	*2001-02 to 2008-09*	*2001-02 to 2019-20*
	TWh[a]	TWh[a]	TWh[a]	%	%
Black coal	125.7	142.4	185.3	1.8	2.2
Brown coal	48.3	52.4	59.4	1.2	1.2
Oil	2.3	2.3	2.4	0.3	0.3
Natural gas	30.5	46.5	69.3	6.2	4.7
Renewables	17.2	25.3	27.5	5.7	2.6
hydro	15.9	17.3	17.8	1.3	0.6
biomass	0.7	4.1	4.1	28.1	10.1
biogas	0.3	1.5	1.5	24.1	8.8
wind	0.3	2.4	4.1	35.3	15.9
Total	**224.1**	**269.0**	**343.9**	**2.6**	**2.4**

[a] 1terawatt hour = 10^{12} watt hours = 3.6 petajoules.

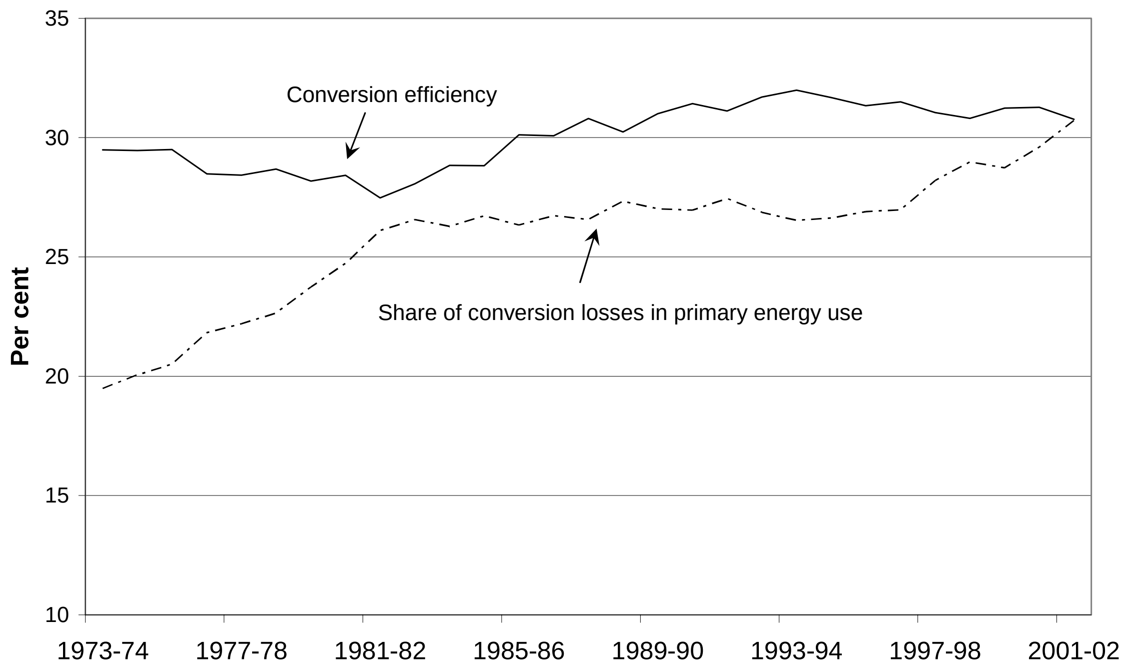
Source: Akmal et al. (2004).

Conversion losses

The conversion sector includes losses from the transport and distribution of natural gas and from refining and distribution of oil, as well as losses from electricity generation. However, electricity generation is by far the largest source of conversion losses, with most of the primary energy used to generate electricity being lost during the conversion process. Conversion losses from electricity generation represent a significant (and growing) proportion of energy use in Australia (figure 3.2).

Conversion efficiency (defined here as the ratio of electricity supplied to energy used in generation) is determined to a large extent by the fuel used in generation. The thermal efficiency of coal-fired generation is low compared to other fuel sources. As a consequence, only about 30 per cent of energy used in generation reaches the end users in the form of electricity. Conversion efficiency of electricity generation has experienced a modest improvement in the period 1973-74 to 2001-02 (figure 3.2). A possible explanation for this improvement is the shift in the generation fuel mix away from (the less efficient) brown coal towards (the more efficient) black coal and natural gas.

Figure 3.2 **Conversion efficiency and conversion losses in electricity generation as a share of total primary energy consumption, 1973-74 to 2001-02**



Data source: ABARE (2004).

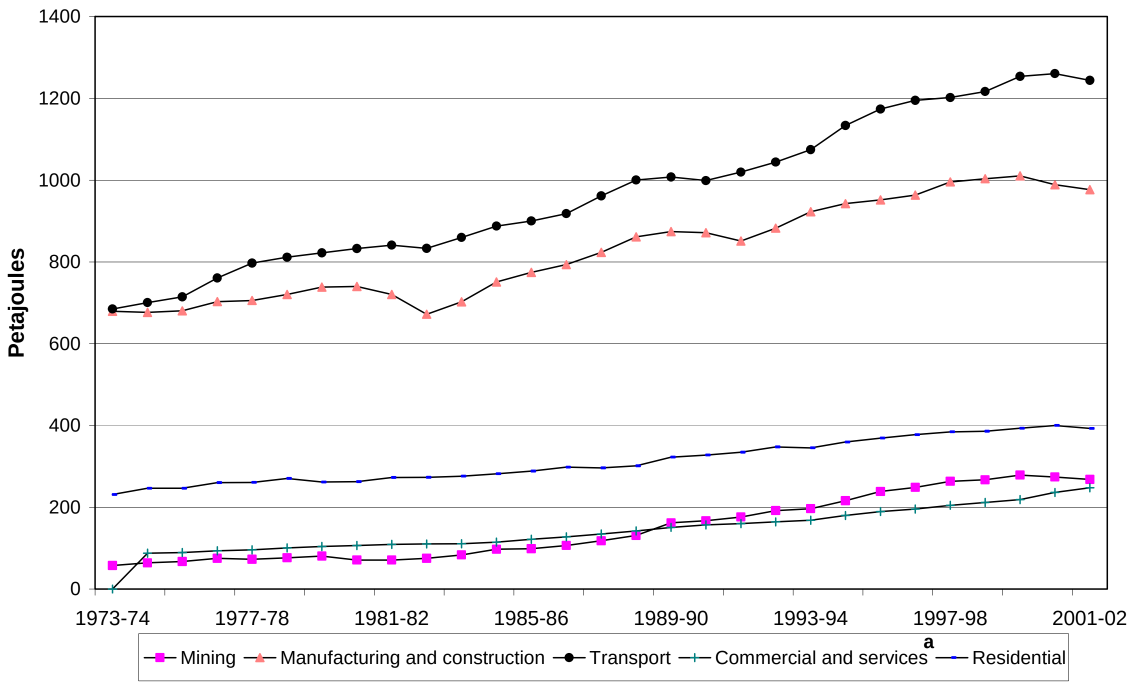
Two implications can be drawn from figure 3.2. Firstly, conversion losses are a major (and growing) contributor to Australia's energy resource consumption. Secondly, to the extent that some sectors are more reliant on electricity than others, their share of final energy use would understate the sectors' actual demand for energy resources. A more accurate picture of the relative energy consumption of each sector can be obtained by apportioning to the sectors the energy used to generate their electricity.

Final energy consumption

Total final energy consumption is the amount of energy consumed by end users. It is calculated as total primary energy consumption less energy used or lost in conversion, transmission and distribution (Akmal et al. 2004).

Final energy consumption in Australia grew from 1852 petajoules in 1973-74 to 3308 petajoules in 2001-02, with all final energy-using sectors increasing their energy consumption (figure 3.3). The greatest contribution to the overall change came from the transport sector, which accounted for 38.6 per cent of the absolute change. The manufacturing (20.8 per cent), mining (14.5 per cent) and residential sectors (11.3 per cent) also made significant contributions to the change.

Figure 3.3 **Final energy consumption, by sector**



a Includes ANZSIC Divisions F, G, H, J, K, L, M, N, O, P, Q and the water, sewerage and drainage industries.
Data source: ABARE (2004).

Projections developed by ABARE (Akmal et al. 2004) show that total final energy consumption is expected to continue to grow at roughly the same rate over time. Growth is projected to average 2.3 per cent each year between 2001-02 and 2019-20, taking total final energy consumption to 4714 petajoules in 2019-20.

The transport sector is forecast to continue to dominate final energy consumption, accounting for 38.9 per cent of the total in 2019-20. Not surprisingly, this sector is also expected to make the greatest contribution to the absolute change in final energy consumption between 2001-02 and 2019-20, accounting for 35.4 per cent of the absolute change.

This is followed by contributions from the manufacturing and construction (27.3 per cent), mining (14.8 per cent), commercial and services (10.5 per cent) and residential (9.8 per cent) sectors.

Final energy consumption by sector and fuel source

The importance of particular fuel sources varies across different industry sectors (table 3.2).

Table 3.2 **Consumption by sector and fuel source, 2001-02**

	Mining	*Manufacturing and construction*	*Commercial*	*Residential*	*Transport*
	Petajoules	Petajoules	Petajoules	Petajoules	Petajoules
Black coal	7	119	<1	<1	4
Petroleum products	77	137	20	15	1237
Natural gas	19	322	43	125	25
Biomass	<1	81	<1	66	<1
Electricity	57	261	174	185	7
Total consumption	**161**	**919**	**238**	**393**	**1272**

Source: Akmal et al. (2004).

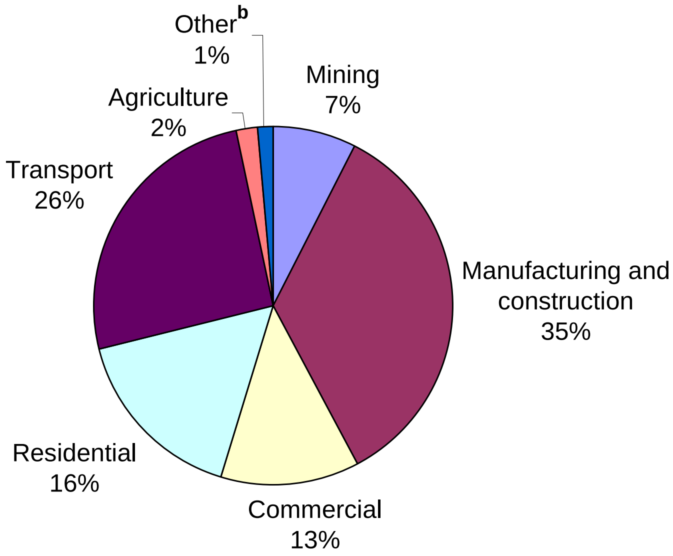
Unsurprisingly, petroleum products are a dominant source of energy in the transport sector. Petroleum is also a major fuel source in the mining sector. The manufacturing and construction sector is a significant user of a range of fuels, but natural gas consumption is the largest contributor to final energy consumption.

Of particular interest is the relative importance of electricity across the sectors. Electricity is a major energy source in the residential and commercial sectors because most of the energy consumed in those sectors is building and appliance-related. Electricity is also used extensively in the manufacturing and mining sectors. On the other hand, the transport sector is a very small consumer of electricity.

Attributing primary energy resources to sectors

In view of the large conversion losses in electricity generation, a better idea of the relative magnitudes of sectoral energy consumption can be obtained by apportioning the resources required to generate electricity to the different sectors. A rough estimate can be made by calculating each sector's share of total electricity use and applying these shares to the total primary energy used in electricity generation. Figure 3.4 shows the shares of primary energy resources attributable to each sector. When resources used in electricity generation are apportioned, the share in energy resource demand of electricity-intensive sectors, like the residential and commercial sectors, increases significantly. The manufacturing and construction sector also overtakes the transport sector as the largest consumer of energy resources on the basis of its large electricity usage.

Figure 3.4 **Primary energy resources attributable to sectors, 2001-02**[a]



a Resource consumption is apportioned on the assumption of uniform electricity conversion losses across sectors. **b** Includes consumption of lubricants and greases, bitumen and solvents.

Data source: PC estimates using data from Akmal et al. (2004).

Importance of energy costs in different sectors

Energy is generally a small item of expenditure in all of the final energy-using sectors of the Australian economy (table 3.3).

Table 3.3 **Share of energy costs in total expenditure, 1998-99**

Sector	*Share of energy costs in total expenditure*
	Per cent
Residential	2.5
Industrial	6.8
Commercial	1.6
Transport	4.5
Total for Australia	**3.1**

Source: PC estimates from ABS (2004).

The Productivity Commission estimates that in 1998-99 (which is the most recent year for which data are available) energy accounted for around 3 per cent of total expenditure in Australia.

The importance of energy varies across different sectors, with the industrial sector being the most energy intensive and the commercial sector being the least energy intensive sector.

Broad sector-wide averages hide the variability of energy costs that would be evident if comparing different sub-sectors or different producers and consumers within those sub-sectors. For some businesses or individuals, energy costs represent a significantly greater proportion of expenditure than their sector average. For example, the Australian Aluminium Council (sub. 29, p. 4) submitted that energy accounted for 23 per cent of the costs in alumina production and 22 per cent of aluminium smelting costs. Conversely, there will be many businesses and individuals for whom energy expenditure would constitute a lower share of total costs than the sector average.

3.2 Energy intensity

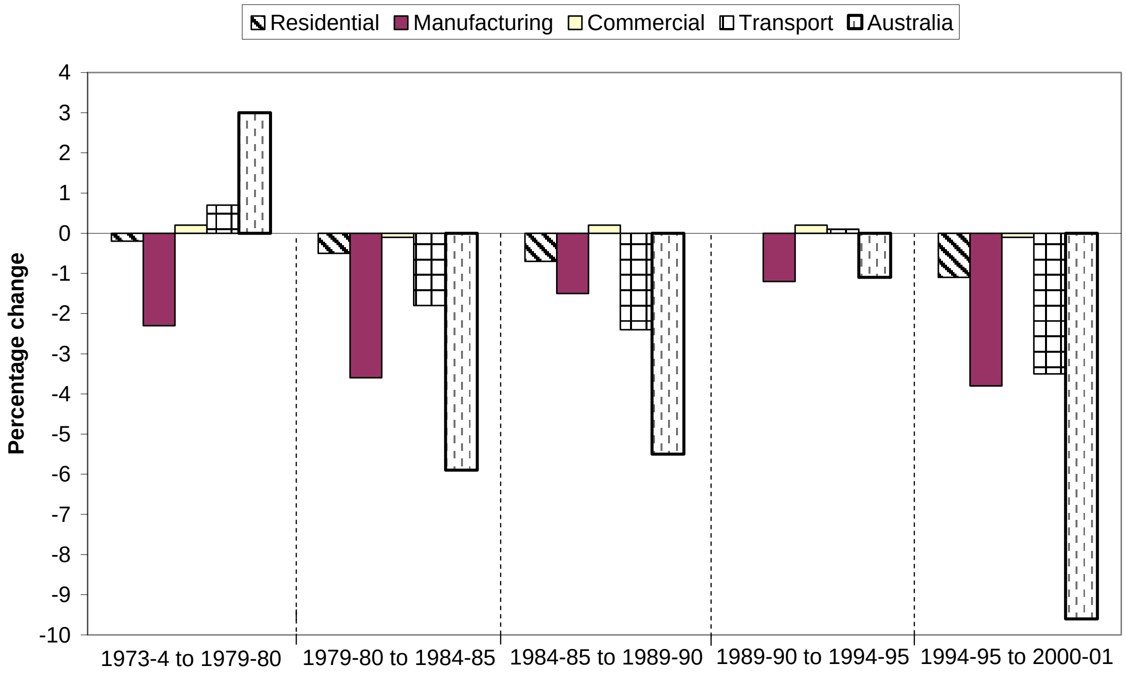
The energy efficiency of a specific process or piece of equipment is relatively simple to measure, by comparing its output of useful services to the energy input. It is much more difficult to measure energy efficiency at aggregate levels, such as for industry sectors, geographic regions or nations, because of the heterogeneity of circumstances and outputs. Energy intensity is one measure that allows analysis of aggregate consumption trends.

Aggregate energy intensity

Aggregate energy intensities are calculated for sectors of the economy and the economy as a whole. For example, residential sector energy intensity can be calculated as energy consumption per household or per square metre, or as energy expenditure per dollar of total household expenditure. Manufacturing and commercial sector intensity can be calculated as energy consumption per unit of output. Economywide energy intensity is defined as energy consumption per unit of GDP (gross domestic product).

ABARE researchers conducted an analysis of trends in Australia's energy intensity between 1973-74 and 2000-01 (Tedesco and Thorpe 2003). They estimated that aggregate energy intensity fell in most sectors and in the Australian economy as a whole (figure 3.5).

Figure 3.5 **Changes in aggregate energy intensity, 1973-74 to 2000-01**



Data source: Tedesco and Thorpe (2003).

Overall, in the period 1973-74 to 2000-01, economywide aggregate energy intensity fell by 18.2 per cent or an average of 0.6 per cent per year.

According to Akmal et al. (2004), aggregate energy intensity is forecast to decline by a further 1.1 per cent a year until 2019-20, suggesting that 18 per cent less energy will be needed to produce a dollar of economic output (measured in 2001-02 dollars) in 2019-20.

Factorising energy intensity

Trends in energy intensity can be decomposed into the factors that underlie changes in energy use. ABARE attempted to 'factorise' changes in energy consumption for the period 1973-74 to 2000-01 into three broad categories of effects (Tedesco and Thorpe 2003):

- Production effect — this shows how changes in the level of total output affect energy consumption.
- Structural mix effect — this is the first component of aggregate intensity which reflects the effect on energy consumption of changes in the mix of industries (such as a contraction in energy-intensive industries relative to other industries).

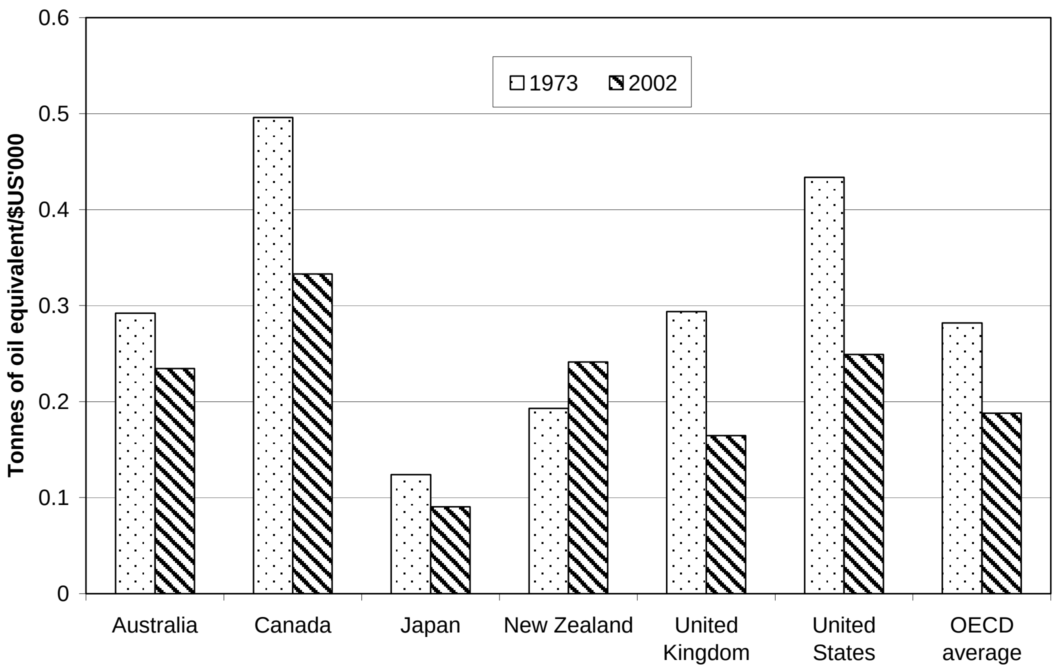
- Real energy intensity effect — this is the second component of aggregate intensity. The real intensity effect reflects the effect of changes in the mix of fuels, and the technical effect which accounts for all remaining changes (such as changes in industrial processes and input mix).

Tedesco and Thorpe (2003) found that, if aggregate energy intensity remained constant, increased production would have raised total energy consumption by 136 per cent from 1973-74 to 2000-01. However, the fall in economywide aggregate energy intensity meant that final energy consumption only grew by 93 per cent. Most of the change in energy intensity (around 69 per cent) was attributed to structural shifts away from energy-intensive sectors of the economy. Fuel-mix effects accounted for the remainder of the reduction in energy intensity.

International comparisons of energy intensity

According to the IEA (2004a), Australia's energy intensity (measured in terms of primary energy supply per dollar of gross domestic product) is higher than the OECD average (figure 3.6).

Figure 3.6 **Total primary energy supply per dollar of gross domestic product[a]**



[a] Gross domestic product is expressed in 1995 US dollars.

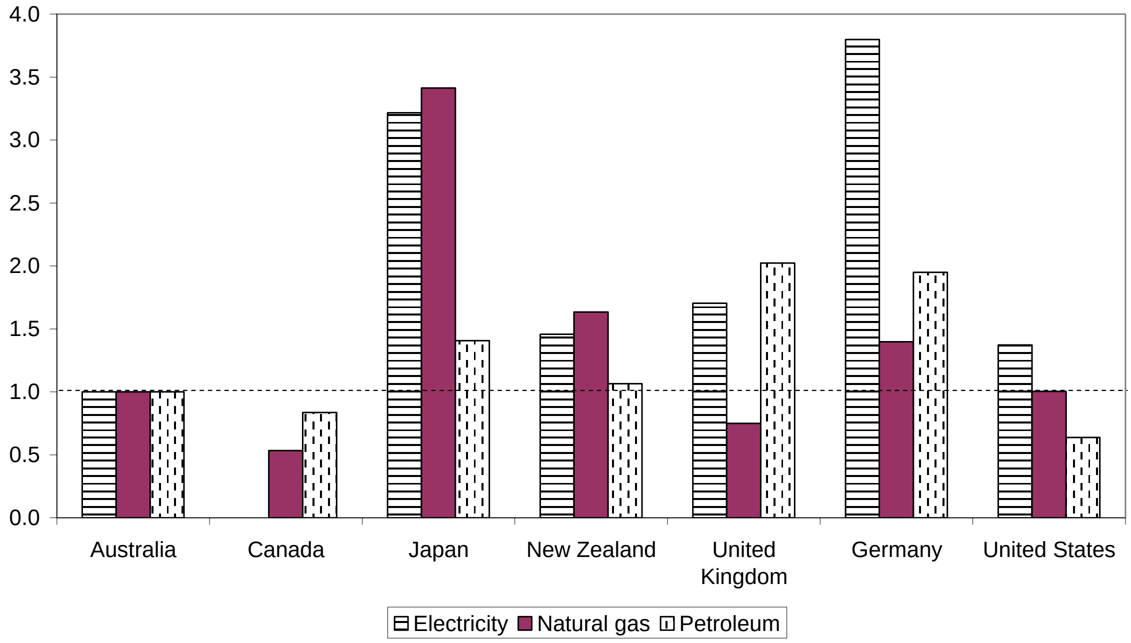
Data source: IEA (2004a).

Further, in the period 1973–2002, Australia's energy intensity reduction has been smaller than in most of the OECD countries.

Chapter 1 outlined why energy intensity does not necessarily reflect energy or economic efficiency. The ABS (2001) argued that Australia's high energy intensity reflects its economic structure and the fact that Australia has relatively more energy-intensive industries (such as the aluminium industry) than the OECD average. The ABS also attributed Australia's relatively high energy intensity to the significant role coal plays as a fuel source in these industries, and particularly for power generation (and coal's relatively poor thermal efficiency).

Australia's relatively high level of energy intensity can also be explained in part by the fact that its energy prices are lower than in most other countries (figure 3.7).

Figure 3.7 **Index of international energy prices for industry**[a]



a Electricity and petroleum prices are for first quarter 2004. Natural gas prices are for 1997. Electricity prices for Australia and the United States exclude taxes. Data on Canadian electricity prices were not available.

Data sources: IEA (2003; 2004b).

Australian electricity prices are among the lowest in the OECD. Similarly, Australian petrol prices are fourth lowest in the OECD (IEA 2004b). While natural gas prices are relatively higher, they are still relatively low by OECD standards.

In view of the above discussion, conclusions about Australia's energy efficiency performance based solely on comparisons of its energy intensity to the rest of the world are likely to be inaccurate and highly misleading.

Ultimately, Australia's energy efficiency performance would have to be assessed in the context of the barriers and failures hindering the operation of Australian markets, rather than through inappropriate comparisons with the performance of other countries.

3.3 Energy prices

As mentioned in the previous section, Australia's energy prices are low by world standards. This section analyses the changes in Australia's energy prices over the last 10 years.

Electricity prices

The average electricity retail price in Australia was estimated to be 9.77 cents/KWh in 2003-04. The price for residential customers was 13.38 cents/KWh, while the price for non-residential customers was 8.23 cents/KWh. Electricity prices vary between states (box 3.2).

Box 3.2 **How average retail electricity prices are estimated**

Retail electricity prices (that is, what customers pay for their electricity) comprise wholesale electricity prices, network service charges, market (pool) fees and the retailers' fees.

Over 87 per cent of electricity users in Australia receive their electricity from the national electricity market (NEM), which operates in New South Wales, Victoria, Queensland, South Australia and the ACT. Wholesale prices are set via a competitive bidding process. The Energy Supply Association of Australia (ESAA) estimates retail prices for customers in NEM jurisdictions based on these wholesale prices.

Retail electricity prices in Western Australia, Tasmania and the Northern Territory are set within ranges regulated by the relevant State or Territory government.

The ESAA estimated that network service charges (transmission use of system and distribution use of system) can be between 30 per cent and more than 50 per cent of the end price to customers. They can be a significant factor in explaining differences in retail prices between and within states and territories.

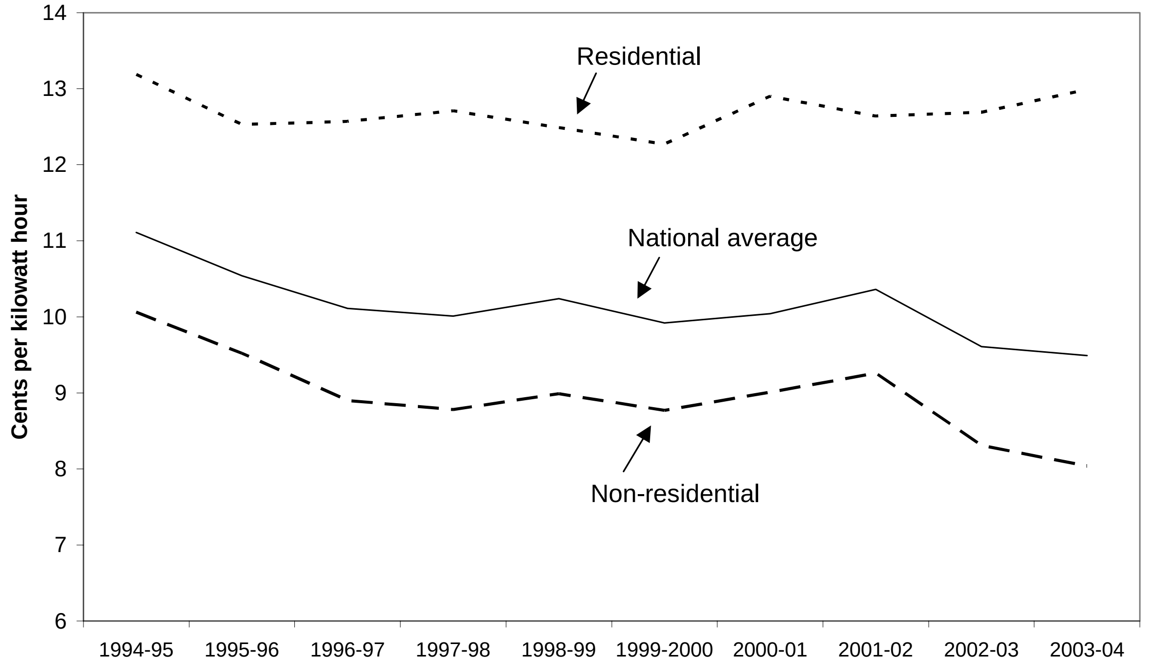
Source: ESAA (2004).

Average retail electricity prices in Australia fell by 14.6 per cent (in real terms) between 1994-95 and 2003-04, an average fall of 1.7 per cent each year (figure 3.8). The fall was greatest in Queensland, where average retail prices fell by 23.1 per cent overall (or 2.9 per cent each year). By contrast, average retail prices rose in South Australia, up 20.8 per cent since 1994-95 (average growth of 2.1 per cent each year).

Overall, residential retail prices fell by 1.5 per cent over the period. However, falls were recorded in only four jurisdictions (New South Wales, Queensland, Western Australia and the Northern Territory). Residential retail prices rose in the remaining jurisdictions (that is, Victoria, South Australia, Tasmania and the ACT).

Non-residential retail prices fell by 20.1 per cent. At the state/territory level, falls were recorded in all jurisdictions except South Australia, where prices rose by 11.1 per cent (or 1.2 per cent each year) over the period.

Figure 3.8 **Average retail electricity prices, Australia (2002-03 prices)**



Data source: ESAA (2004).

Petroleum prices

Petroleum products are traded internationally and around 13 per cent of petroleum consumed in Australia is imported (Caltex 2005). Therefore, Australian retail prices for petroleum are determined to a large extent by international and macroeconomic factors. Caltex (2005) identified the following major determinants of retail petrol prices in Australia:

- price of petrol from Singapore refineries (these being the major source of Australia's imported petroleum) in $US;
- exchange rate;
- taxation regime; and
- profit margins in Australia for storage, distribution, wholesaling and retailing.

Caltex (2005) data shows that average city retail prices at Ampol and Caltex stations grew in all states between December 1997 and December 2004. In real terms, prices increased by 9 per cent in Victoria and Western Australia; 10 per cent in Tasmania and the ACT; 12 per cent in New South Wales; and 14 per cent in Queensland and South Australia. Caltex attributes this increase in prices to the increase in international crude oil prices. In addition, Singapore refinery prices have been increasing due to the reduction of excess refinery capacity.

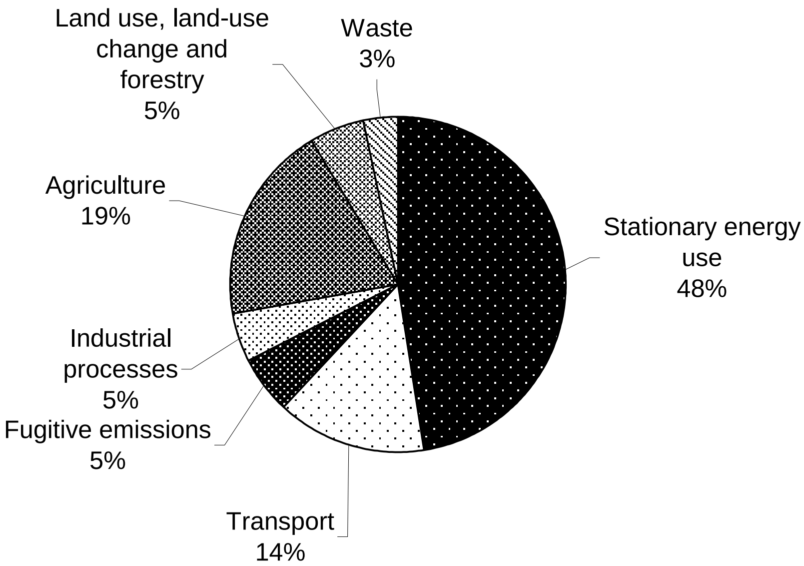
Gas prices

Data on gas prices are quite sparse. From 1990-91 to 1997-98 (the latest year for which data are available), average real gas prices for households and firms combined fell by around 1 per cent (PC 2004a). During that period, gas prices for households rose by 3 per cent, while gas prices for firms fell by 3 per cent. PC (2004a) also noted that gas prices may have fallen further since then.

3.4 Greenhouse gas emissions

Greenhouse gases include carbon dioxide, methane, nitrous oxide and chlorofluorocarbons. The production and use of energy is a large source of greenhouse gas emissions. For example, stationary energy use (comprising electricity generation, and non-transport fuel combustion in the industrial, commercial and residential sectors) accounted for almost half (47.6 per cent) of the 550 megatonnes of carbon dioxide equivalent gases emitted by Australia in 2002 (figure 3.9). Other large contributors were the agriculture and transport sectors (respectively accounting for 19 and 14 per cent of the total).

Figure 3.9 Greenhouse gas emissions by source, 2002[a]



[a] Calculated in terms of carbon dioxide equivalents.

Data source: AGO (2004l).

Among stationary energy users, electricity generation made the largest contribution, accounting for almost 70 per cent of stationary energy emissions in 2002. Within the transport sector, road transport accounted for almost 90 per cent of carbon dioxide equivalent emissions from that sector in 2002.

Overall, Australia's greenhouse gas emissions rose by 1.3 per cent between 1990 and 2002, growing on average by 0.1 per cent each year. However, significant but largely one-off falls in emissions from land use, land-use change and forestry have partially offset large increases in emissions from the stationary energy and transport sectors (which grew by 34.0 per cent and 27.8 per cent respectively).

The Australian Greenhouse Office (AGO 2004n) estimated that greenhouse gas emissions during 2008–12 will on average be 8.1 per cent above 1990 levels (accounting for emission reduction programs). The largest contribution to the rise in emissions is predicted to come from stationary energy users. Emissions from stationary energy users (approximately 70 per cent of which will originate from electricity generation) are forecast to increase by 46.2 per cent over the period. Transport emissions (over half of which are from cars) are also expected to make a significant contribution to the rise in emissions, growing by 42.6 per cent between 1990 and 2008–12. In the longer term, AGO (2004n) forecasted that greenhouse gas emissions will increase by 22.7 per cent between 1990 and 2020. Again, strong growth in emissions is expected to come from stationary energy users, while emissions growth in the transport sector is expected to be slower.

4 Institutional background

Key points

- Developments in the framework for implementing energy efficiency policy have focussed on achieving greater national uniformity to both reduce compliance costs and improve outcomes. Nonetheless, most jurisdictions have their own policy frameworks which at times create interjurisdictional inconsistencies.
- Many of the institutional arrangements for developing and implementing energy efficiency policy have emanated from, or have close links to, federal and state greenhouse gas response strategies.
- Significant institutional reforms have been made to improve the operational efficiency of energy markets, and further reforms are being developed. Reform objectives include reducing regulatory costs, increasing certainty for participants and improving price signals to intermediate and final energy purchasers.

Governments have established a number of mechanisms for developing and implementing energy policy and, in particular, energy efficiency policy. Reflecting their genesis in greenhouse abatement policies, the state and national administrative arrangements for energy efficiency policy have generally been part of the broader greenhouse agenda. Some of the key components of this institutional framework are summarised here together with an outline of the arrangements for regulating key energy markets.

4.1 Institutional arrangements for increasing energy efficiency

This section provides some background to the development of greenhouse gas abatement policies which were an important part of governments' interest in energy efficiency. The main institutional arrangements in place for the development, implementation and national coordination of energy efficiency policies in Australia are then summarised.

The Kyoto Protocol

Control of greenhouse gases is by necessity an international rather than a state or national issue — efficient and equitable outcomes can only be achieved via international agreement. For this reason an international treaty — the United Nations Framework Convention on Climate Change — was established in 1992.[1] The Convention provides a framework for intergovernmental efforts to address climate change and to deal with its impacts.

In order to develop stronger commitments to address climate change, the Kyoto Protocol to the Convention was negotiated and was adopted in 1997. Eighty four countries signed the Protocol.[2] It established individual country targets for industrialised countries to limit or reduce their greenhouse gas emissions — in total summing across all of them to a minimum 5 per cent reduction between 1990 and 2008–12. Australia agreed to a target under the Kyoto Protocol of limiting the growth in greenhouse gas emissions to 8 per cent above 1990 levels over the period 2008–12. A number of developing countries are also Parties to the Protocol but do not have emissions targets.

The Protocol came into force in February 2005. This followed its ratification by industrialised countries that, between them, had 1990 greenhouse emissions represented at least 55 per cent of industrialised country emissions. It is binding on those countries that have ratified it. Australia has signed but not ratified the Protocol, but is committed to achieving its Kyoto emissions target (Campbell 2004).

The national greenhouse strategy

In 1998, the Australian, State and Territory Governments agreed on a National Greenhouse Strategy (NGS) to meet Australia's international commitments on greenhouse gas emissions (AGO 1998). The NGS outlined over 80 measures to be pursued by governments. The NGS built on the 1992 National Greenhouse Response Strategy (which it superseded and which had aimed to address all sources and sinks of greenhouse gases across the whole economy), the Australian Government's *Greenhouse 21C* package of further measures introduced in 1995 and its 1997 *Safeguarding the Future* initiative. Further, Australian Government greenhouse policies were announced in the *Measures for a Better Environment*

1 The Convention came into force in 1994 after the required 50 countries had ratified it. There are now over 180 parties to the Convention, including Australia.

2 Signing the Protocol (which Australia has done) meant agreeing to continue with the treaty making process but did not bind signatories to the conditions of the Protocol.

package in 1999 and the *Climate Change Strategy* detailed in the 2004-05 Budget and the Energy White Paper.

The NGS provides:

> … a broad menu of actions some of which will be implemented by governments acting individually, some by joint intergovernmental initiatives and some through partnerships between government, various stakeholders and the community. (AGO 1998, p. viii)

Several components of the NGS involve improving energy efficiency in the government, industrial, power generation, commercial, residential and transport sectors. In this regard, the NGS focuses on:

> … cost-effective ways to reduce net greenhouse gas emissions in particular through 'no regrets' actions. The actions will deliver substantial non-greenhouse benefits to Australia. (AGO 1998, p. ix)

Implementation of the NGS was initially overseen by an Implementation Planning Group of senior officials from the Australian, State and Territory Governments and a representative of local government. It is progressed through a range of other bodies including Ministerial Councils (such as the Ministerial Council on Energy, formed in 2001, and the Australian Transport Council) which coordinate joint national action and various government committees and working groups which further develop and implement the diverse range of measures contained in the NGS framework. In addition, jurisdictions continue to take independent action on greenhouse and energy efficiency issues and some have their own strategies on greenhouse abatement. The AGO noted:

> Reflecting Australia's regional diversity, the NGS contains measures that different governments are pursuing through different policy approaches. (AGO 2000, p. vii)

A progress report on the early stages of the implementation of the NGS was produced in 2000 (AGO 2000). It noted that Australia's Kyoto greenhouse emissions target appeared achievable as long as there was ongoing significant effort to control emissions. However, strong economic growth had made the task more difficult. All jurisdictions had prepared NGS implementation plans that indicated the abatement measures that they would undertake, and considerable progress had been made in establishing the majority of measures in the NGS. However, the longer-term nature of most of the abatement measures meant that many had not been fully implemented and hence had only had a limited impact at such an early stage of the NGS.

Ministerial Council on Energy

In 2001, the Council of Australian Governments (COAG) established the Ministerial Council on Energy (MCE) to provide 'effective policy leadership to meet the opportunities and challenges facing the energy sector and to oversee the continued development of national energy policy' (DITR 2004d). The MCE is responsible for broad-ranging energy policy including: energy security; energy market reform; and energy efficiency. In doing so it considers both economic and environmental issues.

The Council comprises Ministers with responsibility for energy from the Australian Government and all States and Territories. The Australian Government Minister for Industry, Tourism and Resources chairs the Council and the department provides Secretariat support. The New Zealand Energy Minister has full member status when Trans-Tasman Mutual Recognition Agreement issues are considered; otherwise the New Zealand and Papua New Guinea Energy Ministers have observer status.

Energy Efficiency Working Group

Energy efficiency policies and programs, particularly those involving coordinated action between the jurisdictions, is one of the MCE's responsibilities. The Energy Efficiency Working Group (EEWG) was established under the auspices of the MCE and advises it on the performance of end-use energy efficiency policies and programs.[3] Its major responsibility is to implement the National Framework for Energy Efficiency (NFEE). It has developed the administrative guidelines for appliance labelling and performance (which are administered by NAEEEC).

National Appliance and Equipment Energy Efficiency Committee

The National Appliance and Equipment Energy Efficiency Committee (NAEEEC) is responsible for managing Australian end-use energy efficiency programs (NAEEEC 2004a). It consists of officials from the Australian, State and Territory Government agencies and representatives from New Zealand (box 4.1).

3 The EEWG was originally the Energy Efficiency and Greenhouse Working Group.

Box 4.1 **NAEEEC institutional arrangements**

The Ministerial Council on Energy (MCE) is responsible for the development of the programs for appliance and equipment energy labelling and for minimum energy performance standards (MEPS). Established under the MCE, the Energy Efficiency Working Group has the responsibility for developing administrative guidelines for use by each relevant State and Territory in the administration of its legislation covering energy-performance labelling and performance standards.

In turn, the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) is charged with the ongoing management of these Guidelines. NAEEEC reports to both MCE and the Working Group.

NAEEEC comprises the State and Territory regulatory agencies that are responsible for administering State and Territory legislation concerning energy-performance labelling and performance standards.

The national labelling and MEPS scheme is made up of three elements:

1. the legislation and subordinate regulations of the States and Territories;
2. the Australian Standards published by Standards Australia which are incorporated by reference into the State and Territory legislation and which contain the detail of the minimum energy performance and labelling requirements; and
3. NAEEEC Guidelines.

While the State and Territory legislation is administered by the relevant State or Territory regulatory agency, the legislative scheme is of a national character and is ‘intended to be administered in a uniform and consistent manner’. Although the NAEEEC Guidelines are not a legally binding instrument intended to impose legal obligations upon relevant State and Territory regulatory agencies, they are intended to ‘act as a guide to facilitate uniform and consistent practice’.

Source: Adapted from NAEEEC (2004a).

NAEEEC’s two major programs relate to mandatory energy labelling and mandatory minimum energy performance standards (MEPS) (appendix D). It is currently mandatory for a range of electrical products offered for sale in Australia to carry an approved energy label. Several products are also subject to MEPS (NAEEEC 2004c). These programs are discussed in more detail in chapter 7. In addition to the these two programs, NAEEEC’s charter encompasses a number of broader coordination functions (box 4.2).

Gas appliances are currently subject to voluntary self-regulation run by the Australian Gas Association (AGA). The AGA (sub. 2) argued that MEPS should be extended to gas appliances on the grounds that coordinating the programs would be ‘least-cost’ regulation, and allow direct comparison of the energy and greenhouse performance of gas and electrical appliances.

Box 4.2 The NAEEEC charter

The charter of NAEEEC encompasses the following functions:

- to provide assistance to all States and Territories, as required, in the development and regulatory implementation of technical, legal, and administrative aspects of national appliance and equipment energy-efficiency initiatives;
- to coordinate the national development and implementation of energy efficiency programs of a non-regulatory nature and enhance existing regulator programs. These may include voluntary labelling initiatives, market transformation projects, and similar voluntary actions;
- to coordinate national marketing and communication projects to support new, and enhance existing, energy efficiency programs;
- to review existing appliance energy consumption and improve standards and test procedures;
- to monitor program performance and achievements;
- to provide a forum to exchange information on enforcement/compliance issues and community information and marketing initiatives;
- to administer an effective, coordinated testing regime of the energy efficiency claims of suppliers; and
- to coordinate broad consultative processes with industry and other interested parties in the development and implementation of energy labelling and associated programs.

This charter recognises the maturity of the program and the need for a 'holistic' approach to government policies for greenhouse gas abatement in the appliance and equipment field. The focus of the program continues to be the delivery of nationally consistent regulation. The implementation of most voluntary programs remains an individual jurisdictional responsibility although voluntary programs that assist the regulatory program to maximise benefits are being added to NAEEEC's work plans.

Source: NAEEEC (2004).

National Framework for Energy Efficiency

In November 2002, the MCE endorsed a proposal to develop the NFEE (box 4.3). The NFEE is intended to provide an ongoing framework for national coordination of energy efficiency policy and programs. The development of the NFEE is being directed by the EEWG, under the auspices of the MCE.

Box 4.3 **National Framework for Energy Efficiency Stage One**

There were nine packages included in NFEE Stage One:

- Tightening **residential** building energy efficiency regulation (including through nationally consistent standards for new buildings and major renovations, and the mandatory disclosure of energy performance at time of sale or lease).
- Introducing **commercial** building energy efficiency regulation (including nationally consistent standards for new and refurbished buildings, and the mandatory disclosure of energy performance at time of sale or lease).
- Raising awareness of senior management in the **commercial and industrial** sectors (through mandatory audits for large energy users, and training and accreditation for energy auditors etc.)
- Imposing additional requirements on **governments** (including through developing consistent measuring and reporting, establishing standards for government buildings and developing best practice models).
- Extending **labelling and standards** for electrical appliances and applying the same regulatory approach to gas appliances.
- Developing and integrating energy efficiency **training and accreditation** for key trades and professions that influence energy efficiency outcomes.
- Developing **commercial and industrial** sector capability building (eg through establishing best practice networks and generating highly visible examples of energy efficient equipment or processes).
- Raising **consumer awareness** (e.g. through requiring energy retailers to report data on energy bills, promotional campaigns and through curriculum development for schools).
- Increasing **finance sector awareness** (e.g. through providing tools for the valuation and risk assessment of finance proposals).

Source: MCE (2004a).

The purpose of the NFEE is to unlock 'the significant economic potential associated with increased implementation of energy-efficient technologies and processes to deliver a least-cost approach to energy provision in Australia' (EEGWG 2003, p. 1). The Framework is being developed cooperatively with all jurisdictions and key stakeholders.

The NFEE will largely focus on demand-side energy efficiency in the domestic, industrial and commercial sectors. However, it will also consider energy use in energy conversion and address intermediaries with the ability to influence energy efficiency choices, such as energy retailers, builders, suppliers of appliances, equipment and materials, and financiers. It does not cover the transport sector.

An EEWG discussion paper released in November 2003 argued that a number of barriers prevented adoption of cost-effective energy-efficient practices. The paper called for stakeholder comment on the existence of a perceived energy efficiency gap and on the specific barriers to improving energy efficiency. A summary of the views of those who were consulted about, or responded to, the discussion paper, has been published (EEWG 2004).

Stage One of the NFEE, announced by the MCE in August 2004, involves a set of nine integrated packages of measures designed to improve coordination among jurisdictions in delivering energy efficiency programs. The measures involve nationally consistent minimum energy efficiency design standards (including expansion of the existing MEPS scheme), mandatory disclosure of energy performance, mandatory assessment and reporting of energy efficiency opportunities for large users, government leadership on energy efficiency, and education and training for consumers, the finance sector and a range of industry operatives. The NFEE will involve spending of around $33 million over three years.

The MCE noted:

> With the implementation plans now agreed, governments will also consider possible further measures, which could include broad-based incentives under a Stage Two NFEE … (MCE 2004b, p. 1)

State and Territory Governments have a range of mechanisms for implementing jurisdiction-based energy efficiency policies developed under the NFEE (see below and sectoral chapters).

The energy white paper

In June 2004, the Australian Government released a white paper on energy policy, *Securing Australia's Energy Future*. The paper outlined policies covering exploration and resource development, energy markets, energy security and energy efficiency, together with environmental, taxation and innovation issues. A taskforce covering a number of Australian Government departments, reporting to the Energy Committee of Cabinet, prepared the paper.

The white paper noted the importance of improved energy efficiency for a cost-effective greenhouse abatement strategy and also the potential economic benefits of such improvements. The white paper brought together a range of new and ongoing policies aimed at improving energy efficiency. These included: reforms to energy markets (particularly improving pricing signals); increasing minimum efficiency standards and an expansion of the range of appliances and buildings subject to MEPS; improving and extending energy efficiency information provided to energy consumers for appliances, buildings and motor vehicles; introducing compulsory audits (and public reports) of energy efficiency opportunities of firms using more than 0.5 petajoules of energy per year; and improving energy efficiency of Australian Government agencies.

In addition, the Solar Cities initiative — a series of demonstration projects in sections of at least four cities and receiving $75 million in government funding — was announced. Solar Cities will involve the subsidised large-scale uptake of solar power together with energy efficiency measures and more effective energy market price signalling (including the use of 'smart meters'). It is to be implemented by the AGO. The white paper also foreshadowed the establishment of this inquiry by the Productivity Commission into energy efficiency.

Jurisdictional energy efficiency programs

All jurisdictions have in place policies aimed at improving energy efficiency in both the private and public sector. These policies were often developed, initially at least, as part of greenhouse gas abatement strategies (for example, under the NGS) and in some cases pre-date the national coordination mechanisms now in place.

Some jurisdictional energy efficiency initiatives are discussed in more detail in the following sectoral chapters and are outlined in appendix B. Only selected examples from some jurisdictions are provided below. While these programs are often part of the national institutional framework outlined above, individual jurisdictions also take energy efficiency policy actions within their own greenhouse gas abatement or energy policy frameworks. These programs sometimes go beyond the national strategy requirements. Most larger jurisdictions have developed or are developing their own greenhouse strategies which include a diverse range of energy efficiency initiatives (see below). With regard to implementation of the NGS, the AGO noted:

> A key feature of this process is recognition of Australia's regional diversity, and the capacity for different governments to pursue effective greenhouse response through different policy approaches. (AGO 2005a)

For example, in 2002 the Victorian Government released a Greenhouse Strategy which:

> … does more than just meet Victoria's commitments under the NGS — it represents a significant strengthening of action beyond these commitments. (DNRE 2002, p. 15)

The strategy incorporates a number of energy efficiency elements: For example, all new residential buildings in Victoria are now required to achieve a five star energy efficiency rating, while existing and new Environment Protection Authority licensees and works approval applicants that are medium to large energy users are required to undertake energy audits and implement those options to reduce energy use that have a payback period of three years or less. The Victorian Government has now released a Greenhouse Strategy Action Plan Update (DSE 2005).

The Queensland Government released a greenhouse strategy in 2004 (EPA 2004). Energy efficiency initiatives include the ecoBiz program to encourage and assist business to identify and exploit energy efficiency opportunities and grants to assist commercialisation of new and substantially more energy-efficient products or technologies. The Western Australian Government produced a greenhouse strategy in 2004 which requires companies with large annual greenhouse emissions (above 100 000 tonnes of carbon dioxide from 2006-07) to develop strategies to minimise emissions. The strategy also contains the Building Code of Australia mandatory minimum energy efficiency standards for new homes. The South Australian Government is to publish an industry-wide greenhouse strategy by 2006 which will exceed the State's current National Greenhouse Strategy commitments.

The New South Wales Government has introduced a compulsory greenhouse gas abatement scheme for electricity generators and suppliers, for which certain energy efficiency projects can qualify as abatement activities. The ACT Government requires an energy efficiency rating statement to be supplied for residential property sales. It also subsidises home energy audits and provides rebates for wall insulation.

All jurisdictions place emphasis on government entities taking a leadership role in reducing greenhouse gas emissions, particularly through reducing energy use, including by increasing the energy efficiency of their operations (chapter 10).

4.2 Recent reforms to regulation of energy markets

The terms of reference raise the possibility of achieving cost-effective energy efficiency improvements through energy market reform to facilitate improved demand and supply management. This section briefly outlines some of the important changes to the regulatory framework for the electricity, gas and petroleum markets since 1990. While many of these developments may have limited, if any, direct implications for energy efficiency, they do provide the regulatory framework and incentive structure against which energy efficiency initiatives by energy producers and users are undertaken.

Microeconomic reforms of the electricity and gas industries began in some individual jurisdictions during the 1980s — largely involving corporatising government-owned, vertically integrated monopolies and introducing competitive neutrality reforms. The electricity industry reforms were brought together under the umbrella of COAG, with jurisdictions agreeing to introduce greater competition and vertical separation of the industry and later to establish a National Electricity Market (NEM). In 1994, COAG agreed to a timetable and framework to introduce free and fair trade in natural gas. In 1995 both the national electricity and gas reforms were incorporated as related reforms to the National Competition Policy (NCP).

National Competition Policy reforms

The NCP reforms were, among other things, focussed on improving economic efficiency of the gas and electricity industries. One objective of these reforms was making energy prices more reflective of costs of production at both the aggregate level and for different classes of consumers. Following structural separation, industries were either opened to competition where markets were contestable or were subject to pro-competitive price and access regulation where there were strong natural monopoly characteristics.

Electricity

In 1993, COAG agreed to the development of a competitive NEM in the southern and eastern jurisdictions. The creation of the NEM, which commenced operation in 1998, and the related reforms to the structure and governance of the industry, involved a variety of fundamental changes to the production and distribution of electricity including:

- structural separation of generation, transmission and distribution activities;
- corporatisation of government-owned electricity utilities;
- allowing customers to choose their supplier (whether generators, retailers or traders);
- establishing an interstate transmission network and non-discriminatory access to the interconnected transmission and distribution network;
- removing all discriminatory barriers to entry for new participants in generation or retail supply, and to interstate and/or intrastate trade;
- implementing cost-reflective pricing for network services with greater scope for averaging for distribution network services, and transparency and interjurisdictional consistency of network pricing and access charges; and
- facilitating interjurisdictional dispatch and sourcing of generation capacity, (where cost effective) (PC 2004, p. 21).

Competition has been introduced into the generation and retail sectors. In the case of retail competition, eligible users were permitted to negotiate directly with suppliers of their choice. Full retail contestability is (or will be) available to all users in Australia, except residential and small business customers in Queensland. Structural separation of previously vertically integrated electricity providers has been completed in all jurisdictions. Electricity utilities have been structurally separated and either corporatised or privatised or assets have been leased to the private sector.

Natural gas

In 1994, COAG agreed to the free and fair trade in natural gas. Since then, reforms to the gas market have focussed on increasing the extent of competition in the gas industry. Reforms included:

- removing all legislative and regulatory barriers to free trade in gas;
- corporatisation of government-owned utilities;
- structural separation (or ring fencing) of transmission and distribution activities in each State and Territory;
- introduction of a national framework for third party access to gas transmission and distribution pipelines (the National Gas Access Code); and
- full retail contestability allowing consumers to choose gas suppliers. (PC 2004, p. 23)

Most of these reforms have been implemented, the main exception being the absence of retail contestability in Queensland and the assessment of the Queensland access regime by the National Competition Council as not being effective (PC 2004).

COAG Review of Energy Market Directions (Parer Review)

While the reforms of the 1990s had transformed energy markets, there were concerns regarding the efficiency of regulatory arrangements and the need for further reforms to develop efficient and integrated national energy markets. In 2001, COAG established an independent review of the strategic direction for market reform in the electricity and gas industries — the Parer Review.

The Review reported in December 2002 and, while noting the significant achievements flowing from the previous decade’s reforms, found opportunities for regulatory reform to further improve the economic efficiency of the electricity and gas industries. The Review’s key findings were:

- the energy sector governance arrangements are confused, there is excessive regulation and perceptions of conflict of interest;

- there is insufficient generator competition to allow Australia’s gross pool system to work as intended;
- electricity transmission investment and operation is flawed, and the current regions do not reflect the needs of the market;
- the financial contracts market is extremely illiquid, in part reflecting large regulatory uncertainty;
- there are many impediments to the demand side playing its true role in the market;
- there is insufficient competition in the east coast gas market, and too much uncertainty surrounding new pipeline development;
- greenhouse responses so far are ad hoc, and poorly targeted; and
- the NEM is currently disadvantaging some regional areas (COAG 2002, p. 9).

Of particular relevance to energy efficiency issues, the Review noted that impediments to demand-side responses to market developments meant that NEM pool prices were more volatile than necessary and generation capacity was greater than necessary because of insufficient peak demand pricing signals. For example, retail price caps limited the price incentives for residential users to vary the time pattern of energy consumption.

The MCE and the NEM Ministers’ Forum (now subsumed into the MCE) have sought to address these deficiencies in the operation of the markets for electricity and gas. Major initiatives have included:

- the establishment of the Australian Energy Regulator (AER) to regulate the operations of the national energy market. Initially, the AER will take over electricity transmission regulation from the ACCC and the electricity code enforcement functions of the National Electricity Code Administrator. Its responsibilities are to be extended to include gas transmission by 30 June 2005. Following the development of an agreed national framework, the AER will be responsible for the regulation of distribution and retailing (other than retail pricing) by 2006;
- the establishment of the Australian Energy Market Commission (AEMC) as a separate statutory commission to make changes to energy market rules (codes) and to undertake reviews and other market development functions. It will be accountable to the MCE;
- the MCE to assume the national policy oversight role for the Australian energy market and to oversee the policy framework under which the AER and AEMC will operate;
- all jurisdictions where full retail competition is operating, to align retail price caps with costs and the need for these caps to be periodically reviewed;

- an examination of the scope for facilitating the commercialisation or establishment of a demand side response pool in the NEM; and
- the introduction of a range of reforms relating to pricing, planning and investment in electricity transmission facilities.

In addition, the MCE (2004b) has released a statement on principles for wholesale gas market development and a draft report has been prepared on options for the future development of that market (Allen Consulting Group 2005). Further, during 2005 the MCE proposes to respond to the Productivity Commission's 2004 review of the national gas access regime.

Petroleum

While not possessing the natural monopoly characteristics of some parts of the gas and electricity markets, the petroleum market has been subject to significant government regulation for many years. In the retail sector, the *Petroleum Retail Sites Act (1980) (Cwlth),* places quotas on the number of retail sites that may be operated on behalf of each of the four major oil refining companies in Australia. The quotas are determined on the basis of average wholesale market share and currently limit the number of oil company operated sites to just over 400. A key objective of the Act is to limit the role of vertically integrated oil companies in setting retail prices.

The *Petroleum Retail Marketing Franchise Act (1980) (Cwlth),* provides lessee service station operators of oil company owned sites with protection of tenure, prohibits discrimination in the price of motor fuel sold to franchisees and requires certain disclosures of information by oil companies to potential franchisees.

However, the Australian Government has announced that it intends to:

> … commence consultations with all key industry groups over the next few weeks to see if we can reach an acceptable level of consensus on the introduction of an industry Oilcode and the repeal of the existing legislation. (Macfarlane 2004)

The Government has proposed that this reform package including the repeal of the two Acts and the establishment of a voluntary industry code of conduct will be implemented in the second half of 2005 (Macfarlane 2004).

The Australian Government or State Governments were involved in price regulation of petroleum products at various times from 1939 until 1998 (IC 1994a). From 1973 to 1998, various Australian Government authorities determined maximum wholesale prices for petrol and diesel. There was often substantial discounting below these maximum prices, especially in capital city markets. In 1998, the

Australian Government deregulated petrol and diesel prices and gave the ACCC an informal price monitoring role. The ACCC presently monitors and analyses retail prices in the capital cities and around 110 country towns.

5 Barriers and impediments

Key points

- There are many apparent barriers and impediments to the adoption of energy efficiency improvements. These include:
  - market failures
  - behavioural and organisational barriers
  - the additional costs of adopting energy efficiency improvements.
- The market failures of most relevance arise from imperfections in information. These include imbalances in the information held by vendors and purchasers of energy-efficient technologies, and the undersupply of information because of its public good or positive spillover characteristics.
- The 'split incentives' or 'tenant-landlord' problem may also impede adoption of energy efficiency improvements. For example, landlords may not have sufficient incentive to install energy-efficient appliances if they cannot recover their capital costs from tenants.
- Government intervention to address market failures can be appropriate but it should produce net benefits to the community.
- Many apparent barriers and impediments can be attributed to behavioural norms and organisational limitations. There is no clear case for government intervention to address these issues. Governments should instead strive to provide a competitive environment within which firms operate.
- Other barriers and impediments that are not market failures (for example, high transaction costs, risk and uncertainty in implementation) may provide valid reasons for the nonadoption of energy efficiency improvements that appear (to an outsider) to be privately cost effective. The role of governments in addressing these issues may be quite small.

Chapter 1 introduced the notion of the energy efficiency gap. Such gaps are seen to exist where energy efficiency improvements are not being taken up despite being seemingly cost effective for the individual producers and consumers concerned. The presumption is made that various barriers and impediments must be at work. This chapter provides a framework for assessing those barriers and impediments. In so doing, the Commission recognises the widespread use of the terms barriers and impediments in this policy area. Whereas a barrier might prevent the adoption of an energy efficiency improvement altogether, an impediment might mean the improvement is taken up but not as fully as it otherwise might. In practice, the terms are used more or less interchangeably, depending on the circumstances.

5.1 Introduction

Understanding the nature of the barriers and impediments facing individual producers and consumers is important in devising policy responses that will improve energy efficiency in a way that maximises economic efficiency (and thereby brings net benefits to the Australian community as a whole). Drawing on some of the features of a taxonomy adopted by Sorrell et al. (2000) and Jaffe and Stavins (1994), three classes of barriers and impediments are considered in the subsequent discussion:

- *market failures* — which arise where the market fails to provide or allocate goods and services to their most efficient use (that is, the allocation of goods and services is not one that maximises overall wellbeing of the community);
- *behavioural, cultural and organisational barriers* — which arise because of limits on the decision-making abilities of individuals and organisations; and
- *other barriers and impediments* — such as the additional costs of adopting energy-efficient investments or the impact of those investments on output.

This framework can be broadened to consider how the case for policy intervention would change if there was a change in the market for energy. That is, if energy was priced at its true economic cost, by which it is meant that the price includes all of the costs of resources used in its production and any associated externalities (such as pollution or greenhouse gas emissions).

There are two main sources of market failure in the market for energy: the influence of natural monopoly in the transmission and distribution of energy (such as gas and electricity), and environmental externalities. A related issue concerns the regulatory failures that could follow from imperfectly addressing natural monopoly (such that prices are not as cost reflective as they might be) or as the result of the inadvertent side effects of other policies (such as the effects of taxation on the incentives to consume energy).

Addressing such distortions to the price of energy in turn would influence what energy efficiency measures might be privately cost effective for individual consumers or producers to adopt. These issues are discussed in chapter 13. What is important to note here is that, while changing energy prices would alter the size of the perceived energy-efficiency gap (for example, higher prices would encourage more investment in energy-efficient technologies) they do not change the intrinsic nature of the barriers and impediments in the market for energy-efficient technologies. For example, European policy literature also refers to barriers and impediments to energy efficiency even though prices for electricity, gas and oil in many European countries are often substantially higher than in Australia, and levels of energy efficiency are also higher than in Australia (Sorrell et al. 2004).

5.2 Failures in markets for energy-efficient technologies

Failures in markets for energy-efficient technologies have the potential to impede the adoption of cost-effective energy-efficient investments. Three broad types of market failure are considered:

- *imperfect information* — markets may undersupply energy-efficient technologies and services because consumers do not have access to sufficient and accurate information;
- *split incentives* — markets may undersupply technologies and services because the person purchasing an energy-using technology is different from the person who benefits from its use, and the incentives facing the purchaser differ from those of the user; and
- *positive externalities* — markets may undersupply investment in new technologies and processes because market participants are unable to fully capture the benefits from undertaking an activity.

Imperfect information

Markets work best when consumers and producers have sufficient information about energy-using technologies and services to make choices that will maximise their welfare and profit respectively. However, consumers might not be able to access the necessary information on the energy efficiency of a product, or the price and performance of competing products. Similarly, producers might not have sufficient information about their competitors or their consumers' preferences. Consequently, consumers and producers may make choices that they later regret when they become better informed.

Some commentators have drawn attention to information deficiencies in the market for energy-efficient technologies. For example, the Institute for Sustainable Futures (2004, pp. 77–8) commented:

> … in general, participants identified a lack of knowledge about the actual functioning of appliances. … Participants also lacked information to inform purchasing decisions. … Without knowledge, householders are unable to make informed choices about energy-reduction actions available to them.

And as the Moreland Energy Foundation Ltd pointed out (sub. 18, p. 5) '… you can't implement something if you don't know it exists'.

Although imperfect information can lead to market failure it does not automatically follow that there is a case for government intervention.

Some of the reasons why market information may be imperfect include:

- information can be costly to obtain;
- information can have public good characteristics; and
- asymmetries can develop between those who have the information and those who need it, arising from differences in incentives.

Costs of obtaining information

In some ways, information is like any other commodity in that it can be costly to produce or obtain. Consumers would be acting rationally by incurring costs to obtain information up to the point where the marginal cost of an additional piece of information just equals the marginal benefit. The costs of obtaining information are not just financial — they may include the opportunity costs of devoting time and effort to obtaining information that could be spent elsewhere. For consumers, this might mean less leisure time, and for producers it might mean less attention is given to other business activities and obligations. Moreland Energy Foundation Ltd implied that the opportunity cost of time can be significant, referring to the:

> Lack of time or resources to look at all the options prior to making a decision — renovators often complain about choices they made under stress that they have become unhappy with; sole business operators rarely have the time to look at non-core business issues, even if it would be to their advantage. (sub. 18, p. 5)

Transaction costs

The costs of obtaining information are part of overall transaction costs. For instance, they are part of the costs a producer might incur in purchasing and installing more energy-efficient equipment. As well as gathering, assessing and applying information, transaction costs can also include the costs of negotiating, drawing up, monitoring and enforcing contracts.

In some cases, transaction costs may prevent individual producers and consumers from undertaking investments that might be otherwise economically efficient. Where economies of scale and scope are present, alternative arrangements may make such investment feasible. For example, market intermediaries such as energy efficiency auditors and energy-performance contractors might be able to meet a firm's needs at a lower unit cost. Similarly, for consumers, governments or other intermediaries might be able to supply general information on energy efficiency, through, for example, appliance labelling (see also the discussion below on public goods and chapter 7).

Transaction cost theory can also be useful in explaining the way people behave (section 5.3).

Public goods

Information can have some of the characteristics of a public good. Information can be used many times over without reducing what is available to others, and it can be difficult to exclude its use by others, even if they do not pay for it. This decreases markedly the incentives for private providers to supply such information. The extent to which this is an issue in energy efficiency is debatable and requires a distinction to be made between product-specific information and general information. Vendors in markets for energy-efficient technologies have incentives to provide information that is specific to their particular product. For example:

- To the extent that it may give them a marketing advantage, suppliers of energy-efficient appliances could be expected to provide information on the energy efficiency features of their products.
- Builders and vendors of properties and landlords may draw the energy efficiency features of their properties to the attention of potential buyers and renters where such features will save money on energy bills or significantly enhance comfort or productivity.

However, other suppliers, builders or vendors may not provide comparable product-specific information where that is not to their advantage, such as if their products or properties were less efficient. In these circumstances the consumers do not have a readily-available information base.

Where information is less product specific and offers less opportunity for cost recovery, producers will have little incentive to provide it. For example, information on general energy-saving techniques or practices, such as how to incorporate passive design principles into house design, might not be readily supplied. However, possibly motivated by social and environmental concerns and the spinoffs that might be generated by being seen to be 'eco friendly', some energy and product suppliers are supplying some general information on energy efficiency. For example, on their respective websites, CSR Bradford provides some basic information about passive solar design for houses and AGL provides advice on the typical energy consumption costs of various household appliances.

In the Commission's view, the public-good nature of general information about energy efficiency may provide some rationale for government intervention. However, the method and extent to which governments actually intervene will depend in part on the material nature of this problem and the relative cost effectiveness of the various policy options. This issued is explored in chapter 7 in the context of the residential sector.

Asymmetry of information

Imperfect information includes cases where the information is not available equally to all participants in the market. Such information asymmetries abound in energy efficiency and other markets. They can lead to policy problems where there are incentives not to share information or information is difficult to verify. Typically, information asymmetries occur where producers or sellers have more information about the energy efficiency of their products than their customers.

Market participants nevertheless have incentives to verify the credibility of information supplied by other parties. For example, motor-vehicle buyers often subject second-hand cars to independent road worthiness checks. And prospective building owners and tenants may assess the building quality, likely repair, and the maintenance and energy costs of a building. Yet the cost of verifying the claims of other parties can at times be prohibitive. If the problem of verification is sufficiently widespread, the problem of *adverse selection* can arise (Jaffe and Stavins 1994; Phlips 1988).

Adverse selection

Adverse selection can occur if sellers are much better informed about a product's energy efficiency than buyers. This information asymmetry could persist because sellers have an incentive to promote products as energy efficient even when they are not. If consumers think this is the case, then they will be unwilling to pay a premium for actual higher energy efficiency. This will in turn lead to a 'lemons effect' in which only poorer-quality (less efficient) products are supplied to the market (the logic of the lemons effect was detailed by Akerlof 1970). As a result, markets may undersupply cost-effective energy-efficient technologies (Howarth and Sanstad 1995).

Moral hazard

In some situations, the buyer can possess more information than the seller. If after a contract is agreed, the seller is unable to verify the behaviour of the buyer, the buyer may act in an opportunistic manner to the detriment of the seller (Sorrell et al. 2000; Phlips 1988). This is known as the *moral hazard* problem.

Known primarily for its presence in insurance markets (where insured parties may become less risk averse after taking out insurance), moral hazard may also be relevant to energy efficiency. For example, Origin Energy described the difficulties facing energy efficiency auditors in verifying energy savings made by their clients after contracts for energy efficiency audits have been signed:

> … there is less incentive for the client, after undergoing an energy audit, to recognise fully (and attempt to measure) the benefits that are possible from the consultant's advice. Where the contract involves implementation of the consultant's advice, there is less incentive for the client to attribute fully the actual benefits accruing from that advice. One would expect the party with less information ex post (the consultant) to design a contract upfront to minimise the client's incentive in this regard, but the costs are likely to be prohibitive relative to the size of auditing fees (especially if the consultant is a small operator). (sub. 25, p. 7)

Repeat purchasing

One way in which consumers can address information asymmetries is through the experience gained from repeat purchasing. For example, repeat purchasing of grocery items allows consumers to compare and contrast the performance of different competing products quite quickly and inexpensively. But where transactions are large and infrequent (such as with major appliances, cars and houses), consumers might have little past experience to draw on, creating the potential for poor decisions. If disgruntled customers have little or no influence on future sales, producers (or vendors) have little incentive to provide information. Examples can be found in one-off sales of real estate in private markets. This form of market failure might be less severe in the new property market, where the reputation of a builder or property developer can be established and made known in the marketplace.

Split incentives

Split incentives arise when the person purchasing an energy-consuming product is different from the person who benefits from it and the incentives facing the purchaser differ from those of users.

This problem can occur in real estate markets, where it is sometimes called the *landlord–tenant* problem (see chapter 7). Landlords, it is argued, do not have strong incentives to install more energy-efficient appliances because they might not be able to recoup the additional capital costs through increased rent. Tenants on the other hand might be prohibited from replacing appliances, or might not be confident that they will be able to recoup the savings (through lower energy bills), when the term of their lease is uncertain.

Rheem Australia noted that split incentives is potentially a large issue:

> Approximately 30 per cent of Australian households are in rented accommodation rather than owner occupied. In this market segment the decision maker is primarily concerned about minimising capital cost and is less concerned about the running cost of the water heater. (sub. 46, p. 1)

Alternatively, it might be argued that landlords want to maximise the net returns on their investment and if tenants were willing to pay the higher rent (while still saving overall), the more energy-efficient appliances would be installed. But in many cases the benefits are not sufficient to warrant renegotiating leases. As Sanstad and Howarth (1994, pp. 814–5) noted:

> In the absence of transaction costs, landlords and tenants would presumably enter into contracts to share the costs and benefits of energy efficiency. But structuring efficient contracts is by no means a simple task, and the net gains achievable through improved energy efficiency might be swamped by the associated transaction costs.

The Commission notes that split incentives can occur where there is an information asymmetry, but this is not essential. Even where the buyer and seller have the same access to information, the transaction costs of overcoming their different incentives may result in the nonadoption of what would otherwise have been a worthwhile investment. The case for government intervention would be strongest where it lessens these transaction costs.

Positive externalities

Positive externalities (or spillovers) occur where the actions of one person have beneficial spillover effects for others that are not reflected in market prices. If the person making the investment is unable to capture all of the benefits, they might not provide as much of the good or service as would be appropriate from the broader community perspective.[1]

The positive externalities of greatest relevance in terms of market failures in the supply of energy-efficient technologies concern research and development (R&D) and the demonstration effects of firms adopting energy efficiency improvements.

R&D is an important determinant of technological advances in energy efficiency in the long term. It tends to push out the technical frontier, but because of the need to commercialise new technologies and the inevitable lags in turning over the capital stock, can take time to diffuse through the economy. Addressing barriers to undertaking R&D would contribute to the supply of (potentially cost-effective) energy-efficient technologies and potentially increase Australia's energy efficiency and overall economic efficiency. Where R&D externalities are strong, a firm's incentives to undertake R&D is weakened (IC 1995, Banks 2000).

The incentives for adopting new and innovative technologies and services may also be weakened because of demonstration effects. A firm that adopts a new technology demonstrates the net benefits of the investment to its competitors. In doing so, it reduces the risk to the competitor of adopting the same technology. If firms are unable to appropriate all of the benefits from being the first mover, there will be an underadoption of new technologies (Sorrell et al. 2000; Jaffe and Stavins 1994).

Australian governments currently support R&D in energy efficiency technology and other areas in many ways. These include the provision of a patent system and other intellectual-property laws, and the direct funding of government bodies (such as cooperative research centres, the CSIRO, universities and government agencies), and the provision of general and selective R&D incentives (such as the R&D tax concession, competitive grants, and concessional loans). The extent to which it is appropriate for governments to provide incentives specifically for energy efficiency is addressed in chapter 8.

Market failure and government intervention

The presence of market failure does not of itself warrant government intervention. Such intervention can be costly and introduces its own distortions, especially if the intervention is poorly targeted (chapter 2). Government intervention is only

[1] Positive externalities and public goods are similar in nature — both involve free riders. The difference is largely one of degree. With public goods, the private benefits are assumed to be so small that no private investment takes place. With positive externalities, sufficient private benefit can be captured to ensure some provision of the product but not as much as would be appropriate from a broader community perspective.

warranted when it produces net benefits to the community (including economic, social or environmental benefits and the public and private costs). One way that this might be achieved would be to target the market failure as directly as possible. For example, some information asymmetries may be virtually insurmountable for most consumers at any reasonable cost. Government intervention that provided such information directly or that required that it be provided (through labelling for example) could reduce the search costs of obtaining information and providing net benefits.

5.3 Behavioural, cultural and organisational barriers

There are times when individuals, small businesses and larger organisations do not choose cost-effective energy-efficient technologies even when market information is potentially available to them. Such limits to decision making can give rise to behavioural and cultural norms and organisational constraints.

Behavioural and cultural norms

Behavioural, as well as social and cultural influences, can be instrumental in shaping values and attitudes of individuals towards energy consumption. The Institute of Sustainable Futures (2004, p. xvii) commented that the factors that determined preferences in energy use were complex:

> These factors reflect the interaction between past experiences, socially established norms and expectations, present living conditions and social contexts. They represent long standing and deeply held convictions and understandings that play out in behaviour.

The Australian Consumers' Association (sub. 52, p. 1) argued that consumers 'do choose, and are likely to continue to choose, an energy intensive lifestyle'.

Several inquiry participants argued that behavioural norms were also influenced by economic factors, such as the opportunity cost of management time:

> Behavioural norms are clearly a factor influencing the way energy is used. These norms are likely to reflect many commercial and non-commercial factors operating and evolving in the economy and the community more broadly. (Origin Energy, sub. 25, p. 8; ERAA, sub. 26, p. 31)

Behavioural norms can also bear on the decision making processes of individuals — such as those that have more pressing priorities:

> Another important aspect to behavioural norms is that they may in many instances, for example small business decisions, be driven by time-poor managers. (BPIC, sub. 44, p. 4)

Bounded rationality

In an ideal world, individual consumers and producers would have sufficient information, and the ability to process that information, to make the most appropriate decisions. But individuals are limited in their ability to obtain and process complex information and to handle the uncertainties that invariably arise in a dynamic and evolving operating environment. In this sense, their rationality is said to be bounded. These limits tend to result in *satisficing*, rather than *optimising*, behaviour. Such limits are caused by constraints on time, cognitive resources and attention that mean the quality of decisions may be compromised even when full information is present. Individuals may downgrade the standard of their goals, and settle for outcomes that are less than ideal but which are realistic in the circumstances.

In practice, individuals commonly simplify their decision making through behavioural norms, such as adopting generalised rules of thumb (sometimes called heuristics). These can include:

- Purchasing the same make or brand of equipment that a competitor, family member or friend purchases (following the pack).
- Purchasing the same make or brand of equipment as previously (relying on past experience). In this respect the Australian Conservation Foundation (sub. 24, p. 6) noted that 'some organisations find it easier to continue using the same technologies and processes that they already have in place'.
- Using simplified selection criteria that focus on key features and overlook more technical and (to them) less seemingly-important considerations such as energy efficiency.

In a study of the electric motor market in France, De Almeida (1998) reports that individual managers adopted rule-of-thumb routines, such as continuing to purchase the same type and brand of motor, because of the complexity of the market in which they operated and the organisation of the firms. Another example is the use of simple evaluation criteria, such as the payback period, when comparing different investments. The payback period may be easy to communicate and intuitive (De Canio 1994), but can lead to poor decision making (see chapter 6).

The concept of bounded rationality is important for a number of reasons. First, it helps to explain that, in some cases, supplying information might not be sufficient — decision makers might not be able to process it. This suggests that different ways of providing information might need to be explored. Second, given that information is costly to obtain and process, transaction costs also need to be minimised. Finally, while individuals might not make ideal choices from the perspective of an outside observer, they may well be optimising something else that is just as important to them and that is the value of their time, which might be better spent on core projects or leisure activities. As Conlisk (1996, p. 671) said:

> … heuristics often provide an adequate solution cheaply whereas more elaborate approaches would be unduly expensive.

Thus, while heuristics may not always lead to the adoption of a more cost-effective energy-efficient technology, the behaviour is appropriate given the limits on cognitive abilities, transaction costs and the opportunity cost of time.

While bounded rationality helps explain decision making generally, it is not at all clear that it warrants government intervention. If the government were to address bounded rationality, it would be intervening everywhere. Where it might be helpful is in regard to the form of information to be made available to individuals. Such information should be specific and personalised, vivid, clear and simple, and available close in time to the decision (Sorrell et al. 2000). Governments may have a role in ensuring that general and specific product information is provided in a manner that is readily used and understood. These issues are discussed in chapters 7 to 9.

Organisational limitations

Barriers and impediments to the adoption of cost-effective energy-efficient technologies also occur within organisations — particularly larger businesses and government agencies (Sorrell et al. 2000; De Canio 1993). Larger organisations may not adopt cost-effective energy-efficient technologies even if such technologies can improve their profitability or help meet the objectives of the organisation (Sorrell et al. 2000).

This may be because they face *principal–agent* problems. In many organisations, the owners (the principals) are faced with a problem of how to ensure that its employees (the agents) act in the owners’ interests, given that the interests of the owners and employees are not always aligned. A range of management tools (such as task allocation and incentives) may be employed to enhance the alignment. However, the complexity of designing incentives and allocating tasks is compounded by the difficulties posed by imperfect information within the organisation and by the bounded rationality of owners and employees (Milgrom and Roberts 1987; De Canio 1993; Button and Weyman-Jones 1992; and Sorrell et al. 2000).

Overseas research on this topic has demonstrated principal–agent (and related) problems that may be impeding the adoption of energy-efficient technologies in organisations:

- *Risk aversion* — Managers may have an incentive to avoid risky projects and actions in areas like energy efficiency which are perceived as noncore to the organisation's operations, particularly if they are not rewarded for taking greater risks by the owners of a firm (De Canio 1993).
- *Short time horizons* — Managers might operate with a shorter time horizon than the owners of a firm. Sorrell et al. (2000) claimed that this is an example of split incentives operating inside the firm. Short time horizons might result from policies of rotating managers or of linking managers' compensation to recent performance (short-term profitability) rather than long-term profitability (De Canio 1993). In this environment, projects with short paybacks will be preferred over those with longer paybacks, even if they have lower net present values.
- *Lack of cooperation* — Managers within different parts of an organisation might not cooperate if their incentives have not been appropriately aligned by the owners. The lack of cooperation may be caused by different managers being responsible for different budgets, such as capital and operating budgets, with each trying to minimise their own costs, rather than the costs to the company as a whole (De Canio 1994).
- *Decentralisation* — Organisations with decentralised management were shown to be poorly equipped and less likely to pursue large-scale projects spanning the entire organisation. On the other hand, organisations with centralised management were constrained in adopting small-scale localised initiatives which required the active cooperation of their employees (Cebon 1992).

Some inquiry participants cited the role of organisational barriers in inhibiting the uptake of energy efficiency improvements. For example, the Department of the Environment and Heritage, paraphrasing EEWG (2004), argued that:

- [senior management often has a] … poor understanding … of the potential for improved energy efficiency to increase productivity;
- companies, particularly small manufacturers, often see any change to working processes and practices as a significant risk; and

- finite resources within companies, both staff and financial, to focus on a limited number of issues. This means that energy efficiency falls off the priority list (sub. 30, p. 8)

The Australian Industry Greenhouse Network noted:

> The pursuit of energy efficiency improvements may be influenced by factors such as: the firm's size and corporate structure; information asymmetries within the firm; alignment of management incentives with company objectives; decision making authority of management and rules of procedure; and management acumen.
>
> These things are all symptoms of poor management and no doubt energy efficiency is prejudiced when it is prevalent. (sub. 57, pp. 7–8)

As the Australian Industry Greenhouse Network imply, many of the organisational issues cited above could be used to explain inefficiency in many firms' activities, not just energy use. It is not unusual for firms in many industries to be operating relatively inefficiently. For example, in a review of the literature, Button and Weyman-Jones (1992) found that the minimum possible operating costs ranged between 61 and 97 per cent of the actual costs of the firms surveyed.

Button and Weyman-Jones (1992) and Conlisk (1996) both observed that competitive market forces serve to place a discipline on the extent to which such inefficiencies can occur. As Conlisk (1996, p. 671) argued:

> … market discipline, through repeated transactions with significant stakes, can be potent in attenuating discrepancies between optimising and observed behaviour ...

A number of inquiry participants have also suggested that the relatively low attention given to energy efficiency by many organisations may simply reflect the low priority given by managers to energy use. For example, the Australian Conservation Foundation attributed the low uptake of energy efficiency to:

> … the relatively low cost of energy, the effort required to contemplate energy efficiency options and the risks in implementing them means decisions are often driven by other priorities. (sub. 24, p. 6)

In contrast, the Australian Aluminium Council (sub. 29, p. 9), said that for relatively intensive energy users in the aluminium industry, 'energy efficiency is a priority' for continual improvement because of its effect on costs.

In the Commission's view, there is no clear case for government intervention to address internal organisational issues. The most important policy implication is that governments should strive to provide a competitive environment within which firms operate. Attention may be needed to encourage incentive structures in non-competitive firms (such as natural monopoly utilities and government agencies), but the case for additional measures beyond those already applied would need to be established. This is taken up in later chapters. Another policy implication is that, in conjunction with the lessons to be learned from understanding bounded rationality, information asymmetries within firms might provide some guidance on targeting programs that can be separately justified on the grounds of market failure.

DRAFT FINDING 5.1

Behavioural and organisational limitations on the adoption of energy efficiency improvements do not of themselves warrant government intervention. Understanding these limitations may, however, be helpful in designing efficiency programs that address environmental externalities, information failures and other sources of market failure.

5.4 Other barriers and impediments

Barriers other than market failures and the influence of organisational, cultural and behavioural factors may also be at work. As chapter 6 discusses, estimates of the energy efficiency gap are often made using engineering–accounting models. Such studies tend to overlook a range of costs that are otherwise taken into account by individual energy users, or ignore factors that are important in the assessment of energy efficiency options. These include:

- *Implementation costs* — some energy efficiency technologies and processes entail additional costs when implementing an investment.
- *Risk and uncertainty* — some energy-efficient investments are inherently risky, financially and/or technically. The presence of such risks may reduce the level of investment, or even restrict access to finance.
- *Asset replacement costs* — upgrading plant and equipment to the latest energy-efficient technologies may require the premature scrapping of existing assets.

A further factor to consider is the heterogenous nature of consumers and producers. Although not a barrier as such, heterogeneity can account for differences in the uptake of energy efficiency. Estimates of the cost effectiveness of a particular energy-efficient technology or service are often based on characteristics of an average user within a particular class, or based on assumptions of the performance of the technology or process under specific or average conditions. If engineering–accounting models do not reflect these variations, they will overstate the potential for the uptake of energy efficiency improvements (Jaffe and Stavins 1994; Sorrell et al. 2000).

Implementation costs

Households or organisations may not invest in apparently worthwhile energy-efficient technologies because of additional costs that can be involved in the implementation phase (that is, additional to the direct capital and operating costs of the energy efficiency improvement). Estimates of the size of the energy efficiency gap may be overstated if the models do not take all such costs in to account, given that those costs would be considered by individual firms and households.

Implementation costs can arise for a variety of reasons. Costs can be incurred when the workplace or household must change its behaviour to accommodate the new investment before the new technology can reach its peak performance. Such costs include retraining the workforce or hiring new staff, and adopting new workplace or household practices.

Alternatively, benefits may be foregone when the new replacement technology is not perfectly substitutable for the old technology. In these instances, the firm or household may either incur additional costs to maintain productivity or functionality, or forgo benefits from the new technology (Jaffe and Stavins 1994). The new technology might also pose problems with safety, noise, working conditions or require extra maintenance and service quality. As a result, either the cost effectiveness of the technology might be diminished because of decreased returns, or additional costs might be incurred to ensure that it performs at the same level as the old technology (Sorrell et al. 2000).

Risk and uncertainty

Investment in a new appliance or plant and equipment involves some degree of risk or uncertainty.[2] If the degree of risk and uncertainty facing producers and consumers is not adequately recognised, estimates of the potential for taking up energy efficiency related investments will be overstated.

Three sources of risk and uncertainty associated with energy efficiency investments have been identified:

- *technical* — those associated with the management of the energy efficiency investment, such as the irreversibility of many energy efficiency investments or its effects on production processes;

[2] Risk refers to those possible outcomes for which the probabilities are known, and uncertainty refers to those possible outcomes for which the probabilities are not known.

- *external* — those to which the firm has little direct control, such as sovereign risk; and
- *financial* — those associated with the firm's capacity to manage or to adapt, such as developments within the firm, the costs and availability of capital and changes in energy prices (Sorrell et al. 2000; Hassett and Metcalf 1993).

Origin Energy discussed the technical risks associated with new investments:

> Risks include operational difficulties associated with changing to new processes and opportunity loss of management time and effort as it is diverted away from higher priority areas of the business and towards energy efficiency. (sub. 25, p. 5)

The technical risks can be very high where investment is irreversible. Even where the *prima facie* evidence suggests that an investment is capable of generating high returns, it may be rational for firms and households to delay making such investments until more information is obtained that would help resolve the uncertainties (Dixit and Pindyck 1994).

The Australian Aluminium Council pointed to sovereign risk being an important issue, especially with long-term investments:

> Equally rational is the decision not to proceed with energy efficiency investments where policy certainty is not adequate to support the investment required; this is exacerbated by the large capital requirements and by the length of time required to recover the new capital investment; the involvement of state governments often causes further uncertainty within the market, with policy activity directly and indirectly (eg greenhouse policy actions). (sub. 29, p. 10)

Once these risks are factored in, the apparently high hurdle rates may be reduced, but capital constraints may remain. As Origin Energy observed:

> Many in the debate have also referred to the potential for double digit internal rates of return (IRR) from investments in energy efficiency. While this might be possible, an adjustment for risk is likely to reduce these returns in many circumstances. … Even if risk-adjusted IRRs are substantial, it may be that the net present value of energy efficiency investments are small relative to alternative investment projects, and not pursued as a result (given the practical limits on the availability of capital that often apply). This is likely to be a rational explanation of the reluctance of businesses (and financial institutions) to underwrite investment in energy efficiency improvement in some cases. (sub. 25, p. 5)

Some participants have claimed that people apply higher risk premiums to energy efficiency investments than they do to other investments. For example, the Energy Efficiency Working Group (2004, p. 8) claimed:

> Uncertainty within organisations on the success of energy efficiency projects, has often resulted in higher investment return hurdle rates being applicable to these investments relative to others.

The South Australian Government claimed:

> Key barriers to energy efficiency include the high risk premiums businesses often apply when evaluating energy-efficiency investments. (sub. 80, p. 2)

Although it is difficult to quantify the extent to which producers and consumers are attaching higher risk premia to energy-efficient investments than they do to other investments, it is important to assess the implications for policy. In this respect, the Commission notes that risk and uncertainty *per se* do not represent sources of market failure. As Jaffe and Stavins (1994, p. 805) noted:

> It is reasonable and appropriate for individuals to take uncertainty into account in making investment decisions, and to apply relatively high discount rates to irreversible investments whose returns are uncertain. To the extent that consumers' true discount rates were high for these reasons, this would not represent a market failure.

The Commission notes that market intermediaries, such as energy service companies, can play an important role in helping their customers to manage risk and uncertainty. Such contractors operate by undertaking to develop, install, and manage projects that will improve the energy efficiency and maintenance costs of their customers, in exchange for an agreed portion of the energy savings (chapter 8).

Although risk and uncertainty are not the sources of market failure in themselves, there are important lessons for policy if the source of uncertainty stems from sovereign risk. Minimising sovereign risk is always important, but clearly governments will need to change policy settings from time to time as circumstances change, so some risk is inevitable. The Australian Energy Performance Contracting Association noted:

> Actions of governments have the potential to address both the 'rational' and 'irrational' aspects of the energy efficiency gap. Since 'rational' application of, for example, a high discount rate reflects a perception of a high level of risk, government actions that reduce risk, or perception of risk, can shift the threshold for action. (sub. 47, p. 4)

As this report notes, there is considerable uncertainty in the current policy framework, particularly in relation to a national response to greenhouse policy.

Capital constraints

One reason for high discount rates being applied to energy efficiency investments is that individual producers and consumers face capital constraints of one form or another. These may be externally imposed by the capital market or internally imposed by managers within the firm.

Sorrell et al. (2004) noted that businesses may also be acting rationally in applying high discount rates to energy efficiency projects if they are reliant on debt financing. This is particularly the case in firms where senior managers impose high hurdle rates on noncore projects being administered by more junior staff.

Sanstad and Howarth (1994) noted that financial institutions tend to regard lending to low-income households for energy-efficient investments to be risky investments, and hence that such households may have little access to debt financing. Households:

> … frequently must pay substantial premia to obtain loans from lending institutions; indeed, they may be unable to obtain credit at any price. Under these conditions, the poor might rationally use high discount rates in evaluating the merits of energy efficiency improvements. (Sanstad and Howarth 1994, p. 815)

The effects of capital constraints are that firms and households may purchase cheaper and less efficient appliances because of their lower capital cost:

> In many cases consumers do not have ready access to capital to purchase more efficient equipment (more expensive). This is particularly so in the residential end use sector. Here, initial investment in energy efficiency can be seen to be large compared with significantly lower purchase costs, but higher operating costs of less-efficient alternatives. (TransGrid, sub. 62, p. 3)

However, some financial intermediaries are actively courting business in this area. For example, the Bendigo Bank provides home loan mortgages with reduced interest rates for borrowers prepared to invest in energy-efficient technologies (chapter 7).

Asset replacement costs

Many energy-using technologies have long asset lives. Since the adoption of more energy-efficient technologies can require either the replacement or the refurbishment of existing assets, new investments will usually occur relatively infrequently and will be governed by a variety of economic considerations, energy efficiency being only one of them. For example, the Electricity Supply Association of Australia said that large electricity customers would only change their energy use if their capital stock changed:

> For large electricity customers, the level of consumption tends to be embedded in existing plant and equipment and only replacement investment can effect a substantial change in the efficiency of their energy use. (sub. 68, p. 8)

In some cases, very large improvements in energy efficiency may be needed to bring forward asset replacement, other things being the same. This issue is taken up in more detail in chapter 8.

Commission's assessment

In the Commission's view, these other barriers and impediments to the adoption of energy-efficient investments that appear to be privately cost effective, can be rational explanations for nonadoption. They are not necessarily problems that need to be, or can be, addressed by government intervention.

DRAFT FINDING 5.2

Other barriers and impediments that are not market failures (for example, high transaction costs, risk and uncertainty in implementation) may provide rational reasons for the nonadoption of energy efficiency improvements that appear (to an outsider) to be privately cost effective. The role of governments in addressing these issues may be quite small.

6 Energy efficiency gap

Key points

- An energy efficiency gap is the difference between actual energy efficiency and what is considered to be the most energy-efficient processes and technologies that are achievable.
- Defining the highest achievable energy efficiency is not straightforward. A common approach, and the one set out in the terms of reference for this inquiry, is to only include energy efficiency improvements that would be cost effective for individual producers and consumers.
- To the Commission's knowledge, nobody has quantified the full extent of the energy efficiency gap in Australia. Many researchers have, however, undertaken case studies of selected energy efficiency improvements.
- The case studies typically find that producers and consumers have failed to adopt energy efficiency improvements that appear to be cost effective for them. Such findings, however, are based on many debatable assumptions, including:
  - the criterion for cost effectiveness
  - business-as-usual improvements in energy efficiency
  - extrapolation of audit and best-practice study results to a whole sector
  - representativeness of simulated producers and consumers.

Various studies have identified energy efficiency improvements that seem to be cost effective for individual producers and consumers, but for some reason are not adopted. This apparent underinvestment in energy efficiency improvement is often said to result in an 'energy efficiency gap'. This chapter clarifies what is meant by the term energy efficiency gap, and reviews recent case studies of potential energy efficiency improvements in Australia.

6.1 What is an energy efficiency gap?

An energy efficiency gap describes the difference between actual energy efficiency and what is considered to be the most energy-efficient processes and technologies that are achievable. Such a gap could be assessed at a national level, for particular industries, or for individual producers or consumers.

Defining what are the most energy-efficient processes and technologies that are achievable is not straightforward. At the extreme is the technologist or pure engineering view that any technically feasible improvement in energy efficiency is achievable (regardless of its cost). This is not practical and nor is it likely to be economically efficient.

The approach set out in the terms of reference for this inquiry is to only assess those energy efficiency improvements which are privately cost effective. That is, energy efficiency improvements which, at *current prices* (or prices one would reasonably expect over the life of that asset or technology), would not increase the total cost of producing current output (and may in fact reduce total costs).

The assessment of cost effectiveness is best based on current prices and output because they are the conditions under which actual energy consumption occurs. To do otherwise is to 'compare apples and oranges' and so produce a misleading measure of an energy efficiency gap. Similarly, when forecasting a future energy efficiency gap, predictions of actual and maximum achievable energy efficiency should be based on the same price and output expectations.

Cost effectiveness is not synonymous with economic efficiency. Economic efficiency is a stricter criterion that requires people to use the lowest cost combination of inputs to produce a given level of output (chapter 2). This criterion is rarely used to estimate an energy efficiency gap because it is difficult to take account of all the tradeoffs involved in using different combinations of inputs.

6.2 Case studies of energy efficiency potential

To the Commission's knowledge, there has been no comprehensive assessment of the full extent of the gap between actual and maximum achievable energy efficiency in Australia (based on cost effectiveness or any other criterion). In principle, such an assessment could be achieved by using production frontier techniques that benchmark individual producers and consumers against best practice. However, this requires data on the many possible technologies and management practices available to producers and consumers, and would be computationally demanding.

Numerous researchers have, however, used case studies of a subset of all possible energy efficiency improvements to demonstrate that Australian producers and consumers have failed to adopt energy efficiency improvements that are cost effective for them. Such case studies are reviewed in this section, with an emphasis on those that estimate the combined impact of energy efficiency improvements in several sectors. Sector-specific case studies are described in following chapters.

General methodological issues

In broad terms, the case studies examined in this section use an 'engineering–accounting' approach. An engineering estimate of how far energy efficiency can be increased is converted into predicted savings in running costs. An accounting or financial equation is then used to assess whether it is cost effective to incur the costs of investing in the energy efficiency improvement, in return for lower running costs in the future.

There are various different criteria that can be used to assess cost effectiveness, even within the definition specified in this inquiry's terms of reference (box 6.1). This can, in turn, lead to different estimates of what is cost effective.

Box 6.1 **Possible cost-effectiveness criteria**

Various different criteria can be used to determine cost effectiveness. The following are three possible options.

Net present value (NPV) is positive — the present value of expected future savings in running costs exceeds the present value of expected additional capital costs. Present values are determined by applying a discount rate to future costs and benefits.

Internal rate of return (IRR) is above a minimum threshold — the discount rate at which the present value of expected future savings in running cost equals the present value of the expected additional costs is above a certain level.

Payback period is below a certain time period — the number of years it takes for cumulative savings in running costs to match the increase in capital costs is below a certain level. It is assumed that the benefit from having a dollar today is the same as having a dollar in the future, and so a discount rate is not applied to future cost savings.

If an investment meets the selected criterion, but is not being adopted, then this is regarded as evidence that producers or consumers are not adopting cost-effective energy efficiency improvements.

Another reason why estimates may differ concerns whose costs are considered when assessing cost effectiveness. The terms of reference for this inquiry require the Commission to consider changes in the costs of individual energy users. A broader approach would be to also consider changes in the costs that energy users impose on others (such as from pollution), as would be done in a social (or societywide) benefit–cost analysis.

SEAV-NFEE estimates

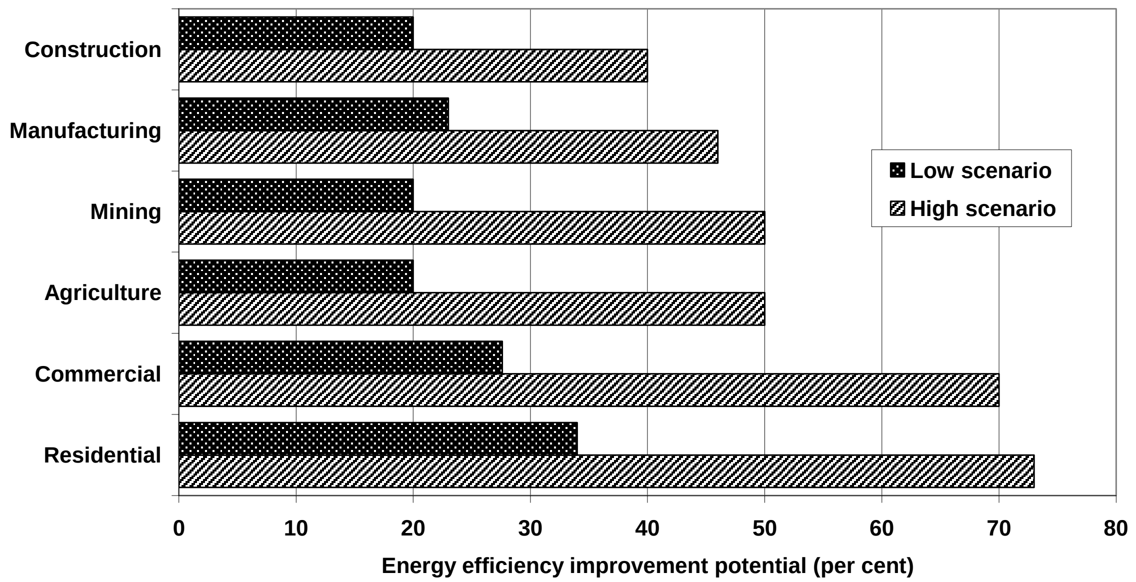
The Sustainable Energy Authority of Victoria (SEAV), with assistance from several consultants, produced estimates of Australia's energy efficiency potential for the National Framework for Energy Efficiency (NFEE).

The SEAV-NFEE estimates were produced in two phases. The first phase used readily available data to generate preliminary results. In the second phase, sectoral studies were undertaken to produce revised estimates of energy efficiency potential.

Preliminary (phase one) estimates

The preliminary SEAV-NFEE estimates were generated for two scenarios — low and high energy efficiency improvement (figure 6.1). The results suggested that there was significant scope for producers and consumers to adopt improvements in their energy efficiency that would be cost effective for them.

Figure 6.1 **Preliminary (phase one) SEAV-NFEE estimates of potential energy efficiency improvements**[a]



a Energy efficiency improvement potential is expressed as a percentage of current energy use. The low energy efficiency improvement scenario was based on current commercially available technologies with an average four year payback period. The high energy efficiency improvement scenario was based on existing or developing technologies potentially available during a 12 year projection period with an average eight year payback period.

Data sources: EEWG (2003); SEAV, Armstrong and Saturn Corporate Resources (2003).

The authors stressed the preliminary nature of their results:

> This work does not purport to be a definitive study on energy efficiency improvement potential in Australia, and its inherent limitations are recognised. (SEAV, Armstrong and Saturn Corporate Resources 2003, p. ii)

They also listed various limitations of their study, including that the estimates were based on national averages and did not take account of the 'rebound' effect or future technological improvements that would lower the cost of adopting energy efficiency improvements.

Phase two SEAV-NFEE estimates

The preliminary estimates of energy efficiency improvements were considered by many to be overly optimistic. For the second phase of the SEAV-NFEE assessment, more detailed studies were commissioned on potential energy efficiency improvements in the residential, commercial and industrial sectors. Different approaches were used for each sector.

Residential sector

For the residential sector, the SEAV commissioned two studies:

- George Wilkenfeld and Associates (2004b) analysed potential improvements in the efficiency of water heating; and
- EMET Consultants (2004b) examined 15 potential energy efficiency improvements for lighting, cooking, refrigeration, dishwashers, clothes washers, building thermal performance and heating/cooling systems.

Both of these studies used spreadsheet models to quantify the benefit to householders from investing in specific energy efficiency improvements. The simulated investments were in addition to those that householders were expected to undertake under a business-as-usual scenario of continuing energy efficiency improvements and expected future increases in mandatory efficiency standards for residential buildings and appliances.

In summary, the residential sector estimates suggested that, by 2014, householders will have overlooked additional cost-effective actions that could have reduced their energy consumption by at least 13 per cent in that year (table 6.1). The majority of these gains were from changes to heating and cooling appliances. Note that this result is much more conservative than the 35 per cent improvement estimated in phase one (figure 6.1).

Table 6.1 **SEAV-NFEE estimates of potential energy efficiency improvements for the residential sector**[a]

Relative to a business-as-usual projection for 2014/2015

Energy efficiency measure	*Reduction in energy use*[b]	*Proportionate reduction in energy use*[b]	*Reduction in running costs*[b]	*Increase in capital costs*[b]
	Petajoules	%	$m	$m
Building shell, heating & cooling	37.7	16.4	458.8	2 175
Lighting	2.7	12.4	97.6	384
Refrigeration	3.5	10.9	126.4	439
Cooking	3.9	17.7	100.4	330
Dishwashers	0.3	8.0	10.5	63
Clothes washers	0.2	13.5	8.5	35
Water heating	21.2	14.9	427.3	1 038
Total	**69.5**	**13.0**	**1 229.5**	**4 464**

[a] Estimates in the table show changes relative to a business-as-usual projection for 2015 (water heating) or 2014 (other measures). Water heating estimates are for measures with a payback period of no more than four years, as estimated by George Wilkenfeld and Associates (2004b, p. 15). Estimates for other energy efficiency measures have a payback period of no more than 6.5 years, as estimated by EMET Consultants (2004b). [b] Compared to annual energy use and costs in the final year of the business-as-usual projection (2014/2015).

Data sources: EMET Consultants (2004b); George Wilkenfeld and Associates (2004b); McNicol (2004).

Commercial sector (buildings)

The SEAV-NFEE analysis of the commercial sector focused on measures that could be implemented in existing buildings, refurbishments or new buildings. Estimates were generated by EMET Consultants (2004a) by using a database of 80 potential energy efficiency improvements, which covered:

- thermal performance of building fabric
- heating, ventilation and air conditioning
- lighting
- hot water services
- lifts and other services and plant.

Individual energy efficiency improvements were ranked according to their payback period. Measures that had a payback period of no more than four years were then combined to produce an overall estimate of energy efficiency potential in six sub-sectors (after taking account of any interactions between the energy efficiency measures). The results were compared to business-as-usual scenarios for 2010 (derived from ABARE sectoral forecasts and EMET Consultant’s assessment of future adoption rates for energy efficiency measures due to improvements in the cost effectiveness of technologies and their availability).

In summary, the commercial sector estimates suggested that, by 2010, the commercial sector will have overlooked cost-effective actions that could have reduced its energy consumption by a further 10.4 per cent in that year (table 6.2). Around half of the estimated potential energy savings were from initiatives to improve lighting and management of hot water systems and processes (such as cooking and heating) in the wholesale and retail trade.

Table 6.2 **SEAV-NFEE estimates of potential energy efficiency improvements for commercial buildings[a]**

Sub-sector	*Reduction in energy use*[b]	*Proportionate reduction in energy use*[b]	*Reduction in running costs*[c]	*Implementation cost*[c]
	Petajoules	%	$m	$m
Wholesale and retail trade	15.2	11.9	920.8	846.9
Accommodation, cafes and restaurants	2.8	14.1	121.4	144.0
Communication services	0.5	7.6	25.6	27.3
Finance, insurance, property and business services	4.1	11.1	196.1	203.6
Government administration, education, health and community services	6.0	7.3	430.0	276.6
Culture and recreation, personal and other services	1.7	9.9	73.6	74.0
Total	**30.2**	**10.4**	**1 767.5**	**1 572.4**

[a] Estimates in the table are for energy efficiency improvements (beyond those under the business-as-usual scenario) that have a payback period of no more than four years. The average payback period was much less than four years for all sub-sectors because most of the energy improvements examined had a payback period well below four years. [b] Compared to annual energy use in the final year of the business-as-usual projection (2010). [c] Before taking account of business-as-usual changes in running and capital costs. This has the effect of overstating the increase in capital costs and fall in running costs.

Data source: EMET Consultants (2004a).

Industrial sector (mining and manufacturing)

The SEAV-NFEE estimates for the industrial sector were produced by Energetics (2004). There were some key differences from the assumptions used for the residential and commercial studies, including that:

- there is no change in the size of the industrial sector over the projection period;
- there are no energy efficiency improvements under the business-as-usual scenario for some industries (mining, ceramics, bakery products, flour milling and cereal products); and

- there is no interaction between different energy efficiency measures when they are combined to estimate overall energy efficiency potential.

Energetics (2004) compared the energy that individual sub-sectors used for specific processes — such as use of a blast furnace — with that found in best practice studies and site audits. The results were used to estimate how far the energy efficiency of a specific process in a sub-sector could be improved. 'Implementation rate factors' were used to recognise that not every firm in a sub-sector could achieve the energy efficiency improvement. Process-specific energy efficiency measures were then ranked according to their payback period. Measures that had a payback period of no more than four years were combined to produce estimates of energy efficiency potential in each sub-sector. The results were compared to a 12 year business-as-usual projection that, for some sectors, included energy efficiency improvements.

In summary, the industrial sector estimates suggested that, in the final year of the projection period, the industrial sector will have overlooked additional cost-effective actions that could have reduced its energy consumption by at least 6.2 per cent in that year (table 6.3). This is smaller than the percentage improvements estimated for the residential and commercial sectors (13.0 and 10.4 per cent respectively) and can be attributed to a number of reasons. Unlike the commercial sector study, the industrial sector analysis excluded greenfield projects and did not take account of reductions in non-energy costs, such as lower maintenance.

The potential reduction in energy consumption was estimated to be similar in percentage terms in most sub-sectors (around 7 to 9 per cent in the final year of the projection period). The exceptions were bauxite mining and alumina refining, and iron and steel manufacturing, where energy efficiency potential was found to be relatively small; and dairy product manufacturing and bakery products, which had a high energy efficiency potential. In terms of the amount of energy that could be saved, aluminium smelting and semi-fabrication was estimated to have the greatest potential.

The relatively small energy efficiency potential (in percentage terms) for bauxite mining and alumina refining, and iron and steel manufacturing, can be partly attributed to the strong incentive for those industries to adopt cost-effective energy efficiency improvements under the business-as-usual scenario. That is, energy accounts for a large proportion of their costs and so there is a strong incentive to reduce energy costs. Such an incentive also applies to aluminium smelting and semi-fabrication, and so it is surprising that an above-average energy efficiency potential was estimated for that sub-sector (8.8 per cent versus 6.2 per cent for all industrial sub-sectors).

Table 6.3 **SEAV-NFEE estimates of potential energy efficiency improvements for the industrial sector**[a]

Sub-sector	*Reduction in energy use*[b]	*Proportionate reduction in energy use*[b]	*Reduction in running costs*[c]	*Cumulative increase in capital costs*[c]
	Petajoules	%	$m	$m
Mining (excluding oil, gas and bauxite)	8.0	8.8	100.0	212.0
Meat and meat products	1.0	8.3	24.1	63.6
Dairy product manufacturing	1.7	11.9	23.9	81.8
Bakery products, flour milling and cereal products	1.5	13.5	19.2	58.1
Pulp and paper manufacturing	3.5	7.4	54.2	149.3
Chemical products manufacturing	9.3	8.9	89.0	211.0
Ceramic products manufacturing	2.1	8.6	13.2	44.8
Cement manufacturing	2.8	9.6	28.3	42.9
Iron and steel manufacturing	6.6	4.0	117.0	160.0
Bauxite mining and alumina refining	1.0	0.6	45.7	111.6
Aluminium smelting and semi-fabrication	11.4	8.8	143.7	438.2
Total	**48.9**	**6.2**	**659.0**	**1 574.0**

[a] Estimates in the table are for energy efficiency improvements that have a payback period of no more than 4 years when implemented over a 12 year period starting from 1999. [b] Compared to annual energy use in the final year of the business-as-usual projection. [c] Before taking account of business-as-usual changes in running and capital costs. This has the effect of overstating the increase in capital costs and fall in running costs.

Data source: Energetics (2004).

There is a significant difference between the potential energy savings estimated for bauxite mining and alumina refining (1.0 petajoule) versus aluminium smelting and semi-fabrication (11.4 petajoules). Energetics (2004) did not explain the reason for the difference, but it did note that the information it had on energy efficiency opportunities in those industries was more limited than what it had for other industries.

Input to SEAV-NFEE general equilibrium modelling

The results of the above-mentioned sectoral studies were integrated by the SEAV into a dataset that was provided to the Allen Consulting Group (2004a) in order to estimate the economywide impacts of adopting potential energy efficiency improvements (table 6.4). Estimates for agriculture, construction and some manufacturing industries were also provided to the Allen Consulting Group. These were based on the preliminary (phase one) SEAV-NFEE results (SEAV, Armstrong and Saturn Corporate Resources 2003) and an extrapolation of the industrial sector case study results (Energetics 2004).

Table 6.4 **Comparison of SEAV-NFEE estimates of potential energy efficiency improvements**

	Energy efficiency potential	
Sector	*SEAV-NFEE sectoral case studies*[a]	*SEAV-NFEE general equilibrium study*[b]
	%	%
Agriculture	**ne**	**5.0**
Industrial sector	**6.2**	**6.4**
Mining	8.8	3.4
Manufacturing	na	6.9
Dairy Products	*11.9*	*11.2* (Dairy Products, Meat Products, Milling & Baking combined)
Meat Products	*8.3*	
Milling & Baking	*13.5*	
Textiles, Clothing & Footwear	*ne*	*6.3*
Pulp & Paper Manufacturing	*7.4*	*7.4*
Chemicals (ex petroleum) – Basic chemicals	*8.9*	*8.9*
Non-Metallic Minerals – Ceramics	*8.6*	*9.1* (Ceramics and Cement combined)
Non-Metallic Minerals – Cement	*9.6*	
Iron & Steel	*4.0*	*4.0*
Alumina	*0.6*	*4.3* (Alumina and Aluminium combined)
Aluminium	*8.8*	
Other Metals	*ne*	*4.3*
Machinery & Equipment	*ne*	*6.3*
Other Manufacturing	*ne*	*6.3*
Construction	ne	6.3
Commercial sector	**10.4**	**10.4**
Wholesale & Retail Trade	11.9	11.9
Accommodation, Cafes & Restaurants	14.1	14.1
Communication Services	7.6	7.6
Finance & Insurance, Property & Business Services	11.1	11.1
Govt. Administration, Education, Health & Community Services	7.3	7.3
Culture & Recreation, Personal Services	9.9	9.9
Residential sector	**13.0**	**13.0**

a EMET Consultants (2004a, 2004b); Energetics (2004); George Wilkenfeld and Associates (2004b). **b** Allen Consulting Group (2004a). **ne** Not estimated in sectoral case studies. **na** Not available.

In its modelling of economywide effects, the Allen Consulting Group (2004a) assumed that 50 per cent of the potential energy efficiency improvements shown in table 6.4 would be achieved over a 12 year period from 2005 to 2016:

> For this modelling it was assumed that 50 per cent of the EEI [energy efficiency improvement] measures with a payback up to and including 4 years were introduced over the 12 year modelling period 2005 to 2016. The EEI potential was introduced uniformly over the modelling period, that is, 1/12 was introduced in each year so that the full potential had been applied by year 12 [2016]. (Allen Consulting Group 2004a, p. 41)

The Allen Consulting Group (2004a) estimated that, in 2016, its assumed increase in energy efficiency would, relative to a business-as-usual scenario for that year:

- increase gross domestic product by 0.09 per cent ($975 million)
- increase real private consumption by 0.12 per cent ($724 million)
- increase employment by 0.02 per cent (2600 people)
- reduce greenhouse gas emissions by 2.8 per cent (9.5 megatonnes of carbon dioxide equivalent).

CEFG estimates

The Clean Energy Future Group[1] (CEFG) commissioned a study by Saddler, Diesendorf and Denniss (2004) to examine whether it was possible to achieve a 50 per cent reduction in carbon dioxide emissions from stationary sources by 2040 with only minor improvements in existing technologies.

A long projection period (36 years) was chosen so that most of the current capital stock could be retired or refurbished cost effectively. Importantly, and in a major departure from the approach adopted for this inquiry, it was assumed that there would be a future constraint on greenhouse gas emissions and this would lead to a significant increase in energy prices. The prices of primary fossil fuels were assumed to increase in real terms by between 25 and 50 per cent above current levels. As the study's authors noted, their price assumptions would also increase the number of energy efficiency improvements that are cost effective.

An assessment of the achievable energy efficiency improvements beyond a 'baseline' scenario was made by drawing on other studies and data sources, such as

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[1] The Clean Energy Future Group comprises the Australasian Energy Performance Contracting Association, Australian Business Council for Sustainable Energy, Australian Wind Energy Association, Bioenergy Australia, Renewable Energy Generators of Australia, and the Worldwide Fund for Nature.

information from the Energy Efficiency Best Practice program. One example of the resulting energy efficiency scenario was the assumption that solar hot water systems would displace 75 per cent of existing electrical hot water heaters and 90 per cent of gas hot water heaters.

In summary, the CEFG study estimated that, in 2040, it would be cost effective (assuming the higher energy prices) to reduce energy consumption by 590 petajoules (20 per cent) below the baseline scenario in that year (table 6.5). The largest percentage savings in energy consumption were estimated to be in sectors where energy accounts for a relatively small share of total costs (residential; commercial; agriculture, forestry and fisheries; food, beverages and tobacco). Only modest savings were estimated for sectors where energy accounts for a large share of total costs (nonferrous metals; iron and steel; wood, paper and printing).

Table 6.5 **CEFG estimates of potential energy efficiency improvements**
Relative to a baseline projection for 2040

Industry	*Reduction in energy use*	
	Petajoules	%
Agriculture, forestry and fishing	21	20
Mining	66	16
Manufacturing	138	11
Iron and steel	*17*	*8*
Food, beverages, tobacco	*86*	*42*
Basic chemicals	*12*	*16*
Cement, lime, plaster and concrete	*10*	*16*
All other non-metallic mineral products	*8*	*11*
Non-ferrous metals	*0*	*0*
Wood, paper and printing	*0*	*0*
All other manufacturing	*5*	*5*
Construction	20	17
Commercial services	197	39
Residential	148	27
Total final stationary energy consumption	**590**	**20**

Data source: Saddler, Diesendorf and Denniss (2004).

The CEFG estimates are much higher than the SEAV-NFEE estimates because of the longer projection period and the assumed significant increase in energy prices. The SEAV-NFEE studies assumed that real energy prices would not change over the projection period to 2014.

6.3 Assessment of case study results

The case studies described in the previous section appear to support the hypothesis that producers and consumers often fail to adopt energy efficiency improvements that are cost effective for them. However, the case studies need to be interpreted with caution because they are based on many debatable assumptions, including the definition of cost effectiveness. The section considers how such assumptions can influence the results.

Cost-effectiveness criterion

The criterion used to determine cost effectiveness can have a large bearing on the number and type of energy efficiency improvements that are deemed to be cost effective.

Defining cost effectiveness in terms of a maximum payback period, as the SEAV-NFEE sectoral studies did, could give undue emphasis to investments with short-term returns. This may cause analysts to overlook projects that have relatively large up-front capital costs, but nevertheless are worthwhile because they generate significant benefits over the longer term. These benefits could be far larger than those available from short-term projects. Projects with longer-term benefits are more likely to be deemed cost effective when using an NPV or IRR criterion (as was done for the regulatory impact assessments discussed in chapters 7 and 8).

Despite the sensitivity of case study results to which cost-effectiveness criterion is used, few studies justify their selected criterion or examine the sensitivity of their results to a change in the criterion.

A related issue is whether the cost-effectiveness criterion used in a case study is the same as that used by the producers and/or consumers being studied. An ABARE survey of participants in the Australian Government's Enterprise Energy Audit Program (EEAP) found that 80 per cent of firms used a payback rule to evaluate energy efficiency investments, 53 per cent used an IRR criterion, and 30 per cent used an NPV criterion (Harris, Anderson and Shafron 1998). Some firms used more than one criterion. Where a payback criterion was adopted, the average requirement was a maximum 3.5 year payback.

A survey of 4400 companies in the United States found that small firms used a payback period criterion to evaluate investments as frequently as they used an NPV or IRR criterion (Graham and Harvey 2001). Most large firms reported that they used an NPV or IRR criterion.

Should higher discount rates be used for the NPV criterion?

The NPV criterion recognises that producers and consumers would prefer to receive a dollar today, rather than a dollar some time in the future, by applying a discount rate to future benefits (reductions in running costs).

Regulatory impact assessments of energy efficiency policies typically use an NPV criterion with a discount rate that is never above 10 per cent, and in most cases is lower (chapters 7 and 8). It could be argued that the discount rates used are far too low and hence the cost effectiveness of energy efficiency improvements is significantly overstated. The ABARE survey of EEAP participants found that firms using an NPV criterion adopted an average discount rate of 13 per cent (Harris, Anderson and Shafron 1998). In an analysis of US mandatory energy performance standards, Sutherland (2003) found that regulators tend to overstate benefits in regulatory impact statements because they use unrealistically low discount rates (3 and 7 per cent). He estimated that the US standards impose a net cost on consumers of around $US50 billion, rather than the net benefit of $US150 billion predicted by the US Government.

It is often observed in the energy efficiency literature that, based on actual consumption patterns, householders discount the future at a much higher rate than the average return on shares or bonds. One of the most comprehensive and widely cited reviews of discount rate estimates found that discount rates for energy-related purchases by householders often range up to very high rates of 30 per cent or more (Train 1985). That study also found that a household's discount rate tends to increase as its income falls, and is higher when the household lives in rented accommodation. This diversity was not recognised in any of the case studies mentioned in section 6.2 (or in the regulatory impact assessments examined in chapters 7 and 8).

Some of the regulatory impact assessments do, however, acknowledge that small changes in the selected discount rate can have a major impact on whether an energy efficiency improvement is cost effective:

> … the discount rate has a major effect on the estimated value of energy savings that accrue in the medium to longer term. (Syneca Consulting 2003a, p. 16)

The assessments often undertake a sensitivity analysis to examine how different discount rates affect their results. However, the range of discount rates used is usually small and no rates above 10 per cent are used. For example, the Australian Building Codes Board (ABCB 2002) used discount rates of 4, 5 and 6 per cent in its assessment of energy efficiency standards for housing.

Business-as-usual projections

The potential for energy efficiency improvement is typically assessed by comparing the modelled scenario to a 'business-as-usual' projection many years into the future. This requires judgements about many aspects of the future that are highly uncertain, such as future changes in the cost of energy saving technologies, relative prices (between different forms of energy, and relative to other goods and services), rate of capital turnover, and the impact of government energy efficiency programs. Examples are provided in box 6.2 from the SEAV-NFEE residential sector case studies. For the SEAV-NFEE industrial sector study, the business-as-usual projection assumed no increase in the size of the sector and, for some industries, no future improvements in energy efficiency.

Sutherland (2003) showed that US policy makers often overstate the potential for cost-effective improvements in energy efficiency because their assumed business-as-usual improvements in energy efficiency are too pessimistic and fail to anticipate the responsiveness of consumers to future reductions in the prices of energy-efficient products.

Despite the uncertainty of business-as-usual projections and their importance to estimated energy efficiency potential, some case studies do not detail how they were constructed. For example, the SEAV-NFEE industrial sector study (Energetics 2004) gave limited detail about its assumed business-as-usual energy efficiency improvements. The basis for the assumed growth rates included 'recent performance of the industry' (pulp and paper manufacturing) and the experience of companies involved in the relevant industry (meat and dairy). For bakery products, flour milling and cereal products, Energetics (2004, p. 32) assumed no energy efficiency improvements under the business-as-usual scenario because it had 'observed no overall decrease in energy usage within the industry over the last number of years'. Energetics (2004, p. 47) also assumed no energy efficiency improvements under the business-as-usual scenario for ceramic products manufacturing because it was 'unaware of data that supports a BAU [business-as-usual] decrease in energy usage in the future'. For other sub-sectors (cement, iron and steel, aluminium, and alumina), no justification for the assumed energy efficiency improvements under the business-as-usual scenario was provided.

Other case studies were more transparent about the assumptions underpinning their business-as-usual projections. For example, the CEFG study (Saddler, Diesendorf and Denniss 2004) detailed its future energy demand scenario, which is based on current energy intensity trends. However, the CEFG estimates are probably the most speculative among the studies examined in this report. The study projected almost four decades into the future and assumed that energy prices will increase by between 25 and 50 per cent (in real terms) by 2040. This has the effect of producing a much larger, and also much more uncertain, estimate of energy efficiency potential than that found in the other case studies.

Box 6.2 A sample of the assumptions used for the SEAV-NFEE residential case studies

The estimates produced for the SEAV and NFEE by George Wilkenfeld and Associates (2004b) and EMET Consultants (2004b) relied on a wide range of assumptions. These included:

- the prices that householders across Australia face for different forms of energy (electricity, gas and wood), including differences between peak and off-peak tariffs;
- business-as-usual projections ten years into the future for:
  - number of households and their distribution between different household types;
  - the distribution of residential buildings between different climatic regions and building types (such as floor area, whether brick veneer or double brick, and whether a detached dwelling);
  - purchases of specific types of appliances (such as top loading washing machines of a certain capacity and reverse cycle air-conditioners with a particular capacity) and their distribution between different levels of energy efficiency;
  - investment in specific energy efficiency improvements, such as insulation and weather stripping and sealing;
  - detailed usage patterns for specific appliances (such as number of times a clothes washer is used each week and proportion of washes done at less than full capacity);
  - amount of energy used for specific purposes (such as space heating, cooking, air conditioning, hot water for showering and hot water for clothes washing);
- no change over the next ten years in the prices of different forms of energy relative to each other, or relative to other goods and services;
- detailed characteristics of specific energy efficiency improvements, including:
  - purchase and installation costs;
  - reduction in energy used; and
  - the rate at which the measure could be adopted by households, and the upper limit on the level of adoption, given household characteristics, usage patterns and stock of buildings and appliances.

Extrapolation of audit results and best-practice studies

A key input to a case study is the engineering prediction of what is the technically feasible reduction in energy use from adopting a particular measure. Such predictions are often derived by extrapolating to a whole sector the results of a limited trial or audit for a small number of producers or consumers.

For example, the CEFG study relied on case study material from the Energy Efficiency Best Practice (EEBP) program, which targeted specific companies that could achieve energy efficiency improvements. Similarly, the SEAV-NFEE industrial sector study (Energetics 2004) was based on a limited number of energy audits, some of which were from overseas.

The ABARE survey of EEAP participants found that 81 per cent of all recommendations from energy audits were implemented. However, the authors of that study noted that a lower implementation rate could occur if audits were made compulsory for all firms (Harris, Anderson and Shafron 1998). This is because EEAP participants had a strong commitment to achieving energy efficiency improvements. That is, their pecuniary and non-pecuniary benefits may be higher than for the typical firm.

A related issue is how case studies tend to simulate impacts for a representative producer or consumer (or several producer or consumer types). This is done because it is not practical to evaluate the cost effectiveness of energy efficiency improvements for every individual producer and consumer. However, where diversity among producers and consumers has a significant impact on their energy consumption, extrapolating the energy savings for a small number of hypothetical energy users to a whole sector is likely to lead to an inaccurate measure of energy efficiency potential.

It appears that energy use is most heterogenous in the commercial and residential sectors. Assessments of the benefits and costs for these sectors typically depend on many assumptions. For example, in its evaluation of energy efficiency measures in the residential sector, EMET Consultants (2004b) relied heavily on debatable assumptions regarding the performance of existing technology, costs of implementing the improvements and the potential energy savings (boxes 6.3 and 6.4). Such an approach raises questions about whether the results provide a representative guide, under real world conditions, of the potential for cost-effective energy efficiency improvements across a sector (Jaffe and Stavins 1994, Sorrell et al. 2000).

As noted in chapter 5, there is a range of barriers and impediments that can make it sensible for producers and consumers to refrain from adopting a proposed energy efficiency improvement. They include:

- the opportunity cost of decision makers’ time
- implementation costs

- risk and uncertainty
- capital constraints
- tradeoffs between energy efficiency and other performance features.

Box 6.3 **Selected measures examined in the SEAV-NFEE residential case studies**

Increased use of insulation in existing homes

Energy efficiency improvements were estimated for a typical home in each State. Key assumptions included:

- 60 per cent of households nationally were currently insulated (based on ABS data);
- the proportion of non-insulated buildings was assumed to be the same across all states;
- an upper limit of 70 per cent adoption could be achieved at a rate of an additional 1 per cent a year; and
- the average cost of insulating a dwelling was assumed to be $750.

Increased energy efficiency of reverse cycle heating and cooling

Energy efficiency improvements were estimated for a typical household across all States. Key assumptions included:

- all existing air conditioners are replaced over a period of 10 years with units that have a coefficient of performance level of 0.5 better than the minimum specified by the Minimum Energy Performance Standard;
- electricity use for existing air conditioners is estimated assuming an average coefficient of performance of 2.0; and
- the additional cost of purchasing a more energy efficient appliance is $400, based on an assumed 25 per cent price premium over a typical air conditioner.

More energy-efficient lighting

Energy efficiency improvements were estimated for a typical household across all States. Key assumptions included:

- 30 per cent of kitchen lights, 30 per cent of lounge room lights and 50 per cent of bedroom lights are converted to fluorescent at a rate of 7 per cent a year; and
- the average cost of making the change is $130 per household.

Source: EMET Consultants (2004b).

The ABARE study of EEAP participants provides an indication of the relative importance of different barriers and impediments. It found that, where an audit recommendation was not implemented, the most likely cause was that the rate of return was too low (table 6.6). Other important constraints were investment risk, expertise of staff, and availability of finance.

Table 6.6 **Reasons why EEAP audit recommendations were not adopted[a]**

Reason for not implementing recommendation	*Proportion agreeing or strongly agreeing with reason*
	%
Rate of return too low	53
Payback period too long	45
Auditor's assessment inaccurate	38
Energy efficiency often overlooked	35
Unclear how to implement	28
Investment irreversible	28
Finance unavailable	20
Investment too risky	20
Lack of staff with expertise	17
Not our decision	13

a Based on a survey of participants of the Enterprise Energy Audit Program.

Data source: Harris, Anderson and Shafron (1998).

The ABARE findings are supported by overseas studies. For example, Anderson and Newell (2002) conducted an evaluation of why 50 per cent of recommendations from 9000 energy audits were not taken up. From follow-up surveys, it was found that audit recommendations were not adopted primarily because important implementation costs had not been recognised in the audits.

With respect to capital constraints, the case studies assumed that producers and consumers are always able to finance an energy efficiency investment if the up-front capital cost is outweighed by future returns. In reality, there is usually a limit to what producers and consumers are able to finance and so they will tend to ration their scarce capital resources to the most highly valued uses, which may not include energy efficiency improvements.

Interaction between different measures

Another issue arising from the analysis of case study methodology is how to account for the interdependence between the benefits that some energy efficiency improvements generate. For example, the energy savings from upgrading residential heating and cooling systems depends on whether or not measures to improve residential thermal insulation are made. All else equal, if thermal insulation is undertaken first, energy consumption will fall and, hence, the energy savings from upgrading cooling and heating systems will be reduced.

Where interdependence is present, but energy efficiency measures are analysed independently and are added, the overall energy efficiency potential will tend to be overstated. The SEAV-NFEE study of the industrial sector (Energetics 2004) did not take account of any interaction between different energy efficiency measures when they are combined to estimate overall energy efficiency potential. The other SEAV-NFEE studies did take account of interaction effects.

Changes in non-energy costs

Energy efficiency improvements can change not only energy costs, but also other expenditure items. In many case studies, these changes in non-energy costs are ignored.

For example, the SEAV-NFEE industrial sector study omitted changes in non-energy costs. It was claimed that this led to an understatement of what is cost effective:

> This study considers energy cost savings … In some cases other factors will be significant, including operating and maintenance savings and increased throughput. While some actions will entail new or ongoing maintenance …, most will involve lower maintenance requirements … The non-inclusion of additional benefits will tend to present a conservative view of potential paybacks. (Energetics 2004, p. 8)

Whether the omission of changes in non-energy costs leads to an overstatement or understatement of what is cost effective can only be judged on a case-by-case basis.

Feedback effects

The case studies do not consider how ‘feedback effects’ could change the cost and energy savings that result from a given energy efficiency improvement.

One possible example of feedback is an energy price effect — if lower energy demand due to greater efficiency led to a fall in energy prices. This would reduce the value of energy savings and so make it less likely that a given energy efficiency improvement is cost effective, *ex post*.

Another example of feedback is known as the ‘rebound effect’ (chapter 2) — some of the benefits of greater energy efficiency are used to purchase more energy-consuming goods and services. This would reduce the overall energy savings from an energy efficiency improvement.

Finally, greater use of an energy-efficient technology could enable economies of scale to be achieved in producing that technology and so lower its unit cost. This would tend to make the technology cost effective for more producers and consumers than otherwise.

The net impact of feedback effects is uncertain and is likely to vary between energy efficiency technologies, depending on a range of factors.

DRAFT FINDING 6.1

Numerous case studies have found that producers and consumers fail to adopt some energy efficiency improvements that appear to be cost effective for them. These case studies, however, are based on many debatable assumptions, including:

- *the criterion for cost effectiveness*
- *business-as-usual improvements in energy efficiency*
- *extrapolation of audit and best-practice study results to a whole sector*
- *representativeness of simulated producers and consumers.*

7 Residential sector

Key points

- Energy efficiency has been increasing in the residential sector since at least the early 1970s. Nevertheless, householders have not implemented all potential energy efficiency improvements that may be cost effective for them. This could be due to information barriers, 'split incentives', or small cost savings (less than 3 per cent of the average household's expenditure is on stationary energy).
- Governments provide subsidies and advisory services to householders to encourage them to adopt energy efficiency improvements. These policies appear to have a small, but positive, impact on energy efficiency. However, subsiding people to take actions that are already cost effective for them is difficult to justify, unless the real policy goal is to reduce 'negative externalities' — such as pollution — rather than to increase energy efficiency *per se*.
- To reduce the energy used by household appliances, governments have also taken a more interventionist approach — mandatory energy performance labels and minimum energy performance standards (MEPS). Labelling has probably generated a net benefit for householders. In contrast, MEPS have the potential to:
  - remove products from the market that are cost effective for some householders;
  - force consumers to forgo product features that they value more highly than greater energy efficiency; and
  - reduce competition.
- Past regulatory impact assessments of MEPS have not given sufficient consideration to the above disadvantages. The Commission therefore recommends that future regulatory impact assessments of MEPS include a more comprehensive analysis of their disadvantages.
- Governments have also introduced mandatory energy-performance ratings and standards for residential buildings. Unlike the arrangements for appliances, building energy efficiency is often simulated rather than measured directly. Case study results indicate that the simulation procedures have major deficiencies — dwellings with high actual energy efficiency can receive a rating of zero stars and be excluded by building standards. In addition, building standards have many of the potential disadvantages of appliance MEPS, such as restricting consumer choice.
- The Commission recommends a comprehensive and independent evaluation of existing requirements for building energy efficiency ratings and standards. This should be completed before governments proceed with their plans to introduce more stringent and widespread requirements.

Around 12 per cent of Australia's final (end use) energy consumption is attributable to the residential sector (ABARE 2004). Despite this relatively small share, the residential sector has been a major focus for energy efficiency policies. This chapter considers the rationale for such policy intervention in the residential sector and assesses the effects of the policies. The analysis is structured as follows:

- key features of residential energy use (section 7.1);
- why householders might fail to adopt energy efficiency improvements that are (or appear to be) cost effective for them (section 7.2); and
- assessment of residential energy efficiency policies (sections 7.3 to 7.8).

7.1 Key features of residential energy use

Household expenditure on energy

At current prices, energy is a relatively minor component of household expenditure. In 1998-99, Australian households spent, on average, 2.5 per cent of their total expenditure on domestic fuel and power (exclusive of motor vehicle fuels) (table 7.1). This approximates to around $21 per week in current dollar terms after adjusting for inflation since 1998-99. Thus, a 10 per cent increase in the energy efficiency of the average household would amount to about a $2 cost saving per week. For households whose gross income was in the bottom 20 per cent of all households in 1998-99, domestic fuel and power still accounted, on average, for only 3.7 per cent of their total expenditure (ABS 2000).

Table 7.1 **Share of household expenditure on domestic fuel and power by state, 1998-99**

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*Australia*
	%	%	%	%	%	%	%
Electricity	1.8	1.7	1.8	2.3	1.8	2.9	1.8
Mains gas	0.3	1.1	0.1	0.6	0.6	0.0	0.5
Bottled gas	0.1	0.1	0.1	0.1	0.2	0.1	0.1
Other	0.1	0.1	0.1	0.2	0.2	0.6	0.1
Total domestic fuel and power expenditure[a]	**2.3**	**3.0**	**2.1**	**3.2**	**2.8**	**3.6**	**2.5**

[a] Excludes expenditure on motor vehicle fuels, which accounted for 3.7 per cent of household expenditure at the national level in 1998-99.

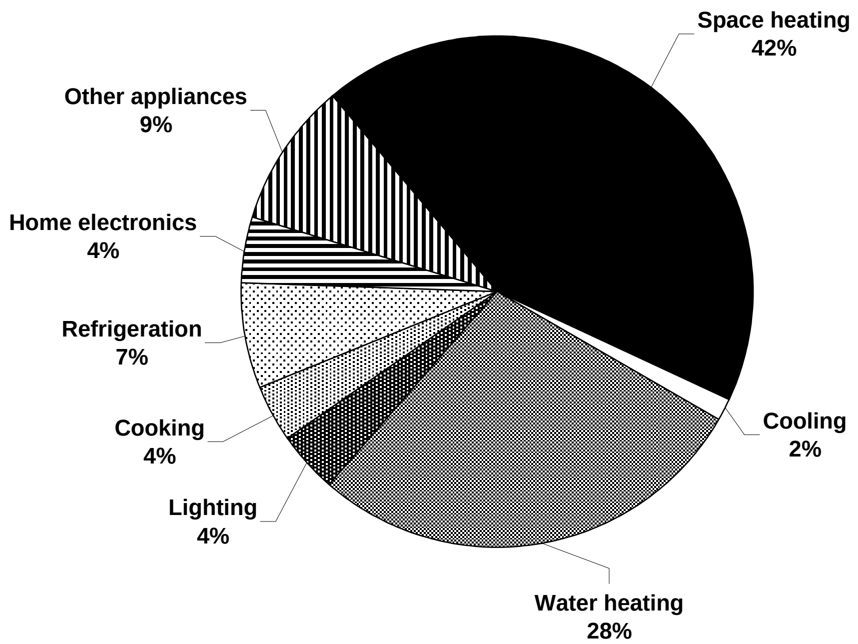
Data source: ABS (2000).

What households use energy for

The purposes for which households use energy are not reported on a regular and comprehensive basis in publicly available statistics. Rather, such information tends to be contained in one-off and irregular studies (for example, State Electricity Commission of Victoria 1984; Fiebig and Woodland 1991; State Energy Commission of Western Australia 1991; Pacific Power et al. 1994; Harrington and Foster 1999; EMET Consultants 2004b). The results of these studies vary and some have become dated by changes in the prevalence and use of appliances.

Among the more recent estimates of energy use are those prepared by EMET Consultants (2004b) as part of the modelling work undertaken for the National Framework for Energy Efficiency (NFEE). EMET Consultants projected that, in 2005, most of the energy consumed by the residential sector would be for space heating and water heating (figure 7.1). Cooling was projected to account for only a small proportion (2 per cent) of average annual residential energy consumption, but it is a major source of peak electricity loads on a small number of hot days each year (chapter 13).

Figure 7.1 **Projected residential energy use by purpose, 2005[a]**



a Purchased energy only. Solar energy is excluded.

Data source: EMET Consultants (2004b).

Caution should be exercised in interpreting such aggregate data because the residential sector comprises a large number of small and very diverse energy users. Factors such as differences in climate, income and household size can lead to marked differences in consumption patterns between households.

Energy efficiency has been increasing

The amount of energy used by the residential sector grew by 70 per cent from 1973-74 to 2000-01. This does not imply that energy efficiency has fallen. Much of the increase in residential energy consumption can be attributed to a growing population and standard of living. That is, there are more householders and their growing affluence has enabled them to enjoy more goods and services that use energy as an input.

In per capita terms, residential energy use grew by 19 per cent from 1973-74 to 2000-01. But the average householder's consumption of all goods and services grew much faster over the same period (real per capita household final consumption expenditure grew 64 per cent). This suggests that, after taking account of a growing population and standard of living, householders have become more energy efficient. It should be noted that this finding applies to the energy consumed directly by householders. The energy efficiency of industries that supply goods and services to households — including electricity — is examined in other chapters of this report.

Detailed analysis by ABARE researchers (Tedesco and Thorpe 2003) confirms that residential energy efficiency has increased. They found that changes in residential energy use during 1973-74 to 2000-01 would have reduced Australia's total energy consumption by 2.5 per cent if there had not been an increase in the number of householders and their consumption of goods and services. About half of this 2.5 per cent reduction was attributed to a substitution toward fuels with a higher conversion efficiency. The remaining half was largely due to so-called technical effects, which include more energy-efficient use patterns, the use of appliances that are designed and built to be more energy efficient, price-induced substitution of energy for other inputs, and improvements in the conversion efficiency of particular fuels.

Potential for cost-effective improvements in energy efficiency

Despite the long-term trend of rising energy efficiency in the residential sector, case studies often find that householders have overlooked energy efficiency improvements that are thought to be cost effective for them. For example, case studies commissioned by the Sustainable Energy Authority of Victoria indicate that, by 2014, householders will have overlooked cost-effective actions that could have reduced their energy consumption by at least 13 per cent in that year (chapter 6). It was estimated that failure to adopt the relevant energy efficiency improvements would, in 2014, lead to the consumption of an additional 69.5 petajoules of energy. This was greater than the potential energy efficiency improvements estimated for the commercial and industrial sectors (30.2 and 48.9 petajoules respectively), even though those sectors use more energy than the residential sector. Despite its relatively small share of Australia's energy consumption, the residential sector has been a major focus for energy efficiency policies.

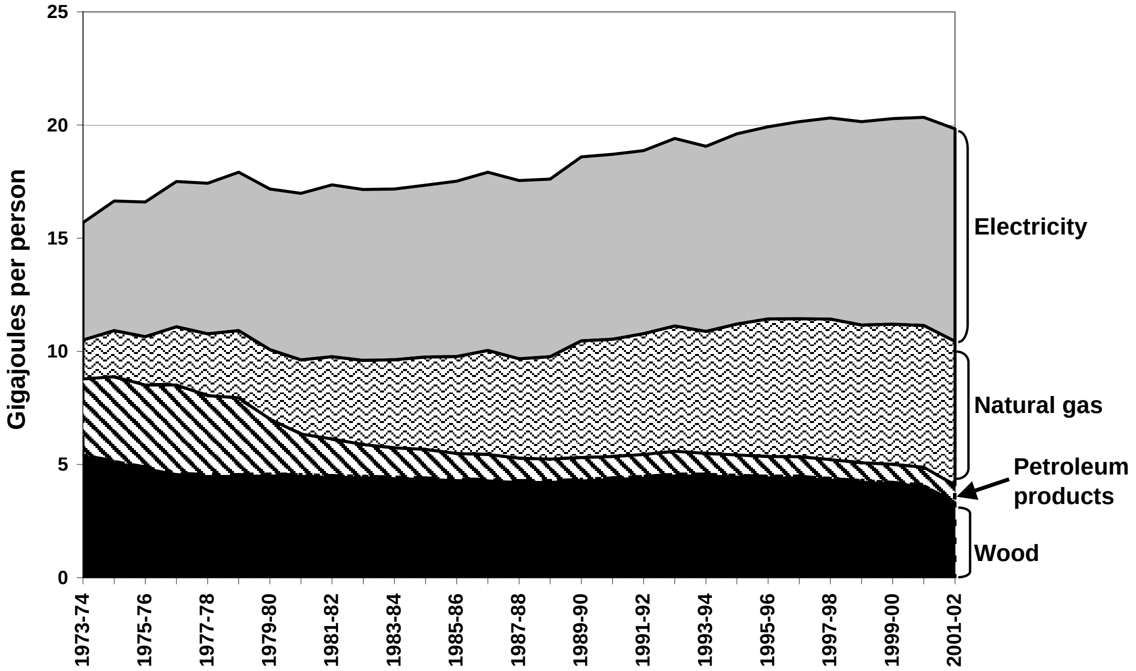
Shift between different forms of energy

While per capita energy consumption by householders has been growing relatively slowly, there has been significant substitution between different forms of energy. The relative importance of electricity and natural gas in per capita residential energy consumption has been growing since at least the early 1970s, primarily at the expense of wood and petroleum products (figure 7.2). This could be due to a range of factors, including changes in the relative prices of different forms of energy, increased availability of reticulated gas, and air pollution controls on the burning of wood for space heating.

In aggregate terms, almost half of the energy used by the residential sector was in the form of electricity in 2001-02, and about another one-third came from natural gas. This was the result of a long-term decline in energy consumed from wood (down 13 per cent during 1973-74 to 2000-01) and petroleum products (down 67 per cent), and increased use of energy from natural gas (up 429 per cent) and electricity (up 159 per cent).

From the 1950s until the oil price shocks of the 1970s, many households in southern Australia used oil heaters. Following the second oil price shock in 1979, there was a rapid and substantial decline in residential consumption of petroleum products (from 18 per cent of residential energy consumption in 1978-79 to 10 per cent in 1980-81). Thus, householders demonstrated that they are capable of quickly changing their energy use when it is cost effective for them to do so, even if it means replacing appliances before they have worn out.

Figure 7.2 **Per capita residential energy consumption by fuel, 1973-74 to 2001-02[a]**



[a] Fuels not shown on the diagram (such as coal briquettes and solar) accounted collectively for an annual average of 0.5 GJ per person during the period 1973-74 to 2001-02.

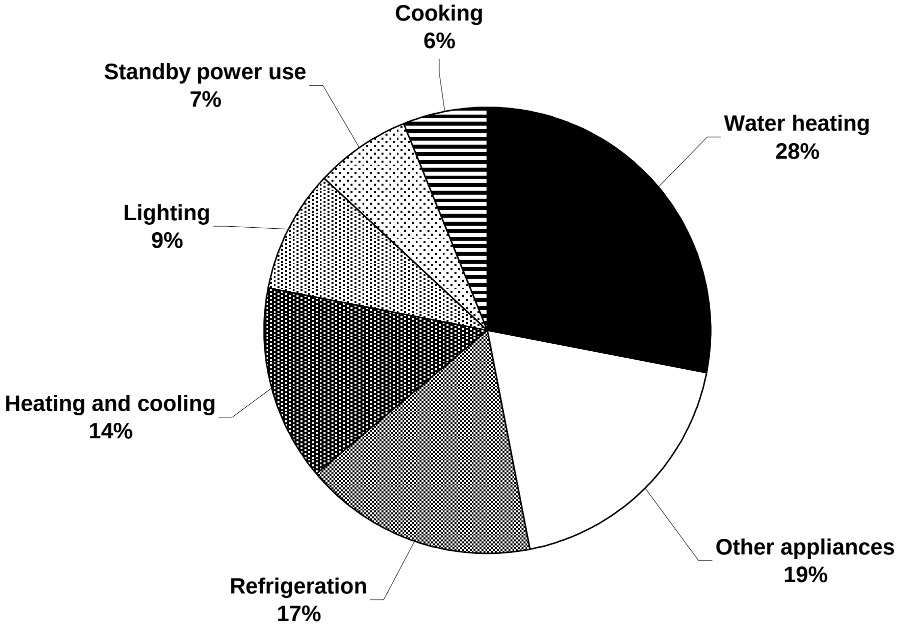
Data sources: ABARE (2004); dX Database.

Emissions

Using data assembled by the Australian Greenhouse Office (AGO 1999a), Reardon (2001) reported that the largest single residential activity contributing to household greenhouse gas emissions was water heating (figure 7.3). It should be noted that the data in figure 7.3 are not comparable with the decomposition of energy use in figure 7.1 because they are not for the same year (1998 versus 2005) and the respective authors used different methods to disaggregate the purposes of household energy use.

Fuel combustion in the residential sector accounted for 1.6 per cent of Australia's greenhouse gas emissions in 2002 (AGO 2004m). Between 1990 and 2002, residential greenhouse gas emissions from fuel combustion increased by 14.3 per cent. Most of these emissions arose from the burning of natural gas by householders. These data do not include the greenhouse gases that were emitted in converting fuels into electricity for residential users.

Figure 7.3 **Household greenhouse gas emissions by purpose, 1998**



Data source: Reardon (2001).

Analysis by ABARE researchers (Tedesco and Thorpe 2003) shows that, during 1973-74 to 2000-01, there was a decline in the residential sector's carbon dioxide emission intensity. They estimated that this would have reduced Australia's total carbon dioxide emissions from energy consumption by 1.2 per cent during 1973-74 to 2000-01, if there had been no increase in the number of householders and their consumption of goods and services.

Tedesco and Thorpe (2003) estimated that about two-thirds of the fall in residential carbon dioxide emission intensity during 1973-74 to 2000-01 was due to technical effects, which includes increased energy efficiency. The remaining one-third was attributed to a shift to less emission-intensive fuels, reflecting the previously noted shift by householders between different forms of energy. In particular, burning less wood and petroleum products reduced emissions at individual residences. This ignores householders' increased reliance on electricity and natural gas, which raises the conversion sector's *total* emissions.

Electricity use and relative importance of residential sector

As noted previously, the residential sector accounts for around 12 per cent of final (end use) energy consumption. However, this does not include the energy lost in converting fuels into electricity for residential users. Accordingly, the Commission has broadly estimated the amount of energy lost in converting fuels into electricity for households, and in transmitting and distributing that electricity to individual residences. The broad estimates were calculated by multiplying the energy used to generate all electricity by the share of electricity supplied to households (based on data from ABARE 2004).

It is estimated that, in 2001-02, the energy lost in electricity conversion, transmission and distribution for households accounted for around 8 per cent of Australia's total energy consumption. The energy consumed by householders in end use applications (including electricity) was equivalent to an additional 8 per cent of Australia's total energy consumption. Thus, a total of about 16 per cent of Australia's total energy use could be attributed to households in 2001-02. Similar shares were estimated for earlier years from 1973-74 onwards.

7.2 Why would householders overlook cost-effective energy efficiency improvements?

The long-term trend of rising energy efficiency in the residential sector suggests that householders have a history of adopting energy efficiency improvements when it is cost effective for them to do so. Nevertheless, it is possible that householders fail to adopt all energy efficiency improvements that are cost effective for them.

The many potential barriers to increased energy efficiency were outlined in the general review in chapter 5. However, not all of those barriers are relevant to the residential sector, or lead to market failures that may justify policy intervention.

There appear to be four broad reasons why householders might fail to adopt energy efficiency improvements that are cost effective for them:

- *asymmetric information* — sellers are much better informed than buyers about the energy efficiency of their products;
- *the public good characteristics of energy efficiency information* — there is little incentive for the market to supply information because it is difficult to exclude householders who do not pay for it;
- *split incentives* — energy-consuming products are purchased on behalf of householders by other parties (such as landlords and builders) who do not benefit from greater energy efficiency; and
- *small cost savings* — the fall in costs is so small that householders do not consider it worth pursuing, even when they are provided with the relevant information.

The information and split incentive barriers that householders might face are described below. The small size of potential cost savings, from the perspective of individual households, is evident from the analysis of household energy expenditure in section 7.1.

Information barriers

It can be difficult for householders to determine the energy efficiency of an appliance or dwelling prior to using it. Physical inspection may not reveal much about energy efficiency because householders do not have the relevant technical expertise and/or ability to undertake comprehensive tests. For example, Rheem Australia noted:

> There is widespread ignorance and misconception amongst purchasers regarding the costs and benefits of solar water heaters and heat pump water heaters ... (sub. 46, p. 3)

In principle, suppliers have an incentive to provide information about the energy efficiency of their products, especially when such information makes the product more attractive to consumers. In practice, such information is not always provided to consumers (possible reasons are discussed below).

Buyers tend to select products on the basis of qualities such as price, performance, capacity and style, and energy efficiency may not be an equally visible attribute:

> Marketing sources report that energy efficiency is often not a primary or even a significant consideration in consumer purchases. The apparent lack of concern is at odds with the fact that energy costs contribute significantly to the 'whole of life' costs of using an appliance. (Syneca Consulting 2003a, p. 4)

In a free market, energy efficiency information may not be readily available. Where sellers are much better informed about a product's energy efficiency than buyers, adverse selection can occur. Sellers can have incentives unrelated to energy efficiency, ranging from profit margins to overall quality and after-sales service issues. This is one of the reasons why consumer associations provide product testing data.

Adverse selection is more likely when the frequency of purchase is low, search costs are high relative to the purchase price, and the product is heterogeneous in price and quality (Sorrell et al. 2004). For householders, these conditions are most likely to apply when searching for a home.

Household appliances are often homogeneous and so the unit cost of providing information on their energy efficiency can be quite low. However, as it can be difficult to exclude householders who do not pay for it, there is little incentive for market participants to provide information that could assist householders in selecting cost-effective products. As noted by the Energy Retailers Association of Australia:

> The information asymmetry between buyers and suppliers of appliances, equipment and building services is potentially significant (particularly for infrequent purchases). The cost associated with small consumers attempting to become informed, individually, is clearly prohibitive in most cases. While provision of this information on a larger scale may lower the cost, standard public good/free-rider problems associated with the provision of information may inhibit such provision by private providers. (sub. 26, p. 32)

Another information issue is that the energy consumption of a dwelling or an appliance (and the consequences of different usage patterns) can be difficult to determine, given that electricity bills are issued well after consumption has occurred, and individual appliances are not metered:

> Most customers act as if they have no control over their electricity bill. What limited feedback they get (a bill every three months, and limited information on that bill) is too late for them to respond. (Jeff Beal, sub. 64, p. 12)

One means of addressing this problem is to install more informative electricity meters (chapter 13).

Split incentives

For the residential sector, split incentives are usually associated with dwellings. Energy-consuming fixtures — such as water heaters — are often selected by a builder or landlord who is primarily concerned about the capital cost, whereas users also have an incentive to reduce running costs. This was identified as a problem by many participants in this inquiry (for example, Rheem Australia, sub. 46, p. 1; Energy and Water Ombudsman NSW, sub. 48, p. 4; Government of Western Australia, sub. 58, p. 6; TransGrid, sub. 62, p. 4; AGL, sub. 66, pp. 2–3).

As noted in chapter 5, landlords/builders and tenants/home buyers could address split incentive problems by entering into a contract to share the costs and benefits of more energy-efficient products, or to separately negotiate contract prices of appliances. In practice, information barriers and transaction costs limit the instances of this happening.

The remainder of this chapter considers whether existing policies are effective in lowering the four barriers to energy efficiency improvements mentioned above, and if the associated benefits outweigh the costs. The policies examined are:

- subsidies

- advisory services
- energy performance labels (new appliances) and ratings (existing buildings)
- minimum energy performance standards (new appliances and buildings).

7.3 Subsidies

Subsidies do not directly address information barriers and split incentives, but they do increase the cost savings that householders can achieve by adopting energy efficiency improvements that are already cost effective for them. Subsidies may also be justified for policy goals that are beyond the scope of this inquiry, such as lowering greenhouse gas emissions.

Some participants in this inquiry advocated the use of financial incentives to encourage greater energy efficiency in the residential sector. For example, the Insulation Council of Australia and New Zealand stated:

> There are a range of areas where financial incentives or the removal of disincentives can assist in removing barriers to the implementation of energy efficiency in the regulation of building energy efficiency:
>
> - The amount of the first home buyers grant could be tied to the energy efficiency of the home, and could decline as house size increased above the average.
> - Infrastructure connection costs could be scaled to reflect the lower impacts of energy-efficient development.
> - The current rebate schemes for solar hot water, photo voltaic systems and water tanks could be consolidated into one grant and broadened to include further aspects of sustainability such as building fabric and appliance efficiency.
> - Rebates for the installation of insulation in existing homes where costs are higher and are therefore a greater barrier to implementation. (sub. 14, p. 14)

Rheem Australia (sub. 46, p. 2) supported subsidies for the purchase of solar hot water heaters. It noted that the higher capital cost of solar water heaters acts as a deterrent to their purchase.

The Queensland Government (sub. 38, p. 11) noted that it already provides rebates to install renewable energy systems, including solar hot water systems. Other jurisdictions also provide subsidies for solar hot water systems and other energy efficiency investments (box 7.1 and appendix B).

It appears that subsidies for residential energy efficiency investments are relatively inexpensive. The impact on residential sector energy use is also probably minor, since few householders are paid subsidies for energy efficiency measures. For example, in 2003-04, the South Australian Government approved 2526 rebate applications for solar hot water systems (Energy SA nd).

Box 7.1 Subsidies for photovoltaic and solar hot water systems

The Photovoltaic Rebate Program is funded by the Australian Government and administered by State and Territory Governments. This program provides rebates to householders who install photovoltaic systems with a peak output of at least 450 watts. For new systems, the rebate is $4 per peak watt up to a maximum total rebate of $4000 (1 kilowatt) for each installation. Extensions to existing systems are eligible for a rebate of $2.50 per peak watt up to a maximum total rebate of $2500 (1 kilowatt).

In addition, the following jurisdictions have their own rebate programs for solar hot water systems:

- Victoria — rebates of up to $1500 to replace an existing gas or solid fuel hot water system, or convert an existing hot water system, to solar power;
- Queensland — rebates of up to $750 for solar hot water systems (dependent upon efficiency) and up to $100 for replacement panels and tanks;
- South Australia — rebates of up to $700 for new solar hot water systems installed at a person's principal place of residence;
- Western Australia — rebates of up to $1000; and
- ACT — rebates of up to $1600.

Householders can also obtain a cash back amount from manufacturers by signing over or 'trading' Renewable Energy Certificates they are entitled to receive under the Australian Government's mandatory renewable energy target. The cash back amount is based upon the performance of the solar hot water system purchased.

The impact of subsidies on household energy efficiency is probably even lower than is suggested by the modest participation rates. This is because subsidies are often paid to householders that would have made the relevant energy efficiency investment anyway. This was evident for an ACT Government program that subsidised 25 per cent of the market price of cavity wall insulation. A survey found that at least 32 per cent of households that received the subsidy would have installed cavity wall insulation regardless of the subsidy (Beckman and Associates 2003).

7.4 Advisory services

Governments have established advisory services to help householders overcome information barriers that limit householders' ability to identify energy efficiency improvements that are cost effective for them (appendix B). For example, the Queensland Government (sub. 38, p. 11) noted that it provides two such services:

- The Energy Advisory Service provides free advice on energy efficiency and renewable energy, and distributes informative brochures and fact sheets.
- The Smart Housing initiative provides information on how to build homes that are more energy efficient.

Similar services are offered in other jurisdictions, including Energy Smart (New South Wales and Western Australia), Energy SA Advisory Service (South Australia) and Home Energy Advice Team (ACT):

> The Western Australian Government … provides information to the community through the energy smart community program. Information is in the form of public seminars and community forums, a free telephone advisory service and attendance at trade exhibitions, brochures and a website that addresses key areas of energy use in the home. The community program also covers house energy-ratings programs in the State and promotes awareness of equipment energy ratings. (Government of Western Australia, sub. 58, p. 10)

These programs often include internet-based advice. For example, the NSW Energy Smart website has an online calculator that enables householders to compare the cost of purchasing and operating different types of hot water heaters (SEDA nd). Some jurisdictions also have programs that provide energy efficiency audits of individual homes.

Government advisory services could be useful in cases where information about cost-effective energy efficiency improvements has public good characteristics, and so would not be supplied by the private sector. Government-provided information may also have greater credibility than that provided by private-sector parties with a financial interest in promoting particular energy efficiency investments. But information provided by private parties without a vested interest — such as the Australian Consumers' Association — could be just as credible, if not more so, than government-provided information.

The public good rationale for government advisory services is more likely to apply to general advice than to information that is specific to an individual home. This is because there is greater scope for private-sector providers to exclude people who do not pay for home-specific information.

Nevertheless, the private sector does provide general advice on energy efficiency improvements. For example, CSR Bradford provides information on its website about the cost effectiveness of building insulation and other energy efficiency investments. Similarly, AGL has an energy advice website:

> Interactive capabilities have recently been introduced that enable householders to visit a virtual home online to see how simple energy housekeeping techniques will reduce energy bills and help save the environment. By clicking on the appliances in each room — ovens, air conditioners, washing machines etc — users can calculate the costs of running different appliances, and discover tips to realise cost savings for each appliance. The site provides advice on a broad range of environmental issues and offers energy saving tips and advice on energy star ratings for different appliances. The site also contains an interactive energy efficiency calculator that provides quick reference information about how much energy appliances typically consume around the home. (sub. 66, p. 7)

In summary, government advisory services could be justified on public good and credibility grounds, but it does not follow that such services should always be provided by governments. The rationale for government provision is strongest in the case of general advice about energy efficiency. But even in that case, private sector providers — such as the Australian Consumers' Association — have demonstrated that they can provide useful general information about energy efficiency.

7.5 Appliance energy performance labels

In addition to the product testing and other activities of consumer associations and others, energy-performance labelling schemes aim to help overcome the market-based information barriers that householders sometimes face. By providing information on the energy performance of specific appliances in a readily accessible and easily understandable format, householders are more able to make well-informed decisions in relation to energy efficiency. This could also provide a greater incentive for suppliers to sell products that use energy cost effectively.

Although many countries require household appliances to have an energy-performance label (Harrington and Damnics 2004; International Energy Agency 2000), it is most widespread in Australia, Canada and the United States (World Energy Council 2004). Household appliances that are required to have an energy-performance label in Australia are listed in table 7.2.

Table 7.2 **Household appliances subject to energy-performance labelling and/or standards**

Appliance	*Energy performance label*	*Minimum energy performance standard*
Air conditioners (single phase)	Mandatory	Mandatory
Clothes washers	Mandatory	
Clothes dryers	Mandatory	
Dishwashers	Mandatory	
Electric water heaters	Voluntary[a]	Mandatory
Refrigerators and freezers	Mandatory	Mandatory
Gas cookers		Mandatory
Gas water heaters	Mandatory	Mandatory
Gas room heaters	Mandatory	Mandatory
Gas ducted heaters	Mandatory	Mandatory

a Electric water heaters can have an energy rating label, provided it follows the Standardised Information Disclosure requirements developed by the National Appliance and Equipment Energy Efficiency Committee.

Administrative arrangements

Mandatory labelling of electrical appliances is run as a national scheme by the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) (appendix D). This comprises officials from the Australian, State and Territory Governments, and is ultimately directed by the Ministerial Council on Energy (NAEEEC 2004c).

Historically, the Australian Gas Association (AGA) has had responsibility for managing the labelling of gas appliances (SEAV 2003). Governments made the labels mandatory by requiring all mass-produced gas appliances offered for sale to be certified by the AGA (appendix D). This is an example of co-regulation.

The administrative arrangements for gas labelling are currently under review (NAEEEC 2004c). The NFEE Stage One measures included a commitment to broaden the scope of the National Appliance and Equipment Energy Efficiency Program (NAEEEP) for electrical products to include mandatory labelling (and minimum energy performance standards) for gas products (Ministerial Council on Energy 2004).

State and Territory regulators monitor compliance with labelling requirements at retail outlets and have taken action where breaches are suspected (NAEEEC 2004c). In addition, NAEEEC has a check-testing program to verify that the performance of appliances sold at retail outlets matches what is recorded on the label. These tests have identified cases where claimed performance does not match test results, and have led to product deregistration.

Voluntary versus mandatory labelling

In some cases, a voluntary labelling scheme may be more appropriate than a mandatory approach. Voluntary labelling programs exist in Australia and some are managed as part of the national NAEEEP arrangements:

- Electric water heaters can have a voluntary energy rating label, provided the label follows the Standardised Information Disclosure requirements developed by NAEEEC. These requirements apply to products that do not have to be labelled, but must still undergo an energy-performance test to satisfy a minimum energy performance standard.
- Appliances that receive the Top Energy Saver Award can use a special award label specified by NAEEEC (appendix D). This is a new award designed to enable consumers to identify the most energy-efficient electrical and gas appliances on the market.

The Department of the Environment and Heritage stated:

> There is a role for voluntary labelling as a supplement to a main mandatory programme. For example, suppliers of the most efficient products on the market can voluntarily use a 'Top Energy Saver Award Winner' in addition to the mandatory energy label.
>
> There is also a role for 'optional mandatory' labelling, in which there is no obligation on suppliers to label, but if they do so they must use the prescribed format of label and are obliged to meet all compliance obligations. (sub. 30, p. 18)

Another example of voluntary labelling is the Energy Star program (appendix D), which was created by the US Government (and since adopted by Australian jurisdictions) for energy-efficient office equipment and home entertainment products. The standard reduces energy consumption by requiring products to automatically switch into a 'sleep mode' when not being used and/or to use less power when in 'standby mode'. Products that comply with the standard are able to use an Energy Star label to demonstrate their compliance.

George Wilkenfeld and Associates (2003a) noted that Australia's voluntary water efficiency labelling scheme has been used by few suppliers, and those that have used it tend to only label their better performing products. This scheme will be replaced by mandatory labelling requirements during 2005. More generally, they noted:

> If labelling is voluntary suppliers will only label their more efficient models, not their less efficient ones. (George Wilkenfeld and Associates 2003a, p. 16)

Thus, voluntary labels tend to be more useful for endorsing the most efficient models, rather than helping consumers to rank the cost effectiveness of different models. In contrast, mandatory labels are better suited to cases where the cost effectiveness of an appliance varies markedly between different models (such that suppliers of inefficient appliances have a disincentive to use voluntary labels), and information barriers prevent consumers from knowing the extent of the differences. In such cases, mandatory labels can enable consumers to rank prospective products according to cost effectiveness.

Private versus government-run schemes

There seems to be a strong case for labelling schemes to be managed by an independent party, so that labels are seen as being credible.

The Department of the Environment and Heritage commented that governments are best suited to this role:

> Government has a natural advantage in ensuring the factors necessary for the effectiveness of labelling — mandatory participation, quality assurance, compliance, publicity and communications and, increasingly — ensuring international consistency.
>
> … a private labelling regime is always subject to undermining by competitors, who can question the basis of the label, launch their own alternative labelling systems or simply refuse to participate. (sub. 30, pp. 18–19)

George Wilkenfeld and Associates (2003a) noted that governments may be more successful in ensuring that there is not a proliferation of different labelling schemes using different rating scales and formats that ultimately does more to confuse than help consumers. This is particularly an issue for water-using appliances, such as clothes washers, that can have one label for energy efficiency and another label for water efficiency.

The Department of the Environment and Heritage observed that the case for government involvement is supported by Australia's experience with labelling schemes:

> All successful resource efficiency labelling programs in Australia have been initiated by governments … or by utilities at the time when they were also regulators and so effectively agents of government (gas labelling by the Gas and Fuel Corporation of Victoria, water labelling by Melbourne Water).
>
> As the gas … utilities have lost the regulatory ability to enforce labelling, the only way to ensure the continued effectiveness of their programs has been to involve government in their management — the Australian Gas Association is working with NAEEEC to establish gas labelling as a regulated joint industry-government program ... (sub. 30, p. 19)

Similarly, an evaluation of five energy labelling programs in the United States found that the more successful programs were run by governments (Banerjee and Solomon 2003).

However, there are many examples of labelling programs that are not run by governments. These include:

- the Heart Foundation's 'tick' label for heart-friendly food;
- labels for primary products associated with the Landcare program;
- the Window Energy Rating Scheme (appendix C);
- the Marine Stewardship Council's eco-label for sustainable fishing; and
- labels for organic food (such as that managed by the National Association for Sustainable Agriculture Australia).

In addition, a private sector organisation — the Australian Gas Association — has historically had primary responsibility for gas appliance labelling. Consumers can also obtain information about appliance energy efficiency from private sources, such as the Australian Consumers' Association's *Choice* magazine.

The Commission therefore considers that an effective labelling scheme does not necessarily have to be run by a government.

Label design and effectiveness

To have a discernable impact on consumers' choices and behaviour, a label needs to present information that is useful, and otherwise costly to obtain, to consumers in a format that can be readily understood. The first labelling scheme in the United States (Energy Guide) was ignored by many consumers because it had too much information and was difficult to interpret (World Energy Council 2004). Researchers also found that about a quarter of consumers thought the number most prominently displayed on the label meant savings rather than usage, suggesting that some consumers mistakenly used the label to search for the least efficient appliances (Meier 2003). Banerjee and Solomon (2003) concluded that endorsement (seal-of-approval) labels are more effective than information disclosure labels:

> Seal-of-approval labels are usually better understood by consumers than information disclosure labels. While seal-of-approval labels may be oversimplified and judgmental, experience has shown that the proportion of informed consumers who are willing and able to use technical information effectively is low. Also, consumers often confuse disclosure labels as a seal-of-approval thus defeating the label's purpose. In surveys, consumers have repeatedly complained about their difficulty in understanding … the Energy Guide. (Banerjee and Solomon 2003, p. 120)

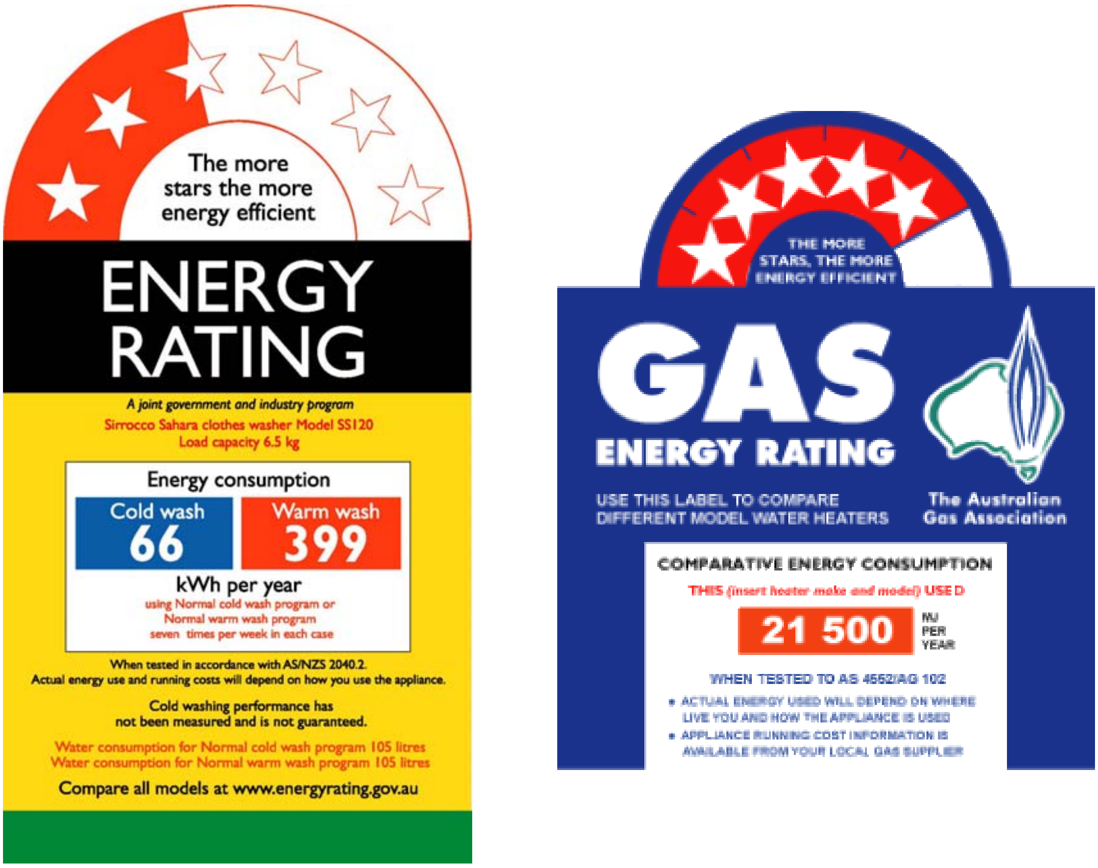
The development of Australia's energy-performance labels has included consumer research on the effectiveness of different label designs, update bulletins and a toll free phone inquiry service for manufacturers and retailers, educational material for sales floor staff, and shadow shop surveys to verify compliance at retail outlets (Energy Efficient Strategies 2004; NAEEEC 2002; Winton 2003).

The label displayed on appliances subject to Australia's mandatory requirements must use a specified design that includes information on:

- annual energy consumption (based on a standard laboratory test); and
- a star rating to indicate energy efficiency relative to competing appliances (on a scale of one to six stars, with more stars indicating higher energy efficiency).

Sample labels for clothes washers and gas water heaters are shown in figure 7.4.

Figure 7.4 **Sample labels for clothes washers and gas water heaters**



Source: National Appliance and Equipment Energy Efficiency Committee.

Do appliance labels change consumer behaviour?

Given that energy accounts for a small proportion of household expenditure (table 7.1), consumers may make their purchase decisions primarily on the basis of other factors, such as price, performance, capacity and style.

However, as advised by the Department of the Environment and Heritage:

> There is evidence from overseas and Australian studies to suggest that many consumers use energy efficiency as a tool to differentiate between the final two or three products that meet their other selection criteria (eg. appearance, colour, size etc). (sub. 30, p. 14)

Consumer research undertaken for the AGO noted that consumers tend to go through distinct steps in deciding to purchase a product, and that labelling has the greatest influence at the final step after particular models have been short listed:

> The purchase decision-making process differs somewhat from appliance to appliance, but in general terms it involves three fairly clearly defined steps: (1) the identification of need, (2) the search and short-listing process, and (3) the final decision from among already short listed appliances. Energy efficiency labels play little if any role in the first step, may play only a secondary role for most in the second step, but become a prominent factor in the final choice of appliances from among already short listed models. (Winton 2003, p. 3)

The consumer research also suggests that the impact of labels differs between consumers, reflecting their different preferences and training:

> The ways in which people use the label vary considerably ... One segment uses the star rating which gives a quick comparative assessment of the model’s energy efficiency, two other segments refer for different reasons only to the energy consumption figure which shows how much electricity the model uses in kilowatt hours per year or load, some people use both the star rating and the energy-consumption figure, while unfortunately some (but progressively a smaller number) still ignore the label. (Winton 2003, p. 3)

In summary, labels are not a primary determinant of which models are purchased, but they do appear to have an impact on some consumers once they have short listed a small number of models.

Measurement of appliance energy efficiency

The energy performance reported on mandatory labels comes from a laboratory test required by NAEEEC or the AGA (appendix D). A review of Australia’s labelling programs for the Australian Greenhouse Office noted:

> … [the estimated annual energy consumption], derived from the laboratory tests, has been found to correspond reasonably well (within 10 per cent) to in-use energy

consumption for refrigerators and freezers. The energy consumption for other appliances is highly dependent on whether actual frequency and duration of use by users corresponds to the values assumed for labelling. (Energy Efficient Strategies 2004, p. 7)

There has been some attempt to account for actual usage patterns in the tests:

… some star rating algorithms include assumptions about user behaviour. For example, a ‘field use factor’ applied to clothes dryers gives a 10 per cent penalty to timer dryers when compared with auto-sensing dryers, on the assumption that manual operation more often leads to overdrying and hence higher energy consumption in use. (Energy Efficient Strategies 2004, p. 7)

However, the Australian Electrical and Electronic Manufacturers’ Association (AEEMA) expressed concerns about the energy-performance tests for air conditioners:

The task of an air conditioner is not easily defined for the purpose of a test method. … Test methods are based on a high heat load condition in which the compressor and fans run continuously. In the real world, generally when air conditioners run they are subject to relatively low heat loads. Over the last 20 years, variable speed compressors with control systems to suit have been developed. Efficiencies of air conditioners with variable speed compressors are similar to those with fixed speed compressors at test conditions. Hence they have similar efficiency ratings. However, they are much more efficient at the lower load conditions at which they usually operate. This is not evident from the efficiency ratings on the labels, so *the labels are misleading in this case*. (sub. 85, p. 4) (emphasis added)

AEEMA also raised concerns about the energy-performance tests for washing machines, dishwashers and clothes dryers:

1. Amount of use: Usage rates of these appliances … are based on a Pacific Power study conducted twelve years ago. … This was a reliable measure at the time but may no longer be valid. …

2. What these appliances do: … Test standards … must be met on a program nominated by the supplier … Efficiency ratings are only pertinent when the appliance is used on the program specified by the supplier. If used on a different program, the appliance will use a different amount of energy and the rating will be irrelevant to energy efficiency in actual use.

… Around half of all users of clothes washers usually wash with cold water. However, the standard test uses 35°C water. …

Many users of dishwashers want their dishes dried more effectively than on the rating program and choose a program that dries better. This uses higher temperature water for the final rinse and uses more energy than the rating program.

The degree to which specified conditions match real conditions of use is important when estimating energy savings and economic benefits attributable to energy efficiency ratings. …

> <u>3. Reliability of results:</u> Test methods in dryer and dishwasher standards are considered to be of adequate reliability for effective check testing, but AEEMA doubts the accuracy of the clothes washer test method.
>
> <u>4. International considerations:</u> Currently these tests are specific to Australia. However, Australian and IEC [international] test methods are progressively converging. Test reliability would be lost if Australia accepted IEC test methods as they stand at present.
>
> <u>5. Effects on product design:</u> Appliances are being designed to maximise ratings while meeting minimum product performance requirements. … However *the principal deficiency of energy ratings in current standards is that they do not provide any incentive for the manufacturer to improve any program other than the rating program*. (sub. 85, pp. 5–6) (emphasis added)

On this evidence, the energy consumption of some labelled appliances — refrigerators and freezers — is unlikely to vary markedly between households, whereas the use of other labelled appliances — air conditioners, clothes washers and dryers, dishwashers and gas space and water heaters — is more diverse. For the latter groups of appliances, this could have implications for the effectiveness of labelling. If labels are not an accurate guide to the *relative* energy efficiency of different models of the same type of appliance, given the usage pattern by a particular household, then they are less likely to help that household to rank those models.

Another concern raised with the Commission was that tests may not take account of all the performance features of a product. At worst, supplier behaviour may be distorted in favour of inefficient products due to an undue emphasis on a particular aspect of an appliance's energy consumption.

Periodic upgrading of rating scales

Over time, there is a tendency for the energy efficiency of appliances to increase, regardless of regulation (see, for example, the study of US appliance energy efficiency trends by Newell, Jaffe and Stavins 1999). This can eventually lead to most appliances clustering near the highest possible energy rating on a label. As a result, labels lose their effectiveness as a device for ranking different models.

SEAV (2003, p. 1) noted this for gas appliances:

> A comparative energy efficiency label works best when the rating system reflects the spread of efficiencies available in the marketplace. Although effective since its introduction, the current energy rating labels for some [gas] appliance categories show considerable bunching towards the upper end of the rating scale. It is time for these labels to be re-scaled in order to provide consumers with the opportunity to select the highest efficiency models, and to encourage manufacturers to invest in further efficiency improvements.

A similar situation applied to electrical appliances in the late 1990s:

> By 1998 … continuous improvements in appliance performance had resulted in star ratings clustering at the top of the range. To overcome this disincentive to further efficiency improvements, NAEEEC recommended the introduction of new energy labelling algorithms (equations used to calculate the 'star' rating) to provide expanded scope for improvements in energy efficiency (5+ star rated units were regraded to become 3 to 3.5 star units). (Energy Efficient Strategies 2004, p. 1)

Regulators have responded to this issue by periodically making the rating criteria more stringent, although this does involve a cost and can lead to consumer confusion until the new scale has become established. There is also a risk that recalibrating the rating scale will exaggerate minor differences between appliances, such that consumers perceive models with the highest energy efficiency as being vastly superior to those with only a slightly lower energy efficiency.

Assessments of labelling

A study for NAEEEC found that, from 1993 to 2001, there was a gradual trend of improving energy efficiency for a range of appliances sold in Australia:

> The analysis presented in this report demonstrates that there is a clear though gradual improvement in the energy related performance characteristics of appliances sold in Australia under the energy labelling program.
>
> As energy consumption is not generally apparent to the general consumer without information programs like energy labelling, the credit for much of this improvement must be attributed to the National Appliance and Equipment Energy Efficiency Program (NAEEEP). (Energy Efficient Strategies 2003, p. 7)

However, such a conclusion cannot be reached without considering other reasons why appliance energy efficiency has increased, including changes in energy prices, technological change that is not attributable to government policy, and increasingly stringent energy efficiency standards in other countries. It is equally plausible that the gradual increase in appliance energy efficiency would have occurred even in the absence of Australian energy-performance labels.

In terms of the costs of labelling schemes, George Wilkenfeld and Associates (2003a) identified:

- The costs to government of program development and administration.
- The costs to product suppliers of any additional product testing, registration, production and fixing of labels, and administration.
- The costs to consumers of any increases in average product price due to greater consumer preference for the more efficient models on the market. (George Wilkenfeld and Associates 2003a, pp. 5–6)

Another potential cost is that labelling distorts the appliance market in such a way that suppliers withdraw models that are cost effective for some consumers. The Department of the Environment and Heritage observed:

> In the lead up to the implementation of energy labelling for refrigerators in 1986, suppliers removed the least efficient models from the market to avoid having to label them. (sub. 30, p. 14)

Some of those refrigerators withdrawn from the market may have been cost effective for certain consumers, or could have possessed characteristics that consumers value more highly than greater energy efficiency.

In 1999, the impact of adopting the national labelling scheme for household appliances was estimated by George Wilkenfeld and Associates and Energy Efficient Strategies (1999) in a regulatory impact assessment. They estimated that the labelling requirements would increase appliance costs by $688 million and reduce energy costs by $1500 million in net present value terms (using a 4 per cent discount rate). However, such engineering–accounting estimates have many of the weaknesses discussed in chapter 6. For example, the discount rates applied to future benefits and costs (three different scenarios were estimated using a discount rate of 0, 4 or 8 per cent) appear to be much lower than those used by householders (chapter 6). As a result, the net benefits of labelling for consumers were probably overstated.

DRAFT FINDING 7.1

Appliance energy-performance labels are not a major determinant of which appliances householders buy. But the labels do have some influence on consumers after they have short listed products on the basis of characteristics such as price, performance, capacity and style. While the benefits of energy-performance labelling may have been overstated in regulatory impact assessments, labelling is likely to have produced net benefits for consumers.

7.6 Appliance minimum energy performance standards

Minimum energy performance standards (MEPS) prohibit the sale of products that have energy efficiency below a specified minimum.

In Australia, MEPS apply to most, but not all, of the appliances that are also subject to mandatory labelling (table 7.2) and are managed in conjunction with labelling requirements (appendix D). Thus, NAEEEC has responsibility for electrical appliance MEPS, and the AGA will continue to manage gas appliance MEPS until this role is transferred to NAEEEC.

As part of the NFEE Stage One measures announced by the Ministerial Council on Energy (2004), the Australian, State and Territory Governments have agreed to expand NAEEEP by introducing new or more stringent MEPS for residential appliances.

There are three key issues associated with MEPS:

1. Why prevent householders from buying less efficient appliances?
2. Do the benefits of MEPS outweigh the costs?
3. Are other interventions more cost effective than MEPS?

These issues are considered below.

Why prevent householders from buying less efficient appliances?

As noted in section 7.2, information barriers, split incentives and the small size of energy cost savings may cause householders to fail to adopt energy efficiency improvements that are cost effective for them. MEPS supposedly reduce this problem by preventing householders from purchasing appliances that are thought to be not cost effective for them.

George Wilkenfeld and Associates and Energy Efficient Strategies (1999) noted that MEPS may also be justified because energy prices do not include the externality cost of global warming, and this can cause householders to undervalue energy efficiency. Whether energy prices are too low because they do not take account of such environmental externalities is an issue that is beyond the terms of reference for this inquiry. In its own right, it could justify energy efficiency improvements that are not cost effective for individual householders at current or expected prices.

Do the benefits of MEPS outweigh the costs?

Benefits of MEPS

The key potential benefit of MEPS for individual householders is lower appliance operating costs.

The Australian Conservation Foundation noted:

> … MEPS is a proven and effective mechanism which has seen progressive improvements in the efficiency of appliances around the world. MEPS should be

> extended to cover all appliances and minium standards should be strengthened over time. (sub. 24, p. 8)

However, not all improvements in appliance energy efficiency can be attributed to MEPS. US research indicates that there is a tendency for the energy efficiency of appliances to increase over time regardless of regulation (Newell, Jaffe and Stavins 1999). Thus, any assessment of MEPS has to identify what proportion of observed improvements in energy efficiency are due to factors other than energy-performance standards. This is not a straightforward task.

The impact of MEPS on environmental outcomes is also difficult to assess, given that improvements in energy efficiency are not solely due to energy-performance requirements. This, combined with the small proportion of emissions that are appliance-related, led the Institute of Public Affairs to question whether the environmental benefits of MEPS have been overstated:

> MEPS targets products that account for only 2 per cent of Australia's total greenhouse gas emissions. The measures, once having reached maturity are estimated to reduce emissions by less than 0.2 per cent of the business-as-usual levels.
>
> Modest though they are, these estimated reductions exaggerate the effect of the regulations because they exclude energy efficiency improvements that are taking place without any regulation. (sub. 6, pp. 13–14)

In addition, MEPS-related increases in energy efficiency could lead to a 'rebound effect' in which the use of appliances increases. This would make the environmental benefits of energy-performance standards lower than otherwise.

Costs of MEPS

The benefits of MEPS could be outweighed by the associated costs of:

- administering and complying with standards;
- removing products from the market that are more cost effective for some consumers;
- forcing consumers to forgo product features that they value more highly than greater energy efficiency;
- reduced competition; and
- regressive distributional impacts.

Administration and compliance costs

The administration costs that governments can incur with MEPS include public consultation prior to mandating a standard, the design of tests to measure energy performance, certification procedures, and a check testing program.

The compliance costs for firms can include changing appliance designs to meet performance standards, having products tested, and complying with registration procedures prior to offering appliances for sale.

AEEMA noted:

> The cost of developing standards and reliable test procedures is high. Whether the standards are national or international, product development costs and compliance testing costs are substantial both in terms of direct costs and opportunity costs when scarce skilled engineers and laboratory resources are diverted from other product improvement or cost reduction projects to meet energy efficiency targets. (sub. 85, p. 3)

The Department of the Environment and Heritage stated that the administration costs of MEPS are substantially lower than for labelling, but the compliance costs can be higher:

> The administrative costs of MEPS are substantially lower, since there is no need for a physical label, for checking that the label is correctly fixed, or for publicising the label. …
>
> MEPS can have a greater cost for suppliers than labelling, since suppliers must adjust their model ranges to meet the MEPS levels by the given date (which is why the lead times for MEPS implementation is often 2 to 3 years). …
>
> The costs to government of ensuring the quality of initial product tests and undertaking random check tests are the same for MEPS and energy labelling. (sub. 30, p. 16)

The level and relative importance of administration and compliance costs will vary between different MEPS, depending on the prescriptiveness of the standard, how stringent it is, and the extent to which firms can spread fixed compliance costs across a large number of appliance sales.

Removing more cost-effective products from the market

For electrical appliances, NAEEEC sets minimum energy-performance standards at a level that will:

> … match, for each appliance regulated, best practice levels imposed by Australia's major trading partners. (Department of the Environment and Heritage, sub. 30, p. 15)

The advantage of this approach is that it:

> … overcomes arguments regarding the technical feasibility of meeting the proposed MEPS levels and avoids elaborate and expensive testing procedures being conducted locally. (Department of the Environment and Heritage, sub. 30, p. 15)

The cost is that the Australian standards are being driven by a range of international environmental and political forces, and that they may not be the most cost effective outcome in Australia.

In an international review of energy policies, the World Energy Council found that the standards set for MEPS in other countries have been such as to force the removal of a large proportion of models:

> In Europe … 40 per cent of appliances on sale in 1996 did not comply with the standards to be introduced in 1999. In the United States, the standards were more ambitious in their goal: none of the refrigerators on the US market at the end of the 1980s met the efficiency standards planned for 1993. (World Energy Council 2004, p. 45)

Similar outcomes appear to have occurred in Australia. The regulatory impact assessment for Australia's air conditioner MEPS estimated that among the single-phase models registered in 2003:

- 13 per cent would not satisfy the interim MEPS introduced in 2004; and
- 89 per cent would fail the MEPS scheduled for 2007 (Syneca Consulting 2003a).

Similarly, the regulatory impact assessment of MEPS for low pressure and heat exchanger water heaters estimated that models accounting for at least 90 per cent of existing sales would be removed from the market when the standard was introduced (Syneca Consulting 2004).

In the case of air conditioner MEPS, it was claimed that the estimated proportions of models removed from the market:

> … somewhat overstate the impact of the MEPS, since normal processes of efficiency improvement in the period to 2007 would have eliminated some part of the product range anyway. (Syneca Consulting 2003a, p. 9)

However, this raises the question as to why MEPS are required if there is already a trend for air conditioners to become more energy efficient over time.

MEPS tend to be beneficial for intensive users of air conditioners — such as retirees and families with young children — because the fall in operating costs more than compensates for the higher capital cost. However, the assessment of Australian air conditioner MEPS noted US research showing that cheaper less efficient models are cost effective for less intensive users of air conditioners (Syneca Consulting 2003a).

It could also be argued that the impact on consumers of removing cheaper less efficient models from the market depends on the level of competition between suppliers:

> If provision is perfectly competitive, markets will offer the variety of energy efficiency levels that consumers demand. However, if producers can price discriminate, using energy intensity to help segment consumer demand, consumers of low-end appliances are offered too little energy efficiency so that high-end consumers can be charged more for efficient appliances. Minimum energy efficiency standards can then improve welfare. (Fischer 2004, p. ii)

The extent to which MEPS remove appliances from the market that are more cost effective for some householders has to be judged on a case-by-case basis.

Forcing consumers to forgo more highly valued product characteristics

Given that energy accounts for only a small proportion of household expenditure (table 7.1), it is unlikely that energy efficiency is as highly valued by consumers as some other appliance characteristics. Where those other appliance characteristics come at the cost of lower energy efficiency, well-informed consumers could be willing to accept the cost (lower energy efficiency) in return for the more highly valued benefit (the relevant appliance characteristics).

For example, a householder may want to buy a refrigerator with narrower side walls so they can fit a bigger capacity model (in terms of internal refrigerated area) into a confined space in her/his kitchen. Although a refrigerator with narrower side walls could involve less insulation and so require greater energy consumption to maintain a desired temperature, a householder may place a higher value on the benefits (a larger refrigerated space) than the associated costs (greater energy use).

MEPS have the potential to prevent well-informed consumers from making such decisions. That is, MEPS could ban products that some consumers want to buy, even when those consumers are aware of the lower energy efficiency and higher running costs. The extent of this problem will vary from one standard to another and so is best judged on a case-by-case basis.

Reduced competition

Another possible cost of MEPS for consumers is that they have the potential to reduce competition in the marketplace. This could lead to higher prices than otherwise and cause consumers to delay the replacement of very energy inefficient appliances (Australian Industry Greenhouse Network, sub. 57, p. 10; Institute of Public Affairs, sub. 6, p. 14).

The Department of the Environment and Heritage acknowledged this possibility, but was unaware of any instance where a supplier had withdrawn from the Australian market because of MEPS:

> ... some ... firms may be driven out of the market if they cannot adjust to MEPS. However, there is no known instance of this happening in Australia. This could reduce market competition, and lead to upward pressure on consumer prices. (Department of the Environment and Heritage, sub. 30, p. 17)

However, one manufacturer told the Commission that it had stopped supplying the Australian market with refrigerators in response to a more stringent MEPS introduced in January 2005. The manufacturer decided that it was not economic to design refrigerators specifically for Australia's new MEPS.

AEEMA also noted that the more stringent MEPS introduced in January 2005 had caused the withdrawal of some refrigerator suppliers, but it considered that there would still be an 'adequate' level of competition:

> … MEPS 2005 has significantly reduced the number of participating suppliers and/or numbers of model registrations in some product types or capacity ranges. At least two formerly significant suppliers have left the market entirely. …
>
> Generally, fewer models will be available in all size ranges of single door refrigerators, freezers and chest freezers. It is too soon to be sure, but there appears to be enough models in the market in each type and size range to maintain an adequate level of competition, even though the number of brands and models available will decrease. (sub. 85, p. 7)

Nevertheless, the Commission considers that, to date, regulatory impact assessments have not included a sufficiently thorough examination of how a proposed new or upgraded standard would affect competition.

Distributional impacts

The Department of the Environment and Heritage noted that the distributional effects of MEPS differ from those for labelling:

> In labelling, a high proportion of the costs and benefits are borne voluntarily by those consumers who use the label to select more efficient products. In MEPS, the costs of increased appliance prices are borne by all consumers, even those — usually very few — who do not stand to benefit (because their energy prices or energy usage is so low). Conversely, the benefits also flow to additional classes of consumers who would not benefit from labelling — those who do not purchase their own appliances (eg tenants) or who are not label-aware. (sub. 30, p. 16)

Sutherland (2003) found that US minimum energy efficiency standards are regressive because poorer households face capital constraints that make it very cost effective for them to buy cheaper less efficient models. That is, the costs of forcing cheaper less efficient appliances off the market are borne disproportionately by less affluent households, while the benefits primarily go to more affluent households.

Australian regulatory impact assessments typically assume that households do not face capital constraints. An energy efficiency investment is usually deemed to be cost effective if the additional capital cost is less than the present value of the fall in future operating costs. This implicitly assumes that householders do not face a constraint on their ability to finance a higher capital cost now in return for a stream of returns well into the future. In practice, such constraints do exist, especially for low-income households.

If a household is capital-constrained, then it is rational for it to allocate its available capital to what it considers to be the most highly-valued uses of that capital. This could involve the purchase of cheaper and less efficient appliances because they have a lower capital cost.

Net benefits of MEPS

It is not possible to say that the benefits of MEPS always outweigh the costs, or vice-versa. Whether there is a net benefit has to be judged on a case-by-case basis, and requires quantification of the various benefits and costs.

Regulatory impact assessments of Australia's household appliance MEPS have predicted that the benefits substantially outweigh the costs (box 7.2). However, these predictions are based on engineering–accounting calculations that have many of the weaknesses discussed in chapter 6. The regulatory impact assessments did not give sufficient attention to the potential for MEPS to remove appliances from the market that are more cost effective for some householders, force consumers to forgo product characteristics that they value more highly than energy efficiency, and to reduce competition. In addition, the discount rates used to calculate the present value of future reductions in running costs appear to be much lower than those used by most householders (chapter 6). As a result, the net benefits of MEPS to consumers are probably overstated.

Positive assessments of MEPS in other countries (such as by Greening, Sanstad and McMahon 1997; and Meyers et al. 2003 for US standards) are also questionable. An analysis of US mandatory energy-performance standards by Sutherland (2003) found that regulators tend to overstate benefits for two reasons. First, they underestimate future energy efficiency improvements that would occur regardless of MEPS. An econometric analysis by Newell, Jaffe and Stavins (1999) found that most improvements in the energy efficiency of air conditioners and gas water heaters offered for sale in the United States were caused by factors other than MEPS. Second, regulators typically use unrealistically low discount rates to evaluate MEPS. This tends to exaggerate the benefits from lower future operating costs.

Box 7.2 **Regulatory impact assessments of MEPS**

George Wilkenfeld and Associates and Energy Efficient Strategies (1999) estimated the combined impact of:

- imposing MEPS for refrigerators, freezers and electric hot water heaters; and
- introducing model regulations in each State and Territory that had the effect of extending the use of mandatory energy labelling requirements to Tasmania and the ACT, and slightly increasing the scope of NSW labelling requirements.

It was estimated that, over the period 1999 to 2015, consumers would incur an additional cost in buying appliances of $954 million in present value terms (using a discount rate of 4 per cent). The present value of the associated fall in energy costs was valued at $2287 million. Thus, the proposed package of regulations was found to generate a significant net benefit for householders. In addition, it was estimated that the proposed MEPS, by removing the least efficient appliances from the market, would generate significant net benefits for householders even if labelling regulations were not changed.

Similar conclusions were reached in a later assessment of Australia’s labelling and MEPS regulations by George Wilkenfeld and Associates (2003b). They also noted that there would be additional (unvalued) benefits from having lower energy-related emissions.

The more recent MEPS introduced for air conditioners and some water heaters were also estimated to deliver net benefits. Syneca Consulting (2004) evaluated the impact of lowering the maximum permitted heat loss for low pressure and heat exchanger water heaters by 30 per cent. It argued that householders generally fail to recognise that standing losses from electric water heaters — energy lost directly to the atmosphere from the storage tank — typically cost more over the life of the heater than its installed cost. Accordingly, it estimated that the proposed standard for low pressure and heat exchanger water heaters would generate a $19.4 million benefit for users that was more than double its cost of $9.3 million (in present value terms using a 5 per cent discount rate). Syneca Consulting (2003a) also evaluated the introduction of MEPS for single phase air-conditioners. It estimated that this would generate benefits for users of $102 million and costs of $34 million (in present value terms using a 5 per cent discount rate).

Are other interventions better?

Given that the benefits of mandatory MEPS may have been overstated, policy makers need to consider whether other options would be more cost effective. Other options include voluntary MEPS, energy-performance labels, and mandatory disendorsement (warning) labels.

Voluntary MEPS

A view expressed by some policy makers and their advisers is that MEPS cannot be effective unless they are mandatory.

The Department of the Environment and Heritage claimed that there is little incentive for firms to unilaterally volunteer to adopt MEPS:

> The reasons why no individual firm would unilaterally introduce MEPS are the same as for labelling but more so. The costs to the producer are higher than for labelling, since not only do product designs have to change physically, but the only conceivable competitive advantage to the supplier is from publicising its actions and convincing buyers that it is a reason to prefer its products — ie the same costs as for a 'private' labelling regime. On the other hand the risks of 'private' MEPS are also higher, since the first mover places itself at a product price disadvantage. (sub. 30, p. 18)

The regulatory impact assessment of MEPS for refrigerators, freezers and electric water heaters assumed that voluntary standards would not be effective:

> Voluntary compliance with the proposed MEPS level (or any given MEPS level) is unlikely to be commercially advantageous for suppliers, as there would always be a risk that competitors would not comply. Some value could be given to voluntary compliance by substantial expenditure on public promotion of a compliance mark, but this is not likely to be worthwhile for any supplier individually. Therefore it is assumed that MEPS will only be effective if it is mandatory. (George Wilkenfeld and Associates and Energy Efficient Strategies 1999, pp. 3–4)

The Commission considers that, while there are plausible arguments for MEPS to be mandatory, these have sometimes been overstated. An international review of energy policies by the World Energy Council (2004) concluded that voluntary agreements between manufacturers and governments can be an effective alternative to MEPS, provided they are accompanied by a credible threat of regulation:

> In certain conditions, voluntary agreements can be an effective alternative to minimum energy efficiency standards. Since they have the support of manufacturers, they can be implemented more rapidly than regulations. Nevertheless, their effectiveness is still dependent on the possibility of imposing precise requirements corresponding to genuine additional efforts from industry. To achieve this, the free flow of information should be ensured. Above all, the regulations must remain credible if negotiating power is to stay in the hands of the public authorities. (World Energy Council 2004, p. 47)

The key issue seems to be that voluntary and mandatory standards do different things. Mandatory standards remove the least efficient models from the market. Voluntary standards tend to be used by suppliers to market more efficient models. This can be done in conjunction with a voluntary (endorsement) label. An example is the voluntary Energy Star label, which suppliers of office equipment and home electronics can use if they adopt the Energy Star standards (appendix D).

The case for mandatory standards appears to be strongest when split incentives typically cause householders to use products that are very cost-ineffective. In such cases, appliance suppliers have little incentive to adopt a voluntary standard to raise energy efficiency, and energy-performance labels will have little impact on purchase decisions. A possible example is water heaters in new houses, which builders might tend to select on the basis of capital cost, rather than the running costs borne by householders.

The urgency often associated with the replacement of water heaters in existing homes could also lead to an undue emphasis on the up-front capital cost, particularly for rented dwellings:

> … the lifetime value of standing losses [for a water heater] is typically greater than the installed cost of the heater, and may be up to 20 per cent larger. Ideally, therefore, the rate of heat loss should be at least as significant a consideration as the purchase price. However manufacturers agree that this is not the case, and that users undervalue the long term impact of additional insulation on their electricity consumption. One obvious reason is that there is usually some urgency about replacing water heaters that have failed, leaving little time for a market search. And new home buyers generally leave heater selection to the builder, whose main concern is to minimise the installed cost. (Syneca Consulting 2004, p. v)

On the other hand, as noted previously, there is a risk that mandatory standards will remove appliances from the market that are cost effective for many householders. Thus, whether voluntary MEPS would be better than a mandatory approach has to be judged on a case-by-case basis.

Energy-performance labels

In Australia, MEPS are often applied to appliances that are also required to have an energy-performance label (table 7.2). This raises the question of why it is necessary to restrict consumer choice if the less interventionist (and hence probably less costly) approach of labelling is effective.

The Department of the Environment and Heritage observed that MEPS can be more effective than labelling because:

> … MEPS … do not rely on the mechanisms of consumer awareness and choice and supplier response to consumer preference, which are all highly variable. (sub. 30, p. 16)

Similarly, the Energy Retailers Association of Australia noted:

> Placing liability on product manufacturers to ensure that products comply with minimum efficiency standards … is an efficient way of realising energy efficiency gains without the need to rely on consumer behavioural change. (sub. 26, p. 40)

George Wilkenfeld and Associates and Energy Efficient Strategies (1999) claimed that labelling is unlikely to be effective if:

- purchasers rarely inspect appliances in a showroom where they can compare energy performance across different models; or
- the purchaser is not the ultimate user, and so has little interest in operating costs (split incentives).

These conditions often apply for water heaters. As a result, NAEEEC has made MEPS mandatory for electric water heaters and labelling voluntary.

It is less likely that other appliances subject to mandatory MEPS (air conditioners, refrigerators, freezers, gas cookers, and gas room and ducted heaters) would satisfy the above-mentioned conditions for labelling to be ineffective. Hence, there is a stronger case for using labelling instead of MEPS. Nevertheless, NAEEEC and the AGA have imposed both mandatory MEPS and labelling requirements for those appliances, apart from gas cookers. Whether this is the most cost-effective approach has to be judged on a case-by-case basis.

Disendorsement (warning) labels

Another option is the use of disendorsement (warning) labels for appliances that would otherwise be prohibited by MEPS. Such a label would have to be mandatory because no supplier would volunteer to use a label that discouraged customers from buying its products.

Consumer research commissioned by the AGO suggests that a disendorsement label warning consumers that an appliance is very inefficient could be effective:

> Many different ways of informing consumers about ... inefficient appliances were tested during the current study, including a series of mock-up labels. The general message ... is that consumers will react positively to a label which informs them that a particular ... appliance is inefficient …

> In terms of strength of message, consumers generally maintain that provided the appliance is deemed sufficiently inefficient to warrant having a disendorsement label, then a stronger message … is to be preferred over a milder message … (Winton 2003, p. 71)

Many participants in that consumer research considered the tested warning labels to be extreme, and questioned why such appliances would be allowed to be sold:

> ... although the warning mock-up labels … are thought to convey a very powerful message, they are thought by many, perhaps most, to be too extreme — for example, ‘If the appliance is that inefficient, it shouldn’t be allowed to be sold at all’. (Winton 2003, p. 71)

This suggests that disendorsement labels would discourage most consumers from buying the least energy-efficient appliances, and so have a similar effect to a mandatory standard that removed those appliances from the market. However, a key difference is that disendorsement labels would not prevent a consumer from buying a less efficient appliance when that is the most cost-effective option for them, or they have a strong preference to buy such an appliance.

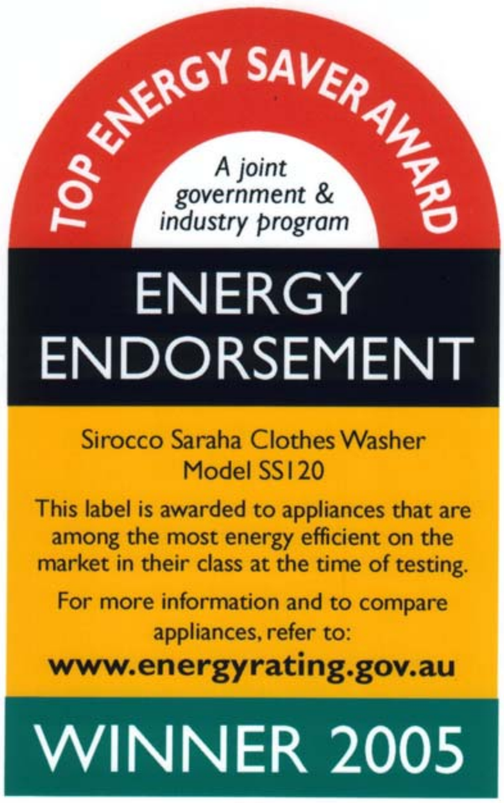
Australian Governments have already agreed to introduce mandatory disendorsement labels for water-consuming products, such as shower heads that have a flow rate above a certain level (George Wilkenfeld and Associates 2003a, p. 32). High-flow shower heads have not been banned, given that water efficient models are unsuitable for homes with low hot water pressure. The water disendorsement label will be introduced as part of the mandatory water labelling arrangements that are expected to come into force in May 2005. The disendorsement label will display zero stars, the words ‘water warning’, and a message that the product does not comply with the relevant standard.

The Ministerial Council on Energy has previously agreed to use disendorsement labels for electrical appliances if such labels are found to be an effective way to reduce standby power consumption. However, this option has not been pursued by NAEEEC.

Disendorsement labels were also considered as part of the MEPS arrangements for electric water heaters. The suppliers had proposed a tradeoff in which small electric water heaters not satisfying the MEPS could remain on the market if they had a disendorsement label, in return for which other heaters would have been more efficient than required by the MEPS. The rationale for the proposal was that small inefficient water heaters were required in situations where a more efficient (and necessarily larger) unit would not fit. Ultimately, suppliers decided not to pursue the proposal.

The converse of disendorsement labels — namely, endorsement labels — is already being used for gas and electrical appliances. For products that receive the Top Energy Saver Award, a separate endorsement label is used for gas appliances and can be used for electrical appliances (figure 7.5). Alternatively, suppliers of electrical appliances can note the award in a green bar at the bottom of the standard energy rating label.

Figure 7.5 **Sample endorsement label for the Top Energy Saver Award**



Source: National Appliance and Equipment Energy Efficiency Committee.

The Commission seeks comments from participants on the strengths and weaknesses of using mandatory disendorsement (warning) labels as an alternative to minimum energy performance standards (MEPS).

DRAFT RECOMMENDATION 7.1

The National Appliance and Equipment Energy Efficiency Committee should adopt procedures to ensure that future regulatory impact assessments of appliance minimum energy performance standards (MEPS) include a more comprehensive analysis of:

- ***why consumers — with guidance from an energy-performance label — are not best placed to judge what is in their best interests;***
- ***whether a voluntary standard, such as the Energy Star program, would be more cost effective;***
- ***what proportion of consumers would be prevented from buying appliances that are more cost effective for them;***
- ***the extent to which consumers would be forced to forgo product features that they value more highly than greater energy efficiency;***
- ***the distributional impacts, including the extent to which MEPS are regressive;***
- ***whether MEPS would reduce competition and how this would affect prices and service quality; and***
- ***whether a disendorsement label would achieve a more cost-effective result.***

7.7 Energy-performance ratings for existing dwellings

The Ministerial Council on Energy (2004) has announced that the Australian, State and Territory Governments will consider making it mandatory in all jurisdictions to disclose the energy performance of houses, units and apartments at the time of sale or lease. This was a NFEE Stage One measure.

Mandating energy ratings for existing buildings is seen as a way to overcome the difficulty that home buyers and tenants face in determining the energy efficiency of a prospective dwelling. By making home buyers and tenants better informed, it is thought that they will be willing to pay the additional capital cost of energy efficiency features, such as roof insulation. This will in turn encourage building owners to invest in such measures.

Audits of home energy performance are already available through State and Territory Government programs (appendix B). There are also regional bodies, such as the Moreland Energy Foundation (sub. 18), that offer such services.

Some inquiry participants supported mandatory energy ratings at the time of sale and lease of residential dwellings:

> ACF [Australian Conservation Foundation] supports the Commonwealth Government's commitment to working with the States to introduce mandatory disclosure of building energy performance at the point of lease and point of sale as announced in the recent Energy White Paper. (Australian Conservation Foundation, sub. 24, p. 9)
>
> For most consumers the energy efficiency of a building is not immediately apparent. Mandatory disclosure programs provide consumers with information that they would not otherwise have access to and allow them to make rational purchase choices between buildings allowing them to include energy efficiency as one of the components of that choice. … If the owner is required to disclose energy performance there is greater incentive to improve the efficiency of the property in order to maintain its market value. (Insulation Council of Australia and New Zealand, sub. 14, pp. 7–8)

The ACT already has an energy-rating requirement for existing residential buildings. Since 1999, anyone wishing to sell an existing dwelling has had to obtain an energy efficiency rating assessment (appendix C). The energy efficiency rating has to be disclosed in all advertisements and the contract of sale.

The Housing Industry Association considered that not enough evidence is available to assess whether the ACT energy-rating scheme has been worthwhile:

> HIA [Housing Industry Association] … is unaware of any empirical evidence that points to the success or impact of this policy. At this stage therefore, HIA is unable to support this initiative. (sub. 27, p. 5)

In contrast, the Insulation Council of Australia and New Zealand viewed the ACT scheme favourably because houses with a higher star rating tend to be more expensive to purchase:

> Experience with mandatory disclosure in the ACT suggests that the market does attach a positive value to the energy efficiency of a home. A survey of star ratings and house prices in the ACT shows that higher star rated houses attract higher sales prices. There are probably more factors at work than simply the efficiency of the home e.g. older less desirable stock may be less efficient. Nevertheless, the difference in prices between 4 star (the current regulated level for new housing in the ACT) and 5 star indicates that energy efficiency is playing some part in the value consumers are attaching to residential property. This value also creates an environment where the owner can feel confident that improvements made to the energy efficiency of the house will be recouped and therefore provides some incentive to undertake such improvements. (sub. 14, p. 8)

This correlation between energy ratings and prices does not prove that higher energy efficiency causes home buyers to pay higher prices. There are many other possible explanations. To determine whether energy ratings have an impact, it is necessary to undertake an econometric analysis that isolates the effects of energy ratings from the many other factors that can determine house prices. To the Commission's knowledge, no such analysis has been undertaken.

A government-sponsored study of the ACT home energy-rating scheme was conducted in 2001 (Wilkenfeld and Associates, Artcraft Research and Energy Partners 2001). But that study *assumed* that the scheme would be effective in increasing residential energy efficiency. Nevertheless, the study found some major problems:

- about a quarter of homes were advertised without an energy rating;
- only 39 per cent of surveyed home buyers received an energy-rating report prior to exchanging contracts (20 per cent received the report on the same day as contracts were exchanged, 13 per cent received the report after the exchange of contracts, and 28 per cent said they did not receive a rating report);
- 52 per cent of surveyed home buyers and 39 per cent of surveyed sellers did not find the energy-rating report useful;
- about half of the ratings were made by an assessor who had not visited the property;
- there were instances where sellers had deliberately inflated their rating by giving false or exaggerated data to the assessor; and
- some people were confused about home energy ratings, incorrectly thinking that they covered the energy efficiency of heating and cooling appliances.

Australian Government officials are currently investigating the possibility of commissioning an *ex post* evaluation of the ACT home energy-rating scheme. This has been prompted by the Ministerial Council on Energy decision to mandate home energy ratings across Australia. The Commission supports the Australian Government's efforts to assess the impacts of the ACT home energy-rating scheme.

It is not clear that energy-rating schemes for existing dwellings would deliver a net benefit (see, for example, the modest gains found by Gilmer (1989) for US house energy labelling). They impose administrative and compliance costs that inevitably get passed on, at least to some extent, to tenants and home buyers. Furthermore, it is questionable whether energy ratings are effective in increasing the adoption of energy efficiency measures. As shown in table 7.1, energy costs account for a very small part of expenditure by most households. Therefore, the decision to rent or purchase a dwelling is likely to be driven more by other considerations, such as the general amenity of the property and its proximity to schools, shops and workplaces.

The effectiveness of home energy ratings is also questionable because it is debatable whether energy performance can be measured accurately. George

Wilkenfeld and Associates (2003a) noted some of the constraints on developing useful energy-performance ratings for homes:

- … The use of ratings as a guide to the purchase of existing dwellings … is limited by the fact that almost every dwelling is unique in its location, quality, affordability and suitability for the buyer.
- Unlike appliance ratings, house ratings cannot directly indicate probable resource consumption, running cost or environmental impacts. Those will depend on whether there is any heating or cooling equipment installed at all, its energy type and efficiency, and the patterns of use …
- Unlike appliance rating claims, which can be tested in the laboratory, house rating claims cannot be directly tested, even after a house is built. (It is even difficult to establish that a house has been built fully in accordance with the approved design). (George Wilkenfeld and Associates 2003a, pp. 34–5)

Case-study evidence submitted by Dr Terry Williamson (sub. 28, pp. 25–8) suggests that such problems have become evident in misleading home energy ratings generated by the software commonly used to simulate building energy efficiency. The development of energy-rating software has been driven largely by energy efficiency standards for buildings. Therefore, further consideration of the accuracy of energy-rating software is deferred until the examination of building standards in the next section of this chapter.

Voluntary building rating schemes

An alternative to mandating energy-performance ratings for existing dwellings, which may be more cost effective, is a voluntary rating scheme.

The Australian Window Association (sub. 59, pp. 1–2) advised that it had developed a voluntary Window Energy Rating Scheme with assistance from the AGO (appendix C). The scheme uses star ratings to indicate a window's energy efficiency:

> The star ratings are based on the relative, whole-house energy improvement caused by the use of a given window compared with using the base-case product (single-glazed clear, thermally unbroken aluminium frame which currently comprises most of the building stock and is arguably the most inefficient for energy). (Australian Window Association, sub. 59, p. 2)

It also noted that there are measures to ensure compliance:

> Companies who participate are subject to a license, an audit and can be asked to withdraw if they make false energy-performance claims. (Australian Window Association, sub. 59, p. 2)

However, it is likely that voluntary ratings would only be provided for dwellings that have a high energy efficiency. In contrast, mandatory ratings could enable home buyers and tenants to compare the energy efficiency of a prospective dwelling against that of any other dwelling offered for sale or lease.

DRAFT RECOMMENDATION 7.2

Before the States and the Northern Territory mandate energy-performance ratings for existing dwellings at the time of sale or lease, the Ministerial Council on Energy should commission an independent evaluation of the ACT rating scheme that has operated since 1999. The evaluation should include an assessment of:

- ***the accuracy of home energy ratings in predicting the actual energy performance achieved by home buyers and tenants; and***
- ***the costs, benefits and effectiveness of the scheme, taking account of the diverse preferences and financial circumstances of individual home buyers.***

7.8 Minimum energy efficiency standards for new dwellings

Mandatory energy efficiency standards apply to new residential buildings. As part of the NFEE Stage One measures announced by the Ministerial Council on Energy (2004), the Australian, State and Territory Governments have agreed that they will also apply energy efficiency standards to all ‘major renovations’.

Building Code of Australia

At the national level, energy efficiency standards for new houses and additions to existing houses are specified in the Building Code of Australia (detailed in appendix C). Energy efficiency standards for residential buildings other than houses are scheduled to be introduced in the May 2005 edition of the Building Code (ABCB 2004a). Energy efficiency standards for commercial buildings are also scheduled for introduction over the next few years (chapter 8 and appendix C).

The Australian Building Codes Board (ABCB), which is responsible for maintaining the Building Code, stated that energy efficiency standards help to overcome the information and split incentive problems that people face when buying a dwelling:

> … in the residential … sector … many participants (including builders, appraisers and prospective purchasers) lack the necessary information to assess the construction and

> design characteristics of buildings in regards to energy efficiency. In addition, the existence of split financial incentives, whereby the person making the decision to invest in energy-efficient products or design is usually not the one who pays the ongoing energy bills, means there is no direct incentive to improve the thermal performance of buildings.
>
> The mandating of minimum energy efficiency requirements through the BCA [Building Code of Australia] helps to overcome these problems by creating an increased awareness and uptake of energy-efficient products and design and construction practices, whilst directly improving the energy efficiency performance of new buildings. The measures will also help to address the issue of split incentives by ensuring that [cost-effective] investments in energy efficiency are made by the appropriate parties during the design and construction stage of new buildings. (sub. 7, p. 5)

However, the objective of the Building Code's energy efficiency standards '… is to reduce greenhouse gas emissions by efficiently using energy.' (Building Code of Australia 2004 (volume 2), s.O2.6). This could be used to justify increases in energy efficiency that are not cost effective for individual householders.

Prescriptive and outcome-based compliance methods

Compliance with the Building Code's energy efficiency standards can be demonstrated by using prescriptive 'deemed-to-satisfy' construction methods and materials detailed in the Building Code. The ABCB (sub. 7, pp. 3–4) noted that most building designers use the deemed-to-satisfy approach.

Alternatively, compliance can be demonstrated by using an outcome-based verification method which shows that a building's annual heating and/or cooling load will not exceed a specified level. An annual heating/cooling load is the quantity of energy that has to be delivered/removed from a space over a year in order to maintain a desired temperature.

There are three outcome-based verification approaches that can be used instead of the deemed-to-satisfy provisions:

1. Demonstrate that the predicted annual heating and/or cooling load (requirements vary between climate zones) does not exceed that of a 'reference building' in the same location. The Building Code details the characteristics of the relevant reference building.
2. In northern climate zones, demonstrate that the predicted annual energy load (combined heating and cooling load) does not exceed the maximum permitted load for the relevant location (specified in table V2.6.1 of the Building Code).

3. Show that the building achieves an energy (star) rating that is no lower than a specified minimum, based on its predicted annual energy load. The rating has to be determined in accordance with the ABCB (2004e) Protocol for House Energy Rating Software. This requires an algorithm that takes account of climate and how specific design features affect energy performance.

In essence, new houses built in northern climate zones are required to achieve a 3.5 star rating, while houses in southern climate zones are required to achieve a 4 star rating. A lower rating is permitted in northern climate zones because the rating algorithms available when the standards were formulated did not adequately account for the benefits of natural ventilation in hot climates. The ABCB (2004d) noted that work is being undertaken to address this issue.

The current minimum 3.5 star standard for houses in the Building Code was chosen because some jurisdictions already had a requirement that residential developments achieve a 3.5 star rating. It was considered:

> … unreasonable to consider options that are weaker than those already implemented in some jurisdictions, given the policy direction from Government, which is to 'improve energy efficiency'. (ABCB 2002, p. vi)

This suggests that the level of the building energy efficiency standards has not been based on a consideration of what is most cost effective among all possible standards. The usual approach in regulatory impact assessments has been to compare the net benefit of a proposed standard against the status quo and sometimes a small number of other options.

The regulatory impact statement for the current standards in the Building Code acknowledged that no attempt had been made to select the minimum required star rating that would lead to the greatest net benefit (ABCB 2002, p. vi). This was seen as being impractical because of:

> … the lack of available information about the intensity of heating and cooling demand in specific climate zones. It is not enough to know how many households use space conditioners; it is also necessary to know how intensively that equipment is used. (ABCB 2002, p. vi).

Indeed, the ABCB expressed a concern that the data used to guide the development of energy efficiency standards for buildings are inadequate:

> … in developing the BCA [Building Code of Australia] energy efficiency measures, some technical and policy decisions have had to be made on limited or anecdotal evidence due to the lack of energy data. … From a government perspective, better coordination and targeting of funding is essential to ensure that reliable data is available for informed policy decisions to be made. (ABCB, sub. 7, p. 9)

This raises questions about whether the energy efficiency standards in the Building Code are based on sound evidence (discussed further below).

Upgrading of Building Code standards

Since the energy efficiency standards for houses were adopted in January 2003, some jurisdictions have announced that they will require a higher minimum star rating than required under the Building Code. The ABCB responded by initiating a review of the stringency of the Building Code's energy efficiency standards:

> In light of this development, and to facilitate a nationally consistent approach, the ABCB agreed in September 2003 that the current Building Code of Australia housing energy provisions should be reviewed and the stringency increased where appropriate. (ABCB 2004d, p. 1)

The ABCB (2004d) has now proposed that the minimum required energy rating for houses in all climate zones be raised to 5 stars in the May 2006 edition of the Building Code. This proposal is currently subject to a regulatory impact assessment.

In light of this, it appears that the minimum required star rating under the Building Code has been driven in large part by a desire to catch up to the most stringent State or Territory standards.

The Housing Industry Association commented that compliance costs are probably increasing at a faster rate than benefits, because it is becoming harder to meet building energy efficiency standards as they have become increasingly stringent:

> … as mandatory energy efficiency regulations become more stringent, the technical means of achieving outcomes become more expensive because the more readily applied measures are likely to have been included as part of the previous requirements. Therefore, a move from 4 star to 5 star stringency becomes more technically demanding to achieve than a move from 3 star to 4 star, even though both have only been 1 star increases. Similarly, any future proposals to increase stringency levels will become even more difficult and more costly to achieve. Therefore, any increase in stringency reduces affordability. (sub. 27, p. 4)

This would be of greatest concern if the dollar increase in compliance costs was also large.

State and Territory standards

In essence, Queensland, South Australia, Western Australia, Tasmania and the Northern Territory have adopted the energy efficiency standards in the Building Code (although the Queensland Government (2004) has proposed additional energy efficiency standards). The exceptions are Victoria — where State-based standards take precedence over some of the energy efficiency requirements in the Building Code — and New South Wales and the ACT — which have adopted their own energy efficiency standards for residential buildings (appendix C).

In the ACT, new residential buildings are required to achieve at least a 4 star rating using the ACT House Energy Rating Scheme (ACTHERS).

In Victoria, new houses must either:

- achieve a 5 star rating for building fabric; or
- achieve a 4 star rating for building fabric, have water-saving measures, and include either a solar hot water system or rain water tank.

From July 2005, all new houses in Victoria must achieve a 5 star rating for building fabric, incorporate water-saving measures, and have either a solar hot water system or a rain water tank.

In New South Wales, all new residential buildings in Sydney must be certified under the Building Sustainability Index (BASIX) scheme. This involves comparing a dwelling against a benchmark building that is deemed to represent the average building of the same type and in the same location. To receive a BASIX certificate, a dwelling must, relative to its benchmark building, have 25 per cent less greenhouse gas emissions (this will be raised to 40 per cent from July 2006) and use 40 per cent less mains supply water. Satisfying the certification requirements will depend partly on the energy efficiency of the building being assessed. From 1 July 2005, the BASIX scheme will apply to all new residential buildings anywhere in New South Wales. From 1 October 2005, the scheme will also cover alterations and additions that require a development application.

Environmental importance of building energy efficiency standards

The Department of the Environment and Heritage stated that, by regulating the thermal performance of houses, building energy efficiency standards influence about 9 per cent of Australia's total energy consumption:

> A disaggregation of the 1999 National Greenhouse Gas Inventory undertaken … for the AGO indicated that space conditioning was responsible for 45 per cent of total residential energy consumption of 381 petajoules ... Thus, the regulation of the thermal performance of houses influences the consumption of about 9 per cent of total energy consumed in Australia. (sub. 69, p. 9)

However, Dr Terry Williamson commented that the Department had overstated the importance of building standards. He estimated that only 4.8 per cent of Australia's final (end use) energy consumption is influenced by energy efficiency standards for residential buildings:

> … this figure [9 per cent of total energy consumed in Australia] would appear erroneous and an overstatement of the relative importance of the house energy efficiency regulation.
>
> ABARE figures show that residential energy consumption, taking Australia as a whole, accounts for around 11.9 per cent of total [end use] consumption …
>
> Space heating and cooling accounts for around 41 per cent (heating 40 per cent, cooling 1.2 per cent) of household delivered energy use … It follows therefore that 'the regulation of the thermal performance of houses' influences around 4.8 per cent (41 per cent of 11.9 per cent) of total secondary [end use] energy (not 9 per cent as stated). (sub. 78, pp. 5–6)

The Housing Industry Association questioned whether the current regulatory focus on residential buildings, rather than other areas of energy consumption, is cost effective:

> Notwithstanding the relatively modest contribution from housing toward national greenhouse emissions and the primary objective of most regulatory provisions to reduce environmental harm, the focus of regulatory efforts to date has been on the residential sector, and not on higher order greenhouse gas generators in other sectors.
>
> In HIA's [Housing Industry Association's] view there needs to be consideration of the practical and affordable limits that should be applied to energy-efficient housing, particularly in consideration of the comparative energy use by other sectors. Housing, and households, should not be considered to be an easier target for government to tackle than other sectors. The cost effectiveness of various energy efficiency measures must have regard for the overall ability of households to absorb additional charges related to their choice of housing. (sub. 27, p. 5)

Such cross-sectoral issues are considered later in this report.

How effective are building energy efficiency standards?

The Department of the Environment and Heritage cited AGO estimates of the extent to which building energy efficiency standards would reduce greenhouse gas emissions in 2020:

> Estimates by the Australian Greenhouse Office show projected greenhouse gas emissions savings from minimum residential building energy-performance standards to reach … around 12 megatonnes carbon dioxide-equivalent and energy savings of around 60 petajoules by 2020 against business-as-usual just from improved thermal comfort performance. (sub. 30, p. 20)

In comparison, the AGO (2004n) estimated that all emission-reducing measures across the economy would cut Australia's greenhouse gas emissions by

121 megatonnes carbon dioxide-equivalent in 2020. Thus, the AGO estimates imply that, in 2020, 10 per cent of greenhouse gas emission reductions would come from residential building energy efficiency standards.

A key assumption underlying such estimates is that building standards are effective in raising actual energy efficiency. In order for the standards to be effective, it must be possible to verify that individual buildings and deemed-to-satisfy construction methods and materials achieve the minimum required energy efficiency. For appliances, compliance is verified by measuring energy consumption under laboratory conditions. In contrast, energy efficiency under the Building Code is:

- simulated, rather than measured directly
- defined in terms of a variable that is not an indicator of energy consumption.

This raises questions about whether building standards are effective in raising actual energy efficiency. The relevant issues are outlined below.

Energy efficiency is simulated, not measured

Unlike appliances and motor vehicles, it is not practical to adopt an energy efficiency standard for buildings that is based on directly measuring energy efficiency. This is because:

- every building would have to be tested, since each one is unique in terms of its design features and location;
- tests would have to be conducted on-site, rather than in a laboratory; and
- test procedures would be far more complex and time consuming (and hence costly) than those used for appliances and motor vehicles, reflecting the greater complexity of building energy performance.

As a result, building standards are based on *simulated*, rather than measured, energy efficiency.

Building energy efficiency is simulated by using a computer software package. Section V2.6 (volume 2) of the Building Code mentions that NatHERS, FirstRate and BERS are suitable packages for this purpose (appendix C). Such energy-rating software is used by:

- policy makers to verify that proposed deemed-to-satisfy building methods and materials achieve the minimum required energy efficiency (expressed in terms of a star rating); and

- designers of buildings who do not use deemed-to-satisfy building methods and materials to demonstrate that such buildings achieve the minimum required energy efficiency.

Because energy-rating software has an important role in formulating, and demonstrating compliance with building energy efficiency standards, the ABCB has developed a Protocol for House Energy Rating Software (ABCB 2004e) to:

> … ensure that rating software is of an appropriate standard, provides results that are repeatable and that results are consistent using different software. It also aims to provide a mechanism for controlling amendments and revisions to software. (ABCB 2004d, p. 7)

In addition, the ABCB (2004d, p. 8) noted that the AGO plans to take responsibility for maintaining consistency between the various BCA-compliant energy-rating software packages.

While the actions of the ABCB and AGO are a positive development, Dr Terry Williamson submitted results from past research and case studies which suggest that the science of building energy efficiency is far from understood:

> Improving dwelling energy efficiency, rather than being a straightforward matter as implied in the existing regulations and rating schemes, is far from understood. The evidence submitted here based on data from surveys and case studies reveals that:
>
> - results are often counter intuitive (effects seem opposite to computer model predictions);
> - results are often confounding …; and
> - results are often inconclusive (small sample sizes, incomplete data of existing studies). (sub. 28, pp. 2–3)

If Dr Williamson's observations are correct, then simulated energy performance may not be an accurate indicator of actual energy efficiency.

In response to Dr Williamson's comments, the Department of the Environment and Heritage noted that the performance of one of the most widely used simulation packages (NatHERS) meets the international benchmark for energy modelling:

> The energy modelling performance of NatHERS is consistent with the international BESTEST program. This is the international benchmark for energy modelling, accepted by building physicists around the world, and based on the collective effort of many thousands of man-years of research and practice. (sub. 69, p. 5)

Dr Williamson responded that the test procedure mentioned by the Department does not address the issue of whether simulation results are an accurate indicator of reality:

> The IEA [International Energy Agency] BESTEST procedure is known as an inter-model validation. That is, aspects of a computer program's operation are compared with other programs (not against 'real' results). It involves comparing the candidate program with the results from a set of 'reference' programs … While such tests are an important aspect of software development quality control they do not address the issue of the accurate simulation of real situations. (sub. 78, pp. 3–4)

Regardless of whether simulation packages are accurate or not, a more fundamental issue is whether the variable being simulated is a useful indicator of energy efficiency. This issue is considered next.

Simulating energy loads, not energy consumption

The energy efficiency of appliances and motor vehicles is measured in terms of their energy consumption. This is not the case for the Building Code standards. Instead, energy efficiency is defined in terms of heating and cooling loads (collectively termed an energy load), which have the following meanings:

> Cooling load means the calculated amount of energy removed from the cooled spaces of the building annually by artificial means to maintain the desired temperatures in those spaces.
>
> Heating load means the calculated amount of energy delivered to the heated spaces of the building annually by artificial means to maintain the desired temperatures in those spaces. (Building Code of Australia 2004 (volume 2), s.V2.6, p. 88)

Heating and cooling loads do not measure energy consumption because:

- they ignore the energy lost by appliances in converting one form of energy into another (or gained in the case of a heat pump);
- not all buildings have the assumed heating and/or cooling appliances;
- many occupants allow indoor temperatures to fluctuate to some extent with changes in external conditions, rather than maintain the assumed temperatures;
- dwellings are often unoccupied for a large part of the day and for some weeks of the year, and this can differ markedly from the assumed occupancy pattern;
- heating and cooling is often restricted to certain parts of a dwelling, which can be very different from the assumed behaviour; and
- climate variation over a year can differ from the assumed weather pattern.

Thus, the Department of the Environment and Heritage noted:

> Would the heating and cooling energy used by a real house with a real family acting in the same way as NatHERS equal measured energy consumption? The answer is no … NatHERS calculates … the amount of heating and cooling required over every hour of the year, and expresses that energy in terms of megajoules/metre^2. The real house buys its energy from the market as measured at electricity or gas meters or at the weighbridge for firewood. The actual energy then passes through a heating or cooling appliance to deliver the heating or cooling service that is calculated by NatHERS. (sub. 69, p. 5)

In essence, policy makers have sought to isolate the impact of a building's design and physical location from the many other factors that affect its energy efficiency, such as householder behaviour, appliance efficiency, whether heating and cooling equipment are installed, and inter-year variability in climate. As a result, building energy efficiency standards do not target many of the determinants of a building's actual energy efficiency.

Does targeting simulated energy loads raise actual energy efficiency?

Given that simulated energy loads exclude many of the determinants of building energy efficiency, it has to be asked whether building standards are an effective way to raise energy efficiency. Building standards may have little impact on actual energy efficiency, compared to, say, a policy that changes householder behaviour.

Dr Terry Williamson submitted case study results for six houses that had won awards from the Royal Australian Institute of Architects. Each house had above-average energy efficiency, but achieved only a 0 or 1 star rating:

> Each house was rated using NatHERS and/or FirstRate software and results compared with actual consumption and AGO projected average house consumption for the areas. ... The houses in each case were built prior to the introduction of mandatory energy efficiency regulations. Despite each of these houses having energy consumption results well below the 'average' house in the location, based on the star rating results, none could now be built because they do not achieve the required rating criteria. (sub. 28, p. 25)

The case-study evidence submitted by Dr Williamson suggests that building energy efficiency standards could distort the housing market in favour of designs that rate highly using available energy-rating software, rather than on the basis of actual energy efficiency. If this is the case, then more cost-effective improvements in energy efficiency may be overlooked in favour of those that are rated highly by the software. In addition, innovation could be stifled in energy-efficient designs that do not fit within the paradigms used for energy-rating software. Dr Williamson concluded:

> Building energy-related advice (and regulation) is wrapped up in a technical framing of the problem that is expected to be relevant and applicable across the whole range of social contexts. There is little or no evidence to show that energy efficiency standards and regulations (including HERS [house energy rating systems]) will be in any way effective. The survey studies and case studies presented here show that energy-related practices are most likely socially specific and localised in terms of time and context. A blind spot is evident in policy making, where it is assumed that the results of computer simulation equate to reality; real household energy use behaviour and the 'virtual reality' results of computer simulation are seen as one and the same, when nothing could be further from the truth. (sub. 28, p. 28)

The Department of the Environment and Heritage responded to Dr Williamson's submission by stressing that NatHERS is not used to measure actual energy consumption:

> The question is not whether NatHERS quantifies actual energy consumption, but whether NatHERS provides households with information about the intrinsic appropriateness of the house design for the local climate. In other words, for the same family, which house will require less energy to maintain thermal comfort.
>
> NatHERS has never claimed that the energy use figures calculated in the course of a rating measure actual energy use (i.e. the energy measured at the meter). A rating is a comparative figure that ranks the intrinsic thermal performance of the building shell. (sub. 69, p. 2)

In response, Dr Williamson commented:

> While NatHERS (or at least those speaking for the scheme) perhaps has never made such a claim directly, the clear and unequivocal implication of employing a rating scheme is that houses with a higher rating will have reduced energy use compared with houses of a lower rating. Examples abound (even from reputable organisations) of NatHERS descriptions that to a normal person would convey this impression. (sub. 78, p. 1)

However, the key issue is not whether it is energy consumption that is simulated (it is not), but whether a building standard designed to reduce energy loads is effective in achieving the policy objective (improved energy efficiency that reduces greenhouse gas emissions).

If, for a given householder, energy load and actual energy consumption are highly correlated, then the energy efficiency standards in the Building Code are likely to be effective. But it cannot be assumed that such a strong correlation exists. Both the Department of the Environment and Heritage (sub. 69, p. 18) and Dr Terry Williamson (sub. 78, p. 2) noted that the behaviour of a given householder may not be independent of a building's characteristics. In some cases, the interaction between householder behaviour and building characteristics could be counter intuitive. For example, the Department of the Environment and Heritage commented:

> Early field studies into the effect of insulation showed that savings attributed to insulation were found to be less in the field than would be predicted by thermal performance simulation.
>
> One possible theory developed to explain the difference between observed and simulated energy savings is the hypothesis known as 'comfort creep'. In an uninsulated house, it is suggested that the thermal performance of the house is so poor that it is difficult to maintain reasonable levels of comfort at an affordable cost, if at all. In houses which have installed insulation it is suggested that some of the improved performance is used to improve comfort i.e. heat larger areas and/or heat to higher temperatures. Consequently the actual energy savings are significantly less than the theoretical energy savings.
>
> It should be noted that this is not the only possible explanation, and other theories may explain this phenomenon. (sub. 69, p. 18)

The interaction between building characteristics and householder behaviour can also be illustrated by comparing a house with no air conditioning to the same house with an air conditioner in every room. The simulated energy load (and hence energy rating) could be the same in each case, because no account is taken of differences in the appliances that are actually installed. However, a householder is likely to use the air conditioners if they are installed, leading to markedly higher energy consumption and greenhouse gas emissions.

DRAFT FINDING 7.2

Energy efficiency standards for residential buildings are based on computer simulation models — such as the Nationwide House Energy Rating Scheme energy-rating software — that exclude many of the determinants of a building's actual energy efficiency.

DRAFT FINDING 7.3

A ranking of residential buildings by star rating (using energy-rating software such as Nationwide House Energy Rating Scheme) may be very different from a subsequent ranking based on actual energy consumption or efficiency.

Financial costs and benefits

Many inquiry participants observed that it is technically feasible to increase the energy efficiency of the current stock of residential buildings above their current levels. However, few participants provided evidence to support the assertion that householders typically fail to adopt energy efficiency improvements when it would be cost effective for them to do so.

The Australian Glass and Glazing Association submitted estimates of the impacts of more energy-efficient glazing for two different project homes offered by Simonds in Victoria:

> … two homes were drawn from the Simonds range of designs, the first being a medium sized home, rating 3.5 stars with ordinary glazing or 5 stars with energy-efficient glazing. The second example was a larger sized residence rating 3 stars with ordinary glazing and 5 stars with energy-efficient glazing. …
>
> The two homes were … simulated on the basis that heating as well as cooling was electric. … Under this scenario, reduction in energy usage for the medium sized home amounted to 2180 kWh when energy-efficient glazing was used and generated greenhouse gas emissions savings of 2921 kg. For the larger house, annual energy savings were 8178 kWh and reduction in greenhouse gas emissions was 10 960 kg. (sub. 16, pp. 1–2)

The Association estimated that the additional cost of the more energy-efficient windows could be recouped by energy cost savings within five years (table 7.3).

Table 7.3 **Cost effectiveness of energy-efficient windows for selected project homes**

	Units	*Glenwood 2201*[a]	*Toscana 4001*[b]
Additional cost of windows[c]	$	1620	5400
Annual energy cost saving[d]	$/year	327	1226
Payback period[e]	years	5.0	4.4

a The Glenwood 2001 is a single storey dwelling with a floor area of 21 squares. **b** The Toscana 4001 is a double storey dwelling with a floor area of 30 squares. **c** For the Glenwood 2201, windows are upgraded from a 3.5 to 5 star rating. For the Toscana 4001, windows are upgraded from 3 to 5 stars. **d** Energy cost savings for homes with electric heating and cooling. **e** Number of years it takes for cumulative savings in operating costs to compensate for the increase in capital costs, assuming that the benefit from having a dollar today is the same as having a dollar in the future.

Source: Australian Glass and Glazing Association.

Moreland Energy Foundation (sub. 18, pp. 6–8) noted its involvement in two household energy efficiency programs which had been successful in achieving higher energy efficiency and lower greenhouse gas emissions. But there was no evidence that such actions had been cost effective for householders. A survey of participants in one of the programs revealed that almost all participants saw cost as the key barrier to implementing energy efficiency improvements.

Sustainable Projects (sub. 3, p. 6) provided information on a building renovation it had been involved with, which indicated that annual water and energy costs were reduced from $2000 to $300. Again, there was no evidence as to whether it was cost effective for the householder to invest in the energy efficiency improvements.

Regulatory impact assessments

Regulatory impact assessments for current and imminent building energy efficiency standards include estimates that such standards are cost effective for home buyers (box 7.3 and appendix C).

Box 7.3 Regulatory impact assessments of building energy efficiency standards

The ABCB (2002) evaluated the residential energy efficiency standards incorporated into the 2003 edition Building Code of Australia. It estimated that, between 2003 and 2010, the standards would raise capital expenditure on residential energy efficiency measures across Australia by $665 million in present value terms (using a 5 per cent discount rate). The associated reduction in residential energy costs, discounted over a 30 year lifetime, was valued at $1150 million. Thus, the Building Code's residential energy efficiency requirements were estimated to generate a net benefit of $485 million in present value terms. For the average house (assumed to be 200 square metres) the present value of energy and equipment savings over 30 years was estimated to be $1859, which would exceed the increase in construction costs of $1147.

Allen Consulting Group (2002) used a general equilibrium economic model to evaluate the impact on Victoria of increasing the minimum allowed energy efficiency rating from 4 to 5 stars for all new houses and major renovations. A critical input to that evaluation was a dataset provided by the Sustainable Energy Authority of Victoria, which contained a revised version of estimates initially made by Energy Efficient Strategies (2002) on the investment and energy costs of moving to a 5 star standard. In summary, the data provided to Allen Consulting Group by the Sustainable Energy Authority of Victoria showed that the net benefit in Melbourne of moving from the standards prevailing in the late 1990s to a 5 star standard would be $1.8 million ($9.1 million reduction in energy costs (in net present value terms) *less* $7.3 million increase in capital costs).

The Queensland Government (2004) estimated that there would be a net benefit to householders if they were required to install more energy-efficient lighting and hot water heaters. However, the estimated benefits of more efficient (solar electric and heat pump) water heaters were partially due to rebates that could be obtained from the sale of Renewable Energy Certificates.

In its recent review of building regulation, the Productivity Commission found that the ABCB has a good record of compliance with the requirements for regulatory impact statements, but there is scope for further improvement (PC 2004b). The Commission noted that there is scope for improvement in a number of areas, including:

- consideration of non-regulatory alternatives
- coverage and treatment of costs and benefits
- the need for more explicit risk analysis
- *ex post* reviews.

The Commission considers that this is evident in the assessments of energy efficiency standards by the ABCB and by individual jurisdictions. There appears to have been little, if any, *ex post* evaluation of the impacts of building energy efficiency standards to verify that the predicted net benefits in regulatory impact assessments were realised. This is of particular concern because the estimation methods used in regulatory impact assessments seem to have many of the weaknesses identified in chapter 6 for case study estimates. Some of the drawbacks of the regulatory impact assessments are outlined below.

Discount rates

The regulatory impact assessments recommended a proposed building energy efficiency standard if it was cost effective. The criterion used for cost effectiveness was that the expected present value of benefits exceeded the expected present value of costs. Present values were determined by applying a discount rate to future costs and benefits. For example, the ABCB (2002) used a discount rate of 5 per cent to evaluate the current Building Code energy efficiency standards for houses (a sensitivity analysis using discount rates of 4 and 6 per cent was also undertaken). The Queensland Government used a 4 per cent discount rate to evaluate its proposed changes (a sensitivity analysis using discount rates of 3 and 5 per cent was also undertaken).

As noted in chapter 6, it could be argued that, based on observed householder behaviour, the discount rates used in regulatory impact assessments are far too low and hence the cost effectiveness of energy efficiency improvements is significantly overstated from the perspective of householders. This of concern because building energy efficiency standards may not be cost effective if a higher discount rate is used. For example, the Queensland Government noted in its assessment:

> Every one percentage point increase in the discount rate decreases the net benefit by 20 per cent. (Queensland Government 2004, p. 62)

In many cases, home buyers will have to finance the additional cost of satisfying building standards by taking out a larger loan. At the time of writing this report, the average interest rate on a standard variable rate home loan was around 7 per cent. Interest rates for personal loans and credit cards are often much higher. Therefore, the discount rates used in regulatory impact assessments are often lower than the interest rates paid by householders to finance energy efficiency improvements.

Diverse financial circumstances and preferences of home buyers

The regulatory impact assessments assume that no home buyer faces a constraint on their access to capital. If the additional capital cost of more energy-efficient building methods and materials can be recouped through lower future operating costs, then it is deemed to be appropriate for householders. In reality, many householders do face constraints on their ability to finance a higher capital cost now in return for a stream of returns well into the future. If a household is capital-constrained, then it is rational for it to allocate its available capital to what it considers to be the most highly-valued uses of that capital. This could involve investment in cheaper and less efficient building methods and materials because they have a lower capital cost.

As for appliance MEPS, some home buyers may prefer to have a less energy-efficient home if that is what is required to obtain certain highly-valued characteristics. Building energy efficiency standards have the potential to prevent well-informed consumers from making such decisions. That is, building energy efficiency standards could ban products that some consumers want to buy, even when those consumers are aware of the lower energy efficiency and higher running costs. This issue is not adequately addressed in regulatory impact assessments.

Tension between effectiveness and compliance costs

The ABCB has commented that the Building Code is performance-based and this leads to lower compliance costs:

> The Building Code of Australia is a performance-based code, which sets out the minimum level of performance that a building is to achieve. This allows cost savings in building construction by:
>
> - permitting the innovative use of alternative materials and forms of construction or designs while still allowing existing building practices through the deemed-to-satisfy provisions;
> - allowing designs to be tailored to a particular building; and
> - being clear and providing guidance on what the BCA [Building Code of Australia] is trying to achieve. (ABCB 2004a, p. 3)

But the ABCB (sub. 7, pp. 3–4) noted in its submission to this inquiry that most building designers use the prescriptive deemed-to-satisfy provisions rather than the performance-based provisions of the Building Code. Thus, it appears that many practitioners view the performance-based option in the Building Code as more costly than following the deemed-to-satisfy provisions. This could be the right decision in many cases, particularly for smaller operators who do not have the resources to investigate innovative new building approaches. Thus, the Commission is not urging the removal of deemed-to-satisfy provisions.

However, from a policy-maker's perspective, the effectiveness of a deemed-to-satisfy provision in raising energy efficiency is less certain than for a performance-based standard. This is because the deemed-to-satisfy approach generalises the energy performance of particular construction materials and methods to all buildings. In practice, there will be a distribution of energy performance associated with a given deemed-to-satisfy provision because:

- some buildings that comply with a deemed-to-satisfy provision will have a lower energy efficiency than the intended minimum; and
- for other buildings, compliance with a deemed-to-satisfy provision will lead to overengineering in the sense that energy efficiency is higher than required.

Hence, in its regulatory proposal to upgrade housing energy efficiency standards in the Building Code, the ABCB indicated a preference for a performance-based approach because:

> A designer is much more likely to achieve the intended stringency using energy-rating software [rather than following deemed-to-satisfy provisions], as it will be easier for the underperformance of some elements to be offset by the overperformance of other elements. (ABCB 2004d, p. 9)

But the ABCB (2004d) noted that jurisdictions were unwilling to move to purely performance-based standards:

> The level of complexity of the proposed provisions could be reduced if the star rating to the Nationwide House Energy Rating Scheme was the only means of demonstrating BCA [Building Code] compliance. However, most jurisdictions have advised that they require deemed-to-satisfy provisions to be retained as part of the energy efficiency provisions to provide a straightforward compliance path for building practitioners, a measure by which alternative solutions can be judged, and as a basis for assessing the energy performance of proposed extensions and renovations.
>
> … Possibly when industry has more experience with the star rating approach and better acceptance of this compliance path, the decision to retain the deemed-to-satisfy provisions can be revisited. (ABCB 2004d, p. 9)

The Commission considers that regulatory impact assessments have not given sufficient attention to differences in the effectiveness and compliance costs of deemed-to-satisfy versus performance-based standards.

Distributional impacts

An issue often overlooked in regulatory impact and background studies for building energy efficiency standards is the potential for the costs of such standards to be borne disproportionately by less affluent groups. The studies often estimate that the standards raise up-front capital costs for home buyers:

- In Victoria, the average cost of a house would increase by $4577 (3.2 per cent) due to moving from the standards prevailing in the late 1990s to a five star performance requirement (using deemed-to-satisfy provisions) (Energy Efficient Strategies 2002, p. 19).
- In Brisbane, the cost of a 'large brick veneer house with a tiled roof' would increase by around $2300 due to the energy efficiency standards included in the Building Code in 2003 (ABCB 2002, p. 18).
- In New South Wales, the cost of a 'typical detached house' (3 bedrooms, 2 bathrooms, and a gross floor area of 250 square metres) would rise by $3878 due to the adoption of the energy and thermal comfort requirements under the BASIX scheme (NSW DIPNR 2004a, p. 3).

The increase in capital costs could make building energy efficiency standards regressive. This will be the case if the proportionate increase in capital costs tends to be greatest for cheaper homes and such homes are typically bought by less affluent people. Poorer (and first) home buyers are more constrained in their ability to finance higher capital costs now in return for lower operating costs many years into the future.

However, some loan providers recognise that a household with lower energy operating costs has a greater capacity to make loan repayments. Bendigo Bank offers a 'Green Loan' for energy-efficient dwellings which has a lower interest rate than its standard residential variable rate. Home buyers qualify for this product when financing the purchase of a dwelling that is awarded a five star rating by an accredited assessor using FirstRate or NatHERS energy-rating software.

DRAFT RECOMMENDATION 7.3

New or more stringent energy efficiency standards for residential buildings should not be introduced until existing standards have been fully evaluated. The evaluation should be commissioned by the Australian Building Codes Board to:

- ***consider whether defining building standards in terms of simulated heating and cooling loads is an effective way to raise actual energy efficiency;***
- ***investigate whether weaknesses in energy-rating software distort the housing market in favour of particular building designs that are not necessarily the most cost effective, particularly over the longer term as innovations are made in building design;***
- ***evaluate costs and benefits in a way that takes account of the diverse preferences and financial circumstances of individual home buyers;***
- ***assess how effectiveness and compliance costs differ between the deemed-to-satisfy and performance-based standards;***
- ***analyse the distributional impacts of standards on different socioeconomic groups, including first-home buyers and less-affluent groups; and***
- ***examine the process used to set the stringency of standards in the Building Code of Australia, including the impact of any increase in stringency by individual States and Territories.***

8 Industrial and commercial sectors

Key points

- Energy is a minor component of expenditure in the commercial sector. In the industrial sector, energy consumption is generally a more important issue for firms, but the importance of energy varies across industrial sub-sectors.
- Information gaps, ‘split incentives’, and their organisational and behavioural characteristics may prevent some firms from undertaking cost-effective energy efficiency improvements.
- The energy services industry could provide a market solution to some of the barriers faced by firms. However, provision of government assistance to the energy services industry does not seem warranted.
- Voluntary agreements between governments and firms can lead to privately cost-effective energy efficiency improvements, so long as the voluntary nature of the agreements is not compromised by incentive or coercive elements.
- General information provision can increase the uptake of cost-effective energy efficiency improvements, but the usefulness of such programs for firms is limited.
- Provision of incentives for firms to undertake energy audits and research, development and innovation may be warranted if it generates spillover benefits from information diffusion. Provision of direct subsidies to firms to undertake privately cost-effective energy efficiency improvements is not warranted.
- The mandatory energy audit and disclosure approach for large energy users — which is currently being implemented by the Australian Government — is not warranted on private cost-effectiveness grounds.
- Mandatory energy performance standards currently in place for some commercial and industrial appliances and equipment have the same potential costs as the corresponding regulations affecting households. Greater attention should be paid to those costs in future regulatory impact assessments.
- Mandatory energy efficiency standards for commercial buildings which are currently being introduced into the Building Code of Australia are unlikely to result in a significant net benefit, and may result in a net cost. A reassessment of the costs of this policy and the costs and benefits of other policy options is warranted.

This chapter examines the issues surrounding cost-effective energy efficiency improvements in the industrial and commercial sectors. The industrial sector has been defined to include all firms in the manufacturing, construction and mining industries. The commercial sector is comprised of firms which specialise in providing services, including hotels, motels, restaurants, wholesale firms, retail stores, and health, social, educational and financial institutions.

A number of current and proposed policies for energy efficiency improvements in the industrial and commercial sectors are analysed in terms of their potential for achieving their objectives.

The chapter is structured as follows:

- energy consumption and greenhouse gas emissions (section 8.1);
- why firms might fail to adopt energy efficiency improvements that are cost effective for them (section 8.2); and
- assessment of policies (sections 8.3 to 8.9).

8.1 Energy consumption and greenhouse gas emissions

Energy is an important resource in the industrial and commercial sectors. It provides a great range of services including driving manufacturing processes; heating; cooling and lighting firms' premises; powering office appliances; and providing communication services. This section examines key features of energy consumption in these sectors.

Energy consumption

The commercial sector is a relatively minor energy consumer, accounting for 8 per cent of final (end use) energy consumption (table 8.1). However, the commercial sector is highly reliant on electricity (over 73 per cent of final energy use). When the conversion, transmission and distribution losses are taken into account, around 13 per cent of Australia's total (primary) energy consumption was attributable to the commercial sector in 2001-02. Average annual growth between 1973-74 and 2001-02 was 3.9 per cent, compared to annual growth in national final energy use of 2.2 per cent (ABARE 2004). ABARE projections (Akmal et al. 2004) suggest that final energy consumption in the commercial sector is expected to continue to grow at a relatively high rate over the next 15 years.

Table 8.1 **Energy consumption in industrial and commercial sectors, 2001-02**

	Final energy consumption		*Primary energy resources attributable to sector*[a]	
	PJ	% of total	PJ	% of total
Commercial	**238**	**8**	**644**	**13**
Mining	**161**	**5**	**379**	**7**
Manufacturing and construction	**919**	**29**	**1759**	**35**
Basic non-ferrous metals	319	10	670	13
Other manufacturing[b]	192	6	289	6
Chemicals	156	5	191	4
Iron and steel	101	3	261	5
Non-metallic mineral products	96	3	128	3
Wood, paper and printing	56	2	96	2

a Resource consumption is apportioned on the basis of uniform electricity conversion, distribution and transmission losses across sectors. **b** Includes the food, beverages and tobacco sector; the textiles, clothing, footwear and leather sector; the machinery and equipment sector; and the construction sector.

Sources: Akmal et al. (2004); PC estimates.

The mining sector is also a relatively small user of energy, accounting for 5 per cent of final energy use in 2001-02. When the mining sector's electricity consumption is taken into account, around 7 per cent of primary energy consumption was attributable to mining in 2001-02. The sector registered the strongest growth in final energy use in the past 30 years (5.9 per cent per annum between 1973-74 and 2001-02) and is projected to maintain that growth up to 2020 (Akmal et al. 2004).

In contrast to the commercial and mining sectors, the manufacturing and construction sector is a major consumer of energy. Although no longer the largest final energy user in Australia, and registering a relatively low growth in final energy use between 1973-74 and 2001-02 (1.4 per cent per annum), the manufacturing and construction sector still accounted for over 29 per cent of final energy use in 2001-02. When the sector's electricity consumption is taken into account, it overtakes the transport sector as the largest consumer of primary energy resources at around 35 per cent of the total energy consumed in 2001-02.

Within the manufacturing and construction sector, some sub-sectors are particularly reliant on energy as an input into their production. The non-ferrous metals sub-sector is the largest final energy user in manufacturing, consuming about 10 per cent of final energy in 2001-02, followed by chemicals producers with 5 per cent of total final energy use.

Business expenditure on energy

Energy costs amounted to less than 2 per cent of the total costs faced by firms in the commercial sector in 1998-99 (table 8.2). In the mining sector, energy is a larger (but still relatively small) contributor to costs, accounting for around 9 per cent of total expenditure. In the manufacturing sector, the importance of energy varies across sectors from 1.8 per cent of total expenditure in the food, beverages and tobacco sector to 11 per cent in the iron and steel sector.

Table 8.2 **Share of energy costs in total expenditure, 1998-99**

Sector	*Energy costs as a share of total expenditure*
	%
Commercial	**1.6**
Mining	**8.9**
Manufacturing and construction	**6.8**
Non-metallic mineral products	11.5
Iron and steel	10.9
Basic non-ferrous metals	8.5
Chemicals	3.6
Wood, paper and printing	2.4
Food, beverages and tobacco	1.8

Source: PC estimates from ABS (2004).

Changes in energy efficiency

While the amount of energy used by the commercial and industrial sector has increased since the early 1970s, a large part of the growth in energy consumption would be due to an increase in the commercial and industrial sector's output, although changes in energy efficiency would also have an impact.

A quantitative analysis by ABARE researchers (Tedesco and Thorpe 2003) has separated the impact of energy efficiency changes from those of output growth. Their results show that movements in energy efficiency have differed markedly between industries within the commercial and industrial sector.

In the mining industry, changes in energy use during 1973-74 to 2000-01 would have increased Australia's total energy consumption by 2.4 per cent if there had been no change in output (table 8.3). However, most of this increase in energy use (1.4 percentage points) was due to structural change — a shift within the mining industry to sub-sectors that used more energy per unit of output — rather than a drop in the energy efficiency of particular mines. The remainder (1.0 percentage point) was due to technical changes that increased energy use per unit of output.

These technical changes could have included less energy-efficient usage patterns, the use of equipment that was less energy efficient, price-induced substitution of energy for other inputs, and a shift to fuels with a lower conversion efficiency.

Table 8.3 **Decomposition of energy efficiency changes in the commercial and industrial sector, 1973-74 to 2000-01**

Sub-sector	*Impact of sub-sector energy efficiency change on national energy consumption*[a]	*Decomposition of impact*[b]		
		Structural change[c]	*Fuel substitution*[d]	*Technical change*[e]
	%	%	%	%
Mining	**2.4**	**1.4**	**0.0**	**1.0**
Manufacturing	**–11.9**	**–10.4**	**–4.0**	**2.5**
Food, beverages and tobacco	–1.7	–1.0	–0.1	–0.7
Textiles, clothing, footwear and leather	–0.4	–0.5	–0.1	0.2
Wood, paper and printing products	–0.9	–0.8	–0.3	0.2
Non-metallic products	–2.3	–1.7	–0.3	–0.3
Metal products	–6.8	–6.5	–3.2	3.0
Other manufacturing	–0.3	–0.3	–0.1	0.0
Construction	**–0.2**	**–0.3**	**0.0**	**0.1**
Services	**0.5**	**0.5**	**–0.5**	**0.6**

[a] Change in Australian energy consumption due to change in the energy efficiency of the relevant sub-sector. [b] May not add exactly to overall impact of energy efficiency changes (first column of numbers in the table) due to rounding. [c] Portion of the overall impact of energy efficiency changes that is due to a shift within the relevant sub-sector between industries that use different amounts of energy per unit of output. [d] Portion of the overall impact of energy efficiency changes that is due to a shift in the relevant sub-sector between fuels with different conversion efficiencies. [e] Portion of the overall impact of energy efficiency changes that is not due to structural or technical change in the relevant sub-sector.

Source: Tedesco and Thorpe (2003).

In contrast, changes in manufacturing energy use during 1973-74 to 2000-01 would have reduced Australia’s total energy consumption by 11.9 per cent if there had not been an increase in that sector’s output. Most of this fall in energy use (10.4 percentage points) was due to structural change. However, there was a widespread shift by manufacturers toward fuels with a higher conversion efficiency (accounting for 4.0 percentage points of the 11.9 per cent decline in Australian energy consumption). This was partially offset by technical changes that increased the amount of energy used per unit of output (2.5 percentage points).

Energy efficiency changes in the construction and services industries had only a small impact on national energy consumption from 1973-74 to 2000-01. Energy efficiency increased in construction, due to a structural shift to less energy intensive parts of the industry. Energy efficiency declined in services, due to a structural shift to parts of the industry that used more energy per unit of output, and technical changes that raised energy use per unit of output. There was, however, a shift to fuels with a higher conversion efficiency in the services sector.

In summary, much of the changes in energy use in the industrial and commercial sectors since the early 1970s can be attributed to the structural shifts within these sectors between more and less energy-reliant sub-sectors, rather than changes in the energy efficiency of particular industries. Most producers in the industrial and commercial sectors appear to have shifted to fuels with a higher conversion efficiency. However, this has been at least partially offset by technical changes that have increased energy use per unit of output in some cases.

Emissions

The commercial sector is a minor source of greenhouse gas emissions. According to the Australian Greenhouse Office (AGO 2004m), emissions from fuel combustion in the commercial sector were 4 megatonnes of carbon dioxide equivalent, which accounted for 0.7 per cent of total emissions in 2002. This figure, however, does not include emissions from the generation of electricity consumed by the sector. If electricity generation, transmission and distribution emissions are allocated to the commercial sector on the basis of the sector's share of electricity supplied, the commercial sector's contribution to greenhouse gas emissions rises to 49 megatonnes or 9 per cent of total emissions in 2002.

Emissions from fuel combustion in the mining, manufacturing and construction sectors were 43.5 megatonnes of carbon dioxide equivalent in 2002, accounting for 7.9 per cent of total emissions. If emissions from electricity generation, transmission and distribution are included, the sector's emissions rise to 127 megatonnes or 23 per cent of total greenhouse gas emissions.

8.2 Why would firms overlook cost-effective energy efficiency improvements?

It could be reasonably expected that firms have strong incentives to minimise their costs and, therefore, achieve economically-efficient levels of energy consumption. This section explores a number of possible reasons for an energy efficiency gap. The section draws on chapter 5, but focuses on issues relevant to the industrial and commercial sectors.

Information barriers

A number of inquiry participants argued that information gaps prevented the full take-up of energy efficiency opportunities by firms. Information gaps for energy users were identified in the following areas:

- information about the various commercial building options and their cost (Royal Australian Institute of Architects, trans., p. 277);
- information asymmetries about construction and design characteristics of commercial buildings (ABCB, sub. 7; Exergy Australia Pty Ltd, sub. 40; Insulation Council of Australia and New Zealand, sub. 14);
- information asymmetries in the market for energy services (Origin Energy, sub. 25); and
- monitoring energy use and quantifying savings from making process changes (AEPCA, trans. p. 360; ESAA, sub. 68, Government of Western Australia, sub. 58).

Sometimes information can be in the public domain but not in a form useful to a particular firm. For example, the Australian Meat Processor Corporation (sub. 12) submitted that general information on improving boiler energy efficiency was available but not in a consolidated and readily useable form.

Some of the above information gaps might be caused by market failures. For example, information on the best currently available technologies for commercial buildings and commercial and industrial appliances may be underprovided due to its public-good characteristics. However, information gaps may also be attributable to market participants placing a low value on energy efficiency and/or a high cost on obtaining the necessary information.

Information-related market failure may also arise from information asymmetries. When the purchaser of a product faces prohibitive costs of finding out the energy efficiency characteristics of the product while the seller of the product has access to the information at low cost, an adverse selection problem may arise (chapter 5). The problem may exist in the markets for commercial buildings where the purchasers may be poorly equipped to inform themselves about the characteristics of the building, while the sellers may be well informed. The Insulation Council of Australia and New Zealand (sub. 14, p. 10) observed that information asymmetries regarding the quality of insulation in buildings resulted in adverse selection and stated that this was a significant barrier to energy efficiency.

When the tenants and purchasers of commercial buildings are large corporations with significant resources and good access to technological expertise to assess the characteristics of the building, the likelihood of adverse selection is low. However, most firms are small or medium sized. The adverse selection problem may also exist in commercial and industrial appliance and equipment markets, particularly for smaller manufacturing and commercial firms.

Generally, less homogeneous products which are purchased less frequently would impose greater information collection costs on the purchaser and hence there would be a greater scope for information asymmetries. However, high-cost (in dollar terms) purchases like commercial building leases or industrial appliances also create stronger incentives for the purchaser to investigate all relevant characteristics of the purchase.

Split incentives

A number of participants identified split incentives in the market for commercial building leases as a barrier to energy efficiency investments in buildings (ABCB, sub. 7, p. 5; Lincolne Scott, trans., pp. 241–42). The Royal Australian Institute of Architects observed that the split incentives barrier was less likely to be prevalent when the lessor or purchaser of the building was a large company:

> … a significant shift has occurred at the big end of town … in some of the major property trusts that are operating in Australia … They really know their stuff. They know about life-cycle costs because they end up being the primary facility manager, the owner long term … At the medium and the small end the frustrations … exist … because the developer has no other incentive other than to get the building up and fully leased out and then sold on possibly to the owner-occupier investors and they have to shoulder the ongoing costs. (trans., p. 277)

The split incentives problem is exacerbated by the different needs of potential future users of the building. Even if the incentives of the developer and the first tenant (or purchaser) of the building are aligned, future tenants may have different energy usage preferences. Nonetheless, future users of the building would take the cost of refitting the building in accordance with their preferences into account when deciding whether to buy or lease the building and how much to pay.

Organisational and behavioural issues

Organisational characteristics of firms, such as their divisional structures and decision-making processes, may influence the uptake of energy efficiency projects. Barriers to communication flows between technical staff and management within firms may result in decision makers not receiving relevant information or not correctly processing the information. In this context, the Australasian Energy Performance Contracting Association observed that:

> The issue is often whether or not the perception of such great benefits that is evident — self-evident even — to an organisation at the engineering level is very difficult to translate up to the decision-making level, and it is often the case that were an ESCO [energy services company] to approach an organisation at an engineering level, it can be very easily and very quickly demonstrated that there are great advantages to be achieved. (trans., p. 363)

The Insulation Council of Australia and New Zealand gave an example of firm decentralisation resulting in inefficient outcomes:

> In one case, it was found that the maintenance group would have to pay for insulation, while the boilerhouse group would gain the benefits, and the two groups were in different cost centres (sub. 14, p. 11).

Misalignment of staff incentives and business outcomes may also be a problem. Exergy gave an example of one of its clients — a firm managing a commercial building portfolio:

> … the chief executive officer commanded from above that there shall be a program of energy work and we're going to do something and middle management killed it by saying basically, ‘We can't be bothered.’ There's a lack of connection to the result. (trans., p. 328)

The Australian Meat Processor Corporation (sub. 12, p. 1) suggested that the flat organisational structure often found in smaller firms with no consolidation of energy efficiency responsibilities in the hands of one person hindered the uptake of energy efficiency improvements.

Organisational characteristics of firms may combine with behavioural factors to inhibit energy efficiency improvement. Chapter 5 gave examples of economising behaviour in decision making caused by the bounded rationality of individual firms. Scarcity of staff resources within firms may contribute to constraints on the quality of decision making.

As noted in chapter 5, the Commission does not consider that organisational and behavioural issues are sufficient grounds in their own right to warrant government intervention. However, these issues may be relevant in the design and delivery of government programs that are otherwise justifiable, for example by environmental externalities or other market failure.

Rational behaviour by firms

The above discussion of market barriers and failures notwithstanding, some of the perceived energy efficiency gap in the commercial and industrial sectors can be explained by rational privately cost-effective behaviour of firms.

The Australian Industry Greenhouse Network (sub. 57, p. 6) expressed a view that '… most of the energy efficiency gap can be explained by rational behaviour, certainly in energy intensive industry'.

Similarly, Origin Energy argued:

> … a significant proportion of the gap between observed levels of energy efficiency and the technical frontier level of energy efficiency can be explained by rational behaviour. … The additional cost required to close the energy efficiency gap … is likely to exceed the extra benefits derived in some cases (sub. 25, p. 3).

Commercial and industrial producers must have regard to many other considerations — product quality, marketing, competitors' actions, other production inputs, occupational health and safety, to name a few — not just the benefits and costs of greater energy efficiency.

DRAFT FINDING 8.1

There are many reasons why firms might choose not to adopt energy efficiency improvements that appear to be privately cost-effective, but the only two that might warrant government intervention are market failures in regard to information and split incentives.

The following sections analyse the policies that have been introduced by governments purportedly to address the barriers and market failures identified above. The discussion starts by looking at less interventionist policies and proceeds to analyse increasingly stronger intervention by governments.

8.3 Promoting the energy services industry

The Australasian Energy Performance Contracting Association (sub. 47, pp. 21-22) submitted that governments could promote the energy services industry in order to achieve greater adoption of cost-effective energy efficiency improvements. Such government involvement could take the form of running an accreditation scheme for energy service providers or playing a facilitating role in transactions between energy service providers and firms.

Advantages offered by the energy services industry

In the absence of government intervention, some energy efficiency improvements will take place as part of business-as-usual strategies. The energy services industry can provide market solutions to some of the barriers faced by firms in improving their energy efficiency. Expert energy consultants conduct energy-use audits and identify cost-effective efficiency improvements. This may be achieved at lower cost than if the firm conducted its own assessments, due to specialisation and consequent economies of scale. Further, consolidation of the responsibilities involved in completing an energy efficiency audit in the hands of one agent (the consultant) can also reduce the organisational transaction costs of the firm.

A number of participants suggested that the energy service industry could play a significant role in achieving energy efficiency improvement for firms (AGL, sub. 66; ESAA, sub. 68; Insulation Council of Australia and New Zealand, sub. 14).

The Energy Retailers Association of Australia observed that market demand for energy efficiency services could generate supply of such services from energy retailers:

> In competitive energy markets customers looking to reduce their energy bill represent a commercial opportunity for energy retailers looking to differentiate their service offering (sub. 26, p. 23).

AGL (sub. 66, p. 6) submitted that 'its business Energy Services' division has helped its customers reduce their energy use, resulting in a net benefit of $3 million to the customers.

An alternative mechanism to energy audits by a firm's staff or outside consultants is energy performance contracting. Energy service companies (ESCOs) can enter energy performance contracts with firms for an integrated package of services ranging from identification of energy-saving opportunities to design and implementation of projects and post-implementation maintenance of equipment. An ESCO usually guarantees a certain level of energy savings and its compensation is tied to the realisation of those savings (box 8.1).

While energy performance contracting is a relatively new and unexplored practice in Australia, it has been used extensively in Europe and the United States for over 20 years. In the United States, projects worth over US$2 billion were commissioned to ESCOs in 2000 alone (Osborn et al. 2002). The US ESCO industry has experienced very fast growth with revenues growing at the rate of 24 per cent per annum in the decade 1990–2000. Analysis of the projects commissioned through energy performance contracts showed that the median payback time for industrial and commercial sector projects was three years and that these projects achieved a median benefit–cost ratio of 2.1 (Osborn et al. 2002).

Box 8.1 Energy service companies and performance contracting

An Energy Service Company (ESCO) is a business that develops, installs, and manages projects designed to improve the energy efficiency and maintenance costs of facilities of a customer firm. Typically, ESCOs provide the following services:

- performing an energy audit of the firm;
- establishing baseline energy use for specific equipment, systems, or the facility as a whole;
- designing the energy efficiency project in consultation with the customer;
- supplying, installing and commissioning equipment;
- training customer personnel;
- operating and maintaining the equipment for the life of the contract; and
- conducting measurement and verification to determine the savings generated.

A distinguishing feature of ESCO operation is the energy performance contract (EPC). An EPC is an agreement entered into by a firm and an ESCO where the ESCO undertakes to provide specific services and guarantees some level of energy savings for the firm. The ESCO's compensation is usually paid from the savings generated by the EPC. Typical contract terms are between four and ten years.

Source: AEPCA (2004).

Energy performance contracting can reduce the information and organisational barriers identified in section 8.2. Further, since the ESCO guarantees a certain level of savings, there is a redistribution of implementation risk away from the firm to the ESCO, which would arguably face a lower risk of project failure due to its technical expertise.

Problems with using the energy services industry

In practice, there are some barriers hindering the operation of the energy services industry. A significant difficulty that has been identified by industry is that energy consultants tend to focus on reducing one of the inputs to production and that this may result in an increase in other business costs. The Australian Aluminium Council noted:

> While there are opportunities for the engagement of consultants who offer the promise of sharing the benefits from reduced energy consumption, care needs to be taken in avoiding the use of a single metric (energy consumption) when the bottom line may be

> influenced by changes in the other inputs to the activity. There is little point in engaging the services of an 'energy efficiency specialist' who is focused on a single performance metric without reflecting the impact on the 'whole-of-business' outcome (sub. 29, p. 11).

The effects of other implementation costs which have not been observed by energy consultants is evident in survey results. A US survey of more than 9000 energy efficiency audits found that while 50 per cent of audit recommendations were not implemented by firms, 75 per cent of those decisions were made for legitimate economic reasons (Anderson and Newell 2002). The most significant factor reported was costs to the firm in other areas of its operation which were not taken into account by the energy auditors. Firms reported costs like unacceptable operating and personnel changes, risk or inconvenience to personnel, costs of installing new equipment including production halts and changes in product quality.

A survey of the Enterprise Energy Audit Program which offered subsidies for firms to conduct energy audits , revealed that the most common negative comment about the program was that auditors failed to understand the way the firm operated (Harris, Anderson and Shafron 1998).

Another major problem identified by Origin Energy (sub. 25, pp. 6–7) involves the information asymmetries between the service provider and customer. The actual savings that arise as a result of the consultant's advice will depend on many aspects of business operation. There is an inherent asymmetry of information between the consultant and the client about the client's business. This makes verification of actual energy savings difficult for the consultant. The problem is exacerbated when the consultant's remuneration is dependent on energy savings achieved, as in the case of EPCs.

Greater upfront contract specification by the energy service provider could reduce the moral hazard problem. However, this would add to the transaction costs.

Policies to promote the energy services industry

AEPCA (sub. 47, p. 10) suggested that the perceived risk of engaging a consultant may be reduced through government intervention in running a national training, accreditation and standards program for energy service providers. This would provide some independently-sourced information to firms about the reliability of the consultant.

The Australian Government may have committed to playing some role in providing this type of service as part of its policy of Mandatory Energy Efficiency Opportunities Assessment for large energy users (discussed in section 8.7). The program, which is currently in development, provides for government facilitation of capacity building in the energy services industry. This could involve training and accreditation of energy consultants.

Accreditation of energy service providers can reduce the risk of engaging consultants. However, this does not necessarily require government involvement. As in many other industries, accreditation could be undertaken by an industry or professional association. Indeed, AEPCA has developed an accreditation process for energy service companies. The Commission considers that there is no particular case for government taking up this role for energy service consultants.

DRAFT FINDING 8.2

Government should not become involved in accreditation of energy consultants and energy service companies because this function can be adequately performed by an industry or professional association like the Australasian Energy Performance Contracting Association.

AEPCA (sub. 47, p. 23) also suggested that governments could reduce the high contracting costs (arising out of information asymmetries) by playing a facilitating role in transactions between energy service providers and firms. One example of such facilitation is the Energy Smart Business Program administered by the Department of Energy Utilities and Sustainability in New South Wales. Under this program, the New South Wales Government acted as an intermediary between energy service providers and large energy users in the commercial and industrial sectors.[1] The Energy Performance in Commercial Buildings program in the ACT (which started in 2002 and was subsequently discontinued) operated in a similar fashion but also provided firms with financial incentives to enter EPCs.

By acting as an intermediary between energy service providers and firms, governments could reduce the high transaction costs of selecting consultants and contract over-specification. Such involvement may provide an implicit guarantee to firms about the consultant, and hence might work in ways similar to a government-run accreditation scheme. However, such involvement is not costless and has some risks. The downside of being seen to endorse particular consultants is that governments implicitly take on the risks of those consultancies turning out less than

[1] The Commission has examined a summary of the evaluation of the New South Wales Energy Smart Business program that claims that the program achieved energy cost savings of $31 million. However, the evaluation provides no information on the administrative costs of the program or on the implementation costs borne by firms in realising the energy savings. The evaluation also does not state whether these savings are incremental to the business-as-usual scenario, in which some firms may have engaged the consultants independently of government facilitation.

satisfactorily. It also encourages favouritism and lobbying by consultants to gain an advantage over their competitors. To be able to provide firms with even the most basic advice on the capabilities of consultants, there is a need for a degree of expertise within government and staff can be exposed to firm capture. If third parties are involved in the accreditation of consultants, governments could take a more neutral intermediary role by simply referring interested firms to the accrediting party or to any published list of consultants.

Other approaches to reducing transaction costs might be more productive. For example, AEPCA and the Australian Greenhouse Office have jointly developed a National Standard Energy Performance Contract which can be used as a template by ESCOs to cover most standard projects. The contract can also be used in combination with additional provisions to reflect the heterogeneity of clients and requirements.

DRAFT FINDING 8.3

The costs and benefits of a policy of government facilitation of business transactions with energy service providers should be evaluated against other mechanisms which promote the market provision of energy efficiency advice or services.

8.4 Voluntary agreements

A number of programs facilitating voluntary initiatives by firms are currently run by governments. These tend to focus on reducing greenhouse gas emissions rather than on improving energy efficiency *per se*. Therefore, the market failure primarily addressed by these programs concerns the negative externalities associated with energy use, rather than market failures that might be preventing the uptake of privately cost-effective improvements in energy efficiency. Nevertheless, voluntary agreement programs can encourage such improvements. Voluntary agreements can address organisational barriers within firms by focusing a firm’s attention on a specific issue. Voluntary programs can also address the information barriers faced by firms.

The two largest voluntary agreement programs are the Greenhouse Challenge and the Australian Building Greenhouse Rating scheme. Analysis of these programs provides a useful basis for assessing potential benefits available from voluntary energy efficiency improvement.

Greenhouse Challenge

The Greenhouse Challenge was launched in 1995 by the Australian Greenhouse Office as a joint voluntary initiative between the Australian Government and industry to abate greenhouse gas emissions. The program was discontinued in 2005 and replaced by the Challenge Plus — Enhanced Industry Partnerships program which is funded to run until 2007-08 and will operate in a broadly similar fashion to its precursor. One major change to the program is that participation in Challenge Plus will be compulsory from 2006 for recipients of fuel excise credits of more than $3 million. This would mean that the program would no longer be a purely voluntary one for some participants. For the purpose of this section, only the voluntary agreement aspect of the Greenhouse Challenge program is discussed here.

In 1999, the Greenhouse Challenge scheme had an annual budget of $6 million. Although the main focus of the program was on emission abatement, one element of Greenhouse Challenge — the Managing Energy for Profits scheme — was a recruitment scheme which involved consultants promoting energy use savings to potential participants. Participating organisations made certain undertakings with the government (table 8.4) and were provided with limited technical assistance in the development of their agreements. This was given in the form of template workbooks and advice from industry advisers. Participants were required to report annually on their actions planned and undertaken and on actual emissions. Reports had to be independently verified.

In 1999, the Greenhouse Challenge covered 47 per cent of national greenhouse emissions, including 100 per cent coverage of the aluminium and cement industries, 98 per cent of oil and gas extraction and 91 per cent of coal mining.

Table 8.4 **Manufacturing and commercial sub-sector abatement commitments under the Greenhouse Challenge program**

Sector	*Abatement commitment*
	%
Non-ferrous metals	7
Iron and steel	23
Petroleum, coal and chemical	23
Non-metallic minerals	12
Textiles, clothing and paper	21
Food, beverages and tobacco	13
Finance, insurance and property services	17
Accommodation, hospitality and other services	10

Source: AGO (1999b).

An evaluation of the program (AGO 1999b) listed some of the benefits and impediments to joining the Greenhouse Challenge, as identified by participants. The major benefits included reduced energy costs, corporate reputation as a responsible environmental manager and improved relationship with the Australian Government. Major impediments included the absence of financial benefits in participating, difficulties in developing a cooperative agreement and the uncertain policy environment. The report suggested that greater participation could be achieved if the link between energy cost savings and greenhouse gas abatement was better communicated.

Australian Building Greenhouse Rating Scheme

The Australian Building Greenhouse Rating Scheme (ABGR) is a voluntary program aimed at reducing the greenhouse gas emissions attributable to commercial buildings (box 8.2). ABGR was developed in 1999 by DEUS in New South Wales and was expanded to operate nationally in 2000.

Box 8.2 **Australian Building Greenhouse Ratings**

The rating is derived using the following process:

- building energy use is identified, based on actual bills;
- hours of occupancy are identified;
- for tenancy and whole-building ratings, the tenant load is characterised based on a count of computers;
- the climate region is identified; and
- the floor area is characterised in terms of the net lettable area of productive office space.

These factors are fed into a calculation that converts the energy use into greenhouse gas equivalent, divides by floor area and applies normalisation factors to compensate for hours of occupancy, climate, and (if assessed) tenant loads. The resultant figure is then compared against a scale set on the basis of the statistical distribution of energy use in office buildings in the same state as the building. This estimate is converted into a rating between 1 star and 5 stars, where 1 star represents very poor performance and 5 stars exceptional performance.

Source: Exergy Australia Pty Ltd (sub. 40).

The program offers a performance-based rating system for office buildings. Office building owners and tenants can initiate an ABGR assessment at their expense — usually between $1000 and $3000 (NSW DEUS 2004a). Upon initiating the assessment, the firm is provided with a third-party accredited assessor who measures the building's energy use and assigns it a star rating, which indicates the building's relative energy efficiency. Ratings of one to five stars are given, with a three-star rating indicating current market standard practice (NSW DEUS 2004a). A database of building ratings derived using the ABGR methodology is maintained by DEUS. The database currently includes over 100 buildings, most of which are in New South Wales.

Originally, the ABGR operated as a performance-rating methodology. However, it has subsequently expanded to include other government initiatives. Currently, a number of information provision programs are run nationally as part of the ABGR scheme. These include the Star Performer diagnostic software which provides advice on reducing greenhouse emissions on the basis of building characteristics; and the Tenant Energy Management Handbook. At a state level, a number of voluntary agreement programs are run where building owners or tenants commit to achieve certain levels of emission reductions after undergoing an ABGR assessment. Examples of such programs include the 3CBDS Greenhouse Initiative and the Parramatta Greenhouse Leaders Project in New South Wales. DEUS has also developed commitment agreements to achieve a certain ABGR rating which can be signed by developers of new buildings.

The Commission considers that voluntary agreement programs can be an effective policy tool for promoting energy efficiency improvement. Voluntary agreements give organisations the flexibility to self-select as well as choose the level and nature of their undertaking. There is, therefore, a lower risk of firms being forced into adopting practices which are not privately cost effective for them.

However, the voluntary character of such programs is easily compromised. Some of the participation in the Challenge Plus and the ABGR programs may have been instigated by the presence in those programs of incentive or coercive elements. Firms may have decided to participate as a precaution against the threat of higher-cost policy measures being adopted by governments. Alternatively, participants may be motivated by government provision of technical support and financial assistance (for example, participation in the Challenge Plus program is compulsory for recipients of fuel excise credits of over $3 million). To the extent that participation is not purely voluntary, there is a higher risk that firms would undertake projects that are not privately cost effective.

Voluntary agreement programs are often criticised for, ultimately, not being able to guarantee participation or outcomes. However, the success of the Greenhouse Challenge program demonstrates that firms will participate in voluntary initiatives even when the program does not have an explicit focus on private cost effectiveness.

8.5 General information provision

General information programs seek to address the market failure arising from the public good nature of information.

A number of government programs seek to address this barrier in the commercial and industrial sectors. The Ecobusiness program in the ACT runs workshops which cover general energy efficiency issues in the commercial sector. The Energy Smart Business Program in Western Australia included seminars which provided information to small and medium firms on energy efficiency issues including lighting, air conditioning and energy audits.

A number of product information programs for the commercial and industrial sectors are also run by governments. The Australian Government Department of the Environment and Heritage (DEH) publishes an electronic newsletter called Switched On, which provides current information on energy-efficient appliances and equipment. DEH also runs the Motor Solutions Online program, which provides industrial and commercial users with information on energy use of various electric motors. Governments have also focused on advertising energy-efficient products and services. For example, the South Australian Government sponsored the Energy Efficiency Conference and Trade Fairs in 2003 and 2004, which provided a forum for manufacturers of energy-efficient products and the energy services industry to advertise their products and services to firms. The Government of Western Australia publishes an electronic Energy Smart Directory of suppliers of ‘sustainable’ energy products and services.

An alternative way of disseminating general information about current industry best practice involves governments identifying and publicising the existing ‘success stories’ of firms that have made significant improvements in their energy efficiency. Awards schemes like the annual Energy and Water Green Globe award scheme which is run by DEUS in New South Wales are an example of such a policy mechanism. The awards need not be pecuniary to encourage participation by firms. Often the corporate reputation benefits of obtaining an award certificate can be sufficient to encourage effective participation. Energy efficiency award schemes do not have to be run by governments. Private industry bodies can and do run award schemes recognising energy efficiency achievements. For example, the Royal Australian Institute of Architects has a National Award for Sustainability of building designs that (among other criteria) excel in energy efficiency.

General information and education provision may resolve some of the informational market failure effectively and at low cost. In some cases, government provision of information may be more credible than if it was supplied by private agents. If the information is relatively generic, a government agency may also be able to provide it at a cost which is lower than that faced by individual firms due to economies of scale and scope. Government provision of some information may also be cheaper because it provides a centralised source of information which reduces the search costs for users.

A frequent criticism of general information provision programs is that they do not guarantee outcomes, particularly if there are barriers within an organisation to the processing or implementation of the information. However, non-action on the basis of received information may also reflect rational decision making by the firms.

There is also usually a tradeoff between the generality of information and its relevance and usefulness to the recipient. A review of the Energy Efficiency Best Practice program run by the Australian Government Department of Industry, Tourism and Resources (DITR) found that its original approach of general information provision was relatively ineffective in changing energy user behaviour in the industrial sector. General information provision '… did not directly assist companies in improving their energy efficiency…' (EnergyConsult Pty Ltd 2002, p. E1).

The Australasian Energy Performance Contractors Association commented that, compared to energy audits, general information provision programs:

> … provide information on the benefits of energy efficiency, … provide information on specific technologies, but don't provide enough information for a consumer to actually exploit the opportunity. They may still not be certain how to specify a technology, how to be sure they are paying the right price for the technology. (trans., p. 359)

This illustrates the fine line between public and private goods and the dilemmas facing governments in pursuing anything but the most basic information. If information is specific enough to the needs of a particular firm, there will be sufficient incentives for them to obtain it and for others (consultants, performance contractors and ESCOs) to want to provide it to them. Generally speaking, the information failures in the commercial and industrial sectors are less significant than in the householder sector, suggesting a commensurately smaller role for governments in information provision.

8.6 Financial incentives

Financial incentives do not directly address the information barriers, split incentives and organisational barriers identified in section 8.2. Further, provision of financial incentives may simply improve the return on projects that are already privately cost effective. However, provision of financial incentives for actions that improve the energy efficiency of a firm increases the attractiveness of such actions to the firm, and thus can have a direct bearing on whether these actions are undertaken. Government financial assistance might be justified if it reduced the negative externalities associated with energy use or helped promote positive spillovers associated with research and development (R&D) and better practices.

Subsidies for audits

The most common type of financial incentive program in the commercial and industrial sector involves governments assisting firms in conducting audits of their energy use and opportunities for energy efficiency improvements. A number of state programs adopt this approach. For example, the Queensland Government ran the Cleaner Production Partnerships in 1999-2000 and the Greenhouse Industry Partnerships programs in 2001-02 in which participating firms were given grants to conduct eco-efficiency assessments on their premises. (Participants could then apply for grants to support the implementation of their consultants' recommendations.) In Victoria, the Energy Smart Business Program, which ran between 2000 and 2002, provided financial and technical assistance to large energy-using firms to undertake energy audits and develop energy-saving projects. In South Australia, the Business Energy Efficiency Opportunity Identification program is currently in operation. The program provides 30 small and medium size firms in Adelaide with subsidised energy efficiency assessments and assists them to formulate action plans to reduce their energy consumption.

One of the largest energy audit assistance programs of recent times was the Enterprise Energy Audit Program (EEAP), run by the Department of Primary Industries and Energy between 1991 and 1997. Under the EEAP, firms were provided with subsidies of 50 per cent of the cost of an energy audit up to a maximum of $5000. Approximately 1200 firms took part in the EEAP.

An evaluation by ABARE researchers (Harris, Anderson and Shafron 1998) concluded that the EEAP was very cost-effective in generating cost savings for firms (box 8.3). However, the analysis showed that most of the improvements would have been initiated by firms in the absence of government subsidies. Harris, Anderson and Shafron (1998) argued that the role of government should be limited to promoting the private take-up of the EEAP auditing process by firms, but should not extend to providing firms with specific information or direct subsidies for audits.

Box 8.3 Enterprise Energy Audit Program outcomes

A survey of the EEAP participants conducted by ABARE researchers resulted in the following findings:

- The total net present value to firms of audit recommendations that were implemented was $189 million. The energy savings generated amounted to 8 per cent of old energy costs.
- Total costs of program administration were $1 million and the total cost of audits was $8.7 million, of which the Government funded half.
- The average implementation rate of audit recommendations was 81 per cent (the implementation rate was lower for larger firms).
- Participation in the EEAP led to increased awareness of energy efficiency within the firm and acted as a 'springboard' for further actions.

Source: Harris, Anderson and Shafron (1998).

The EEAP was superseded by the Energy Efficiency Best Practice Program (EEBP) run by the DITR during 1998–2002. The EEBP commenced in 1998 with funding of $10.3 million allocated over five years. Initially, the Program focused on conducting sector studies and providing benchmarking reports to participants in sectors including hotels, aluminium, pulp and paper, bread baking, beverages and packing.

From 2000, EEBP evolved to targeting specific companies and directly assisting them in improving their energy efficiency (box 8.4). Two approaches were developed under the program — the Big Energy Projects and the Best Practice, People and Processes. The Big Energy Projects involved DITR facilitating and subsidising a series of workshops which brought together representatives from different industries and external consultants. The objective was to foster exchange of knowledge and generate innovative solutions that would otherwise not be detected within the firm or the industry. The Best Practice, People and Processes component of the EEBP aimed to build capacity within organisations to deal with energy use issues. The EEBP assisted firms in forming internal energy management teams and trained those teams to measure and monitor energy use in their organisations.

Box 8.4 **Examples of firms which participated in the Energy Efficiency Best Practice Program**

Amcor received approximately $25 000 from the Department of Industry, Tourism and Resources (DITR) to engage an energy consultant to work part time for four months at the Amcor Botany Mill. The resulting energy audit identified potential energy savings of $654 800 per year. These came from efficiency improvements at operations level (including equipment maintenance issues, process optimisation and staff training) and the more fundamental improvements in underlying energy efficiency through replacement of equipment and significant changes to processes. Subsequently, Amcor implemented projects which resulted in annual savings of $240 000.

Carlton & United Beverages participated in the workshop organised by the DITR as part of its Big Energy Project approach. Opportunities for optimisation of the refrigeration system at the company’s Abbotsford plant have been identified and implemented, resulting in net savings of $300 000 per year.

Barrett Burston Malting took part in the Big Energy Project workshop. Opportunities identified included improved monitoring and control of the company’s electricity consumption; equipment upgrades in the kiln, germination and refrigeration areas; and cogeneration from the waste heat used in the kilns. The savings that were identified amounted to 36 per cent of the company’s energy costs. Subsequently, Barrett Burston Malting implemented projects which reduced its energy costs by 12 per cent.

Sources: Amcor, pers. comm., 7 October 2004; DITR (2002).

A review of the EEBP program estimated that the program resulted in energy cost savings within participant firms of $74 million (EnergyConsult Pty Ltd 2002). The review also found that the program was becoming more efficient over time and forecast that additional funding of $4.9 million after 2002 would have resulted in energy savings of $199 million. These estimates, however, did not take into account the impacts of the EEBP on other costs to the firm.

Programs which assist companies in obtaining and utilising specific information may be a cost-effective way of changing business practices. Further, the long history of government involvement in such programs, has led to considerable improvements in their effectiveness. For example, the Big Energy Project component of the EEBP, which was adopted during the latter stages of the program, has attracted very positive feedback from participants. The approach of conducting workshops with external consultants, representatives from other industries and internal staff was seen as effective in generating innovative ideas that would otherwise not be considered by the firm. More generally, comments from EEBP participants published on the EEBP website (DITR 2004a) and made during private meetings with the Commission suggest that the program in its final form was one of the most successful government programs to tackle energy efficiency in firms.

A policy of assisting firms to obtain specific information may be warranted if it results in spillover benefits to third parties, but is less likely to be justifiable on the grounds of market failure correction than general information provision. Firms have an incentive to obtain and utilise information that would lead to cost savings, particularly where the net savings are as large as those identified in the EEAP and EEBP programs. Poor management or organisational characteristics do not, in their own right, justify government assistance.

One potential externality could involve a positive demonstration effect for other firms in the industry. For example, the EEBP program published a number of case studies of program participants. This approach could diffuse the specific information obtained with government assistance across and within industries. It could also promote the uptake of energy auditing without government assistance if the private cost effectiveness of doing so can be demonstrated in the case studies. An examination of the EEBP case studies reveals, however, that most of them have tended to be relatively nonspecific summaries of the projects that lacked concrete details about the cost-saving opportunities that were identified and implemented.

If the policy of assisting firms to obtain specific information is to be pursued, more can be done to diffuse the information that has been generated. In order to be useful for other firms, the information would need to be concrete and relevant, providing details of the opportunities identified and the associated costs and benefits of implementation. However, governments may be constrained in doing this by firms being unwilling to disclose confidential information about their operations to their competitors.

Subsidies for research, development and innovation

Australian governments currently operate a framework of general policies supporting R&D which include maintaining an intellectual property rights system, tax concessions, competitive grants and concessional loans for R&D (chapter 5).

In addition, all jurisdictions operate a number of financial assistance programs aimed specifically at promoting research and innovation in energy use in the industrial and commercial sectors. Some programs take the form of a fund which distributes grants to research organisations and private firms (often on a competitive tender basis) to undertake research into energy efficiency technologies and practices. For example, DEUS administers the Sustainable Energy Research and Development Fund in New South Wales, which provides funding to universities and private firms to engage in energy efficiency research. The Sustainable Energy Research Grants scheme in South Australia, and the Queensland Sustainable Energy Innovation Fund, operate in a similar fashion.

Other programs take a more applied approach, promoting the take-up by firms of existing new technologies and innovative solutions. Two examples are the Commercial Office Building Energy Innovation Initiative and the Business Energy Innovation Initiative schemes in Victoria (box 8.5). These programs are aimed at fostering the demonstration of new energy efficiency technologies in the commercial building and manufacturing sectors through subsidising the uptake of new technologies by individual firms.

Box 8.5 **Commercial Office Building Energy Innovation Initiative and Business Energy Innovation Initiative**

Commercial Office Building Energy Innovation Initiative

The program commenced in 2003 and is currently in operation. The program aims to demonstrate innovation in the design and application of sustainable energy in new and existing office buildings. Financial incentives are provided to 'property industry leaders' to support the development of projects that demonstrate high quality and energy efficiency in commercial property. The Sustainable Energy Authority of Victoria estimates that, within 15 years, the demonstration projects will influence 30 per cent of office building activity.

Business Energy Innovation Initiative

The program provides support for projects that invest in new and innovative energy efficiency solutions, or in solutions that combine energy efficiency with sustainable industry practices. This can involve identifying and assessing new technology options; performing detailed technical and commercial appraisals; installing and commissioning new solutions and securing local and international expertise for energy efficiency initiatives. The focus is on productivity improvement through innovative demonstrations of sustainable energy supply, design and operation of state-of-the-art production facilities, and the development of new energy-efficient or renewable-energy products. The SEAV may contribute up to $150 000 matched dollar for dollar with the business partner.

Source: Victorian Government response to PC request for information (unpublished).

The largest program aimed at demonstrating new technology to industry is the Low-emission Technology Fund, which was announced in the Australian Government's Energy White Paper (Australian Government 2004) and will come into operation in 2006. The Fund will provide subsidies to firms for investment in new technologies that have significant greenhouse abatement potential, with the aim of demonstrating the commercial potential of those technologies to the wider industry. Among technologies listed as potentially eligible for subsidies are more energy-efficient manufacturing technologies. The grants will be made on the basis of competitive funding rounds. There is also an eligibility prerequisite that the technology has potential for greenhouse gas emission abatement of 2 per cent of national energy-related emissions. A total of $500 million has been allocated to the Fund for projects initiated between 2006 and 2020. It is anticipated that government funding will drive private R&D investment of $1 billion.

The Commission considers that a fundamental question to be answered is whether R&D and innovation programs focusing specifically on energy efficiency are required in addition to general R&D assistance already in operation.

The EEWG argued that there is a need for further government support of R&D into energy efficiency and recommended that governments:

> Enhance levels of government support and partnerships with industry and research institutions to promote appropriate research, development and demonstration activities (EEWG 2004, p. 32).

Similarly, the Australian Industry Greenhouse Network argued that the public benefits from energy efficiency R&D justified further government support:

> … there is a case for additional incentives to induce private sector expenditure in this area. Energy efficiency improvement may provide unusual public benefit, in terms of enhanced energy security, reduced greenhouse gas emissions, etc (sub. 57, p. 10).

However, some inquiry participants doubted whether R&D into energy efficiency warranted special treatment compared to other forms of R&D. The Energy Retailers' Association of Australia and Origin Energy argued:

> Positive externalities are likely to exist where research and development (R&D) in energy efficiency technology is undertaken. However it is not clear … that the social rate of return for this type of R&D should differ markedly from other types of R&D. Unless this difference can be demonstrated, general R&D policy should apply equally to energy efficiency technology as it does to other types of R&D activity in the economy. (ERAA, sub. 26, p. 38; Origin Energy, sub. 25, p. 13)

In outlining the principles of good R&D policy, the Industry Commission (1995) suggested (among other things):

- assistance levels should be broadly consistent
- contestability should have a major role in research funding.

Having an assistance policy which favours some fields of R&D and innovation over others may generate a number of costs. The major one is that such policy would have a distorting effect by encouraging R&D investment in one field at the expense of other (potentially greater benefit-yielding) fields. To the extent that there are economies of scale in administering a uniform R&D policy regime, having an additional R&D policy framework for energy efficiency is also likely to increase government administrative costs. Having energy-specific R&D programs in addition to general R&D assistance also creates coordination issues in preventing firms from exploiting the opportunity for additional funding through 'double dipping'.

The benefits of running energy efficiency specific R&D programs are unclear. There would appear to be no special case to promote R&D into energy efficiency at the expense of other R&D solely on the basis of diffusion of technology but there may be a case on the grounds of reducing negative externalities. However, while energy efficiency research may result in public benefits, this does not of itself justify energy-specific R&D assistance. In the Commission's view, there is no reason why these public benefits cannot be considered in assessing project applications in a general competitive grants scheme.

DRAFT FINDING 8.4

The need for special energy efficiency research and development funds has not been substantiated, given that funds can be sourced from existing more general research and development programs.

Other financial incentives

A number of participants suggested that governments need to provide direct financial incentives for firms to undertake energy efficiency improvements.

For example, Moreland Energy Foundation Ltd stated:

> At present there is a scarcity of financial schemes that encourage or assist practical retrofitting of businesses. (sub. 18. p. 36)

It also cited the results of a survey of small firm behaviour that it had commissioned, which found that 44 per cent of firms in the Moreland City area were interested in low or zero interest loans to finance energy efficiency improvements, while 58 per cent of firms would apply for grants if they were available.

The Green Building Council of Australia (GBCA) argued:

> Fiscal incentives are likely to be the most effective way to facilitate refurbishment that addresses efficiency or green building initiatives … The GBCA recommends fiscal incentives for existing buildings refurbishment or retrofits should include accelerated depreciation, land tax abatement, utility rate abatement, local government abatement. (sub. 41, p. 12)

The Aluminium Council of Australia (sub. 29, p. 11) and the Energy Supply Association of Australia (sub. 68, p. 9) suggested that incentives to hasten capital turnover, like accelerated depreciation, would improve energy efficiency.

Origin Energy had some reservations about subsidies. It stated that it:

> … does not consider financial incentives, generally, to be the most appropriate policy tool available. The basic premise of cost-effective energy efficiency improvements is that there are private benefits from undertaking the investment. Policy tools that rectify pricing distortions and information problems, which may be inhibiting this investment and the realisation of net private benefits, are more likely to be effective and efficient. (sub. 25, p. 13)

Direct subsidies to undertake energy efficiency improvements increase the attractiveness of such projects for firms. It is natural for firms and individuals to respond to incentives. However, there is also a risk that subsidies may distort business decision making by diverting resources away from other potentially more important areas. Therefore, the Commission considers that provision of subsidies to support investment into energy efficiency improvements that are privately cost effective for individual firms is not justified.

While the Commission's focus is on barriers to the uptake of privately cost-effective energy efficiency investment, it notes that environmental externalities could justify a subsidy program even when the energy efficiency improvements are not cost effective. However, subsidising firms to improve the energy efficiency of their operations would need to be considered among all policy options for achieving environmental goals.

DRAFT FINDING 8.5

The Commission does not support provision of direct subsidies to firms to undertake energy efficiency improvements which are privately cost effective for those firms. Subsidies may, however, have a role in encouraging the uptake of improvements that have important spillover effects.

Hypothecated levies to fund subsidies

The terms of reference for this inquiry require the Commission to consider the role of levies. Levies could be used to ensure that energy users bear more of the full cost to society of their energy use. Such a rationale underpins arguments for imposing a carbon tax on greenhouse gas emissions. However, the terms of reference limit this inquiry to actions that would be cost effective for individual consumers and producers. Therefore, the Commission has interpreted the mention of levies as referring to the possibility of using ‘hypothecated’ levies to finance subsidies for energy efficiency improvements that are privately cost effective.

Hypothecated levies can be a useful revenue-raising tool when there is a close connection between the levy and services received. One example is the funding of road repairs and maintenance from the fuel excise paid by truck operators. A levy on fossil fuel use to finance subsidies for energy efficiency improvements also has some appeal on equity and environmental grounds, since all users of fossil fuels contribute to environmental externalities and they would pay the levy in proportion to their environmental impact.

Climate Action Network Australia favoured the use of levies:

> CANA [Climate Action Network Australia] supports the principle of using levies and/or taxes on fossil fuel generated energy to:
>
> - encourage a culture discouraging wasteful use of polluting energy forms;
> - provide funds for reinvestment into demand management, through the creation of demand management funds; and
> - ensure that the cost of pollution as a result of energy generation is reflected in the cost of electricity. (sub. 19, p. 6)

Moreland Energy Foundation Ltd supported the use of levies to finance a demand management fund:

> MEFL [Moreland Energy Foundation Ltd] supports the creation of a demand management fund or funds, through the application of a levy on energy consumers, linked to consumption levels but also making allowances for social equity. Hypothecating a fund in this way is positive as it:
>
> - sends a signal to energy users that demand management in its broadest sense is a priority for the community;
> - creates a source of income to undertake much needed demand management work; and
> - is fair in that bigger energy consumers pay more than small energy consumers.
>
> It could also be possible to build in additional incentives for companies to act to reduce their energy consumption, by reducing the burden from those who have taken action under their own initiative.
>
> The demand management funds in the US are capable of undertaking very ambitious energy efficiency and demand-management work, because they have a real budget to work with. (sub. 18, pp. 36–37)

However, various participants expressed concerns about levies:

> The AAC [Australian Aluminium Council] is opposed to the use of levies (tax) to drive energy-efficiency improvements or to raise funds for energy-efficiency improvements. A levy would increase the cost of energy to the consumer and would distort/change resource allocation and competitiveness away from those sectors who use more energy to those who use less energy. This suggests that this policy option is based on the assumption that energy is incorrectly priced in the market. Economic growth will be reduced to the extent that the levy/tax and its subsequent redistribution results in a shift of resources away from more efficient or productive sectors of the economy. (Australian Aluminium Council, sub. 29, p. 14)

> AIGN [Australian Industry Greenhouse Network] agrees … that any uniform levy on all energy users would penalise both energy-efficient and energy-inefficient users, and that targeting only those deemed to be inefficient would be difficult, arbitrary and discriminatory. Levies and other nonrebatable penalties risk affecting the competitiveness of Australian industry adversely and, in consequence, the jobs and living standards of many Australians. (Australian Industry Greenhouse Network, sub. 57, p. 12)

The Commission considers that hypothecated levies would have major drawbacks because:

- they would unduly penalise those who are already achieving high levels of energy efficiency; and
- there is rarely, if ever, a nexus between the appropriate level of taxes and funding needs.

Existing broad-based taxes are likely to be less distortionary and have lower administration and compliance costs than hypothecated levies.

DRAFT FINDING 8.6

The case for government subsidies to encourage energy efficiency improvements should be separated from the means of funding those subsidies, such as by hypothecated levies.

8.7 Mandatory energy audits

The policy of Mandatory Energy Efficiency Opportunities Assessment (EEOA) for large energy users was announced in the Australian Government’s Energy White Paper (Australian Government 2004) and is currently being developed by the DITR. The regulation is expected to come into operation in 2006.

The EEOA is a successor to the EEBP program that was discussed in the previous section. However, it signals a considerable change in the policy instrument towards a more coercive approach. This reflects a perception that large energy users are still overlooking privately cost-effective opportunities to improve their energy efficiency despite the past and current information provision and financial incentive programs run by governments.

The EEOA seeks to address the perceived organisational failure by firms to focus on identifying and implementing cost-effective energy efficiency improvements. The disclosure element of the scheme appears to be aimed at exerting external shareholder pressure on firms.

The EEOA will operate by mandating that energy users whose annual consumption is greater than 0.5 petajoules (at the moment around 250 firms representing two-thirds of total business energy use) must conduct energy efficiency assessments every five years. Firms would be required to identify all opportunities to reduce their energy use with a payback period of four years or less, and to disclose this information to the public.

The EEOA approach has some similarities to the Victorian Environment Protection Authority Greenhouse Program (box. 8.6). However, in contrast to that program, the EEOA does not require that firms implement the opportunities identified.

Box 8.6 **Victorian Environment Protection Authority Greenhouse Program**

Under the Victorian State Environment Protection Policy (Air Quality Management), firms operating under licenses issued by the Environment Protection Authority, and consuming over 500 gigajoules of energy per annum are required to conduct an energy audit of their premises. The audits must identify all options to reduce energy consumption and greenhouse gas emissions.

Firms must conduct financial feasibility assessments of the opportunities identified by the audit and prepare action plans for implementing the opportunities. The audit process, findings and the action plan must be documented and reported to the Environment Protection Authority. Firms are then required to implement all energy improvements that have payback periods of up to three years. Firms may be required to implement opportunities with a longer payback if the working life of the project is greater than 10 years.

Sources: DSE (2005); EPA Victoria (2002).

The EEOA framework is still in development, and elements like the assessment, reporting and verification procedure have not been finalised. It is anticipated, however, that external consultants will play some role in assessing the energy efficiency opportunities of individual firms. One of the auxiliary elements of the framework involves capacity building in the energy services industry through training and accreditation.

As part of the policy development process, extensive consultation with interested parties has been undertaken. The subsequent draft consultation report (DITR 2004b) outlines the potential benefits and problems associated with the EEOA policy as identified by interested parties. Some of the identified benefits include:

- focusing management's attention on cost-effective energy efficiency improvements;
- overcoming the organisational communication barriers between technical staff and management;
- improved access to external capital sources through a credible assessment process;
- public recognition for energy-efficient companies;
- demonstration and information diffusion effects through industry benchmarks and sector case studies; and
- strengthening of the energy services industry.

The potential problems identified by interested parties included:

- the small size of potential privately cost-effective efficiency improvement;
- difficulties in clearly specifying the boundaries and process of EEOA;
- difficulties of designing an EEOA process that reflected differences between firms;
- unsuitability of the four year payback as a benchmark for cost effectiveness;
- risk to corporate reputation if the firm did not implement the opportunities, even if the decision was taken for economically valid reasons, and the associated moral hazard in conducting a thorough assessment; and
- disclosure of confidential information to the public.

No regulatory impact statements or any other evaluations of potential costs and benefits of the EEOA program have been completed yet, so it is difficult to make a conclusive assessment of it. However, the Commission expresses a strong reservation about this program. A number of potential problems can be identified.

First, the EEOA will apply to organisations on the basis of one criterion only — the amount of energy used (which appears to have been set at an arbitrary level). Companies are not targeted for their apparently energy-inefficient practices, only for being large energy users. This conflicts with the implicit aim of improving the cost-effective take-up of energy efficiency improvements. If anything, the targeting criterion is counter-intuitive and counter-evidentiary as energy-intensive users already have a strong incentive to use energy efficiently, as well as greater resources to identify and implement cost-effective energy efficiency improvements.

Second, the EEOA is likely to create significant administrative costs and procedural difficulties. Several difficulties have already been identified in the consultation with interested parties (DITR 2004b). It is unclear how a uniform assessment and disclosure process could be designed to reflect the differences across and even within organisations. It would be difficult to set clear boundaries for the assessment process and disclosure criteria. For example, the definition of cost effective as actions having a four-year payback has already been criticised by some interested parties because it excludes considerations of risk and profitability of other competing projects within a firm. And, as noted in chapter 6, using payback as an investment criterion may prejudice projects that have longer payback periods but higher net present values.

Verification of assessments is also likely to be problematic and costly. There would be information asymmetries between regulators and companies; companies would have an incentive to minimise costs of assessments and withhold assessment results which may damage their corporate reputation.

However, the most significant weakness of the EEOA framework is the context in which it is to be applied. While the EEOA policy does not specify what barriers to energy efficiency it seeks to address, judging from the consultation report and the DITR presentation to stakeholders, it appears that the main issue is the perceived lack of managerial attention to energy efficiency matters.

The Commission reiterates its strongly held view that organisational barriers alone cannot justify regulatory intervention. To the extent that firms feel compelled by the EEOA process to invest in projects they would otherwise reject, the EEOA would distort investment decisions and reduce overall cost effectiveness. Competitive pressures on firms give them strong incentives to maximise their efficiency. This is particularly true for industrial firms competing in export markets, which make up a large proportion of the organisations targeted by the EEOA.

In the words of Origin Energy:

> Policy should be based on the presumption that businesses are in the best position to allocate capital efficiently. Government involvement would be second best, except in cases where clear market failure (and minimal scope for government failure) can be demonstrated. The claim that managements' capital allocation decisions are ill informed with regard to energy efficiency investments is not sufficient, alone, to warrant government involvement. A sound approach to policy needs to ask why businesses and their shareholders would not seek and invest in information that maximises the long run value of the businesses assets (as they are presumed to be able to do effectively in relation to other aspects of their operations). (sub. 25, p. 12)

The Australian Industry Greenhouse Network described organisational barriers to energy efficiency improvement as 'symptoms of poor management' and noted:

> Poor management might equally be responsible, of course, for over-investment in energy efficiency technologies and practices and this is a risk when governments intervene, especially with mandates. (sub. 57, p. 7)

Nevertheless, the Commission acknowledges that the EEOA framework has some positive elements. Modest benefits might be achieved through demonstration and information diffusion effects. These effects would arise out of public disclosure of energy efficiency opportunities by firms and the resultant development of industry benchmarks and case studies. However, this benefit would need to be balanced against the disclosure costs for companies, including the cost of releasing potentially confidential information. Engaging firms in demonstration and information diffusion on a voluntary basis through schemes specifically targeted at achieving this aim (for example through a program similar to the old EEBP) would be a better alternative.

A further benefit is that the scheme could enhance the development of the energy services industry. However, it would do so only at the expense of the participating firms and, as noted earlier, it is arguable that these audits would be in the best interests of those firms.

More generally, the benefits arising out of the EEOA program are likely to be modest while the costs of this type of policy approach would be significant. In view of this, the Commission does not consider that introducing the EEOA program can be justified on the grounds of private cost effectiveness for individual firms. The Commission also cautions against any further regulatory intervention in the form of mandating the implementation of EEOA results.

DRAFT RECOMMENDATION 8.1

A policy of mandatory energy efficiency opportunities assessments is not warranted on private cost-effectiveness grounds. There would be no justification for mandating the implementation of Energy Efficiency Opportunities Assessment results.

8.8 Minimum energy performance standards

Minimum energy performance standards (MEPS) are used to regulate the energy efficiency of household appliances (chapter 7). Some MEPS also affect firms in the commercial and industrial sectors. As explained in chapter 7, this policy tool works by prohibiting the sale of appliances that fail to achieve at least a specified level of energy efficiency. Thus, this policy instrument attempts to address all market barriers that might discourage the use of energy efficient appliances and equipment, by banning all inefficient appliances and equipment from the market.

MEPS are currently in place for the following appliances and equipment:

- three-phase electric motors (box 8.7)
- linear fluorescent lamps
- fluorescent lamp ballasts
- commercial refrigerators
- three-phase packaged air conditioners
- distribution transformers.

All of the regulatory impact statements (RISs) prepared for the above MEPS estimated that the MEPS would result in significant net private benefits and eliminate market failures. Market failure was variously defined in the RISs to include:

- Split incentives in the commercial building and appliances market — commercial refrigerators (Mark Ellis & Associates and Steven Belletich Associates 2004); fluorescent lamps (Mark Ellis & Associates 2003); fluorescent lamp ballasts (George Wilkenfeld and Associates 2001); air conditioners (George Wilkenfeld and Associates 2000).
- Lack of attention paid by management to energy use due to energy being a small proportion of business costs — electric motors (Syneca Consulting 2003b); commercial refrigerators.

- Externalities associated with energy use — commercial refrigerators, air conditioners, fluorescent lamp ballasts.
- Lack of technical expertise and transaction costs of obtaining information — commercial refrigerators.

Box 8.7 Minimum energy performance standard for electric motors

Electric motors are responsible for the majority of electricity consumption in the industrial sector. Typical industrial applications include crushing; grinding; mixing; materials conveying; driving of fans, pumps, air compressors and refrigerators. They are also used extensively in the commercial sector for air conditioning, ventilation, refrigeration, water pumping, lifts and escalators. Electric motors are estimated to account for about 30 per cent of total electricity consumption in Australia.

A minimum energy performance standard (MEPS) for electric motors with a power rating of 0.73 kW – 185 kW was introduced in 2001 and will remain in force until 2006. A regulatory impact statement (RIS) prepared for the current MEPS estimated that the policy would result in benefits which are 80 per cent greater than the costs (Syneca Consulting 2003b).

A new standard which will operate in 2006-12 has already been developed. The new standard will require an average reduction of electricity consumption of 10–20 per cent which would exclude approximately 70 per cent of existing models from the market. A draft RIS has been prepared for the new standard which assessed the benefits of the MEPS to be between two and five times greater than the costs (Syneca Consulting 2003b). The RIS considered that the costs of the MEPS were insignificant. The RIS stated that energy efficiency was often not a significant consideration in electric motor purchases and attributed the current commercial success of inefficient motors to energy being a small proportion of total business costs. The RIS considered voluntary agreements with suppliers (used in the European Union) as an alternative to the MEPS and concluded that a MEPS was preferable. The RIS argued that suppliers were unlikely to agree to comply with the standard proposed in the MEPS, and that a voluntary agreement did not address the threat of non-complying imports.

Source: Syneca Consulting (2003b).

The common approach in all of the mentioned RISs was to develop and use representative scenarios of appliance usage to estimate the aggregate costs and benefits of replacing current appliances with more energy efficient ones. The RISs advocated the replacement of all appliances whenever the average life-cycle cost of a more efficient appliance was lower than that of an inefficient one. The objective of successful policy has then been defined as achievement of perceived energy-saving potential through the quickest and most effective elimination of all inefficient appliances from the market. It is not surprising, therefore, that all the RISs concluded that a policy instrument which completely prohibits the sale of an appliance is more effective than voluntary, informational or financial incentive mechanisms.

The Commission is also concerned that MEPS might result in reduced competition and the imposition of solutions which are not privately cost effective for some users.

All of the RISs included some discussion of competition issues. The draft RIS for MEPS of electric motors included information on the proportion of existing motors excluded from the market by the standard (70 per cent) (Syneca Consulting 2003b). This could have some influence on competition. The RIS also included information obtained from interviewing motor manufacturers about their business response to the proposed standards. However, this approach has generally not been followed in the other RISs, which have tended to make general observations that competition effects were likely to be insignificant.

Proposals that rely on developing representative scenarios ignore the different circumstances and needs of potential users. They tend to disregard the costs imposed by MEPS on users for whom the regulation would lead to outcomes that are not cost effective. The private cost effectiveness of a particular appliance may vary with usage patterns, capital constraints and individual discount rates. By their nature, MEPS limit choice. A Bureau of Industry Economics case study (BIE 1994), which compared the potential benefits of introducing labelling and MEPS in the electric motor market, found that labelling delivered a slightly greater potential benefit. The report observed:

> The potential benefits of labelling are always higher than those of standards because labelling does not force manufacturers to buy motors which are a poor choice for some applications. (BIE 1994, p. 86)

The application of MEPS to commercial and industrial appliances and equipment has given insufficient consideration to the use of the most appropriate policy instrument to address the market failure circumstances of each case. As in the residential sector, the strongest case for MEPS may be where split incentive problems are significant and appliance replacement occurs relatively infrequently, thus limiting the ability for firms to learn from doing. For example, the commercial refrigerator market includes many small firms that lease refrigerators from large soft drink and ice cream chains. In such situations, the lessee may have little influence on the choice of appliance, and may end up with higher operating costs as a result. But in other cases, information provision might be the more appropriate instrument.

In the market for electric motors, the major barrier identified in the draft RIS (Syneca Consulting 2003b) was the low priority given to energy efficiency in purchasing motors, despite energy being a dominant component in life-cycle costs. However, giving a low priority to something does not equate to market failure. Even if it did, it is unclear why MEPS would be a preferable instrument to an information provision policy. The RIS noted that information and education programs were not considered in detail because education programs were already run as part of the Australian Motor Systems Challenge and the National Appliance and Equipment Energy Efficiency Committee considered that significant opportunities for cost-effective efficiency improvement remained.

In the Commission's view, before a regulatory instrument which overrides consumer preferences like MEPS is introduced, a thorough evaluation of other policy options should be conducted. The Commission is concerned that this approach has not always been followed in developing the MEPS of appliances and equipment used in the commercial and industrial sectors. Recommendation 7.1, therefore, applies to MEPS for not only household appliances, but also appliances and equipment used by the commercial and industrial sectors.

8.9 Building energy efficiency standards

In the next two years, the Building Code of Australia will be changed to incorporate new provisions that will require builders of commercial buildings to comply with specific energy efficiency standards. Like MEPS, building energy efficiency standards attempt to address all of the barriers that prevent the adoption of cost-effective energy efficiency improvements by imposing a blanket ban on energy-inefficient building practices.

Mandatory efficiency standards for multiple-occupancy buildings (class 2–4 buildings) such as apartment buildings, hotels and motels will be introduced into the Building Code in May 2005. Standards for all other commercial buildings (class 5–9) will be developed in 2005 and introduced into the Building Code in 2006. The regulatory proposal for changes to the Building Code relating to class 5–9 buildings shows that the changes would be in a similar form to class 2–4 building changes (ABCB 2004b). Thus, the analysis that follows focuses on class 2–4 buildings (for which a draft RIS has been released already), but applies to all regulations covering energy efficiency standards of commercial buildings.

Measures for class 2–4 buildings proposed for inclusion into the Building Code include provisions for the building fabric, glazing, natural ventilation, building sealing and engineering services (including some lighting systems; air conditioning, heating and ventilation systems; hot water supply systems; and maintaining these systems). The measures impose a performance requirement on builders which can be met by either:

- following a 'deemed-to-satisfy' provision; or
- adopting an outcome-based alternative solution.

Deemed-to-satisfy provisions are detailed prescriptive technical requirements of how a building can be constructed. The alternative is for the builder to comply with an outcome-based performance requirement. The options include verification against a star rating scheme, verification against a maximum allowable value or verification against a reference building (appendix C). In practice, most builders choose to follow a deemed-to-satisfy provision (ABCB, sub. 7, p. 3), possibly for risk-minimisation reasons.

The draft RIS for class 2-4 buildings states that the performance requirements are intended to address two market failures:

- greenhouse gas emission externalities (identified as the main driver of the policy); and
- owner-tenant split incentives arising out of information asymmetries between owners and tenants (market failure), compounded by cognitive constraints on tenants (i.e. behavioural barriers) (ABCB 2004a).

The Australian Building Codes Board (ABCB 2004a) identified the following private benefits and costs arising from the regulation:

- increased capital costs of construction — net present value estimated at $32.4 million;
- reduced capital costs on heating, ventilation and air conditioning equipment — net present value estimated at $14.5 million; and
- reduced energy costs — net present value estimated at $31.2 million.

In addition, the ABCB (2004a) identified a broader social benefit of reduced greenhouse gas emissions, which was valued at $8.2 million (net present value). The ABCB concluded that the regulation had a benefit–cost ratio of 1.66:1. The ABCB evaluated the proposed regulation against two other scenarios of more stringent insulation requirements and less stringent glazing requirements than the option ultimately adopted, and concluded that the other options would have resulted in smaller benefits relative to costs.

The Commission considers that the value of net benefits of the regulation estimated by the ABCB (2004a) is very marginal and there is a strong chance that the regulation will lead to outcomes which are not privately cost effective. The estimates are sensitive to modelling assumptions. The ABCB's analysis shows that net benefit estimates vary greatly depending on the discount rate that building users apply to expected future streams of income from reduced energy costs. An increase in discount rates from 5 per cent (default assumption) to 7 per cent nearly halved the estimated net benefit. And, as noted in chapter 6, firms frequently require much higher returns than these (one survey found that firms used a 12 to 15 per cent discount rate) before judging an investment to be cost-effective.

The estimate of net benefits of regulation also appears to be overstated because it does not include the costs incurred by governments in administering the regulatory regime. Compliance costs for builders from learning the new requirements and integrating them into their processes are assumed to be small and also appear to be excluded from net benefit calculations.

Finally, the ABCB's estimates of energy use reductions resulting from compliance with the standards may be difficult to achieve in practice. In chapter 7, it was noted that the Building Code standards for houses may not be effective because they target heating and cooling loads, rather than energy consumption. It appears that a similar problem arises with some of the proposed verification methods for commercial buildings.

In addition, while one of the options for compliance is for builders to satisfy an actual performance requirement, most builders choose to follow the prescriptive design standards in the deemed-to-satisfy provisions. Exergy Australia (sub. 40) stated that building design features did not necessarily deliver actual energy efficiency benefits. Exergy's survey of 66 commercial buildings in Sydney showed that there was virtually no connection between design features and actual energy performance. A number of potential factors (most of them not related to tenant behaviour) could destroy the relationship between design and actual energy use including:

- poor commissioning of the building;
- poor workmanship;
- issues with the control of the hardware that determines energy use within a building; and
- design details not being captured in computer simulations.

As a consequence, estimates of energy-use savings on the basis of deemed-to-satisfy design provisions are likely to be unreliable.

The Commission is concerned that little consideration was given to the alternatives to the proposed regulation. The ABCB (2004a) assumed that energy efficiency standards were going to be introduced into the Building Code and thus there was no analysis of other policy options like voluntary agreements, information provision and education, or financial incentives. The proposed changes to the Building Code may not be the most efficient policy tool for overcoming the market failures identified.

DRAFT RECOMMENDATION 8.2

Energy efficiency standards for commercial buildings should not be introduced without a more thorough evaluation of the costs and benefits of such a policy and a comprehensive analysis of the other policy options. In such an evaluation, the Australian Building Codes Board should give greater consideration to:

- ***the sensitivity of regulatory impact statement estimates of cost savings to the assumptions used;***
- ***the costs of introducing energy efficiency standards, including administration costs and compliance costs; and***
- ***the effectiveness of standards in achieving higher actual energy efficiency.***

9 Energy efficiency in transport

Key points

- Many potential improvements in energy efficiency in transport which would be privately cost effective, result from policies designed mainly to obtain other efficiency benefits (for example congestion pricing and improved efficiency of rail freight).
- The compulsory fuel consumption label and voluntary national average fuel consumption target for motor vehicles are likely to generate small improvements in motor vehicle fuel efficiency. Similarly, the TravelSmart information program to encourage less motor vehicle use has reduced energy use and increased energy efficiency in transport. As these schemes do not compel consumers and producers to move to more energy-efficient vehicles, any such improvements should be privately cost effective.
- The introduction of efficient congestion-pricing schemes in the larger capital cities could generate energy efficiency improvements which are cost effective (even excluding environmental benefits) for the community.
- Further regulatory reform in road and rail freight would be likely to engender some privately cost-effective energy efficiency improvements in each sector.

This chapter considers the potential for achieving energy efficiency improvements that are cost effective for individual producers and consumers in passenger transport (section 9.2) and freight (section 9.3). The terms of reference direct the Commission to examine the potential for energy efficiency improvements in vehicles and fuels resulting from improved energy efficiency information, minimum energy efficiency standards and new and improved technologies and equipment. They also require the Commission to consider policy options for improvements in transport-related areas — including from urban planning, congestion pricing, intelligent transport systems, travel-demand management and increased efficiencies in the business and freight sectors — which may have implications for energy efficiency.

Unlike some other sectors of the economy, potential energy efficiency gains in transport are often associated with policies that offer significant other efficiency benefits — energy efficiency tends to be a useful byproduct of achieving worthwhile gains such as reducing inefficient levels of road congestion or improving the efficiency of the provision of rail services. Particularly in such cases, the sole pursuit of energy efficiency should not determine policy settings. Conversely, in some instances policies adopted to meet other objectives — for example, obtaining cleaner exhaust emissions from trucks and restricting or slowing traffic in suburban streets — can lower fuel efficiency. Hence, in the transport sector, perhaps even more so than in other sectors, it is essential to consider energy efficiency in a broader economic, social and environmental context.

9.1 Introduction

As noted in chapter 3, transport is a significant user of energy. In 2001-02, 37 per cent of final energy consumption in Australia was consumed in the transport sector. As in many other countries, energy use (and resultant greenhouse gas emissions) in Australian transport is growing faster than in other sectors.

Because Australia is a large sparsely populated continent, the transport task of moving people and freight is commensurately greater than in many other countries. Also, the availability of relatively cheap land and Australians' preferences for larger residential blocks, has also meant that major cities have generally expanded in a sprawling low-density fashion. While largely reflecting individuals' preferences, this style of development has added to the urban transport task for firms and private purposes.

In addition to providing significant benefits of mobility and lifestyle options, transport also creates important negative environmental externalities. Motor vehicles cause localised air pollution and noise in larger urban areas, particularly at peak hours, while public transport also creates noise and air pollution. In addition, motor vehicles and, to a lesser extent, public transport, contribute significantly to greenhouse gas emissions either directly or indirectly. In 2000, direct transport energy use accounted for around 14 per cent of Australia's greenhouse gas emissions, of which road transport made up close to 90 per cent.[1] By 2020, the level of greenhouse gas emissions from transport is forecast to grow by around 60 per cent from its 1990 level (AGO 2004n).

There are usually a number of outputs provided to users by a given transport service. As well as moving between two points, factors such as comfort, flexibility, reliability and time taken are all important attributes — in some cases travellers enjoy the trip itself. For producers, convenience, reliability, time taken and absence of damage to goods are all important. Hence, in some cases, there can be a degree of difficulty in defining and measuring the total output of a transport service, and

[1] This excludes indirect emissions resulting from the use of energy generated in other sectors (for example, electricity).

therefore some uncertainty in determining if an observed fuel-efficiency improvement resulting from government policy intervention is cost effective.

9.2 Passenger transport

This section considers a range of current and potential programs which might result in privately cost-effective improvements in the energy efficiency of road and rail passenger transport. Road-based passenger transport is the major user of energy in the transport sector and hence has been a particular focus of energy efficiency programs for transport under the National Greenhouse Strategy and the Environmental Strategy for the Motor Vehicle Industry. There may be potential for cost-effective improvements to energy efficiency of road transport by more efficiently managing traffic flows by using road pricing and intelligent transport systems. Planning policies have also been suggested as a longer-run tool which could increase energy efficiency by facilitating greater use of public transport.

Passenger motor vehicle fuel efficiency

There are several existing programs aimed at improving the fuel efficiency of passenger-transport activities (particularly of the motor vehicle fleet), usually with a focus on achieving communitywide benefits (reduced air pollution and greenhouse gas emissions) rather than providing direct benefits for the individuals directly affected. Any privately cost effective energy efficiency improvements are incidental to achieving environmental objectives. Hence, an examination of any private benefits of these policies should not be viewed as a complete assessment of their performance. Indeed, many are best considered as possible low net cost (after allowing for any private benefits and both private and government costs) greenhouse and pollution abatement schemes — whether they fulfil this criteria is beyond the scope of this inquiry.

Whether reducing fuel consumption through greater fuel efficiency is privately cost effective will depend on the savings from lower fuel consumption compared to any capital cost of improving fuel consumption and the value to consumers of any other loss in amenity required to achieve those savings. The absence of any clear market failures impeding privately cost-effective energy efficiency improvements suggests that opportunities for such improvements are limited.

Fuel consumption labelling scheme

Since 2001, all new passenger cars and all off-road vehicles and light commercial vehicles powered by petrol, up to 2.7 tonnes in gross mass, have been required to display (at the point of sale) fuel consumption labels (showing litres used per 100 kilometres).[2] A standard laboratory test procedure is applied to all vehicles (for both city and highway cycles) and hence the resultant fuel consumption figures are comparable between models. Actual fuel consumption will vary from the test results due to different driving conditions, driver behaviour and vehicle condition.

From July 2003, the label has also indicated the grams of carbon dioxide the model would emit (under standard test conditions) per kilometre travelled. In addition, all new vehicles weighing up to 3.5 tonnes (regardless of fuel source) are now required to display the label, bringing some larger off-road vehicles under the scheme. Many other countries (for example, the United States, Canada and Japan) have similar compulsory labelling requirements providing fuel efficiency and/or greenhouse emissions information while others (for example, the United Kingdom) have voluntary arrangements adhered to by all producers.

The fuel consumption labelling requirement is supported by the Fuel Consumption Guide (published by the Australian Government since 1980) and the Green Vehicle Guide. The Fuel Consumption Guide contains data on the fuel consumption of vehicles (passenger motor vehicles, four wheel drives and light commercial vehicles) manufactured between 1986 and 2003, for both city and highway conditions. The Green Vehicle Guide provides information on the environmental performance and fuel consumption of new vehicles sold in Australia since 2004, using the fuel consumption label data. The Australian Government will spend $1.5 million over four years promoting the guide. These sources allow consumers to readily compare information on the fuel consumption of different vehicles.

As discussed in chapter 7 with regard to home appliances, it could be argued that the market does not necessarily provide consumers with sufficient information regarding the energy efficiency of alternative products. With regard to motor vehicles, the Bureau of Transport and Communications Economics (BTCE) commented:

> In making informed purchasing decisions, buyers generally have to rely on the claims of competing manufacturers. Because of uncertainty on the part of buyers, genuinely more fuel-efficient products may attract prices below their optimal value. A vehicle labelling scheme supervised by the government has the potential to reduce the information asymmetry between buyers and sellers. (BTCE 1996b, p. 154)

[2] The labels are mandated under the *Motor Vehicles Standards Act 1989* (*Australian Design Rule 81/01*).

Nonetheless, energy is a much more significant and visible cost for motor vehicle use than for most home appliances. Hence, consumers would be expected to be reasonably aware of fuel efficiency differences, even if other factors are more influential in their final purchase decision. For example, the RACV (2004) indicates that for most new passenger motor vehicles, fuel costs make up around 15 to 20 per cent of the total cost of running a motor vehicle and over one-third of the non-capital costs. A wide variety of market sources — car magazines, newspapers, motoring organisations and motor vehicle retailers and producers — provide consumers with information on fuel consumption. Any small deficiencies in this market-provided information may not justify the expense to government, the industry and consumers of government intervention. There may be many areas of motor vehicle performance about which consumers have less than perfect knowledge.

However, the fuel consumption labelling scheme is part of the broader environmental strategy for the motor vehicle industry. In this regard, the new requirement that fuel efficiency labels include information on greenhouse gas emissions — something markets would underprovide from a social perspective — better focuses on the program's primary objectives, namely to lower emissions and reduce urban air pollution. In particular, the environmental performance of vehicles powered by fuels or fuel combinations producing lower greenhouse gas emissions will now be better brought to consumers' attention.

As the fuel labelling scheme provides comparative information to consumers to assist in making informed decisions, rather than restricts or directs their purchasing decision, any resultant improvement in the energy efficiency of the motor vehicle fleet should be privately cost effective. However, analysis by the Bureau of Transport and Regional Economics (BTRE 2002a) indicates that actual fuel consumption is consistently above the test results by an average of 20 per cent, with underestimation greatest for the highway cycle. This may distort the vehicle choices of some consumers, possibly towards less fuel-efficient vehicles, as the absolute size of the underestimation of fuel consumption will be greater for vehicles with higher fuel consumption. The Ford Motor Company of Australia (sub. 76) noted the potential for greater in-use fuel efficiency that has been achieved in Europe by changing motorists' driving behaviour.

Overseas studies of the impact of fuel-labelling schemes on consumer behaviour indicated that many consumers were aware of fuel consumption labels. European studies suggested that only modest reductions in fuel consumption, in the order of one to four per cent, were likely to have been attributable to the schemes (BTRE 2002b and BTCE 1996b). However, greater gains might be expected as awareness of environmental impacts of motor vehicle use increases. A 1993 survey of two Australian car showrooms indicated a 15 per cent reduction in fuel-consumption due to consumers changing their preferred vehicle on the basis of fuel consumption labels (Wallis 1993). In assessing the likely impact of an Australian fuel consumption label, the BTCE (1996b) assumed an average (over time) 1 litre per 100 kilometre (around 12 per cent) reduction in fuel consumption of the new vehicle purchases of private buyers in response to a label. On this basis, the fuel-saving benefits of the scheme were found to make it a privately cost-effective measure.

The labelling scheme appears relatively low cost to administer and comply with, particularly given that manufacturers have to meet similar requirements in many overseas markets. The BTCE (1996b) suggested a cost of between $2 and $15 per new car sold. These costs have been further reduced, particularly for imported vehicles and export models, by bringing the test procedure into line with internationally-recognised standards.

DRAFT FINDING 9.1

Markets provide extensive information to consumers regarding fuel consumption of motor vehicles. Nonetheless, the Australian Government's Fuel Consumption Labelling Scheme and Green Vehicle Guide provide relatively low cost, accessible and comparable information to consumers, and may be justified as part of the more fundamental objective of encouraging consumers to reduce the adverse environmental impacts of motor vehicle use.

National average fuel consumption target

A voluntary industry-wide fuel efficiency target for new (petrol-powered) passenger motor vehicles was first negotiated between the Australian Government and the automobile industry association (FCAI) in 1978. It aimed for a 15 per cent improvement in fleet-wide fuel efficiency (to 9.5 litres/100 km) by 1983 and a 20 per cent improvement by 1987 (9 litres/100 km). A further voluntary target of 8.2 litres/100 kilometres by 2000 (12 per cent below the actual 1990 levels) was agreed to in 1996. Outcomes have been slightly above the targets but no penalties apply as it is a voluntary scheme.

The current target, established under an industry voluntary code of practice in 2003, is 6.8 litres/100 km by 2010 — a reduction in average new vehicle fuel consumption of 18 per cent below the actual 2001 level of 8.28 litres/100 km. This compares with the United States corporate-specific target for new passenger vehicles of around 8.6 litres/100 km (box 9.1). In assessing possible fuel efficiency targets, ACIL (1999) argued that a figure of 6.7 litres/100 km by 2010 would be a challenging but realistic lower limit. Sharp increases in fuel prices in recent years should increase consumers' interest in fuel efficiency. The FCAI (2005) suggested 6.3 litres/100 km as a feasible objective for 2015.

In addition, a separate national average carbon dioxide emissions target covering cars, vans, four wheel drives and light commercial vehicles up to 3.5 tonnes is being negotiated with the industry. The existing fuel-efficiency target will also be converted to a carbon dioxide (grams per kilometre) target. Achievement of the fleet fuel efficiency target is estimated to represent a reduction of greenhouse gas emissions from motor vehicles of up to a total of two million tonnes per annum (around 4 per cent) by 2010 compared to that which would have occurred under base level fuel consumption (Kemp 2003).

The impact of these various targets on observed fuel consumption is likely to be limited by the high import share in the new motor vehicle market. Around 70 per cent of new motor vehicles are imported and the fuel efficiency or emission levels of these vehicles will be significantly affected by the preferences of overseas consumers and government regulations on fuel efficiency in those countries. A good deal of the technology used in Australian-made vehicles is also developed overseas or developed in Australia to meet overseas fuel-efficiency standards for models exported. In this regard, such voluntary and mandatory fuel-efficiency targets implemented overseas (box 9.1) may have served to further encourage innovation for greater fuel efficiency by putting the motor vehicle industry in those countries on notice that fuel efficiency is an important government priority.

The rate at which Australian producers and importers incorporate overseas developments in fuel saving technologies which consumers are willing to pay for, might be influenced somewhat by the voluntary fuel-efficiency target. The possibility of mandatory targets could also affect industry behaviour. The Federated Chamber of Automotive Industries commented:

> … the industry has sought to cooperate with successive Australian governments to adopt voluntary targets to achieve improvements in the energy efficiency and environmental performance of vehicles, thereby avoiding unnecessary resort to more draconian mandatory regulation which would otherwise increase compliance costs and undermine the competitiveness of the Australian industry. (sub. 77, p. 1)

Box 9.1 **Overseas fuel efficiency targets**

Many countries have implemented mandatory or voluntary motor vehicle fuel-efficiency targets, sometimes supported by other fiscal or regulatory policies aimed at reducing petrol consumption (for example, the US tax on vehicles with high fuel consumption).

United States

Since 1978, the United States has had compulsory Corporate Average Fuel Economy (CAFE) standards for each automotive manufacturer's sales (segregated between their imported and domestically produced vehicles) in the US market. These standards were introduced because of concerns about energy security after the 1970s oil price shocks. The initial CAFE for passenger motor vehicles was 18 mpg (13.1 litres/100 km) rising to 27.5 mpg (8.6 litres/100 km) by 1985, where, after a brief reduction to 26.5 mpg, it has remained. Light trucks, SUVs and minivans are required to average at least 20.7 mpg. Penalties exist for companies failing to meet the target and overseas producers (mostly European importers of larger cars such as BMW and Mercedes-Benz) have paid over $US 500 million in penalties since the scheme's inception.

Average actual fuel economy for new passenger cars had fallen from 16.1 mpg in 1955 to 13 mpg in 1973. The first oil price shock saw fuel economy increase to 15.9 mpg in 1975 and 19.9 mpg in 1978, gradually rising to 28.8 mpg in 1988. Since then it has varied between 28 mpg and 29 mpg, but has risen above 29 mpg in the last two years.

European Union

In 1998, the European Commission negotiated a voluntary agreement with European manufacturers for a fleet-wide target for carbon dioxide emissions from new passenger vehicles of 140 grams per kilometre (equivalent to fuel consumption of around 5.7 litres/100 km) by 2008. This represents around a 33 per cent reduction from 1995 average fuel consumption (and a 25 per cent reduction in average emissions). Japanese and Korean manufacturers have also agreed to meet this target for their exports to the European Union by 2009. The focus on emission levels means that the target can also be met by increasing the share of vehicles using less-polluting fuels as well as by improving fuel efficiency.

Japan

In 1999, Japan established fuel-efficiency targets for new passenger cars and light trucks (up to 2.5 tonnes) based on vehicle weight classes and fuel type. For most vehicles, the targets are to be met by each vehicle maker for each vehicle weight class by 2010. The targets represent fleet-wide new vehicle fuel consumption of around 6.7 litres/100 km for petrol passenger cars (23 per cent lower than the average for 1995). Small penalties apply if the targets are not met. The targets are based on the most fuel-efficient vehicle in each weight class in 1997, adjusted for likely feasible future fuel-saving technologies and factors adversely affecting fuel efficiency (for example, tighter pollution, noise and safety regulations). Because the Japanese testing procedure is weighted more to lower fuel-efficiency driving cycles, vehicles would achieve lower fuel-efficiency ratings under the Japanese regime than the European and US testing procedures.

Achieving the targets will also depend on the preferences of Australian consumers for fuel-saving technology and other features which might affect fuel efficiency, as well as by the mix of vehicles sold (weight and engine size).[3] Higher petrol prices should increase the importance consumers place on fuel efficiency. The voluntary code of practice (FCAI 2003) acknowledges that external influences (such as consumer preferences) may affect the achievement of the target. In such instances, the industry will discuss changes to the target with the Australian Government.

Unlike many industrial and commercial enterprises where energy is a relatively small cost, the importance of fuel in vehicle operating costs should make motor vehicle producers particularly cognisant of consumers' interest in fuel efficiency. The highly competitive nature of the Australian motor vehicle market should mean that producers provide the vehicle features sought by consumers, of which energy efficiency is one. The Ford Motor Company of Australia observed that significant reductions in industry protection in Australia had contributed to the development of a highly competitive automotive market and argued:

> In such a congested marketplace, a manufacturer's success will inevitably be dependent on sought-after and high value product (sub. 76, p. 2)

Fleet-wide fuel-efficiency targets that go much beyond what the market would deliver are likely to suffer from a number of drawbacks. To the extent that targets distort producer and consumer behaviour the energy efficiency gains from such a compulsory target will not be privately cost effective — consumers will value improved fuel efficiency less than the associated costs and additional constraints on vehicle choice. In addition, with over 50 producers supplying around 350 models of motor vehicles to the Australian market, the temptation to free ride on any efforts of others in meeting a marketwide target would be strong.

As with other sectors of the economy, increased motor vehicle energy efficiency will also have some 'rebound effect' by encouraging greater use of motor vehicles, hence partly offsetting the environmental benefits from the initial fuel saving. Greene et al. (1999) estimate that for US households, a 10 per cent increase in vehicle fuel efficiency leads directly to a 2 per cent increase in distance travelled.

3 The BTRE (2002a) indicated that estimated national average fuel consumption of new light vehicles had fallen by around 15 per cent between 1979 and 2001. Engine technologies had improved substantially, reducing fuel consumption per unit of maximum engine power output of around 45 per cent. However, the impact of this improvement on fuel consumption had been largely offset, particularly during the 1990s, by consumers' preferences (on average) for larger more powerful vehicles with more accessories which increased fuel consumption.

DRAFT FINDING 9.2

Fleet-wide fuel consumption targets for new motor vehicles sold in Australia are likely to have had only a limited impact on the fuel efficiency of the new vehicle fleet. Significantly tightening such targets and making them compulsory would be likely to impose additional costs on consumers.

Composition of the motor vehicle fleet

A number of participants (for example, Sara Gipton, sub. 34; Sustainable Transport Coalition, sub. 70) observed that the fuel efficiency of the motor vehicle fleet would increase if the proportion of vehicles with relatively poor fuel economy (in particular, four wheel drives used in the city) were reduced. Fuel consumption of large four wheel drive vehicles and larger sedans is significantly higher than smaller engine capacity sedans.[4]

The share of larger vehicles and Sports Utility Vehicles (SUVs) in new car sales has increased significantly in recent years, mirroring trends in a number of large developed countries such as the United States and Canada. This trend may partly reflect the relatively low petrol prices experienced during much of the 1990s, along with growing real incomes.

Given the extent of competition in the motor vehicle industry, it would be expected that the attributes of different vehicles would be well communicated to consumers[5]. Hence, consumers’ current purchasing patterns should adequately represent their view of the most cost-effective vehicles for their needs. Any policy measures to mandate or subsidise a switch to a less energy-intensive car fleet are unlikely to provide privately cost-effective energy efficiency improvements, although they might contribute to broader policy objectives.

In the past, four wheel drives have faced much lower tariffs than passenger motor vehicles, thereby distorting demand towards them and lowering the energy efficiency of the motor vehicle fleet. With the progressive lowering of passenger motor vehicle tariffs, only a small tariff preference remains (5 per cent compared to

[4] The Green Vehicle Guide (AGO 2005b) shows that many small 4 cylinder manual vehicles average petrol consumption of around 6 to 9 litres of petrol per 100 kilometres (under the assumed driving cycles and testing conditions used) while larger sedans and four wheel drives predominantly range from 12 to 17 litres per 100 kilometres.

[5] This is particularly so since the reduction of the very high levels of assistance to the domestic motor vehicle industry commencing in 1989 has significantly increased competition.

the 10 per cent for passenger motor vehicles). This will be removed in 2010 when passenger motor vehicle tariffs fall to 5 per cent.

The composition and fuel efficiency of the government motor vehicle fleet are discussed in chapter 10.

New vehicle and fuel technology

Technological developments (engine, chassis, tyres and transmissions) have been critical in delivering improvements in the energy efficiency performance of the Australian motor vehicle fleet. At the same time, consumer demands for more comfortable motoring and improved vehicle performance have seen a greater provision of accessories (for example, air conditioning) and larger cars which have had a detrimental impact on fuel efficiency, while providing other services of value to consumers. The wide variety of market niches suggests that consumers' varied preferences for fuel efficiency and other vehicle attributes should be well provided for.

Currently available and potential new technologies which would significantly improve the fuel efficiency of new vehicles include improvements in aerodynamics, direct injection engines, cylinder deactivation, on board diagnostic systems and automated manual transmissions. As well as consumer preferences, the rate at which more fuel-efficient technology of this type is introduced to the motor vehicle fleet depends on the level of new car sales and the rate at which old vehicles are scrapped. In this regard, the very large reductions in protection to the local motor vehicle industry in the last 15 years has significantly stimulated demand for new vehicles.

Average fuel efficiency of new vehicles in Australia was over 11 litres/100 km in the 1970s, improving to around 9 litres/100 km by 1990. This compares to current levels of close to 8 litres/100 km. Hence the rate of replacement of the existing fleet will make a more significant impact on total fleet fuel economy (depending as it does on previous improvements in new vehicle fuel efficiency) than foreseeable future improvements. The fall in passenger motor vehicle tariffs to 10 per cent in 2005 and the scheduled reduction to 5 per cent in 2010 should further stimulate the modernisation of the fleet. Prohibitive tariffs on second-hand vehicles ($12 000 plus the normal vehicle tariff) preclude relatively new overseas used cars as a source of improving the fuel efficiency of the Australian fleet.

Sara Gipton noted that, in some cases, fuel-efficient technology may require increased energy use in other parts of the production process:

> … energy saving in one step of production or operation may in fact cause an increase in energy use in a different part of the process. For example, to reduce fuel consumed per distance travelled by the substitution of more energy-intensive materials such as aluminium to reduce the weight of a vehicle. The net impact of energy consumption over the life of a vehicle should therefore be taken into account. (sub. 34, p. 5)

Improved fuel quality is a prerequisite to the efficient introduction of certain more fuel-efficient engine technologies. The FCAI noted the importance of adopting new fuel standards if the current voluntary fuel consumption targets are to be achieved:

> The achievement of these targets is dependent on a range of factors including more widespread uptake of higher octane (95 RON) petrol and introduction of very low sulphur petrol to facilitate the introduction of a range of advanced engine and emission control technologies. (FCAI 2005)

Some technological improvements in fuel would also offer the potential to improve the energy efficiency of the whole motor vehicle fleet rather than just new vehicles. The BTRE (2002a) noted that about half of new passenger vehicles sold in any year are still on the road 20 years later.

Several participants have noted that the use of non-petroleum based automotive fuels (for example, ethanol and fuel cells) offer considerable environmental benefits. However, comparisons of alternative fuel sources are beyond the scope of this inquiry.

Congestion pricing

Every vehicle entering a road space imposes congestion costs on *all* other vehicles using that road. The heavier the traffic, the greater the impact on congestion of an additional vehicle on all other vehicles — as road usage approaches the capacity of a road, additional vehicles slow traffic significantly and fuel consumption is around twice that under free-flow conditions[6] (BTE 2000). However, for individual drivers (and their passengers) the congestion costs they impose on others are externalities and do not enter the decision to make the trip by road at that time on that route. Because these congestion costs are largely 'external' to the individual driver's decision making, the level of traffic on a congested road will be inefficiently high.

[6] The BTE (2000) noted that 'free-flow' conditions are an unrealisable hypothetical situation which provide a benchmark to indicate the size of the congestion problem, but which could not be attained in practice.

One approach to dealing with this externality is to require road users to directly meet a significant cost of their travel choice through user charges, thereby improving overall economic efficiency. The Bureau of Transport Economics (BTE 1999) estimated that the social costs of congestion on capital city roads was around $12.8 billion in 1995, nearly half of which was in Sydney, and a further 20 per cent in each of Melbourne and Brisbane. It predicted that due to urban traffic growth exceeding increases in road capacity, annual congestion costs in the six capitals could increase to around $30 billion by 2015.

However, even under optimal pricing, only some of this congestion would be alleviated and there would also be initial and ongoing costs involved in implementing such charges and losses for those 'tolled-off' the road at congested times. The BTCE (1996a) estimated that accurately calibrated peak period congestion pricing in the five largest Australian state capitals would provide net benefits of around $1.1 billion per year (only including time savings benefits).[7] The BTRE (2002) reported that the fuel savings resulting from optimal congestion pricing would be around 30 per cent, with consequent reductions in greenhouse gas emissions of 5 million tonnes per annum (about one per cent of Australian emissions from all sources in 1995).

As far back as the 1960s, the UK Ministry of Transport (1964) concluded that direct road pricing in the United Kingdom would yield net benefits of between £100 and £150 million (1964 prices). Hau (1990) reported annual net benefits (in 1985 prices) of introducing road pricing in Hong Kong of over $US150 million. MVA (1995) estimated the net benefits from road pricing in London at £225 million per annum. Prud'homme estimated annual net benefits for Paris at 2.5 billion francs (reported in Nash and Sansom 1999). Schrank and Lomax (2004) estimated that in 2002, the cost of congestion to US travellers in 85 major metropolitan areas at peak times was $US63 billion.

Despite the significant potential benefits, congestion pricing has been applied internationally in only a few quite localised cases of particularly severe traffic problems, such as in Singapore and London (box 9.2). Although toll roads have become more prevalent in a number of countries, they are not examples of congestion pricing as such — prices do not vary between times of higher and lower congestion. Express transit lanes (for vehicles with two or more occupants) have been one non-price strategy aimed at reducing congestion by encouraging car pooling. However, these lanes tend to be underutilised and result in increased congestion in the remaining lanes (BTRE 2002b).

[7] The BTCE (1996a) stressed that, particularly given that data for different cities was for different years and did not take account of recent changes in the road system, their estimates were to be treated as 'indicative and exploratory'.

Box 9.2 **Congestion pricing schemes**

While there are numerous instances where tolls have been used to finance road building, there are only a few cases where road-user charging has been totally or partially focused on reducing inefficient levels of road congestion. These include:

Singapore

Singapore, in 1975, introduced a requirement for a pre-paid area license for a vehicle to *enter* a restricted zone encompassing the most congested parts of the city. Initially the charge was only for the morning peak but was later extended to between 7.30 am and 7.00 pm on weekdays and 7.30 am and 2.00 pm on Saturday. The entry charge varied between vehicle types and was greater for entry during the morning and evening peaks. While achieving only a portion of the potential benefits from congestion pricing, the scheme's administration costs were relatively low. Car parks were set up around the restricted zone to facilitate the use of public transport into the city. During the 1990s a similar scheme was progressively introduced along congested sections of a number of expressways between 7.30 am and 9.30 pm on weekdays. While manually enforced and fairly rudimentary as a congestion control technique, the scheme did serve to reduce traffic congestion towards more efficient levels. In 1998, Singapore switched to electronic tolling and enforcement methods, facilitating the better targeting of the level of charges to address congestion.

London

In 2003, a daily charge of £5 was introduced for all vehicles (with certain exemptions and also discounts for residents) driving or parking in a 21 square kilometre zone of central London between 7.00 am to 6.30 pm on Mondays to Fridays. In periods when congestion is not considered a serious problem there is no charge. The scheme is a paper-based charge enforced by a series of over 200 camera sites. It is now proposed to extend the charging zone to include adjacent congested areas of central London. The charge has been accompanied by a 30 per cent reduction in the level of congestion in the charging zone, an 18 per cent decline in motor vehicles entering the zone and a 12 per cent fall in vehicle emissions. Public transport usage increased by around 40 per cent of which about half was attributed to the congestion charge.

California

Since 1995, a ten mile section of a four-lane tollway (located on the median strip of the existing congested eight-lane public freeway) in Orange County, has had tolls which vary according to the time of day, week and year. Motorists have a direct choice between priced and unpriced (on the parallel freeway) travel. Tolls currently vary from $US 1.05 to $US 6.25. Tolls are reviewed every six months to recognise changing congestion levels to more efficiently ration tollway use. In 1998, the first 'dynamic congestion pricing' scheme was introduced in San Diego by converting two existing underutilised 13 kilometre high-occupancy vehicle lanes on the ten lane I-15 into reversible high-occupancy toll lanes. Tolls are continuously varied according to the level of congestion, normally ranging from $US 0.75 to $US 4.00 but potentially increasing to up to $US 8.00 if congestion is very high.

Congestion (or peak) pricing is widespread in other services where it is designed to spread demand for fixed infrastructure more evenly over time. Higher long-distance telecommunications prices during weekdays, lower train fares during certain off-peak periods, lower overnight electricity charges, cheaper cinema tickets for particular days and times, and higher accommodation charges during peak seasons are all examples of congestion pricing. Often these differentials are expressed as off-peak discounts — in the case of congestion-priced roads, such discounts might be no charge at non-congested times.

Whether switches of some journeys from congested roads to (often subsidised) public transport provide net community benefits will also depend on the costs and benefits in the public transport sector of making this transition. For example, if greater peaks in public transport were to result, this might require more capital and labour resources which are idle for much of the day and at weekends. Alternatively, the public transport system may become more congested at peak times imposing costs of additional discomfort and delays on commuters. If these costs are not adequately reflected in fares, the choice between private and public transport (or with other options facing the traveller) will be distorted.

Congestion pricing does not result in energy efficiency improvements that are cost effective for those drivers priced off the road — they are shifted to other options which they value less than travelling on (congested) roads at a particular time. If congestion tolls are set appropriately, these costs will be more than made up for by the efficiency gains (time saving and lower vehicle operating costs) accruing to those still using (and now directly paying for) the less-congested road system. The size of the net efficiency benefits will then depend on the costs of administration and compliance. However, remaining road users will also be paying tolls (a transfer payment to government that does not have negative efficiency implications). These charges will, on average, exceed the efficiency benefits received by this group (BTCE 1996a) and hence, in a financial sense, they are also worse off. Those travellers who place a high value on time will be better off but those with low valuations of time savings will be worse off after paying the congestion charge. The latter group still make the journey because the value of the trip to them is greater than all of the costs involved including vehicle operating costs, travel time and the congestion toll.

The Industry Commission (IC 1994b) recommended the incremental introduction of area-wide electronic road pricing, starting with new or upgraded urban arterial roads in Sydney and Melbourne. The AATSE (1997) inquiry into urban air pollution also recommended that congestion pricing be introduced as part of a range of demand-management measures to enable consumers to make informed travel choices. Governments have not acted on these recommendations.

However, since then further advances in charging technology and the extension of the use of (non-congestion) toll roads to finance expansion of the road capacity, together with increasing congestion on certain urban roads, have increased the technical (and political) feasibility of introducing congestion pricing. In this regard, the National Action Plan of the Australian Transport Council gives the Standing Committee for Transport the responsibility to:

> Develop an approach to move travel costs from predominantly fixed to predominantly variable costs in the areas of registration pricing; the cost of fuel; insurance charges; parking policies and congestion pricing.

DRAFT FINDING 9.3

Efficient road congestion pricing would lead to increases in energy efficiency by improving traffic flow and diverting some peak-hour journeys to alternative times or to more energy-efficient means of transport. These increases would be cost effective for the community (if tolls are set appropriately) in that costs to those excluded are more than offset by the gross efficiency benefits to those who continue to travel. However, these energy efficiency gains will not be privately cost effective for all road users. Reductions in fuel consumption and cleaner burning of fuel would also provide significant local environmental benefits and reductions in greenhouse gas emissions.

Intelligent transport systems (ITS)

ITS Australia defines intelligent transport systems as '… the application of computing, information and communications technologies to the vehicles and networks that move people and goods' (ITS Australia 2003, p. 4). Generally ITS are a range of relatively small projects which cumulatively could provide useful economic benefits, including privately-profitable gains in energy efficiency and possibly environmental benefits. The BTRE noted:

> There is a wide range of ITS developments with equally varied impacts. ITS should result in more efficient use of the transport network through better informed decision making and low cost communication for the transport community. (BTRE 2002b, p. xvi)

Examples of ITS include managing and coordinating traffic signals, provision of transport information and optimising train, bus and truck fleet operations. The feasibility and potential benefits of congestion pricing have also been significantly enhanced by advances in ITS.

Austroads argued that the National Strategy for Intelligent Transport Systems offered significant benefits from further implementation of ITS:

> This Strategy will harness ITS to meet Australia's transport challenges. Estimates suggest an overall reduction in the total costs of road accidents, congestion and vehicle emissions by at least 12 per cent by 2012 from using ITS, is achievable, and indeed should be a minimum expectation of the total gains from using ITS. (Austroads 1999, p. 8)

The private benefits of improved traffic flow and efficiency in the use of transport vehicles may justify the public (and sometimes private) expenditure in certain ITS involved in achieving such improvements. However, the resultant energy efficiency and environmental benefits may not be as great as expected. Reduced congestion caused by more efficient traffic control (rather than by congestion tolls) may encourage more road use which may eventually partly or wholly offset the initial reduction in fuel consumption and emissions — effectively a 'rebound effect'.

Much of the investment in ITS likely to deliver energy efficiency improvements is undertaken by government. The key to such investment being cost effective for the community is the rigorous benefit–cost analysis of projects implemented within an efficiently operated, regulated and priced transport system. With regard to the latter, implementation of remaining regulatory reform in transport, reform of the rail sector and introduction of efficient congestion pricing are all necessary to enable accurate assessment of the benefits of further developments in ITS. Indeed, use of ITS would play an important part in achieving greater benefits from any introduction of congestion pricing.

In some cases, government budgetary restrictions can prevent or delay efficient capital investments. However, the Commission has not received any indications of any regulatory or other impediments to the implementation of efficient ITS investments which would have improved energy efficiency.

Urban planning and energy efficiency in transport

The terms of reference direct the Commission to consider the role which urban planning policies might play in achieving privately cost-effective energy efficiency improvements in transport. The availability and cost of the various transport options for individuals and firms can be significantly influenced by urban and transport planning decisions of state and local authorities. In turn this can affect actual transport choices with associated energy efficiency implications. Planning also impacts on the amount of energy used in transport activities by influencing both the need to make journeys and their length.[8] This latter effect is not the focus of this inquiry, but particular government programs often focus on both improved energy efficiency and reduced energy use simultaneously.

Urban planning involves a complex interaction of multiple objectives and multiple policy instruments to influence the way cities develop. Once made, the impacts of planning decisions are often effectively irreversible for long periods. Also, the extent of externalities — the actions of one person or firm impacting on others — means that urban planning has to deal with the sometimes conflicting interests of individuals and firms in their roles as producers, employees and consumers.

The Planning Institute of Australia's (PIA) view of planning was that:

> Planners guide and manage the way suburbs, cities and regions develop, making sure that they are good places in which to live, work and play. Planners are involved in making decisions about land use proposals and other types of developments whilst balancing the needs of communities and the environment. (PIA 2005)

With regard to transport issues, the National Charter of Integrated Land Use and Transport Planning[9] (developed by the National Transport Secretariat for the Australian Transport Council) states:

> Land use and transport planning has a key role to play in delivering social, economic, and environmental sustainability. Roads will continue to dominate as the means of movement for the majority of people and freight in Australia in the foreseeable future. However, by shaping the pattern of development and influencing the location, scale, density, design and mix of land uses, planning can help to facilitate an efficient transport and land use system … (DOTRS 2003, p. 1)

The Australian Transport Council has developed national guidelines for transport infrastructure planning:

> They adopt a total system approach to transport planning and investment. A multi-modal approach, providing for integrated infrastructure, travel demand management strategies (including land use planning), travel behaviour and Intelligent Transport Systems (ITS)/traffic operations is taken. (ATC 2004)

8 For example, planning which facilitates residential, shopping, leisure and industrial and commercial zones in a local area can reduce the number and extent of energy-using transport journeys.

9 DOTRS (2003) notes that the Charter originated as an action in the Integrated National Strategy and Action Plan for Lowering Emissions from Urban Traffic which had been developed by the National Transport Secretariat following a request from the Australian Transport Council to improve the environmental performance of the transport sector. The Charter also incorporates the intent of the strategic responses prepared for the National Greenhouse Strategy measure 5.3 on land use and transport planning.

A number of parties have argued that urban planning needs to place greater emphasis on facilitating passenger journeys other than by private vehicle, thereby reducing energy use and increasing energy efficiency in transport. In some cases, the underlying objective is to reduce greenhouse gas emissions. The Public Transport Users Association commented:

> It makes no sense to continue to build suburbs that have street layouts that are unsuitable for anything but the private car. Instead new subdivisions should provide sensible street layouts for efficient direct bus routes, and have permeable easily crossed local grid streets so residents can walk or cycle to neighbourhood facilities. (sub. 63, p. 7)

Environment Victoria argued:

> Energy efficiency and reductions in greenhouse emissions should be planned for in land-use and transport planning and where new Commonwealth funded development is proposed; as such development design affects energy use for generations. (sub. 67, p. 1)

The National Charter of Integrated Land Use and Transport Planning place a focus on:

> … developing an urban and regional form that concentrates the provision of goods and services at hubs, and provides effective transport linkage between those hubs. (DOTRS 2003, p. 3)

The National Charter notes that improved environmental performance of the transport sector (involving both less travel and improved energy efficiency of those journeys undertaken) is one of many outcomes resulting from best practice in integrated land-use and transport planning.

Similarly, the PIA considered that transport considerations should play an integral role in urban planning:

> Australian cities should pursue urban development policies that strengthen the multi-modal city by increasing density and diversifying uses in activity centres linked to public transport, and by promoting integrated residential and employment precincts at the urban fringe and in larger infill development. (PIA 2003, p. 58)

However, the BTRE argued that an excessive focus on transport outcomes could lead to inefficient planning decisions:

> While there are many lessons to be learnt from past development practices, these alone do not justify a radical change in direction. The uncritical pursuit of policies to increase the density of cities to achieve better utilisation of public transport may not be in the public interest. A prerequisite for sound land use would be to ensure that development costs are not distorted by subsidies (such as partial recovery of infrastructure costs): In other words, that the price signals that determine settlement patterns accurately reflect the benefits and costs facing society. (BTRE 2002b, p. 56)

The Industry Commission report on the impacts of financial policy on urban settlement noted the potentially high cost of mandating shifts in travel mode:

> It is not practical or cost effective to attempt to control urban land use such that no pollution or other adverse environmental impacts occur. Simple solutions are scarce: for example, mandated reduction in use of private motor vehicles is often advocated to remedy air pollution and congestion but this would imply an extreme judgement about alternative means of achieving those objectives, and neglect the considerable range of benefits to households and firms of the mobility enabled by private vehicles. (IC 1993, p. 8)

The energy efficiency of transport is only one relatively small and rather indirect consequence out of numerous outcomes influenced by the planning process. For the impacts of planning on transport energy efficiency to be privately cost effective, the other costs and benefits to individuals flowing from planning decisions will need to have been appropriately incorporated into the planning process. In particular, if outcomes are to be privately cost effective, the shares of motor vehicle and public transport use will be determined by individuals' and firms' responses to an efficient planning framework. Similarly, setting target shares is unlikely to result in minimum-cost greenhouse gas abatement.

Given the complexity and longevity of the impacts of the planning process and the limited role of pricing signals, the costs and benefits of planning decisions can be difficult to determine. However, any focus of planning on improving transport energy efficiency and reducing energy use must be balanced against other objectives of individuals, firms and the economy and society more generally. Urban planning involves many competing social, economic and environmental priorities. No single consideration, such as energy usage or energy efficiency, should be given undue weight.

Other passenger transport issues

Corporate and leased vehicles

There can be tax advantages for individuals in using a vehicle leased for them by their employer rather than purchasing a vehicle out of their after-tax income. However, some employers, particularly governments, require that leased vehicles be produced in Australia. As only medium and large vehicles are produced in Australia, such requirements will tend to lead to lower energy efficiency in transport. In addition, to the extent that fuel is paid for by the employer, there will be a lower incentive for employees to select more fuel-efficient vehicles and to drive them economically.

A motor vehicle provided by an employer which is available for an employee's private use, is subject to fringe benefits tax (FBT) payable by the employer. Under the predominant method for calculating the tax liability (the statutory formula method) the tax liability reduces as kilometres travelled increase through various thresholds. If a company-provided vehicle is driven less than 15 000 kilometres in a year, its taxable value for that year is 26 per cent of its purchase price, whereas travelling over 40 000 kilometres reduces this to 7 per cent. The presumption is that, as a 'rule of thumb', the greater the kilometres travelled the lower the proportion of private travel.

The FBT methodology provides an incentive to use a company-provided vehicle more, either by substituting for other modes of travel or for other family vehicles, or by increasing the amount of travel undertaken. To the extent that any substitution is away from more fuel-efficient means of travel, the energy efficiency of passenger transport will be reduced. Several participants argued that the FBT statutory formula method should be amended to remove this encouragement to increased car travel (Public Transport Users Association, sub. 63; Sustainable Transport Coalition, sub. 70).

Many factors determine the choice of particular taxation rules — for example, efficiency, equity and, particularly it would appear in this case, administrative simplicity. While the FBT rules will encourage greater use of the vehicle concerned, the impact on energy efficiency of the transport sector appear likely to be small and unlikely to justify amendments to rules which have been developed to meet other objectives.

Changing transport modes

Public transport will be generally more energy efficient as a means of transporting passengers than are motor vehicles. However, as many factors other than energy efficiency are considered when making travel-mode decisions, the vast majority of passenger trips are undertaken using private transport.

TravelSmart is a travel behaviour change program which aims to reduce the reliance on cars for private travel by providing information to transport users on the benefits of alternative means of travel, and the environmental costs imposed by car travel. State, Territory and local governments implement a wide range of projects under the TravelSmart banner and TravelSmart Australia brings together many government and community programs aimed at reducing the use of cars and increasing the energy efficiency of the transport task.

The objectives of TravelSmart are local and global environmental improvements together with improving individual's health. TravelSmart Australia commented:

> TravelSmart is essentially a voluntary program that aims to inform and motivate people for changing their travelling behaviour through personal choice. It does not involve any form of regulations, fees or taxes directed at compelling changes in travel behaviour. (TravelSmart Australia 2004).

The Conservation Council of Western Australia argued that the public needs to be educated about travel choices because:

> Lack of awareness of travel alternatives or misconceptions about the relative performance of different modes or preference for driving is a major factor behind car use in our cities — behavioural programs should be run to capitalise on system improvements. (sub. 54, p. 12)

The Queensland Government commented favourably on the program, observing:

> TravelSmart enables each participant to review and adjust their own travel behaviour to achieve reductions in vehicle travel within the context of their lifestyle and transport needs. The initiative does not compromise an individual's mobility needs. (sub. 38, p. 15)

TravelSmart initiatives aim to reduce the energy requirements of the passenger transport task by providing information aimed at encouraging a voluntary switch from motor vehicle travel (particularly involving a single occupant) to other less energy-intensive methods of transport. Hence aggregate reductions in transport energy intensity resulting from the campaign should be beneficial for the private individuals affected, but will involve government expenditure. Whether TravelSmart is an effective means of achieving these private benefits will depend on the costs of the campaign and the value of any environmental and health benefits flowing from it. It is also important to consider if the program is the most cost-effective means of achieving these benefits.

The Victorian Government has evaluated a TravelSmart trial in suburban Alamein and found that there had been reduced car trips (10 per cent) and increased public transport, cycling and walking trips, compared to a control group not covered by the project. The South Australian Government (sub. 80) indicated benefit–cost ratios ranging from 4:1 to 44:1 from TravelSmart programs, with significant shifts observed from motor vehicles to public transport.

Even if the whole journey is not changed from motor vehicle to public transport, there are opportunities for part of the journey to be substituted. There are many possibilities for passenger transport (particularly in urban areas) to involve several modes. For example, in 2003 the Victorian Government developed a park and ride facility with 400 car spaces, bike lockers and a fast 'drop-off' zone to link with a freeway bus service to the city. If such facilities meet appropriate benefit–cost criteria they can generate both private and economywide, cost-effective energy efficiency improvements.

As noted above, cost-effective opportunities for greater use of multiple transport modes would be efficiently enhanced if congestion pricing were introduced on urban roads in conjunction with planning for efficiently satisfying the resultant increased demand for public transport.

DRAFT FINDING 9.4

The TravelSmart program improves the energy efficiency of transport by providing consumers with information regarding less fuel-intensive travel options and means to reduce the need to travel. TravelSmart simultaneously addresses several policy issues — greenhouse gases, air pollution, and personal health and fitness — in a way that allows consumers to choose which options are most cost effective for them.

9.3 Freight transport

In many (although not all) cases, rail freight will be a more energy-efficient means of transport than road, particularly for heavy loads over long distances. Voluntary shifts by producers towards using rail (on the basis that it was more cost effective than road transport) would usually result in cost-effective increases in the average energy efficiency of the transport sector. A number of possible impediments or barriers to using rail freight may distort producers' choices away from rail — some are rational and efficient reasons while some reflect market or regulatory failures.

Efficiency of rail freight

If the costs of rail transport services are inefficiently high, or service quality too low, firms (and passengers) will, in the absence of subsidies, tend to use less rail transport (and more of other forms of transport) than is potentially desirable for economic efficiency. Generally, this will also have adverse energy efficiency implications for the freight transport task.

The reform process in road transport proceeded ahead of that in rail and did so on an integrated national basis via the National Road Transport Commission (NRTC) which was established by COAG in 1992. As a result, inter- and intra-state road reform is well advanced and the already strong competitiveness of road freight has improved further.

While producing highly beneficial economic efficiency gains in road freight transport and the economy, the success of these reforms, in conjunction with a slower rate of rail reform, is likely to have encouraged some substitution of long-distance freight from rail to road. The NTC (replacing the NRTC in 2004) was established principally to progress nationally-consistent regulatory and operational reform in road, rail and intermodal transport. While recognising the recent increased pace of rail reform, the NTC argued:

> Further reform, however, is required to enable rail to meet its full potential — especially if it is to carry a much larger proportion of the nation's rapidly growing non-bulk freight task. (NTC 2003, p. 1)

Improving the competitiveness of the rail sector offers the potential for cost-effective gains in energy efficiency through freight being shifted from road to rail transport. In addition, there are also likely to be opportunities for improved fuel efficiency of rail freight (and passenger) services through greater competitive pressure, improved regulation and better incentives for rail operators.

As part of a process to develop a national freight system that is neutral across transport modes, the Commission's discussion draft into National Competition Policy (PC 2004) recommended that a national reform agenda be developed for the rail sector in order to identify and facilitate further necessary regulatory change.

Heavy vehicle charges

There has been considerable debate over many years regarding the appropriate level of road-user charges that heavy vehicles should pay. Interest has focused on equity and efficiency between different classes of road users and on competitive neutrality between road and rail.

The NTC is responsible for recommending the level of road charges to be levied on heavy vehicles. It has established a nationally-uniform set of charges (registration fee and fuel excise) which aims to recover the share of current road construction and maintenance costs attributable to heavy vehicles as a group and, at least to some degree, for sub-classes of heavy vehicles. The charges do not contain any allowance for environmental costs (such as noise and pollution), road safety costs or the costs of enforcing heavy vehicle regulation.

The former NRTC produced two heavy-vehicle charging determinations in 1992 (implemented in 1995 and 1996) and 2000. The NTC is currently undertaking a third determination.

There has been considerable argument that heavy vehicles are undercharged for their use of road infrastructure. For example, Pacific National considered:

> Road access pricing policy provides a significant subsidy for heavy vehicle owners, which not only inflates charges for passenger car owners, but also severely impacts on the competitive position of rail. (Pacific National 2004, p. 4)

In particular, Pacific National (2004) argued that both the averaging processes involved in determining fixed charges for particular vehicle classes and the use of fuel excise as a proxy for recovering variable road-use costs, resulted in undercharging of the large heavy vehicles which typically competed with rail for long-distance freight. It argued that a charging regime which was more closely correlated with mass carried and distance travelled would more accurately reflect the costs imposed by heavy vehicles. This in turn would enhance the competitive position of rail freight. It also noted that external costs of road freight, such as congestion, accidents and environmental costs, were not incorporated into road charges.

Conversely, the Australian Trucking Association (ATA) was concerned about subsidies to rail freight, arguing that the road freight industry:

> … more than pays for its attributed share of road costs. The same does not apply to rail freight, which pays for part of its infrastructure costs but benefits from government grants towards some of its infrastructure upgrading. (ATA 2004, p. 14)

The Commission (PC 1999) has noted that the averaging process used to determine charges by vehicle class masks significant within-class differences in the road costs attributable to individual vehicles. It concluded that, at the time, heavy vehicles travelling longer distances — those most likely to be competing with rail — were being undercharged.

Since then the NRTC implemented a second charging determination in 2000, which significantly increased charges (which had not changed from the cost base used to establish the 1992 charges determination) for heavy vehicles and introduced an adjustment process to annually update charges between formal determinations. The determination increased charges differentially between categories of trucks in order to better recognise average differences in factors such as distances travelled, utilisation of load capacity and fuel efficiency.

In preparation for the third heavy vehicle determination, the NTC (2004c) noted that there remain important issues to be resolved in determining efficient charges. Further refinements to the level and method of charging offer important economic efficiency benefits.

However, the extent of further appropriate increases in charges for heavy vehicles and the extent to which these would lead to energy efficiency improvements from switches in freight from road to rail is unclear. With regard to competitive neutrality, the NTC argued:

> … the impacts of road pricing, within the scope of NTC's current sphere of influence, are likely to produce only marginal changes in the overall pricing of transport services. (NTC 2004b, p. 8)

The process for determining heavy vehicle charges is detailed and transparent, involving substantial industry consultation and an opportunity for public involvement. The charging methodology has evolved over time in order to more closely approximate the costs attributable to different classes of road users. Nonetheless, the charges necessarily involve many approximations and are averages of attributed costs across each of the various heavy-vehicle charging categories rather than the marginal costs imposed by individual vehicles.

Competitive neutrality between competing transport modes is an important objective of the NTC in undertaking this process. However, administrative simplicity and cost are also significant factors which are likely to continue to restrict the precision with which charges can be set to reflect the road costs attributable to individual vehicles or narrow vehicle groups. Equity and efficiency benefits from introducing a more sophisticated charging system would need to clearly outweigh the additional costs of implementing it. While increases in heavy-vehicle charges would encourage substitution of rail for road freight, any resultant energy efficiency improvements would only be cost effective if the charges were set appropriately.

The NTC process does not include an allowance for external costs of road freight. Some of these such as safety, urban air pollution and noise are being partly handled by regulatory approaches rather than pricing mechanisms. Addressing the broader greenhouse gas issue may justify higher prices for carbon-based fuels used by both road and rail. However, such increases in fuel prices may be best dealt with in an economywide (or indeed worldwide) context, rather than introduced on a sector-by-sector basis via, for example, increased heavy-vehicle charges.

Energy efficiency of road freight

Because fuel represents a significant proportion of the costs of road freight, providers would be expected to place considerable emphasis on energy efficiency.

The ATA noted:

> Because fuel consumption comprises some 25 to 30 per cent of the operating costs in line-haul trucking, in hire and reward trucking, then the trucking industry is well apprised of the need to control its consumption for business as well as environmental reasons… (trans. p. 253)

Energy efficiency of road freight movements has been further enhanced by regulatory reforms overseen by the NTC, such as greater opportunities for the use of B-doubles where appropriate. The BTRE (2003) indicated that, over the 1990s, fuel efficiency in terms of litres per net tonne kilometre travelled had improved by around 3 per cent for rigid trucks and 17 per cent for articulated trucks. Given that, on average, the latter's fuel efficiency per tonne kilometre is nearly three times greater than that of rigid trucks (BTRE 2003), the 10 per cent increase over the 1990s in the share of tonne kilometres carried by articulated vehicles has further increased the average fuel efficiency of the road freight transport task.

However, further reform opportunities remain, some of which would deliver additional privately cost-effective fuel-efficiency gains — for example, the ATA observed (trans. p. 258-59) the potential for a number of jurisdictions to further increase regulatory mass limits for trucks with 'road friendly' suspensions without causing more road damage than under previous limits. Reviews of mass limits which identify justified increases (with higher heavy-vehicle charges if appropriate) would tend to generate privately cost-effective energy efficiency improvements within the road freight industry.

DRAFT FINDING 9.5

There remains some scope for additional regulatory reform in the road and rail sectors, which would improve overall efficiency and would probably lead to some increase in energy efficiency within each sector. Reforms may alter the competitive position of road freight compared to rail, which might change the energy efficiency of the overall freight task, but this would not be an appropriate reason for delaying such reforms. There appear to be few regulatory impediments to a privately efficient modal split in the freight sector that would have any significant impact on energy efficiency.

Intermodal transport

Many longer-distance transport tasks offer potential for the use of a combination of several types of transport to complete the task — intermodal transport. For most freight (other than some bulk commodities), at least some road element is usually needed. The opportunities for more energy-efficient transport modes to also be involved will be influenced by the cost or efficiency of intermodal transfers. In particular, concerns have sometimes been raised that barriers or impediments to intermodal operations have limited the share of rail and, to a lesser extent, sea in domestic freight transport.

Reforms to remove inefficient impediments to intermodal transport could generally improve both economic and energy efficiency. However, an NTC discussion paper into impediments to improving efficiency in intermodal transport concluded:

> … there are no obvious gaps and/or shortcomings of regulation that has influence on interaction of operations between modes. (NTC 2004a, p. 63)

Similarly, this Inquiry has received no submissions arguing that regulatory impediments to intermodal transport are inhibiting energy efficiency in freight transport. Nonetheless, concerns have been raised (for example, ACEA 2004) about the need for a more integrated approach to investment (some of it by government) in transport infrastructure. The Minerals Council of Australia (2004) argued that significant future growth in container throughput at ports would place pressure on the linked-land transport infrastructure. In this regard, the Australian Government has appointed a taskforce to identify physical or regulatory bottlenecks in the operation of Australia's infrastructure which may impede the realisation of export opportunities (Howard 2005).

The NTC also noted that there appeared to be strong support for its existing road and rail reform program. It observed:

> Improved efficiency of modes (rail in particular) and flexibility of mode regulation (road in particular) is needed to improve attractiveness of potential intermodal transport chains. (NTC 2004a, p. 64)

Reliability and timeliness are critical elements of freight transport in today's 'just in time' world. Intermodal transport may increase the duration of a transport task and the risks of missing deadlines. As well as coordination between modes, minimising these costs requires efficient operation within all of the transport modes involved. Regulatory issues impacting on within-mode efficiency were discussed above.

Sea transport has played only a very small role in intermodal freight within Australia. It has been limited by the high cost and limited availability of Australian coastal shipping, together with the restrictions on the use of international vessels —

cabotage.[10] Although the number of single voyage permits granted has increased substantially since the late 1980s, the considerable uncertainty created by the need to obtain permits has inhibited any long-term relationship between overseas shipping lines and current or potential users of the coastal trade. The use of international vessels already travelling between Australian ports offers the potential for lower-cost freight transport which might also increase transport energy efficiency to the extent that it displaced road freight. The scheduled review of cabotage under the NCP is yet to occur.

Conclusion

There appear to be limited opportunities for privately cost-effective increases in energy efficiency in freight transport. Improvements to the regulatory environment and efficiency of the rail sector could increase rail's share of the long-distance freight market and lead to cost-effective increases in energy efficiency in that sector. Road freight operators have significant incentives to be efficient in their use of fuel, although some further efficient regulatory reforms allowing greater use of large trucks would enable road freight transport to be somewhat more energy efficient. As with passenger transport, an appropriate congestion pricing regime in large capital cities would provide a cost-effective increase in energy efficiency of urban freight transport.

[10] Cabotage refers to the practice of restricting access of international (essentially foreign-flagged) vessels to the Australian coastal trade. Vessels participating in the coastal trade must be licensed. A licence is only granted if the crew is paid at least Australian wage rates. Alternatively, a single voyage or a continuing voyage permit may be granted if licensed ships able to adequately provide the shipping task are not available.

10 Governments as energy users

Key points

- Governments account for a small proportion of the energy used in Australia and energy costs account for a small proportion of total government expenditure.
- In some ways, governments are like other energy users, but there are significant differences, including that:
  - their incentives for energy efficiency are different, and may be less pronounced; and
  - they should consider flow-on effects to the community from their own energy use (for example, demonstration effects).
- These differences may warrant specific energy efficiency policy measures, but these need to be consistent with broader reforms of government activities.
- The Australian and most State and Territory Governments have programs that seek to improve the energy efficiency of their own operations. These typically include measures such as energy-use targets, procurement policies and information provision.
- Energy-intensity targets have advantages over energy-use targets, but both risk placing undue emphasis on an input that only accounts for a small proportion of expenditure. The use of energy-intensity performance indicators can reduce this risk.
- Procurement policies that encourage cost-effective energy efficiency could lead to a range of benefits to governments and the wider community.
- To the extent that it is cost effective, governments should disseminate energy efficiency information to their own agencies.
- Government agencies should be able to access capital for energy efficiency investments that can be demonstrated to be cost effective and are consistent with overall fiscal policy. This does not require governments to reserve part of their capital budget for energy efficiency projects.

Some of the energy used in the commercial and transport sectors is by government agencies. The findings of chapters 8 and 9, which deal with these sectors, generally apply to both government and private operations. The particular characteristics of government operations, however, may warrant and/or lend themselves to energy efficiency policy measures that specifically address governments as energy users. This chapter examines these characteristics and their implications for energy efficiency policy.

10.1 Characteristics of government energy use

Government agencies use energy in undertaking a range of activities, including administration, defence, service provision (for example, hospital services and school education) and more commercial activities (for example, water supply).[1] The available data show that the majority of government energy use is in buildings and transport (table 10.1). In terms of greenhouse gas emissions, buildings are more important than would be suggested by energy use alone. For example, buildings accounted for 50 per cent of the greenhouse gas emissions by New South Wales Government agencies, but only 38 per cent of energy use, in 2001-02 (table 10.1). This is because electricity, generated using coal, has a higher greenhouse gas emission intensity than other primary fuels, such as natural gas and petrol.

Table 10.1 **Energy use and greenhouse gas emissions for some Australian Governments, 2001-02**

	NSW[a]	*SA*[b]	*ACT*[c]	*Australian Government*[d]
Energy use (Petajoules)				
Buildings	9.0	2.4	0.7	3.9
Transport	12.6	2.1	0.4	1.2
Other	1.9	0.1	0.1	3.1
Total	**23.5**	**4.7**	**1.2**	**8.3**
Greenhouse gas emissions (Mt CO_2 equivalent)				
Buildings	1.7	0.5	0.1	0.9
Transport	1.2	0.2	–	0.1
Other	0.5	–	–	0.6
Total	**3.4**	**0.7**	**0.2**	**1.6**

[a] Includes general government sector agencies and public trading enterprises. [b] Excludes commercial public trading enterprises. [c] Data are for 2002-03. Includes almost all ACT Departments and Statutory Authorities. [d] Includes defence establishments but not defence operations. – Nil or rounded to zero. Mt = million tonnes.

Sources: AGO (2003d); Environment ACT (nd); NSW DEUS (2004b); SA Government (2003).

Governments account for a small proportion of the energy used in Australia. New South Wales Government agencies, for example, used about 2.3 per cent of total energy consumed in New South Wales in 2001-02 (NSW DEUS 2004b). Energy also accounts for a small proportion of government expenditure. For example, New South Wales Government agencies incurred energy costs of $416 million in 2001-02 (NSW DEUS 2004b). This compares to $34 101 million gross operating expenses for the New South Wales Government in the same year (ABS 2003). On this basis, energy costs represented 1.2 per cent of gross operating expenses.

1 This chapter does not cover government as a supplier of energy. Supply of energy is covered in chapter 13.

Despite this, it is worth focusing on government as an energy user in circumstances where there is:

- a significant potential for improving energy efficiency; and/or
- scope to encourage improvements by other energy users through demonstration and leadership.

10.2 Government-specific barriers and policy issues

Chapters 2 and 5 provide a framework for assessing where government intervention to increase energy efficiency may be warranted. This framework generally applies to government energy use, although there are some additional barriers and policy issues that need to be considered.

Government agencies are different from private-sector organisations in the following ways:

- the incentives for energy efficiency are different, and may be less pronounced;
- whole-of-government policy can be used to direct the energy-management practices of specific (or all) government agencies; and
- leadership, demonstration and market development objectives may be justified on the grounds of communitywide benefits.

As argued in chapter 5, organisational barriers to energy efficiency in the private sector do not of themselves warrant government intervention. For the most part, businesses manage their own affairs. The profit motive provides an incentive for them to pursue cost-effective energy efficiency opportunities. In most industries, competition provides a further incentive to minimise organisational barriers to the uptake of energy efficiency opportunities (and other economic-efficiency opportunities).

For the public sector, however, the profit motive and competition do not provide these incentives. The government, in its role as owner, has responsibility for ensuring that its operations are as efficient as possible. Without the driving force of market incentives, organisational barriers in government agencies may require a stronger and more direct response.

It is important to emphasise that this challenge is not confined to energy use — it applies more generally as governments seek to improve the overall efficiency and effectiveness of their operations. In response, a wide range of reforms have been undertaken, including:

- an increased focus on outputs and outcomes, rather than inputs and processes;
- increased decentralisation of decision making;
- a recognition that agencies are able to perform better if they are given objectives that are well defined, nonconflicting and few in number;
- the use of efficiency dividends and other cost-cutting initiatives to promote efficiency;
- improved accountability through performance reporting and other mechanisms; and
- government trading enterprises operating in an environment similar to the private sector, through corporatisation and the application of competitive-neutrality principles.

Policies aimed at overcoming organisational barriers to cost-effective energy efficiency need to be consistent with these broader reforms of government activities, particularly in relation to the respective governance and accountability roles of central and operational agencies.

10.3 Policy options

The Australian Government and all State and Territory Governments, with the exception of Tasmania, have programs which seek to improve the energy efficiency of their own operations. The Tasmanian Government is planning to introduce a program of this type, consistent with the National Framework for Energy Efficiency (NFEE) Stage One (box 10.1). In addition, the Australian, Victorian, Queensland and South Australian Governments run programs that aim to improve the energy efficiency of local government operations.

Box 10.1 NFEE Stage One measures for government energy efficiency

At its meeting on 27 August 2004, the Ministerial Council on Energy (MCE) agreed to the implementation of nine policy packages constituting the first stage of NFEE. The measures relating to *government* energy efficiency are as follows.

To demonstrate leadership to the business sector and wider community, governments will:

- develop nationally consistent standards for measuring and reporting on government energy efficiency programs;
- introduce public annual reporting by all jurisdictions on energy use and progress towards achieving targets set for government agencies;
- establish minimum energy performance standards for government buildings; and
- develop best practice models for government departments to implement energy efficiency programs.

Ministers also agreed to develop a database of low standby power and high-efficiency appliances to guide government purchasing decisions.

Source: MCE (2004c).

The current programs generally have objectives that extend beyond improving the cost-effective energy efficiency of government operations. In this respect, some programs seek to demonstrate 'good practice' and thereby promote energy efficiency to businesses and the wider community. Additional objectives of most programs are to reduce energy consumption and/or greenhouse gas emissions, and indeed, in some cases these are the primary goals. In its submission to this inquiry, the Australian Government Department of the Environment and Heritage stated:

> The objectives of energy efficiency initiatives in the government sector are to lead by example and illustrate to others the economic and environmental benefits of improved energy efficiency. (sub. 30, p. 19)

Most inquiry participants that expressed views on government energy use felt that it was appropriate for governments to pursue a range of objectives through their energy management programs. The Australian Conservation Foundation (ACF) noted:

> Governments have a long yet mixed history of implementing energy management programs. These programs allow government to reduce its own energy consumption, associated costs and production of greenhouse gases, support a local sustainable energy services industry, and lead by example, thus both demonstrating the potential and providing valuable information on appropriate design and implementation of energy efficiency programs in the wider community. (sub. 24, p. 10)

Origin Energy stated:

> The government, as a significant user of energy and participant in the market for energy efficiency services, is well placed to affect cost-effective energy efficiency improvements simply by adopting them internally. Additionally, government tenders could emphasise energy efficiency as a way of motivating higher standards more generally. This would directly improve energy efficiency outcomes in the public sector and serve as a demonstration vehicle (reducing the risk) for the private sector. (sub. 25, p. 15)

Most governments combine a number of measures in a strategy or program, as has been done in the Queensland Government's *Government Energy Management Strategy* and the New South Wales Government's *Energy Smart Government* program. This section assesses the individual policy instruments (such as targets, procurement policies and information provision) that make up these programs. In doing so, impacts on the cost effectiveness of government operations and possible benefits to the wider community through demonstration and other means are considered. Other government policies which are not focused on energy efficiency but which may impact on it are also addressed.

Targets and performance indicators

The Australian Government and most State and Territory Governments have set targets to reduce energy consumption in government buildings. These targets vary with respect to:

- the percentage reduction in energy use required and the time period for its achievement (for example, one New South Wales Government target is a 25 per cent reduction of the 1995-96 level by 2005-06 (NSW DEUS 2004b) and the Western Australian Government target is for a 12 per cent reduction from the 2001-02 level by 2006-07);
- whether they are expressed in terms of energy intensity, energy use or energy cost (for example, the Australian Government targets relate to energy intensity levels; New South Wales, Western Australian and South Australian Government targets are for reductions in the quantity of energy used; and the Queensland Government target is for a reduction in energy cost); and
- whether penalties are imposed on government agencies that do not meet their targets (for example, the Western Australian Government's policy refers to penalties, while the New South Wales Government's policy does not).

The targets for individual agencies are often expressed in the same terms as the overall targets. For example, the Western Australian Government target of a 12 per cent reduction in stationary energy consumption applies to each participating agency. In New South Wales, however, each agency sets its own target, which must be aligned with the overall target. Some agencies have set energy-intensity rather than energy-use targets. The New South Wales Department of Education and Training, for example, has a target level for energy use per student per annum in schools (NSW Department of Education and Training 2004).

Progress toward meeting targets is mixed, as indicated below.

The Australian Government Department of the Environment and Heritage stated:

> … the Australian Government has reported, since 1997-98, falls in energy consumption of 15.4 per cent, reduction of greenhouse gas emissions by 12.7 per cent and an estimated fall in annual energy costs of $30 million. (sub. 30, p. 19)

In aggregate, the Australian Government has achieved some of its energy-intensity targets. For example, the target for energy use for tenant operations in office buildings was 10 000 megajoules per person per year by 2002-03 and the actual average use in that year was 8980 megajoules per person. The Department of Defence has not met its target for defence establishments (AGO 2003d).

Building energy use from New South Wales Government buildings is estimated to have fallen by 2.3 per cent between 1995-96 and 2001-02 (Passey, MacGill and Watt 2004). The target was for a 15 per cent reduction over this period.

In relation to its energy management strategy, the Queensland Government reported:

> This Queensland Government initiative is aiming to achieve annual savings of $20 million by June 2008. The first target of $2 million is to be achieved by 30 June 2005. Early indications are that initiatives are already well in hand to achieve reportable savings in excess of the first target in June 2005. (sub. 38, p. 12)

The Western Australian Government target is for a 12 per cent reduction from the 2001-02 level by 2006-07, with a milestone of a 6 per cent reduction by 2003-04. This milestone was not met at the aggregate level as the average reduction to 2003-04 was 3.3 per cent.

As indicated, government agencies may have energy-use or energy-intensity targets. While neither of these relate directly to cost-effective energy efficiency, intensity targets have the following advantages:

- they make allowance for changes in agency work load; and
- they can be set in a way that does not penalise agencies that are relatively energy efficient at the commencement of the assessment period (ie. a target level, rather than a percentage reduction, in energy intensity).

Targets can increase the incentives to implement energy efficiency improvements, particularly where there are penalties for failing to meet them. They are, however, not directly focused on the objective of increasing cost-effective energy efficiency. Achieving a partial performance target, such as one for energy use, may result in the deterioration of the overall efficiency and effectiveness of government services. This may result from managers placing an undue emphasis on an input that accounts for as little as 1 to 2 per cent of expenditure. For example, deciding against installing electronic-mail-sorting equipment may assist in meeting an energy target, but a large increase in output, or a large saving on labour costs, may be forgone.

Performance indicators are preferable to targets because they provide less incentive to adopt measures which are not cost effective, but still assist in providing incentives for improved energy efficiency. Reporting on energy intensity as a performance indicator allows for comparisons within and between agencies that can be used to identify opportunities for improvement. An example of this was provided by the Western Australian Government:

> … early results from an energy efficiency program targeting government agencies have been positive. These suggest that there is considerable scope for improvement in some agencies indicated by a wide difference in energy intensity from the highest to the lowest case. (sub. 58, p. 5)

In making such comparisons, care needs to be taken to distinguish between differences due to energy efficiency performance and those due to differences in functions and operating environment.

DRAFT FINDING 10.1

The use of energy targets for government operations could result in a deterioration of the overall effectiveness and efficiency of government services. Using energy-intensity performance indicators instead of targets can reduce this risk and help identify opportunities for cost-effective improvements in energy efficiency.

Procurement policies and guidelines

Jurisdictions have a range of procurement policies and guidelines that relate to the energy efficiency of appliances, equipment, motor vehicles and buildings. Examples include the following:

- the New South Wales Government's procurement and purchasing guidelines, which aim to ensure that agencies achieve the objectives of the Government Energy Management Policy (NSW Department of Public Works and Services 1998);

- the ACT Government's Environmentally Sustainable Procurement Guideline, which relates to environmental performance in areas such as waste, water and energy;
- the requirement that Australian Government departments and agencies purchase office equipment that complies with the US EPA Energy Star standard, where it is available and fit for purpose (DISR 2000);
- the Australian Government's Environmental Strategy for the Motor Vehicle Industry, which includes a target to increase the proportion of the Government's general pool vehicles with scores in the top half of the Green Vehicle Guide from 18 to 28 per cent by December 2005; and
- the Western Australian Government's Office Accommodation Policy, which incorporates minimum environmental criteria, including energy efficiency, for all buildings and tenancies occupied by government agencies (sub. 58).

Some inquiry participants support strengthening government procurement policies. The ACF stated that 'There is … a clear role for governments in pushing the frontier of efficiency in equipment through procurement strategies, and R&D and demonstration support' (sub. 24, p. 8). With respect to passenger vehicles, Sara Gipton commented that '… by its own procurement practices and actions it [the Australian Government] can lead industry and consumers alike in adopting more fuel efficient practices' (sub. 34, p. 11).

Procurement policies can address energy efficiency with one or more of the following objectives:

- promoting cost-effective energy efficiencies within government operations;
- demonstrating good practice, in order to bring about a greater uptake of energy efficiency opportunities by others;
- changing market conditions in a way that results in a greater uptake of energy efficiency opportunities by others; and
- achieving environmental objectives, such as a reduction in greenhouse gas emissions.

Making cost-effective energy efficiency an objective of procurement policies can increase the likelihood that decision makers consider factors such as the relative importance of initial costs and operating costs. This can help to address some of the organisational barriers to energy efficiency technologies discussed in chapter 5. Provided there is flexibility to select less energy-efficient alternatives when this is necessary to obtain other desirable features, such policies could improve energy efficiency, provide environmental benefits associated with reduced energy use and contribute marginally to the overall efficiency and effectiveness of government operations.

Procurement policies that seek to demonstrate good practice are only effective if they result in a greater uptake of energy efficiency opportunities by firms and the wider community. For this to occur it is important that the energy efficiency measures advocated are genuinely cost effective. Measures that are not cost effective are likely to be ignored (and if not, will lead to net costs for those that implement them). In addition, consideration needs to be given to whether governments are necessarily in the best position to demonstrate good practice. A small manufacturing firm that achieves high energy efficiency would have a more powerful demonstration effect on other small manufacturers, than would a government department. In this respect there may be a role for energy efficiency awards and other mechanisms to publicise good practice in energy efficiency.

Procurement policies may go beyond cost-effectiveness criteria in order to change market conditions to the benefit of firms and the wider community. Some inquiry participants supported the view that governments could change markets in this way. For example, Origin Energy argued:

> Demand for energy efficiency services from the public sector (including skills and other inputs) provides a base of support for further development of the energy efficiency sector. In particular, large volume purchases (orders) from governments can assist emerging manufacturers in acquiring economies of scale and lower costs. (sub. 25, pp. 15–16)

However, Australia has little ability to influence global technological development, and Australian Governments, through their purchasing power, have even less influence. Accordingly, the Commission sees only limited potential for procurement policies to lower the costs of energy-efficient appliances, equipment and buildings. The potential that exists is likely to relate to importers and distributors achieving critical volumes.

The market for energy efficiency services is somewhat different in that it relies more heavily on local skills and industry capability. There is some potential for procurement policies to influence the development of this industry, leading to new and more cost-effective services being available to private businesses and the wider community. If development of the industry is a byproduct of government purchase of cost-effective energy efficiency services, then this can produce gains for all. However, it is the Commission's view that governments should not seek to promote development of any specific industry, through purchases of services that are not cost effective. If governments determine that an industry requires assistance, for explicit reasons, then more direct policy alternatives are available.

To achieve environmental objectives, procurement policies may mandate or encourage energy efficiency standards which are not cost effective for government operations. This may be socially beneficial if the resulting environmental benefits exceed the costs imposed on government operations. While a full assessment of this approach to procurement policy is beyond the scope of this inquiry, it is clear that measures which impose high costs relative to environmental benefits should be avoided. Minimum energy efficiency criteria for buildings occupied by government agencies may fit into this category, particularly where high stringencies are applied. There is a range of costs to government agencies associated with this measure, including:

- costs of locating in a building that, while more energy efficient, is otherwise less suitable than alternative buildings;
- relocation costs, where a move is required to meet the criteria; and
- higher construction or lease costs.

DRAFT FINDING 10.2

Addressing cost-effective energy efficiency in procurement policies, provided there is sufficient flexibility, could lead to environmental benefits and a small increase in the overall efficiency and effectiveness of government operations. There may be some additional benefits through demonstration effects and market development, but these are unlikely to justify procurement decisions which are not cost effective for government operations.

Information provision

The provision of information on energy efficiency to government agencies forms part of some government programs. For example, energy awareness material is provided as part of the Northern Territory Government's Energy Management Services program, and awareness and training form part of the Western Australian Government's Energy Smart Government program. Energy ministers have also agreed to develop a database of low standby power and high efficiency appliances for government use (MCE 2004c).

The Commission supports governments disseminating information on energy efficiency to their own agencies, including:

- awareness raising regarding the potential to improve cost-effective energy efficiency;
- information to assist agencies to make effective use of external energy efficiency expertise; and

- examples of good energy efficiency practice.

This is analogous to large companies supplying information to their constituent parts. To the extent that it is cost effective, governments should be doing this as part of normal operations.

Currently, most government agencies are also required to provide information on their energy use to allow for monitoring of targets and performance indicators, and/or for inclusion in annual reports. As part of the NFEE Stage One measures, it is intended that nationally-consistent standards for reporting on government energy efficiency programs will be developed and this may alter these information requirements. While governments need to be able to evaluate their programs, there are costs associated with providing and analysing data and this should be taken into account when decided on what, if any, energy-use information is required.

Access to capital

Access to capital has been cited as a barrier to government agencies improving their energy efficiency (EEWG 2004). There are various reasons why this might be the case. As described in chapter 5, different managers being responsible for capital and operating budgets can limit the uptake of energy efficiency improvements, if there is a lack of cooperation. Other organisational issues, such as a poor understanding of energy efficiency investments by those responsible for allocating capital, can also hinder uptake. It is also possible that what is perceived as a barrier may, in some cases, be rational decision making.

One way for governments to address this potential barrier is to allocate part of their capital budget specifically for energy efficiency projects, as has been done by the following State Governments.

- The Western Australian Government makes capital advances available to agencies to invest in energy-saving capital projects. The funding is in the form of an interest-free advance, with repayments based on the estimated annual cost savings from the project (SEDO nd).
- The New South Wales Treasury has, since 1998, provided $20 million annually to government agencies to finance energy efficiency capital upgrades (sub. 50).

Governments determine their overall capital works programs according to various considerations including: the absolute merits of proposed projects; the relative merits of projects across sectors and policy areas, including energy efficiency; potential crowding out of the private sector in the capital market; and overall fiscal policy. Within this framework, it is desirable that agencies be able to access capital for any investments, including for energy efficiency, that can be demonstrated to be cost effective and are consistent with overall fiscal policy. This can be facilitated either through normal capital-approval processes or specific arrangements for energy efficiency investments. In principle, the Commission is not persuaded of the justification or merits of having special hypothecated funds within governments for special 'worthy' purposes outside of normal capital budget allocation processes.

Other policies with energy efficiency impacts

Many governments require the purchase of Australian-made vehicles for a significant part of their fleets. As the Australian industry predominantly produces medium to large vehicles these restrictions will tend to increase fuel consumption of the government fleet. Governments face tradeoffs in terms of the desired attributes of the vehicles they purchase — energy efficiency is one consideration, but others include safety, size, reliability, comfort and local manufacture. Purchasing practices must attempt to balance all of these attributes to achieve the most appropriate vehicle for each task and context.

11 Coordinating government programs

Key points

- Many inquiry participants felt that the coordination of energy efficiency policies needs to be improved, often with the aim of reducing compliance costs for businesses that operate nationally.
- Levels of coordination across jurisdictions range from strict uniformity at one end, to consistency between similar programs at the other. The benefits and costs of different levels of coordination need to be compared on a case-by-case basis.
- National uniformity has been achieved in the regulation of energy labelling and minimum energy performance standards for electrical appliances. A lack of uniformity would be likely to increase business costs and inconvenience consumers.
- Despite efforts to achieve minimum energy efficiency standards for new houses that are nationally uniform, there are some state and territory based variations. These increase business costs and the case for continuing with them appears weak. Also, some local governments effectively override these standards. Ways to reduce the scope for this to occur should be examined.
- For a range of other energy efficiency measures (such as information provision) national uniformity would not necessarily be beneficial. However, the inclusion of common elements (such as measurement systems) is desirable. Consistency with other policies is always appropriate.
- There is scope to improve the coordination of energy efficiency policies with other greenhouse gas abatement policies and economic efficiency objectives.
- The Ministerial Council on Energy has made some progress in improving the coordination of energy efficiency programs. Elements of the National Framework for Energy Efficiency (NFEE) Stage One could result in further improvement. However, in the development of the NFEE there has been insufficient:
  - articulation of the objectives of government intervention
  - identification of the types of coordination required
  - evaluation of past policies and programs.
- Implementation of NFEE Stage One measures should be deferred until independent evaluations of existing energy efficiency programs have been undertaken.

There are over one hundred Australian, State and Territory Government programs directed, at least in part, at improving energy efficiency (appendix B). Energy efficiency is also affected by many government activities that do not have an explicit energy efficiency focus (such as urban planning and public transport policies). Programs aimed at improving energy efficiency can in turn affect other government policies, such as those aimed at stimulating economic growth. The interaction of all of these government initiatives raises a range of coordination issues.

The terms of reference direct the Commission to consider the level of coordination between Australian, State and Territory Government energy efficiency programs. This chapter examines:

- coordination of energy efficiency policies and programs;
- coordination between energy efficiency policies and other policies; and
- institutional frameworks for achieving coordination and the role of the National Framework for Energy Efficiency (NFEE).

Chapter 4 provides detailed background on the existing institutional arrangements for coordinating government policies in regard to increasing energy efficiency.

11.1 Coordination of energy efficiency policies

Participants’ views

A common theme expressed by many inquiry participants is that the coordination of government energy efficiency policies — both within and between jurisdictions — needs to be improved (box 11.1).

Box 11.1 **Selected inquiry participants' views on policy coordination**

Origin Energy:

> Poor coordination between current jurisdictional energy efficiency policies and related programs reduces the potential for cost-effective energy efficiency improvement across the economy. (sub. 25, p. 9)

Building Products Innovation Council:

> … there are a number of different approaches to energy efficiency in Australia and the eastern states are certainly leading the way. Unfortunately they are each leading their own way and we have a need to understand and implement different energy solutions for the same building requirement, varying based on the state in which it is constructed. (sub. 44, p. 3)

Western Australian Government:

> A lack of government coordination has meant that organisations operating across jurisdictions often face different regulations, reporting requirements and formats in relation to energy programs. (sub. 58, p. 8)

Sustainable Projects:

> There are over four energy rating programs around Australia, each of which costs over $3000 to buy and train one person, not counting the additional costs of buying updates and training. So if your business operates in Qld, NSW and other states (as mine does) I may have to buy over four programs to do the same job to comply with different state rules and prejudices (NatHERS, BERS, FirstRate). (sub. 3, p. 8)

GridX:

> GridX has found it difficult to access and comply with the regulatory landscape which is different in each state. It is an extremely costly process to obtain approval and licences for our projects within the various states of Australia and it would be better to have one framework. (sub. 5, p. 1)

Plastics and Chemicals Industries Association:

> Policies and programmes remain unfocused and uncoordinated, even to the extent that there is no consistent method to measure greenhouse gas emissions, or the implications for this of energy efficiency or energy consumption. (sub. 49, pp. 5–6)

Moreland Energy Foundation Limited (MEFL):

> One feedback MEFL receives from schools is their confusion at the number of different approaches and initiatives underway which relate to sustainability. While innovation is good and different approaches are needed for different situations, it would be much easier for schools if all the sustainability initiatives came under one Government umbrella, linked to a State level strategy and policy. (sub. 18, p. 22)

Several inquiry participants supported national coordination as a means of overcoming current deficiencies. The precise form of coordination favoured, however, is sometimes unclear, given the use of different, undefined terms (such as coordination, harmonisation, consistency and uniformity). Some examples of support for a national approach, however expressed, are included below.

> [The Australian Gas Association] believes that national consistency is required in any energy efficiency framework for it to be workable for industry and at least cost to the community. (sub. 2, p. 2)

> Friends of the Earth … recommend … tough MEPS [minimum energy performance standards] and building standards in a timely manner, coordinated nationally as imperative measures in energy efficiency (sub. 20, p. 15)

> The Australian Aluminium Council supports the coordination of energy efficiency programs at the national level. While recognising the need for variations to accommodate differing climatic conditions across Australia and hence the need to be flexible around any notion of national uniformity in some areas, such as building standards, national coordination can have benefits, such as economies of scale in the development of programs and reduced costs of compliance for national businesses. (sub. 29, p. 11)

> From the Building Products Innovation Council perspective a nationally coordinated approach is essential to ensure the most efficient operation of the materials suppliers. (sub. 44, p. 5)

> The Australian Industry Greenhouse Network is utterly convinced that national coordination and national uniformity of these [energy efficiency] programs … is an imperative for the efficient governance of the economy. (sub. 57, p. 7)

The Australasian Energy Performance Contracting Association (and the Australian Business Council for Sustainable Energy) had a different view, arguing that attempts to achieve national coordination can result in delays or failure:

> While coordination of energy efficiency policy and programs potentially reduces the costs and time spent in delivery and enhances compliance, the reality is often far from this. … history shows very long delays or complete failures in the delivery of such energy efficiency programs when attempts have been made to coordinate programs nationally. (sub. 47, p. 17)

In summary, coordination is often perceived as being inadequate where there are different regulations in each jurisdiction, resulting in increased compliance costs. This mainly affects businesses which operate nationally. Other problems that can result from poor coordination are a lack of program effectiveness and confusion for those targeted by information programs. National coordination is supported by many inquiry participants as a means of overcoming these problems. The main arguments presented against national coordination are that it can take too long and there may be failure to agree on a common approach.

Many of the concerns raised have the potential to be addressed through the Ministerial Council on Energy's (MCE's) NFEE. The role of the NFEE is considered in section 11.3.

General principles of coordination

Greater coordination at the national level can reduce duplication of effort, improve program effectiveness and reduce costs to firms and the wider community. It is not always the case, however, that more coordination is better.

Decentralised government action can generate the following benefits:

- Development of more effective policies — different approaches in different jurisdictions can allow for greater innovation and opportunities for learning from the experiences of others.
- Reduced information asymmetries — it may be easier for local agencies to obtain accurate information about the firms and communities who are to be regulated or provided with programs.
- Closer matching with community needs — regional variations in community needs may justify differences in government objectives and policies.

Of relevance to these benefits is the principle of subsidiarity, which recognises that decisions whose impact is restricted to a local area should be made at the local level. The European Community make use of this principle to require that actions be left to member states unless 'by reason of the scale or effects of the proposed action, [it] be better achieved by the Community' (van den Bergh 1996). A recent Productivity Commission draft report into National Competition Policy (NCP) applied the principle of subsidiarity to the coordination of ongoing reform, arguing:

> For some areas … reform will best be pursued on a jurisdictional basis. This would be the case, for example where an activity is not of national significance and where the impacts of policy decisions taken by individual jurisdictions are largely confined within those jurisdictions. (PC 2004a, p. 261)

On the other hand, some policy problems transcend regional boundaries and may require a more coordinated approach that involves a higher level of government or a combination of jurisdictions (local, state, national, international). The three broad approaches to coordination are:

- uniformity — the same across all jurisdictions;
- harmonisation — agreement on common elements, such as definitions, measurement systems and rating systems; and
- consistency — not contradicting broader policy settings.

Each approach has its own strengths and limitations and these determine the circumstances in which they are likely to be appropriate (box 11.2). The following section considers these strengths and limitations in assessing the desirable approach to coordination for individual energy efficiency policy measures.

Box 11.2 **Approaches to coordination**

Uniformity

Uniformity can have the following benefits:

- Scale economies for government — costs of policy development and implementation may be lower when undertaken centrally or collectively.
- Scale economies for firms — costs may be lower because one product or service can be supplied across Australia, rather than having variations to meet local regulatory requirements.
- Reduced transaction costs — firms' costs may be lower where there is no requirement to provide different information, or follow different administrative procedures, when operating in different jurisdictions.
- Enhanced competition — uniform regulation may encourage Australian firms to expand their operations across jurisdictions and encourage international manufacturers to supply the Australian market.
- More effective treatment of externalities — where government action is required to address externalities (such as greenhouse gas emissions), it may be more effective when taken at a level that can 'internalise' the effects of the externality.

Uniformity has benefits where governments impose mandatory standards, where different standards in different areas (for example, in different industry sectors or across jurisdictions) could increase costs and have anticompetitive effects. Different mandatory standards for substitutable goods (for example, cars and four wheel drive vehicles) could distort consumer choices. Different standards in different jurisdictions will affect national companies and cross-border trading.

Uniformity is also important where governments establish regulatory schemes where trading is possible, such as emissions trading schemes. The larger the potential trading pool, the greater the potential gains from trading. Schemes that allow inter-jurisdictional trading (between States and, potentially, internationally) create scope for achieving given outcomes at least cost.

Where the Australian Government does not have responsibility, national uniformity requires the agreement of all States and Territories. Such agreement can be brought into effect by enacting model or template legislation across all jurisdictions.

(Continued on next page)

Box 11.2 **(Continued)**

Harmonisation

Harmonisation can be used to achieve the minimum effective resolution of coordination issues in circumstances in which uniformity is not appropriate. For some policies, uniformity may not be necessary, or even desirable. For example, it might be beneficial to tailor educational and awareness programs to specific circumstances. Similarly, different approaches to incentive programs (such as energy audits and subsidies on energy-efficient products) are not likely to significantly affect competition, and might enable best practice approaches to evolve. Even in these circumstances, however, having uniformity in the definition and measurement of energy efficiency improvements can allow the effectiveness and efficiency of different programs to be compared, and can facilitate the assessment of each program's contribution to national or international objectives.

Consistency

Consistency of government policies within a jurisdiction is highly desirable. Policy makers should place a specific objective in a broader context, otherwise there is a risk that the pursuit of the specific objective will come at the expense of other, perhaps more important, objectives.

Government energy efficiency policies need to be consistent with broader government objectives of economic efficiency, equity and community wellbeing. Energy efficiency policies should also be consistent with related policies, including those addressing climate change.

Governments employ several mechanisms to promote consistency in their programs, including Cabinet, central agencies (including Premier's Departments and Treasuries) and rules and procedures for policy decision making. Governments have established policy development and evaluation mechanisms, such as regulation impact statement guidelines and environmental impact assessment guidelines, to assess the effect of specified activities on priority areas of government interest.

Consistency of policies and programs across jurisdictions is, however, often the only level of coordination that is able to be achieved, even where greater uniformity would be desirable.

Appliance labelling and standards

Schemes for energy labelling and minimum energy performance standards (MEPS) for electrical appliances are developed and coordinated by the MCE and its committees — the Energy Efficiency Working Group (EEWG) and the National Appliance and Equipment Energy Efficiency Committee (NAEEEC). Further information on the these bodies and the schemes themselves are provided in chapters 4 and 7 respectively.

Regulations for these schemes are included in State and Territory Government legislation and are administered by State and Territory regulatory agencies. The legislation, however, is based on a nationally endorsed 'model regulation' and is intended to be administered in a uniform manner. The aim is to achieve '… consistent outcomes for all affected products irrespective of the product or jurisdictional location' (NAEEEC 2004b).

Historically, the Australian Gas Association (AGA) has had responsibility for managing energy labelling and MEPS for gas appliances (SEAV 2003). The NFEE Stage One measures include a commitment to broaden the scope of the National Appliance and Equipment Energy Efficiency Program to include MEPS and labelling for gas products. The AGA has argued:

> The objectives for a NFEE scheme covering gas appliances and equipment should be the establishment of a national energy efficiency scheme involving MEPS and energy labelling. If the scheme is to be mandated through legislation … then this would best be implemented through a nationally consistent legislative scheme, using commonly agreed national standards or codes and methods of test. … The legislative requirement could most easily be enshrined in individual State legislation by agreement of State Energy ministers through the Ministerial Council on Energy. (sub. 2, p. 2)

The coordination of energy labelling and MEPS for electrical appliances is designed to achieve uniform outcomes across jurisdictions. If these schemes are to continue, it is appropriate that they be coordinated in this way, given that a lack of uniformity would be likely to increase business costs, for what are internationally traded goods. In the case of labelling, such uniformity also assists consumers who purchase appliances in different jurisdictions.

DRAFT FINDING 11.1

National uniformity has been achieved in the regulation of energy labelling and minimum energy performance standards (MEPS) for electrical appliances and this is appropriate. If a revised scheme for energy labelling and MEPS for gas appliances is to be introduced, a similar approach to coordination would be desirable.

Minimum energy efficiency standards for new buildings

The Building Code of Australia (the Building Code) is intended to form the basis of building regulation across Australia. The Building Code was amended in 2003 to include standards to ensure a minimum level of energy efficiency in new houses and additions to existing houses.[1] Most jurisdictions have adopted these standards in full but some have not. The exceptions are Victoria — where state-based standards take precedence over some of the energy efficiency requirements in the Building Code — and New South Wales and the ACT — which have adopted their own energy efficiency standards for residential buildings (appendix C). In addition, some local governments, through the planning approval process, have imposed building requirements related to energy efficiency that are beyond the scope of the Building Code (PC 2004b).

Energy efficiency standards for multiple-occupancy buildings and commercial buildings are scheduled to be introduced in 2005 and 2006, respectively. While coordination of these standards is not considered here, many of the same issues apply.

Research report into the reform of building regulation

In 2004, the Australian Government requested the Productivity Commission to examine reform of building regulation. In its report, released in November 2004, the Commission found that:

- some progress had been made in reducing differences in mandatory technical requirements across jurisdictions;
- further reductions in variations across jurisdictions should be pursued;
- ways to reduce the erosion of a national approach to building regulation caused by actions of local governments should be examined; and
- a new intergovernmental agreement should be negotiated to, amongst other things, strengthen the commitment to national consistency.

The Commission noted that business and industry were frustrated by the multiple regulatory environments of the States and Territories, which limit interstate and international trade, and result in lower growth (PC 2004b). The research report concluded:

> Any variations to the BCA [the Building Code] need to be justified. Sometimes, differences are intrinsic to a locality and require particular, tailor-made regulations. Sometimes, they reflect the aspirations of the inhabitants of a community. In almost all cases, where a particular jurisdiction wants to set a different standard from the national one, the case for the variation should be put under scrutiny. Important questions to ask include what is the difference worth and how much would it cost to maintain it (for

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[1] The desirability of including minimum energy efficiency standards in building regulations is discussed in chapter 7 and further information on the Building Code and its administration is included in appendix C.

example, in terms of greater costs of compliance and decreased competition)? (PC 2004b, p. 38)

Arguments for and against uniformity of minimum energy efficiency standards

State and local governments may see a benefit in departing from uniform standards because their constituents have views on energy efficiency that differ from those that underpin the national standards. Where governments propose standards that are higher than those in the national code, however, the importance of this reason is weakened. This is because home owners who are strongly in favour of energy efficiency are free to go beyond the minimum standards required for their own homes. Variation in climate has been suggested as another possible reason for variations in standards. However, as the Building Code currently has energy efficiency standards that vary by climatic zone, there is no necessity for jurisdiction-based variations on these grounds.

A benefit of uniform standards is the reduction of costs to the building and building-products industries. While many builders operate solely within one state, there is sufficient cross-border activity for variations in standards to increase costs. Several inquiry participants have provided information of the effects of variations in standards on their businesses (box 11.1). As stated by the Australian Glass and Glazing Association:

> It is very inefficient, difficult and costly, for a manufacturing industry to deal with fundamentally different state based approaches to energy efficiency, or any other regulation. (sub. 16, p. 3)

The case for state and territory based variations in energy efficiency standards for new houses appears to be weak. The benefits of national uniformity (for each climate zone), however, can not be considered in isolation from what those standards are. Common adoption of the most stringent standards could result in the benefits of uniformity being outweighed by a reduction in the cost effectiveness of the regulations in those states whose stringency must increase to comply with uniformity.[2] An analysis of the cost effectiveness of minimum energy efficiency standards for new houses, including the influence of stringencies, is included in chapter 7.

[2] A discussed in chapter 7, recent efforts to achieve national uniformity, while being only partially successful, involved this sort of ‘ratcheting up’ to the most stringent existing standard.

DRAFT FINDING 11.2

The current state and territory based variations in energy efficiency standards for new houses increase costs for the building and building products industries. The case for such variations appears to be weak.

The case for local government area-based variations in energy efficiency standards is weaker than for state and territory-based ones. This is because the costs are potentially higher due to the degree of regulatory fragmentation. In relation to this issue, the Commission recommended in its final report on building regulation:

> The future work agenda for the Australian Building Codes Board (ABCB) should include an examination of ways to reduce the scope for the inappropriate erosion of national consistency of building regulation by local governments through their planning approval processes. (PC 2004b, p. 184)

A number of avenues for doing this were also given in the report. In the context of the current inquiry, and in respect of energy efficiency regulations, the Commission supports this recommendation.

DRAFT RECOMMENDATION 11.1

The Australian Building Codes Board should examine ways to reduce the scope for local governments to erode the uniformity of minimum energy efficiency standards for new houses.

There are also some more minor coordination issues concerning the administration of the Building Code. These are covered in appendix C.

Other energy efficiency policies

Coordination issues relating to information provision, incentives, government energy management and reporting requirements are considered below. The focus is on whether national uniformity is necessary or desirable. Harmonisation of programs, which includes uniformity of some elements (such as defining and measuring energy efficiency improvements), may be desirable where this allows the effectiveness and efficiency of programs to be compared. Policy consistency is desirable in all cases.

Information provision

There are many programs in which governments provide households and firms with information about energy efficiency. With the exception of appliance labelling (see previous discussion), information programs do not require national coordination. Local programs may more closely match local needs, foster innovation and allow governments to learn from successful programs in other jurisdictions. Uniform programs would not result in scale economies for business or enhance competition. There may be some scale economies for government in developing information programs that are implemented nationally. Provided governments are able to learn from one another, however, duplication of effort is unlikely to be a significant disadvantage of local programs.

Incentives

The benefits of uniformity do not apply in any significant way to programs that provide financial and other incentives for the uptake of energy efficiency opportunities. By contrast, a benefit of allowing regional variation is that programs can respond to particular local circumstances. For example, the Remote Area Energy Efficiency Rebates Scheme provides rebates on compact fluorescent lamps and insulation to households and businesses in off-grid communities in regional and remote South Australia. One objective of this scheme is to reduce government expenditure on electricity subsidies that are provided to these communities. While the Commission has not evaluated the program itself, clearly this objective is not relevant to other areas, where these subsidies are not paid.

Government energy management

Managing energy use is an operational issue for each government. It would not be appropriate, therefore, to have a uniform approach to government energy management programs. It would be beneficial, however, to be able to compare the effectiveness of these programs and so a uniform approach to matters such as measurement of energy use would be a significant advantage. The NFEE Stage One measure to develop nationally consistent standards for measuring and reporting on government energy efficiency programs has the potential to improve policy coordination in this regard.

Reporting requirements

Firms are required to provide information on their energy use and greenhouse gas emissions to a range of Australian and State and Territory Government agencies. The Australian Government is looking to streamline the provision of this information, using the Greenhouse Challenge program as a single point of entry (Australian Government 2004). This initiative, which is directed at improving administrative coordination, appears to be worthwhile provided that the information collected serves a valuable purpose.

11.2 Coordination with other policies

There is some evidence of a lack of consistency between energy efficiency policies and other government policies. As noted in chapter 2, energy efficiency is rarely a policy objective in its own right. Community wellbeing is enhanced through economic efficiency, including the efficient use of natural resources and the environment's assimilative capacities. In some circumstances, policies designed to improve energy efficiency may well be the appropriate response (for example, if greater energy efficiency proves to be a relatively low-cost way of reducing greenhouse gas emissions). Even in these circumstances, however, energy efficiency is best regarded as a means to an end, not an end in itself.

Energy efficiency policies do not operate in isolation. They affect, and are affected by, a variety of other policies. This section distinguishes four situations which lead to different coordination issues, as follows:

- The consistency of energy efficiency policies with other policies for greenhouse gas abatement.
- The integration of energy efficiency into other energy-related policies.
- The consistency of energy (including energy efficiency policies) with economic efficiency policies and objectives.
- The pursuit of policies that do not have an explicit energy focus (such as urban planning policies) which nevertheless affect energy efficiency.

Greenhouse gas abatement policies

This is not an inquiry into Australia's response to climate change (see terms of reference and chapter 1). However, the Commission recognises that many energy efficiency policies are embedded within broader policies designed to reduce greenhouse gas emissions by reducing the overall demand for energy.

As noted in chapter 2, an important policy principle is the alignment of policy objectives and policy instruments. This inquiry is focused primarily on the policy objective of addressing barriers and impediments to the adoption of energy efficiency improvements which are cost effective for individual producers and consumers.

The main objective of climate change policies is to reduce emissions of greenhouse gases, including those that result from the production and consumption of energy from fossil fuels. Energy efficiency policies are consistent with these policies when they result in energy efficiency improvements that are cost effective, after allowing for the costs of implementing them (including the cost of government programs). More marginal energy efficiency improvements may still be consistent with greenhouse policies if they result in a reduction in emissions with no net financial gain, or even a small loss. Inconsistency arises where energy efficiency measures are pursued in favour of other abatement options that have a lower cost (per unit of carbon dioxide equivalent gases abated). The Commission is concerned that energy efficiency measures that are justified on the basis of case study estimates may not actually be cost effective, due to the uncertainty of the assumptions used (chapter 6). This concern is compounded by a lack of rigorous evaluation of current programs.

The Commission's discussion draft for its Review of National Competition Policy concluded:

> COAG should immediately play a greater role in relation to greenhouse gas abatement policies. Notwithstanding current coordination arrangements in this area, divergent approaches by governments to dealing with greenhouse gas emissions, and uncertainty about future policy directions are impeding necessary investment in many parts of the economy. Early action to address regulatory fragmentation and promote greater policy certainty is therefore very important. (PC 2004a, pp. 278–9)

There are some lower order coordination issues between energy efficiency policy and greenhouse gas abatement policy that concern the relative emphasis given to the economic and environmental benefits of increasing energy efficiency. Appliance labelling is an example, where there is a choice between providing information on end point energy use, greenhouse gas emissions, or both. For appliances that have both gas and electric models available, this choice potentially makes a significant difference to rankings. Resolution of these issues relies on coordination between policy makers involved in both policy areas.

Energy policies

The Australian Government's 2004 White Paper, *Securing Australia's Energy Future* announced its commitment to 'energy prosperity, security and sustainability'. The White Paper states:

> Improving Australia's energy efficiency performance is a key part of the government's plans to deliver prosperity and sustainability from energy. Increasing the uptake of commercially attractive energy efficiency opportunities would deliver substantial economic and environmental benefits. (Australian Government 2004, p. 17)

Energy efficiency is only one aspect of an integrated energy policy. As noted by the International Energy Agency:

> Energy policy must achieve a balance between energy security, economic growth and environmental protection. (IEA 2004c, p. 1)

The price of energy is a key factor that influences the balance between environmental protection and economic growth. High prices encourage greater energy conservation and energy efficiency, which may have environmental benefits. High energy prices, however, tend to reduce economic growth. It would appear that developers of energy efficiency policy in Australia have generally been cognisant of this balance, and have sought to avoid measures which increase domestic energy prices.[3] However a more comprehensive view of government objectives relating to economic efficiency and economic growth would appreciate how energy efficiency policies may decrease economic efficiency through means such as restricting the choices available to households and firms.[4]

Economic efficiency policies and objectives

Whether policies to improve energy efficiency are consistent with government policies and objectives to improve economic efficiency depends on the extent to which they result in increased use of other inputs (such as labour and capital), and the cost of government programs. Energy efficiency improvements which are privately cost effective are generally consistent with economic efficiency objectives.

In this report there are examples of where the Commission considers that energy efficiency programs are likely to be inconsistent with economic efficiency objectives.

Urban planning and other policies

Many government policies outside the energy field nevertheless affect energy efficiency. Urban planning policies can affect the energy efficiency of residential and commercial developments. Policies affecting traffic congestion or public transport can affect the observed average energy efficiency of transport (energy efficiency in transport is considered in detail in chapter 9). In most cases, energy efficiency is not the driving force or main objective behind the policy, although the

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3 One of the major consequences of microeconomic reform in the 1990s was a fall in real prices of energy, especially electricity and gas.

4 A wider ranging and more detailed discussion of energy pricing issues is included in chapter 13.

benefits of improved energy efficiency would be an input into any benefit–cost analysis of the policy.

Governments already employ mechanisms to encourage good regulatory practice. All Australian jurisdictions — with the exception of Western Australia — use regulatory impact statements (RISs) (PC 2004c) to formalise and document the steps taken in developing good regulation. RIS systems applied in Australia are integrated with — and reinforce — other regulatory quality control systems, including regulatory performance indicators and regulatory plans, and the requirements of National Competition Policy (PC 2004c). These mechanisms can contribute to the coordination of the overall policy platform, including consideration of energy efficiency.

11.3 Institutional framework and the National Framework for Energy Efficiency

The institutional framework for coordinating energy efficiency programs needs to be able to address coordination across jurisdictions, between programs and with other policies. As argued in this chapter, coordination needs to take the form of uniformity, harmonisation or consistency, depending on the circumstance.

The current institutional framework includes the MCE and its committees — the EEWG and NAEEEC. The ABCB also has a role in relation to coordinating building regulations. These national bodies make recommendations and decisions that require agreement by the government in each jurisdiction, before they come into effect. Further information on the institutional framework is included in chapter 4.

The institutional framework for coordinating energy efficiency policy appears to be appropriate for achieving coordination across jurisdictions and between programs. Appliance labelling and MEPS is an example of where the MCE has achieved an appropriate level of coordination. The MCE is also well placed to coordinate energy efficiency policy with other energy policies. There are, however, aspects of coordinating energy efficiency policy with other government objectives, such as those for climate change and economic growth, that are likely to require a broader perspective. The current arrangements allow this to occur as individual Australian, State and Territory Governments make the final decisions, and it is at this level that energy efficiency policy can be considered in the context of broader government objectives. Nonetheless, throughout this report there are various examples of where the Commission's assessment is that energy efficiency programs are likely to be inconsistent with other government objectives — in particular those relating to economic efficiency.

The MCE has overseen the development of the NFEE. In August 2004, Energy Ministers committed to implementing a package of measures as Stage One of the NFEE. The MCE has stated that '[t]he package will assist improved coordination amongst jurisdictions in delivering energy efficiency programs' (MCE 2004c).

Many inquiry participants are supportive of the NFEE and the role that it can play in coordination. For example:

> The Australian Industry Greenhouse Network applauds the agreement within the Ministerial Council on Energy (MCE) to proceed with energy efficiency improvement initiatives on a national basis through the NFEE framework. If the NFEE delivers in coordinating and delivering uniform national programs in this area, it will be a success. (sub. 57, p. 9)

> Moreland Energy Foundation Limited is aware that the MCE has signed off on a package of measures as part of the NFEE. We support the policy package as a significant positive step towards overcoming the barriers to energy efficiency and unlocking the potential benefits. (sub. 18, p. 4)

Some participants were qualified in their support for the NFEE, arguing that there were deficiencies. Origin Energy noted:

> Development of the National Framework on Energy Efficiency (NFEE), although clearly valuable in many respects, has not focussed sufficiently on the underlying rationale for government policy intervention in the area of energy efficiency. A poor understanding and specification of the policy problem being addressed potentially leads to misguided and ineffective policy prescriptions which risk imposing unnecessary costs on the economy and the community more generally. (sub. 25, p. 1)

NFEE Stage One includes some initiatives that may improve coordination. For example, 'developing nationally consistent standards for measuring and reporting on government energy efficiency programs' is potentially beneficial.[5] In other instances, however, there is common agreement to measures that do not meet the criteria for benefiting from national uniformity and which do not appear to have been evaluated. In several cases it is foreshadowed that all States and Territories will adopt measures which currently exist in one or a few jurisdictions. For example, mandatory disclosure of the energy performance of homes at the time of sale or lease is included. At present this measure, which forms part of the ACT House Energy Rating Scheme (ACTHER), is only required in the ACT.

In the Commission's view, the NFEE should articulate the rationale for government intervention and identify the areas with greatest potential for cost-effective

5 In the terminology used in this chapter, this is a 'harmonisation' measure.

interventions. Reference to specific policy measures would then be confined to those instances where national uniformity or harmonisation are warranted. Such a framework could improve national coordination, without being overly prescriptive. It would also assist individual governments to develop energy efficiency programs which deliver the greatest net benefits.

The MCE decision to extend elements of the ACTHER to all other jurisdictions without having established the efficiency and effectiveness of the scheme illustrates another weakness in the NFEE. In general, there appears to have been little *ex post* evaluation of progress by any jurisdiction.

In conducting this inquiry the Commission asked all jurisdictions to supply it with copies of any public evaluations of existing and recent programs that they had undertaken. The jurisdictions provided the Commission with several RIS assessments undertaken before programs commenced, but few evaluations of past programs. In some cases, presumably, internal assessments of programs were undertaken. Formal, independent evaluation of key programs would help establish the knowledge base needed for future policy and program development. These should all be made publicly available. To achieve the widest possible benefits, the evaluations could be overseen by the MCE, or by relevant Auditor-Generals' offices.

DRAFT FINDING 11.3

The National Framework for Energy Efficiency has the potential to improve national coordination and guide the development of energy efficiency programs. At present, however, there is insufficient clarity on the rationale for, and the objectives of, government intervention. There has also been insufficient evaluation of past policies and programs.

DRAFT RECOMMENDATION 11.2

National Framework for Energy Efficiency Stage One proposals (that are not directly affected by other recommendations) should be deferred until independent evaluations of existing energy efficiency programs have been undertaken. The evaluations should determine the effectiveness of these programs in promoting the uptake of cost-effective energy efficiency improvements.

12 National energy efficiency target

Key points

- There are various options for how a national energy efficiency target (NEET) would operate. The Commission's assessment focuses on schemes in which:
  - major energy users or energy retailers would be required to achieve target levels of efficiency-related energy savings; and
  - trading in eligible energy savings would be permitted via the use of certificates (known as white certificates).
- In Europe, there is considerable interest in such schemes as part of climate change policy.
- Modelling for the National Framework for Energy Efficiency suggests that a NEET would have substantial economywide benefits. The Commission's view is that it would not be possible to design a NEET scheme that would have the effects assumed by the modelling.
- A NEET is not supported because it:
  - would not directly address the market failures that cause the energy efficiency gap;
  - would be difficult and costly to verify energy savings;
  - would alter investment patterns and encourage energy efficiency investments that are not cost effective; and
  - is not a well targeted measure to reduce greenhouse gas emissions.

The terms of reference require the Commission to consider a national energy efficiency target (NEET) including, but not limited to, the establishment of an annual requirement for major users of stationary energy to generate, or otherwise acquire, a target level of efficiency-related energy savings. This chapter examines this approach to a NEET, and also canvasses other options that involve placing obligations on energy retailers and allow for trading in efficiency-related energy savings.

12.1 Broad options for introducing a NEET

At its simplest, a NEET could be no more or less than what it implies — an aspirational target. It could, for example, be an objective of energy policy that energy intensity in the economy be lowered by a given amount. A NEET could also be implemented through voluntary partnerships with industry, much as the Greenhouse Challenge program currently does.

More commonly, a NEET is seen as a regulatory approach that would require a specified group to achieve energy savings targets. This group could be all major energy users or — as is the case for the Mandatory Renewable Energy Target (MRET) — energy retailers.

If major energy users were regulated, each would presumably be required to achieve target levels of efficiency-related energy savings on an annual basis. A regulator would set targets relative to a business-as-usual case for each user and annually verify the energy savings claimed. Firms would face a penalty if they failed to meet their target.

If energy retailers were regulated, targets could be set for reductions in energy sales relative to a business-as-usual scenario, to be achieved through efficiency-related energy savings. To avoid penalties, the retailers could devise ways of rewarding their customers for achieving eligible energy savings. This would require negotiations with customers and annual verification of energy savings. The costs to energy retailers of such a scheme could be expected to be passed backwards to energy suppliers through lower wholesale prices and forwards to all energy users via an increase in retail energy prices.

Irrespective of the group regulated, the national target could be the aggregate of the energy savings targets for each firm. Alternatively, the national target could be set first, with targets for individual firms set so as to aggregate to the national level.

Trading could be included in a NEET scheme by allowing regulated firms to purchase the right to claim efficiency-related energy savings made by other firms. A firm could then meet its target by making energy savings itself, or purchasing the rights to savings made by others, or a combination of the two. Trading could allow efficiency-related energy savings made by unregulated firms to count towards the national target, provided they could be verified. Energy efficiency certificates (usually referred to as ‘white certificates’) could be issued for this purpose. A range of options for various aspects of a NEET are summarised in table 12.1.

Table 12.1 **Options for various aspects of a NEET**

Aspect	*Options*
Purpose of targets	Targets could be aspirational, used to measure progress or used to create mandatory obligations.
Scope	The responsibility for meeting targets could be assigned to major energy users, energy retailers or all energy users.
Penalties	Under a mandatory scheme, firms would face a penalty if they failed to meet their targets. No penalties would be imposed where targets are used to express an aspiration or to measure progress.
Trading	A NEET could operate with or without trading in eligible energy savings. Trading could be bilateral (with each trade requiring approval by the regulator) or autonomous (requiring the use of energy efficiency (white) certificates). Trading could be between those entities with responsibility for meeting targets, or could involve other energy users who enter the market as suppliers of credits.
Attribution of costs	Where trading is permitted, the cost of purchasing eligible energy-savings credits would be borne by those entities responsible for meeting targets (who would seek to pass them on to their customers). The cost to government of administering the scheme could be borne by taxpayers or recovered through a levy on energy prices.

12.2 International experience with energy efficiency targets

In Europe, there is considerable interest in schemes that set mandatory energy efficiency targets and involve tradeable white certificates. Some countries have introduced such schemes and others plan to. Research is also being undertaken by the International Energy Agency (IEA). The key policy driver for this is climate change.

IEA research

The IEA is working on market-based policies for accelerating energy efficiency programs. Five member countries (France, Italy, Norway, Sweden and the United Kingdom) are examining:

- whether, and how, a scheme involving the issuing and the trading of white certificates provides an effective means of attaining targets of reduction of primary energy consumption (main concern) and carbon dioxide emissions (secondarily);
- what is the most suitable format for such a scheme;
- what implementation problems are involved, at national and extra-national levels; and

- how it can interact with other schemes (such as renewable energy target schemes (which may involve trading in green certificates) and greenhouse gas emissions emissions trading schemes).

The IEA is considering both ‘principle’ and ‘practical’ issues (box 12.1).

Box 12.1 IEA issues in trading white certificates

Principle (or policy) issues include:

1. specificity and effectiveness of a certificate trading mechanism to promote energy efficiency projects;
2. who the obligation-bound actors should be;
3. who can buy and who can sell;
4. which sectors and which energy efficiency programs should be targeted;
5. how to create demand for white certificate trading;
6. possible cost-recovery mechanisms;
7. competition issues;
8. interactions with other policy tools;
9. interactions with other trading schemes:
   – green versus white certificates; and
   – interaction between green and white certificates, and emissions trading permits; and
10. prospects for an enlarged extra-national market for tradable certificates.

Practical (or operational) issues include:

1. criteria for design and development of projects for energy efficiency in end use;
2. valuation issues;
3. monitoring mechanism and noncompliance regime;
4. trading mechanisms; and
5. rebound effects.

Source: IEA (nd)

Italy

In 2001, targets were set for reducing the consumption of electricity by 18.6 terawatt hours per year and of gas by 15.1 terawatt hours per year against a business-as-usual scenario for the period 2002 to 2006 (Langniss and

Praetorius 2004). The national targets are apportioned to electricity and gas suppliers with more than 100 000 customers.

A green certificates scheme was introduced in Italy in 2003. A white certificates scheme to support energy-savings targets is still being designed. It is envisaged that this scheme will credit energy efficiency measures that reduce consumption of electricity, gas and other fuels, such as heating oil.

United Kingdom

The Energy Efficiency Commitment (EEC) scheme obliges gas and electricity suppliers to save a total of 62 terawatt hours over the three years to 2005 (compared to 2002) (Langniss and Praetorius 2004). This obligation only covers the energy supply to households and there is a requirement that half of the savings come from lower income households.[1] The regulator has defined standard energy efficiency measures that are acceptable for filling obligations. Other measures can be accepted, but require independent verification.

The objectives of the scheme are to:

- reduce greenhouse gas emissions in line with the United Kingdom's Kyoto Protocol obligation;
- help electricity and gas consumers to use less energy, and reduce their fuel costs, or to enjoy greater comfort; and
- to give particular help to lower-income consumers (DEFRA 2001).

Energy suppliers have the option of trading energy savings and obligations. However, each trade needs to be approved by the regulator, and there are no tradable certificates as such. In the first year of the scheme, there was no trading activity (OFGEM 2003).

In addition to enabling trade in efficiency-related energy savings:

> … it is expected that suppliers will have the option of trading excess energy savings onto the national emissions trading scheme as carbon savings. The rules and mechanisms for this shall be devised … when the emission trading policy has been finalised. (OFGEM 2001, p. 24)

[1] Lower income households include approximately one-third of all households.

France

The French Government proposes to introduce a white certificates scheme to help reach their goal of stabilising energy consumption at 2003 levels by 2015. Under the scheme, major suppliers of electricity, gas, fuel oil and motor fuels would be obliged to achieve a level of energy savings based on the amount of energy they supply. These obligations could be achieved through their own operations and/or the purchase of white certificates. In a recent review of French energy policies, the IEA reported that there were some important design and administrative issues which the government was working to resolve, including:

- which suppliers will be given energy-savings obligations;
- the process for setting the levels of energy savings to be required;
- how to set the baseline against which the savings will be measured;
- the treatment of new entrants; and
- the interaction between the white certificates scheme and an emissions trading scheme (IEA 2004d).

The scheme is expected to begin in 2005, with a total energy-savings target of 54.5 terawatt hours over the first three years (IEA 2004d). These savings are equivalent to 2.7 per cent of French total final consumption of energy in 2001 (or 0.9 per cent per year).

European Union

A draft directive of the European Parliament and the Council of the European Union dealing with energy efficiency has been prepared. The directive proposes that member states adopt a six-year indicative target for energy savings that is at least 1 per cent of energy consumed during an earlier reference period (Council of the European Union 2005). Once reporting on this target has commenced, consideration will be given to whether a white certificates scheme should be introduced.

12.3 Related schemes in Australia

A NEET has parallels with the MRET (box 12.2) and the New South Wales Greenhouse Gas Abatement Scheme (box 12.3) that currently operate in Australia. Under the New South Wales scheme, credit toward meeting greenhouse gas abatement targets can be gained by implementing energy efficiency measures. Both schemes involve tradeable certificates.

Box 12.2 **Mandatory Renewable Energy Target (MRET)**

The *Renewable Energy (Electricity) Act 2000* (Cwlth) (the Act) originated as part of the Prime Minister's 'Safeguarding the Future: Australia's Response to Climate Change' announced in November 1997. The Act is supported by the *Renewable Energy (Electricity) (Charge) Act 2000* (Cwlth) and the *Renewable Energy (Electricity) Regulations 2001* (Cwlth) (the Regulations).

The effect of the legislation, known as the Mandatory Renewable Energy Target (MRET), is to place a legal liability on wholesale purchasers of electricity to proportionately contribute towards the generation of an additional 9500 gigawatt hours of renewable energy annually by 2010. This level of generation is equivalent to more than twice the annual output of the Snowy Mountains Scheme.

The legislation is administered by an Australian Government statutory authority, the Office of the Renewable Energy Regulator (ORER). Tradeable Renewable Energy Certificates (RECs) are created on the basis of eligible renewable energy generation. Each REC is equivalent to one megawatt hour of renewable generation. A range of energy sources and technologies is eligible including hydro, wind, solar and various biomass sources, with provision for emerging technologies not yet commercialised in Australia, such as wave, tidal and geothermal energy.

Accredited generators which commenced operating on or after 1 January 1997 can earn RECs for all eligible electricity following accreditation. Pre-existing generators can only earn RECs for an increase in output above baselines determined by the ORER. Achievement of the 9500 gigawatt hours target and interim targets prior to 2010 is underpinned by a $40 per megawatt hour shortfall charge.

Source: AGO (2003e).

Box 12.3 **NSW Greenhouse Gas Abatement Scheme**

The New South Wales Greenhouse Gas Abatement Scheme commenced on 1 January 2003 and remains in force until 2012. The purpose of the scheme is to reduce the emissions of greenhouse gases associated with electricity consumption. To accomplish this, the scheme sets benchmarks for per capita emissions of carbon dioxide equivalent gases. The statewide benchmark is to reduce per capita emissions to 5 per cent below the 1989-90 levels by 2007 and to maintain this level through to 2012.

The scheme covers all electricity retailers operating in New South Wales, as well as some large electricity consumers who have voluntarily elected to manage their own greenhouse gas emissions benchmarks, thereby avoiding having the compliance costs of the scheme being passed on to them by energy retailers. Energy retailers do not manage a benchmark for the load supplied to these consumers. Nine large consumers were voluntary members of the scheme in 2003, joining the 22 compulsory participants. Each of these benchmark participants is responsible for meeting a share of the statewide emission reduction target that is based on the proportion of electricity that they sell or use. Penalties are imposed on firms who fail to meet their targets (currently $10.50 per tonne of carbon dioxide equivalent gases).

Under the scheme, benchmark participants must meet their targets by surrendering the required quantity of New South Wales Greenhouse Abatement Certificates (NGACs). These certificates can be traded.

NGACs can be earned by:

- using low or zero emission technology to generate electricity;
- demand-side abatement through energy efficiency and/or fuel switching; and
- carbon sequestration.

In 2003, electricity-generation measures accounted for 95 per cent, and demand-side abatement accounted for 5 per cent, of NGACs surrendered.

Source: Adapted from IPART (2004c).

12.4 Participants' views

Many inquiry participants commented on national energy efficiency targets. While most attention was given to schemes that created mandatory obligations and involved trading, others saw a different role for targets. The Australian Conservation Foundation (ACF) advocated the use of a hierarchy of targets to assess what is being achieved:

> A structured hierarchy of many indicators and targets is needed given the very different roles they play in the policy process, and the problems of measuring energy efficiency. Macro indicators at the top of this hierarchy provide a basis for intercountry

> comparisons and performance towards strategic targets. However, they provide little information about the effectiveness of actual policy measures. Increasing disaggregation can increase the sensitivity of comparisons, establish benchmarks and develop industry strategies. Specific bottom-up indicators are often the most useful for driving and assessing specific policy programs. (sub. 24, p. 12)

The Australian Government Department of the Environment and Heritage (DEH) stated that voluntary schemes were an option:

> Options for a NEET range from a voluntary scheme with voluntary agreements between the government and the business, to a hybrid regulatory/market-based scheme where liable parties are required to source energy saving to meet targets, but the market determines which eligible energy efficiency activities were undertaken. (sub. 30, p. 9)

The Australasian Energy Performance Contracting Association recommended 'that broad-based market signals be introduced to drive investment in energy efficiency'. This could involve one of, or preferably both, 'a greenhouse market signal, such as a comprehensive emissions trading scheme' and 'an energy efficiency certificate trading scheme' (sub. 47, p. 19).

The Green Building Council of Australia supported the conclusion of the National Framework for Energy Efficiency (NFEE) Stakeholder Consultation Report to:

> Introduce [a] national energy efficiency target scheme and provide market drivers to assist the transition to increased energy efficiency. (sub. 41, p. 7)

Strong opposition to a NEET involving mandatory obligations was common, particularly amongst large energy users. For example:

> The Australian Industry Greenhouse Network accepts that such a scheme would help ensure the arbitrarily mandated energy efficiency improvements are met at least cost. However, artificial markets in government-created property rights (if indeed the certificates were to be 'property' in a legal sense) are problematic in themselves, for all sorts of reasons. And this would be a market created for completely misguided reasons. Energy efficiency improvement is not an end in itself. It can benefit profits, consumer welfare and energy security and the mitigation of climate change. Policy makers would do better to address and improve markets more directly related to those benefits than to a partial objective like energy efficiency improvement. (sub. 57, p. 13)
>
> The Australian Aluminium Council is strongly opposed to any form of a national energy efficiency target (NEET). A NEET would cause economic inefficiency due to the enforcement of a particular outcome irrespective of the cost imposed on the economy and individual enterprises to achieve the specific target. (sub. 29, p. 14)

The Energy Retailers Association of Australia (ERAA) also questioned the rationale for a NEET:

> A national energy efficiency target, considered by some participants an appropriate policy response, is not in the interests of the community because it fails to address an underlying market failure. (sub. 26, p. 3)

12.5 The Commission's assessment of a NEET

Although the idea of adopting a NEET has been canvassed by the EEWG (2004), there is no formal proposal for how it would operate in Australia. As mentioned in the previous section, the ACF and the DEH have raised the possibility of having a NEET that does not involve mandatory obligations for energy savings. However, without sanctions for noncompliance, such arrangements could not be expected to result in any significant changes in energy efficiency.

The assessment presented here focuses on NEET schemes that include:

- a regulator that sets efficiency-related energy-savings targets for designated participants (who could be energy retailers or all major energy users);
- financial penalties for those who fail to meet their targets;
- trading in eligible energy savings that is open to all via the use of white certificates; and
- the eligibility of energy-savings measures and verification of claimed energy savings being determined by the regulator.

Under such a scheme, designated participants would be able to meet their target through eligible energy savings in their own operations, or the purchase of white certificates, or both. The penalties for noncompliance would establish the maximum value of white certificates, although their value could be less depending on the supply of eligible energy savings. Trade in certificates would theoretically result in the lowest-cost compliance with the national target.

Investments in energy efficiency typically involve an upfront capital cost and a stream of benefits from energy savings over the life of the investment. A NEET would increase the benefits for those investments deemed to be eligible. For designated participants, this would take the form of a reduction or elimination of the penalty they face for failing to meet their target. For suppliers of energy savings credits, it would take the form of payments for white certificates. The effect would be similar to a tax on energy, the proceeds of which provide incentives to energy users to invest in energy efficiency improvements. As they would do if taxed, designated participants would seek to pass these costs on to their customers.

While the idea of a NEET seemingly draws on well-established principles for creating tradeable permits as a means of addressing environmental objectives, the Commission considers that the proposal has significant flaws. These largely concern its failure to address the policy-relevant market failures and the ill-defined nature of the attendant property rights.

In chapter 2, the Commission set out some important principles for good policy design. In particular the objective of the policy needs to be identified clearly and policy measures chosen that target that objective as directly as possible. In this context the problem that a NEET seeks to address needs to be clearly articulated.

It might be presumed that the objective is the adoption of cost-effective energy efficiency opportunities. A NEET, however, would not directly address the underlying market failures, such as imperfect information, that may limit the uptake of these opportunities (chapter 5). If cost effectiveness is the objective, policy instruments that target these failures directly would be more appropriate. The Energy Supply Association of Australia referred to this issue:

> … since the target would not address the underlying barriers to the uptake of energy efficiency improvement opportunities, particularly information asymmetries and capital investment hurdles, it would be unlikely to drive significant energy efficiency gains. (sub. 68, p. 12)

By, in effect, subsidising energy efficiency investments a NEET would not address the problem of people failing to adopt energy efficiency improvements that are cost effective for them at currently expected energy prices.

The reduction of greenhouse gas emissions is an objective that could potentially warrant an increase in the private benefits from energy efficiency investments (either through subsidy or by increasing the price of energy). A NEET, however, would fail to address the greenhouse gas abatement objective in the most direct or least cost way. The introduction of an emissions trading scheme, or a carbon tax, would be more direct and better targeted ways of using prices to reduce greenhouse gas emissions. They are also likely to have lower costs. Support for this proposition is provided below.

Defining property rights

Markets work best when property rights are clearly defined, allow exclusive use of the property in question, are readily transferable, and can be enforced at law (Murtough, Aretino and Matysek 2002; PC 2002). A NEET would appear to have major shortcomings in this regard, largely because the attendant property rights can not be readily defined.

For a NEET to work effectively, property rights need to be assigned to parties that undertake energy efficiency measures that result in energy savings that are additional to what would have occurred without a NEET. This requires:

- measuring energy savings resulting from energy efficiency measures
- determining what would have happened without a NEET
- verifying that eligible energy savings have occurred.

Changes in energy use over time can be measured relatively easily. However, isolating energy savings resulting from energy efficiency measures from other influences on energy use is much more difficult. This is because energy efficiency is difficult to define and distinguish from variations in energy use due to other factors, such as changes in the output of firms, lifestyles, and the weather. If energy savings resulting from energy efficiency measures could not be isolated accurately, as is likely, a NEET might discourage energy consumption *per se*. This would be distortionary by discouraging energy-intensive but economically efficient activities.

Determining what would have happened without a NEET is more difficult still. While it is relatively easy to measure how much of a product has been produced (for example, how much renewable energy in the context of an MRET scheme), it is very difficult to measure how much of a product has not been produced, because it relies on estimating a hypothetical business-as-usual baseline.

As discussed in chapter 6, it is highly debatable what business-as-usual energy use might be. To estimate business-as-usual baselines in a way that considered the individual circumstances of each entity would be impractical, necessitating the use of indiscriminate rules. A balance would need to be struck between issuing certificates for activities that would have occurred anyway and disallowing activities genuinely motivated by a NEET. Certification of activities that would have occurred anyway is likely to be more prevalent, as people would have a strong incentive to seek credit for these zero-cost opportunities.

A NEET would require a verification system that balanced the competing objectives of minimising transaction costs and maintaining the integrity of the scheme. For large industrial energy users, this would involve detailed scrutiny of individual energy efficiency projects. For savings made by households, it would be necessary to deem that energy savings had occurred from consumer actions, such as the purchase of an energy-efficient appliance or the installation of insulation.

Due to the ill-defined nature of the property rights, and the potentially large number of suppliers of energy-savings credits, the task of verifying white certificates would be extremely difficult and time consuming. The likely result is that verification would fail to maintain a high level of integrity. This is particularly the case for energy savings made by small energy users, and as has been argued in this report, it is often these users that have the greatest potential for energy efficiency improvements.

While the initial distribution of target obligations could create serious equity issues, in an economic efficiency sense this might be of less concern if secondary markets in white certificates operated efficiently. However, due to the difficulties in defining property rights, markets would not develop properly, thus failing to allocate the obligations to improve energy efficiency in the most cost-effective way.

Irrespective of how targets are set, there is the risk that once the scheme was announced firms would try to game the system by downgrading business-as-usual projections and delaying energy efficiency improvements that they already had in the pipeline.

Effect on investment

Several inquiry participants were of the view that a NEET would distort investment. For example the Energy Retailers Association of Australia argued:

> Liable entities would be collecting an energy efficiency tax from energy consumers and forced to spend the proceeds on energy efficiency investments to meet some arbitrary target at the expense of other capital projects. Energy efficiency performance in the economy may improve as a result but the allocation of capital would deteriorate. (sub. 26, pp. 39–40)

A NEET is likely to alter investment patterns and encourage investment in energy efficiency projects that are not privately cost effective under current expectations about energy prices. In addition, it is likely that the difficulty of defining property rights would result in a bias against energy consumption *per se*. This would discourage energy-intensive but economically-efficient activities. The effect of these distortions would be to cause a reduction in economic efficiency and economic growth.

An alternative view of the possible effects of a NEET on investment can be inferred from modelling undertaken as part of the NFEE process (box 12.4). The modelling suggests that the benefits of achieving a NEET are substantial. However, the Commission would be concerned if this modelling was to be used to justify the desirability of introducing a NEET scheme (and indeed no claim of this type is made in Allen Consulting Group 2004b or MMA 2004, by the consulting firms that undertook the modelling). The Commission's concerns focus particularly on the assumptions needed to incorporate energy efficiency and a NEET into general equilibrium and other models.

In effect, the modelling estimates the benefits of achieving certain targets, and assumes that targets are met solely through the widespread uptake of investments that are highly profitable, even in the absence of a NEET. The Commission's assessment is that this would not occur for three main reasons:

- secondary markets would not operate efficiently and so would not result in the most cost-effective investments being made;
- certification of activities that would have occurred anyway is likely to be prevalent; and
- the scope for cost-effective energy efficiency investments may be less than assumed in the modelling, for reasons explained in chapter 6.

Box 12.4 **NFEE modelling of a NEET**

The Allen Consulting Group was engaged by the Sustainable Energy Authority of Victoria (SEAV) to undertake analysis of the impacts of reaching targeted annual reductions in end-use energy consumption, as part of the NFEE process (Allen Consulting Group 2004b). This work involved general equilibrium modelling to assess economywide impacts. The results suggest that the benefits of achieving a NEET are substantial.

The DEH referred to the results for one version of the model:

> Analysis done for the NFEE showed that a 1 per cent NEET (annual energy savings of 1 per cent beyond business-as-usual) would deliver an increase in [real private] consumption of approximately 0.18 per cent by 2014, while reducing greenhouse gas emissions by 16.5 megatonnes carbon dioxide equivalent and reducing electricity prices to end users. The total net present value of increased consumption over the life of the investments initiated by a 1 per cent NEET is $8.4 billion. (sub. 30, p. 9)

A version of the model which seeks to simulate the effects of trade in energy efficiency certificates shows a lower, although still strongly positive, net present value of $6.4 billion (Allen Consulting Group 2004b).

McLennan Magasanik Associates was engaged by the SEAV to estimate any additional benefits that might flow from achieving targeted reductions in energy consumption. They estimated benefits with a net present value of $2.4–$6.6 billion (depending on the NEET scenario) from:

- deferral of new electricity and gas plants
- higher levels and longer periods of mothballing of plants
- plants operating at reduced capacity (MMA 2004).

Choice of designated participants

Mandatory targets could be assigned either to major energy users or energy retailers. If major energy users were chosen, this would be likely to cause serious inequities. This is because the economic potential for energy efficiency improvements differs from one industry to another and from one firm to another. Accurately tailoring targets to each firm's circumstances would not be feasible. There would be the potential for firms that were already energy efficient to be most disadvantaged. The extent to which firms could pass on the costs imposed on them by a NEET also varies. Many firms, including those that are export oriented, have little scope to pass on costs to their customers. Of these, those that use energy intensively could be seriously damaged.

Assigning targets to energy retailers could lessen these equity problems. The prices charged by many energy retailers is subject to regulation and it would be possible through regulatory means to allow the costs of a NEET to be passed on to all energy users (effectively all firms and households). This would spread the costs across a very large group. For equity reasons, it would be preferable to assign targets to energy retailers rather than all major users of energy. This would, however, have the disadvantage of placing a heavier reliance on trading in a market that is likely to operate inefficiently.

Administration and compliance costs

Administration and compliance costs could be significant. The Australian Aluminium Council noted:

> The administration and compliance costs of a NEET scheme would be very significant given the individual circumstances of firms even within the same industry. Establishing benchmarks for each business, accounting for 'business-as-usual' improvements, setting uniform industry or individual targets for each business, avoiding the danger of penalising those who have achieved a high level of energy efficiency make such a policy almost unworkable, very costly and counter-productive to achieving economic efficiency. (sub. 29, p. 15)

The task of regulating a NEET would involve setting targets, determining the eligibility of energy-savings measures, verifying energy savings and administering the issue and surrender of certificates. Verification would likely be the most costly component. The verification task has been described earlier — to maintain even a moderate level of system integrity would require considerable resources and expense. The costs associated with performing the other tasks would also be significant.

A NEET would impose a range of costs on designated participants. Apart from the costs of purchasing white certificates and/or paying penalties, firms would incur administrative costs associated with obtaining and trading certificates and the opportunity cost of forgoing more profitable uses of capital.

Consistency of a NEET with other policies

A NEET might be viewed as being complimentary to existing energy efficiency programs and the NFEE Stage One measures. This is because it would encourage the uptake of energy efficiency investments by regulated firms or those producing white certificates. To some extent, it might be thought that it would even obviate the need for some of these programs. However, the distorting impacts of a NEET would also encourage the uptake of energy efficiency investments that are not cost effective. And since the NEET does not directly address the underlying market failures preventing the uptake of cost-effective energy efficiency improvements, it will tend to cut across, rather than complement, programs that do.

Some proponents of a NEET regard it as being able to operate effectively in combination with a greenhouse gas emissions trading scheme and an MRET scheme. Indeed, as discussed earlier, the implementation of all three measures is being considered in some European countries.

There is doubt as to whether a NEET can be integrated with an emissions trading scheme without threatening the credibility of the latter (box 12.5). This would arise through grafting the NEET problems of defining business-as-usual onto the 'cap and trade' architecture of an emissions trading scheme, which does not rely on business-as-usual assumptions.

A more fundamental question, however, is why would a NEET (or an MRET) be required if there was an emissions trading scheme in place? In the case of a NEET, the proposition seems to be that an emissions trading scheme will not overcome all of the barriers to energy efficiency (MacGill and Outhred 2003). To some extent this may be true. Emissions trading schemes seek to achieve emissions targets at lowest cost and this may not occur to its full extent if failures in the market for energy efficiency technologies — such as those caused by asymmetric information — prevent the adoption of some low-cost options. If this is the case, however, policy measures that address these barriers directly are required. As discussed above, a NEET does not do this.

Box 12.5 **Integrating a NEET with an emissions trading scheme**

The issues involved in integrating a NEET with an emissions trading scheme depend in part on the type of emissions trading envisaged. It is possible, with some assumptions, to convert energy savings under a NEET to emissions reductions (MacGill and Outhred 2003). This allows for a NEET to be integrated with other systems that trade in emission reductions from a business-as-usual baseline. This could involve having a NEET for emissions reduction from energy efficiency, and similar schemes for emissions reductions from low-emission fuels and carbon sequestration. An alternative would be to subsume efficiency-related energy savings within an economywide scheme for trading in emissions reduction. No target would be set for energy efficiency, as the amount of emissions reductions from each type of abatement activity would be left to the market. The New South Wales Greenhouse Gas Abatement Scheme is an example of such an approach.

The generally preferred option, however, is for trading in *emissions*, not *reductions in emissions*. This is consistent with the Kyoto Protocol, that set emissions caps for developed countries, rather than targets for reductions from a business-as-usual baseline. There are substantial difficulties in integrating a NEET (which trades in intangible energy savings) with a ‘cap and trade’ emissions trading scheme (which trades in tangible emissions). While work is being done on ways to overcome the difficulties, some commentators believe that the inclusion of intangible emissions reductions would threaten the credibility of emissions trading schemes (MacGill and Outhred 2003). This is mainly because of the uncertainty involved in setting baselines, difficulties in verification and the possibility of double counting across the two schemes.

An emissions trading scheme, an MRET and a NEET all, in effect, use a price signal to reduce energy consumption and/or the related environmental externalities. The Commission is of the view that there are many potential overlaps and inconsistencies between these schemes. An emissions trading scheme has several advantages over a NEET, including:

- more direct targeting of the objective of greenhouse gas abatement;
- comprehensive inclusion of abatement options (potentially including reducing land clearing, storing carbon dioxide in geological strata, increasing the use of energy from renewable and/or nuclear sources, and increasing energy conservation and energy efficiency);
- better functioning markets due to more easily defined property rights; and
- potentially lower administration and compliance costs.

While it is beyond the scope of this inquiry to assess the benefits and costs of a greenhouse gas emissions trading scheme the Commission observes that a NEET is likely to be a very poor substitute. With or without an emissions trading scheme, a NEET, as generally proposed, has serious flaws.

DRAFT FINDING 12.1

A national energy efficiency target is a poorly focused policy instrument that would be very difficult and costly to implement in an effective manner. It can not be justified on the grounds of privately cost-effective energy efficiency. It may help to drive investment in energy efficiency, but this would be at the expense of economic efficiency. As a measure to address greenhouse gas abatement, it has serious disadvantages compared to other options such as an emissions trading scheme.

13 Role of energy market reform

Key points

- Recent reforms have led to more efficient pricing of gas and electricity. Yet electricity prices still do not fully reflect the costs of supply because of:
  - the regulation of retail prices and network tariffs;
  - imperfect competition among electricity generators; and
  - the unaccounted environmental externalities associated with energy use.
- Retail prices of residential and small business customers, and network tariffs for all users, are regulated in all jurisdictions. Postage-stamp pricing means that prices cannot vary between locations.
  - Though retailers and distributors have some ability to set tariffs for individual customer groups, the absence of interval metering has limited the use of more cost-reflective pricing methods such as time-of-use tariffs.
  - As a result, the electricity supply industry faces muted incentives to invest, and energy users have little incentive to modify their demand. Such limited responses limit the scope for effective markets, or for greater energy efficiency.
  - One option is to free up retail prices and network tariffs. This will encourage demand- and supply-side responses. An alternative is to encourage demand-side responses within existing regulatory frameworks.
  - Either approach requires the roll out of interval meters. Any proposed mandated roll out should be subject to a comprehensive benefit–cost assessment. Competition in the provision of metering devices and services should be encouraged where possible.
- Imperfect competition in the electricity industry may increase electricity pool prices and the volatility of spot prices. Improving competition will lower prices, which will tend to decrease incentives to invest in greater energy efficiency. But decreasing price volatility could decrease risk and uncertainty, thus enhancing the economic viability of a range of energy efficiency investments.
- Environmental externalities associated with the use of energy, such as greenhouse gas emissions, add to the cost of producing and consuming energy. Recognising these costs, either explicitly or implicitly, would encourage a greater uptake of energy efficiency as well as substitution towards renewable technologies.

The scope for energy market reforms to improve energy efficiency is discussed in this chapter. The terms of reference direct the Commission to consider the scope for energy market reform (including, but not limited to, more efficient cost-reflective pricing) to improve the management of the demand and supply of energy.

Other chapters presented in this report are concerned with the policy implications of barriers and impediments to the adoption of cost-effective investments in energy efficiency. Each case study examines the effect of barriers and impediments from the perspective of current energy prices — that is, current expectations about the energy prices likely to be experienced over the relevant investment time frame. In contrast, this chapter is mainly concerned with how reforms to energy markets, by influencing energy prices, can improve demand- and supply-side responses in energy markets and bring about energy efficiency improvements.

Demand and supply responses are most likely to occur when all of the costs of supplying energy are reflected in energy prices paid by energy users (section 13.1). Although microeconomic reforms since the early 1990s (chapter 4) have improved the cost-reflectivity of energy prices, some distortions are still present. These include:

- the regulation of retail prices and network tariffs (section 13.2);
- insufficient levels of competition in electricity generation (section 13.3); and
- the unaccounted environmental externalities, such as those arising from greenhouse gas emissions (section 13.4).

These distortionary factors generally result in the demand for energy being greater than it is economically efficient (inclusive of externalities) for the industry to supply. Before addressing these issues the chapter gives a brief account of some of the influences on electricity costs and prices.

13.1 Energy pricing and costs

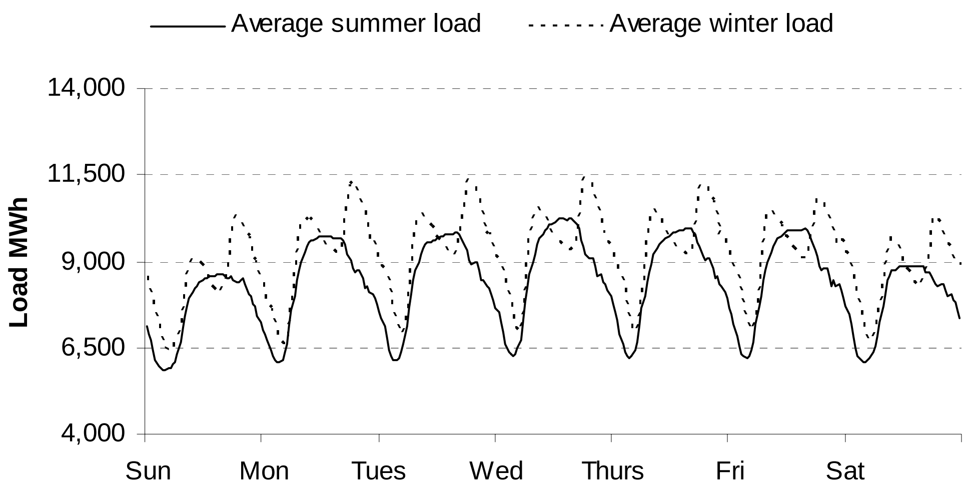
One means of encouraging demand- and supply-side responses in an energy market, and thereby promoting economic efficiency in the use of energy, is to ensure that the price of energy reflects the economic cost of its supply.

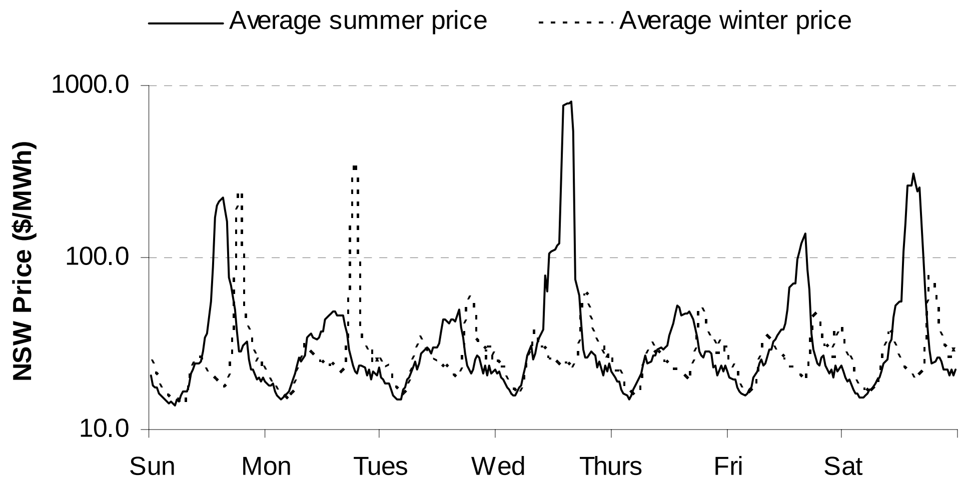
Economic efficiency does not imply that energy use must be minimised. In some circumstances, using high levels of energy might minimise the total costs of production (including the costs of capital and other inputs) as energy is used or consumed in preference to other inputs (chapter 2).

Electricity markets

Electricity markets are dynamic. Demand and supply are constantly changing throughout the day, week, season and year, and these changes vary between different locations in the market. In the case of electricity, there is considerable volatility in both the volume of electricity supplied and price for which electricity is traded in the spot market (figure 13.1).

Figure 13.1 **New South Wales regional electricity prices and loads, daily averages for summer and winter, 2004**





Data source: NEMMCO (no date).

The reasons why electricity costs vary dramatically in the course of a day and year are well understood (Sayers and Shields 2001, Salerian 1991). As demand increases during the day, so does the cost of supplying additional energy, since incrementally more expensive capacity is required to be brought on-stream. Coal-fired generators have the lowest operating costs and provide base load electricity, while gas-fired generators have higher operating costs and supply the market's intermediate and peak demands.

Electricity costs can also vary over time because of congestion in transmission and distribution networks. Networks frequently experience congestion as a result of peak demand or following the construction of a new housing or industrial estate.

In recent years, peak wholesale prices in some regional markets have been highest in summer. Peak loads have only been occurring for a few hours and days of the year. The switch from winter peaking to summer peaking appears to be primarily driven by the increasing adoption of air conditioners by residential customers. The Energy Supply Association of Australia (ESAA) attributed the increased penetration of space cooling equipment to:

- the impact of hot summer temperatures on discretionary purchases of space cooling equipment;
- improved marketing penetration and technological advances in space cooling equipment;
- the coincident increase in construction activity in both the commercial and residential sectors. The increase in townhouse and apartment construction for residential dwellings is a key factor, as these buildings are particularly suited to reverse cycle units; and
- the continued ageing of the population and the associated expansion in retirement villages for senior persons. (sub. 68, p. 3)

The costs of supplying electricity will differ according to the location of the user. Costs will vary according to how much transmission and distribution infrastructure is needed to service each customer and because of line losses.

Line losses are, on average, a relatively small proportion of the overall amount of electricity transported. For example, the Queensland Department of Energy estimated that its average line losses were about 4.2 per cent and 6.2 per cent across transmission and distribution networks respectively (Queensland Department of Energy 2005). In Tasmania, distribution line losses were estimated to be 6.0 per cent in 1999 (OTTER 2003).

TransGrid commented on the average efficiency of its transmission network:

> The existing high voltage network is about 97 per cent efficient with some components such as large transformers achieving 99.8 per cent efficiency. Increased dependence on power transported from other States could see a slight increase in average transmission losses over time. (sub. 62, p. 4)

Even though under current National Electricity Market (NEM) arrangements, line losses are averaged throughout a region, they can increase significantly during periods of congestion. Sections of a network can experience marginal losses that are much higher than the average network losses.

The Ministerial Council on Energy (MCE) is currently exploring options to reduce the extent to which line losses are averaged within a region — such as by increasing the number of NEM regions and by increasing the number of spot market pricing nodes. However, these matters are made complex by the need to represent the physical flows of electricity and the system conditions of trading models (East Cape 2002).

Microeconomic reform since the 1990s has improved the economic efficiency with which electricity is priced (chapter 4). Despite efforts to implement cost-reflective pricing, actual prices faced by electricity users and producers may not reflect the dynamic and spatial nature of the industry. As a result, the energy market's demand- and supply-side responses are muted. As explored in section 13.2, retail price regulation and network tariff regulation may each be partly responsible for the lack of alignment between prices and costs. Other contributing factors, dealt with in later sections, include the degree of imperfect competition in the generation of electricity and unpriced environmental externalities associated with the consumption of fossil fuels.

There has also been considerable reform of the natural gas market since the 1990s (chapter 4). Participants to this inquiry have not raised any particular concerns regarding the efficient pricing of natural gas — apart from those issues surrounding distributed generation and greenhouse gas emissions — both of which are discussed in later sections (box 13.1). This contrasts with the extent of participants' concerns regarding the efficient pricing of the electricity market.

Box 13.1 **Natural gas markets**

Natural gas markets demonstrate some of the dynamic and spatial characteristics of electricity markets. However, unlike electricity, natural gas can be stored, and as a result, natural gas markets do not exhibit the same degree of price volatility or network congestion.

Participants to this inquiry have not raised any issues regarding opportunities to improve cost-reflective pricing of the natural gas market apart from the inclusion of environmental externalities. The Queensland Government noted:

> Gas pipeline service providers have raised concerns that, under the current regulatory environment for gas pipeline access, the level of risk and associated costs involved in major pipeline investments is not fully considered in the regulator's determination of reference tariffs included in pipeline access arrangements.
>
> The Productivity Commission's Review of [the National] Gas Access Regime indicated that whilst the current National Gas Access Regime has delivered benefits, it is also likely to be distorting investment in favour of less risky projects. Such issues have the potential to impact the introduction of energy efficient practices if infrastructure owners see it as an additional risk. (Queensland Government sub. 38, p. 8)

Matters regarding the efficient pricing of natural gas are more comprehensively discussed in the Commission's review of the Gas Access Regime. These matters have been included in the work program of the Ministerial Council on Energy. As part of this program, the Council has developed a set of fundamental principles for the future development of the Australian gas market, and explored the feasibility of promoting more competitive arrangements (MCE 2004b, 2004d).

13.2 The regulation of electricity prices

The existing regulatory arrangements governing electricity retailers and network service providers are numerous and their full examination is beyond the scope of this inquiry. While the purpose of these arrangements is primarily to encourage economically-efficient prices, they can have consequences for the incentives of market participants to invest in new infrastructure and to undertake energy conservation and energy efficiency measures.

Retail price and network tariff caps

All jurisdictions have adopted, or are adopting, policies of full retail contestability (FRC) in electricity. FRC is intended to encourage price and service competition between retailers. Increased competition has the potential to encourage retailers to introduce innovative pricing strategies that reflect the dynamic and spatial nature of electricity markets. In Queensland, FRC has not yet been scheduled for residential and small business customers.

Despite having adopted FRC, all jurisdictions continue to cap retail prices for residential and small business customers that have chosen to remain with the incumbent retailer and not accept market (negotiated) contracts. Price capping is intended to protect residential and small business customers from the market power of the energy supply industry. Similarly, governments cap distribution network tariffs to protect electricity users from the market power of network operators.

For most governments, an additional objective for capping retail prices and network tariffs is to minimise or eliminate the retail price differences between metropolitan and non-metropolitan energy users. In many cases, the policy objectives were achieved by:

- directly subsidising residential and small business customers for their distribution network costs (for example, the Network Tariff Rebate in Victoria);
- directly subsidising distributors funded from general revenue (such as the community service obligation payments in Queensland);
- requiring metropolitan distributors to cross-subsidise non-metropolitan distributors (for example, through the VENCorp administered tariff equalisation scheme in Victoria) (ORG 2000a); and
- revaluing non-metropolitan network assets (for example, by setting network tariffs through government regulation and allowing these to be reflected in the value of the assets) (ORG 2000a, ESCOSA 2004).

In addition, the New South Wales Government has implemented the Electricity Tariff Equalisation Fund to reduce the price volatility faced by government-owned retailers. Retailers are required to contribute to the fund when pool prices are lower than the costs they recover from regulated customers. When pool prices are higher than the recoverable costs, the fund will compensate retailers. If at certain times there are shortfalls in the fund, government-owned generators will contribute to close the shortfall (New South Wales Treasury 2000).

Impediments to more cost-reflective pricing

Retail price caps can limit the ability of retailers to use prices to encourage consumers to adjust their demand and producers to adjust their supply in response to changing market conditions (PC 2004a). Retailers do not have flexibility in setting the overall price level in any given year or to restructure overall price levels between years — that is, to accept low or high prices in one year in exchange for high or low prices in another year. Retailers are required to comply with price paths that specify the overall prices that can be charged in each year.

However, retail price caps do provide retailers with the flexibility of setting the prices for individual electricity users and groups of users, provided the sum of the individual prices complies with the overall price cap. This is because retail price caps are applied to a hypothetical basket of individual electricity tariffs. As a result, retailers could adopt some forms of time-of-use pricing within the current regulatory framework (box 13.2).

Box 13.2 **Time-of-use pricing**

Time-of-use pricing includes both time-of-day pricing and real-time pricing.

Real-time pricing

Under real-time pricing, retail prices are allowed to vary half-hourly every day, based on the actual cost of electricity for that half hour.

Time-of-day pricing

Time-of-day pricing is a simplification of real-time pricing, where different prices are set in advance for set time blocks during the day (such as off-peak, shoulder, peak and critical peak) (USGAO 2004). Critical peak prices can occur at any time, but can be constrained to occur for a preset number of hours per year. Tariff schedules can also vary each season (such as winter and summer). Each tariff is determined from historical use patterns, forecasts of future requirements and average costs of supply for each period and/or season.

The variable component of a time-of-day price can be configured to a declining, flat or even inclining block tariff. Inclining block tariffs can be used as a demand management strategy to reflect costs of network congestion, since network congestion tends to be correlated with increasing peak demand.

Similarly, network tariff caps restrict network operators from setting and varying overall network tariffs. As with retail price caps, network operators have the freedom to set the tariffs for individual customers and groups of customers — provided that the sum of the individual tariffs complies with the overall cap. This is because network tariff caps are applied as either a weighted average tariff cap, or a revenue cap, or a hybrid of the two approaches.

To date, retailers have not adopted time-of-use prices for residential and small business customers except in the case of off-peak hot water systems — a very simple and limited form of time-of-day pricing. One exception is South Australia, where seasonal winter/summer and peak/off-peak tariffs have been introduced (South Australian Government sub. 80). Similarly, distributors have not widely implemented time-of-use network tariffs for residential and small business customers.

In relation to location-based tariffs, Origin Energy observed:

> … customers face largely uniform network tariffs regardless of capacity congestion at various locations in the network. (sub. 25, p. 10)

The most significant barrier to implementing more cost-reflective retail prices and network tariffs is the absence of smart metering among residential and small business customers. Smart meters provide energy users, retailers and distributors with the means of obtaining information about energy consumption and network use.[1] Since wholesale electricity costs vary during the day, week and season, and across locations in a network, smart metering provides a means by which retailers and distributors can set retail prices and network tariffs to reflect time-of-use for different locations.

Other reasons for the limited adoption of more cost-reflective retail prices include government policies aimed at equalising or minimising price differences between metropolitan and non-metropolitan customers. For example, the Victorian Network Tariff Rebate limits the extent to which final electricity prices differ between locations of customers.

Finally, the New South Wales Electricity Tariff Equalisation Fund could provide a disincentive for government-owned retailers to adopt time-of-use and location-based pricing. Since the fund provides a hedge against volatile wholesale prices, retailers face weakened incentives to manage the demand of their regulated customers by adopting more innovative pricing strategies (IPART 2002).

Effects of price regulation

The Commission has argued previously (in its review of Part IIIA of the *Trade Practices Act 1974*, the review of the Gas Access Regime, and the draft report on National Competition Policy) that retail and network price capping may act as a disincentive for investment in the industry. If prices are unduly suppressed, the

[1] Traditional electromagnetic electricity meters provide a cumulative record of electricity consumed. More advanced metering devices are available that, depending on the model, can provide: interval meter readings (a record of electricity used in half-hourly increments), maximum demand readings (for capacity related charges), multiple time-of-use readings (reporting consumption for different time-of-use tariff structures), tariff switching functions, prepayment meters, and modem communications with the distributor (for remote meter readings and automatic load shedding).

industry will face diminished incentives to invest in new capacity despite the demand of consumers (PC 2001, 2004a and 2004d).

Undue suppression of retail prices also compromises the long-term sustainability of energy supply. Since retail price caps prevent retailers from passing on any cost increases of energy supply, retailers are exposed to considerable risk of default if they are unable to mitigate the effects of increasing wholesale prices. The electricity crisis in California in 2000-01 highlights the dangers, among other things, of undue focus on containing consumer prices while wholesale prices rise (PC 2004a).

In the case of network industries, network price regulation can also compromise longer-term investment in network infrastructure. Differences in the principles applied by individual regulators in setting allowable charges, the short-term imperatives confronting regulators, and the fact that price regulation ‘taxes’ successful projects but does not subsidise unsuccessful ones, have the effect of diminishing the incentive to undertake new network investment (PC 2004a).

A number of commentators have argued that the absence of time-of-use and location-based pricing has the effect of maintaining cross-subsidies between different customer groups. The New South Wales Independent Pricing and Regulatory Tribunal (IPART) argued that current regulatory approaches lead to ‘cross-subsidies across different kinds of residential and small business customers’ (IPART 2003, p. 8). According to the ESAA:

> … where individual customers are not exposed to the costs associated with their individual consumption patterns, a cross subsidy is effectively paid by lighter users of peak electricity to heavier users of peak electricity. In other words, a heavy peak user doesn’t pay the full cost of their contribution to the need for investment in generation to meet peak demand. (sub. 68, p. 7)

Effects on demand- and supply-side management

The current regulatory arrangements and the absence of smart metering among residential and small business customers, combine to inhibit residential and small business energy users from responding to the economic costs of electricity supply. This can distort the demand for electricity. For example, in the absence of peak prices, final users have an incentive to demand more electricity than it is economically feasible for the industry to supply.

The Climate Action Network of Australia said it:

> … recognises that the lack of time-of-use tariffs for most customers masks the real cost of electricity during peak times. (sub. 19, p. 5)

The current regulatory arrangements and lack of smart metering also inhibit electricity suppliers from responding to the economic costs of supply. For example, there are muted incentives to invest in distributed generation.

To manage electricity demand, retailers and distributors instead employ a number of management strategies. Such strategies include interruptible supply contracts and voluntary reduction programs. However, these strategies are currently limited to the largest energy users (box 13.3).

The limited ability of network operators to manage the load of their customers has also meant that regulators are under increased pressure to approve expansions in network capacity to meet the growth in demand. IPART noted:

> In most cases, DNSPs [distribution network service providers] have addressed these [network] constraints (or potential constraints) by augmenting the network to increase its capacity. This has resulted in substantial increases in their capital expenditure and reduced their asset utilisation. (For example, 10 per cent of EnergyAustralia's network capacity is used for less than 1 per cent of the time.) (IPART 2004b, p. 89)

Origin Energy said that current regulatory approaches did not provide distributors with sufficiently strong incentives to undertake demand-side practices because:

> … networks [operators] face asymmetric incentives between augmenting network infrastructure and implementing initiatives that reduce capacity constraints to the extent that they are unable to capture the net saving from avoided or deferred network infrastructure expenditure. (sub. 25, p. 10)

Similarly, the Total Environment Centre noted:

> The pricing system in the NEM does not impose limitations on distribution network augmentations even when more cost-effective demand management alternatives are available. (sub. 81, p. 6)

Effects on energy efficiency

The limited ability to encourage a demand- or supply-side response also affects energy efficiency. The absence of a demand-side response in a market can lead to excessive use of energy by users for a given level of output.

In the absence of time-of-use tariffs, uniform retail prices obscure the true economic costs of energy supply. Users face no penalty from overinvestment in peak-load energy-intensive appliances such as air conditioners, nor do they receive the full benefit from investment in off-peak and energy-efficient appliances.

The absence of location-based pricing can also discourage energy efficiency. There are weakened incentives for distributed generators to locate near their customers and to bypass the effects of line losses — particularly in rural and regional communities where line losses and network costs are greatest.

Box 13.3 **Selected demand- and supply-side management programs**

Voluntary reduction programs

Voluntary reduction programs (or voluntary load control) are targeted to larger commercial and industrial customers. During peak load, the retailer or network operator negotiates and compensates customers to reduce their load below an agreed baseline level.

Interruptible supply contracts

Utilities provide participants with discounts on the normal tariff rate in exchange for the right of the electricity retailer to interrupt electricity supplies as needed. Typically, there is a predetermined amount that the customer has agreed to reduce electricity, and interruptions are limited to only a few hours per year.

Direct load control

Similar to interruptible supply contracts, utilities compensate customers for the right to interrupt from a distance the electricity use of one or more devices, such as air conditioners. Interruptions may last for an hour or more, and may be rotated through several appliances. Generally, these programs rely on a switch installed in the appliance that the retailer can remotely activate.

Demand bidding

Demand bidding allows retailers and large customers to sell back into wholesale markets electricity that they otherwise would have consumed. Customers are not penalised if they do not bid, but they are penalised if they bid but fail to act on the agreed reduction.

Investment in energy efficiency technologies

Energy retailers can also sell a range of energy-efficient technologies to reduce demand during peak periods. For example, retailers will supply (and sometimes provide the up-front finance) for households to install insulation and energy-efficient appliances. This may be cheaper for the retailer than supplying the additional energy the household would have used.

Distributed generation

Distributed generation is sometimes used to reduce network congestion because the distributed generator bypasses the congested part of the network. Where distributed generators are embedded with energy users, they can also provide a standby role.

Sources: USGAO (2004); IPART (2004a); CR Associates (2004).

Options to improve electricity price regulation

Suggestions to improve cost-reflective pricing of energy have included deregulating retail prices and taking a light-handed approach to setting network tariffs, and encouraging greater demand-side responsiveness in existing regulatory frameworks. Both of these options have implications for the roll out of smart metering.

Freeing-up prices and tariffs

The first option is to remove retail price caps altogether and to take a light-handed approach to regulating network tariffs. Retailers and distributors would be permitted to set overall energy prices and would have more flexibility in implementing time-of-use and location-based prices for individual customers. This has the effect of improving the incentives faced by producers to increase investment and the incentive for final customers to use energy commensurate with its economic cost.

However, the regulation of retail prices and network tariffs provides an important check on the potential for market power which, as discussed later, still appears to be present in some regions of the NEM. For this reason, retail price caps should only be removed once effective competition has been established.

Freeing-up price regulation would also require removing 'postage-stamp' pricing of electricity networks since, as noted, these policies discourage investment in local distributed generation and encourage inefficient use of energy. (Related to this, is the treatment of line losses in regions, but the Commission notes that this is currently being explored by the MCE).

Some measures may still be needed to ensure that specific customer groups, such as non-metropolitan households, continue to have adequate access to services at affordable prices. However, these would be better pursued through explicit and transparent community service obligations (or other appropriate mechanisms).

The Commission reiterates its draft recommendation from its inquiry into National Competition Policy that retail price caps can be removed as soon as effective competition has been established, and that governments and regulatory agencies should explore opportunities to improve the efficacy of price setting for network service providers.

Improving existing incentives

A second option is to encourage demand- and supply-side management within existing regulatory frameworks. IPART has already signalled that it is prepared to compensate New South Wales distributors for revenue foregone from undertaking demand-side management strategies. IPART also encouraged distributors to undertake trials of congestion pricing (2004b).

As a result, Country Energy, a New South Wales government-owned electricity distributor and retailer, is currently trialling 'smart meters' and time-of-use prices to improve demand management in parts of New South Wales (box 13.4).

Box 13.4 **Trialling smart meters and time-of-use pricing**

Country Energy, a New South Wales government-owned electricity distributor and retailer, launched a trial of 'smart metering' technology to assist households to manage their electricity demands.

The trial involves 200 households in Queanbeyan and Jerrabomberra, in south eastern New South Wales. During the trial households would use an in-house display unit to receive real-time information about their household energy consumption.

To coincide with the trial, Country Energy has introduced time-of-use pricing that includes a fixed charge, peak price and critical peak price.

Such information will allow customers to monitor their energy consumption and modify their behaviour as they judge appropriate.

The trial is scheduled to last for approximately 18 months and include two summers and one winter.

Source: Country Energy (2005).

Distributors in most jurisdictions, such as Victoria, are currently exploring options to introduce time-of-use pricing and expand their demand- and supply-side management programs for smaller energy users (ESC 2004a). In South Australia, ETSA Utilities is proposing to: trial voluntary load curtailment for large customers; trial direct load control for residential equipment (such as air conditioners and pool pumps); trial the use of standby generation; and to explore the use of incentives to encourage customers to reduce demand during peak times (ESCOSA 2004).

The effect of this option is to improve the incentives and effectiveness of demand- and supply-side responsiveness in managing electrical load. It does not, however, directly address the disincentives for new investment in the electricity supply industry created by retail price caps and network tariff caps.

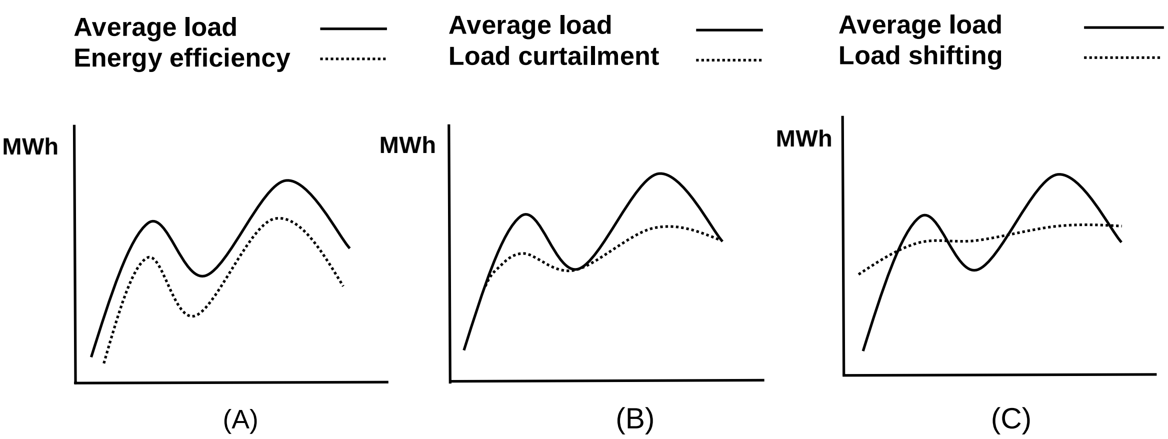
The Commission, nevertheless, considers the current trials of demand- and supply-side management techniques are a welcome development. It encourages further trials of ways to signal to consumers and producers the real costs of electricity they consume and supply, and monitoring changes in their behaviour and electricity use.

Effectiveness of cost-reflective pricing

There is an economic case for cost-reflective prices, but it is far from clear how much effect such pricing might have on energy efficiency. More cost-reflective pricing can potentially change energy use in three ways. Depending on whether final energy users are sensitive to electricity prices, consumers can:

- *improve their energy efficiency* — users reduce their level of energy use for a given amount of output by adopting more energy-efficient appliances and equipment (figure 13.2, chart A);
- *conserve (curtail) their energy use* — users curtail their electricity demand at peak-load prices while reducing the corresponding level of output (figure 13.2, chart B); and
- *shift their energy demand* — users redistribute their energy use from peak to off-peak times, leaving total energy use unchanged (figure 13.2, chart C).

Figure 13.2 **Potential demand-side responses to cost-reflective pricing**
Megawatt hour load during the course of a day



Load curtailment and load shifting do not necessarily result in energy efficiency improvements. Load curtailment is a conservation measure. Load shifting similarly does not constitute an energy efficiency improvement, since the overall level of energy use may not change. According to the South Australian Government, load shifting could in some instances lead to a decline in energy efficiency:

> Not all peak demand management strategies deliver energy efficiency outcomes. Measures such as off-peak water heating — one of the most common forms of peak load shifting — result in energy inefficiency due to standing losses from storage water tanks. (sub. 80, p. 8)

A number of inquiry participants were circumspect about the ability of cost-reflective prices to alter consumer behaviour. The National Generators' Forum (NGF) argued:

> … it is unrealistic to assume that this [time-of-use pricing] will better drive energy efficiency as electricity use is notoriously unresponsive to price signals. (sub. 65, p. 3)

The New South Wales Government in its Energy Directions Green Paper said:

> Electricity demand is likely to be reasonably inelastic. Even if time-of-use pricing is implemented, consumers are unlikely to turn off many 'essential service' appliances (eg. heating and air conditioning) at times of high demand. (2004, p. 44)

The Australian Consumers' Association (ACA) argued that time-of-use prices would not lead to reductions in air conditioning use:

> It is far from clear exactly how high prices would have to rise to actually deter consumers from using their air conditioning units in the circumstances for which they bought them, that is when it is very hot. If the consumers continue to use their air conditioners in the face of even savage pricing … then the peak reduction sought will not be achieved. (sub. 52, p. 4)

Even if consumer behaviour could be altered, it was not clear to the NGF that it would lead to improvements in energy efficiency:

> Responding to price signals, requiring at least a ten-fold price differential between lowest and highest prices, will lead to some load shifting where this is practicable (i.e. having real loads to shift) … In general, US evidence suggests that consumers may curtail some load where possible … (sub. 65, p. 3)

Yet several inquiry participants argued that more cost-reflective pricing would change consumer behaviour in a way that would also encourage greater energy efficiency. The Australian Industry Greenhouse Network noted:

> Correct locational pricing signals also offer some prospect of improved system efficiency, and may result in better aggregate energy efficiency overall in power generation. But this is not a straightforward issue by any means … (sub. 57, p. 10)

The South Australian Government commented:

> Greater cost-reflective pricing would allow for energy efficiency and energy conservation to be aligned better to peak [load] management objectives … (sub. 80, p. 9)

The ESAA pointed out that while electricity demand is known to be inelastic in the short term:

> … behavioural patterns will change over time as consumers are made increasingly aware of the economic and environmental costs of the energy they use and are equipped with the information required to make better consumer choices. (sub. 68, p. 8)

Yet others have pointed to experience from the United States showing that time-of-use pricing will, on balance, encourage greater energy efficiency:

> Time-of-use rates that charge more for electricity use during peak load, high cost periods (and less during off-peak, low cost periods) can also stimulate energy savings. While time-of-use rates primarily shift electricity use from peak to off-peak periods, experience shows that there tends to be a larger reduction in peak period electricity use than the increase in electricity use during off-peak periods, meaning some level of energy savings at least for residential time-of-use programs ... (SWEEP 2002, chap. 5, p. 11)

In the Commission's view, more cost-reflective pricing has the potential to influence consumer behaviour and encourage improvements in energy efficiency (as well as energy conservation), particularly in the longer term when consumers have both more information and the opportunity to modify their behaviour.

DRAFT FINDING 13.1

More cost-reflective pricing has the potential to improve energy efficiency by influencing both consumer and supplier behaviour, particularly in the longer term when consumers have both more information and opportunity to modify their behaviour, and producers have the opportunity to respond to changed market conditions.

Roll out of smart meters

The successful implementation of more cost-reflective pricing necessarily requires the roll out of advanced (or 'smart') metering devices — such as interval meters. The Energy Retailers Association of Australia argued for 'suitable metering, or other load control and measurement infrastructure' to manage demand-side responsiveness of energy users (sub. 26, p. 22).

Similarly, the Climate Action Network of Australia suggested that the success of time-of-use pricing required 'a large roll out of metering technology to make it economically feasible'. It noted that meters would 'enable householders and businesses to obtain information in a straightforward manner' (sub. 19, p. 7).

However, the case for any roll out of smart metering is not straightforward. IPART noted that while interval metering for residential and small business customers could improve price signals, the cost of a widespread roll out was likely to be considerable. IPART recommended that any roll out of interval meters be subject to a benefit–cost assessment (IPART 2003).

A benefit–cost assessment would need to compare the costs of rolling out meters with the benefits of reduced energy costs arising from:

- reduced network congestion — through avoiding the costs of augmenting transmission and distribution networks;
- reduced electricity generation — through avoiding the costs of new generation capacity;
- increased supply reliability — through reducing the number of interruptions; and
- fewer environmental externalities — such as reduced greenhouse gas emissions.

Where smart meters have direct communication links with distributors, benefits also can include reduced site visits, more efficient connection and disconnection of customers and the detection of outages and voltage fluctuations. Finally, where smart metering allows for more precisely specified cost-reflective prices, benefits include the increase in welfare that results from the removal of cross-subsidies (ORG 2000b).

An assessment of the net benefits of managing network congestion using interval metering and time-of-use pricing was commissioned by the Essential Services Commission of South Australia (ESCOSA). It was found that the widespread roll out of interval meters in conjunction with time-of-use pricing was not as cost effective in reducing network load as other options, such as correcting for power factors and employing standby generation (CR Associates 2004, ESCOSA 2004).[2]

In its assessment of the net benefits of interval metering, the Victorian Essential Services Commission (ESC) found that there were sufficient net benefits to warrant the widespread roll out of interval meters. The ESC found that metering would provide, among other things, effective electricity competition, improved conservation, improved market efficiency through demand management, and improved security of supply (ESC 2004b).

[2] Power factor is defined as the ratio between the actual load power (measured in terms of kilowatts) and the apparent load power (measured in terms of kiloVoltAmperes) drawn by a load. Inductive loads (such as electric motors) and switching loads (such as switch mode power supplies) can distort the wave pattern and reduce the efficiency with which energy is used. Power factors can be corrected (that is, the efficiency of energy use can be improved) through the installation of capacitors in the equipment itself or the mains switch.

The ESC also argued that there was a case for *mandating* the widespread roll out of meters. It argued that allowing customers, retailers and distributors to choose whether to voluntarily invest in meters would not maximise the net benefits of metering because individual market participants are not able to capture the full benefits of the roll out. For example, a retailer that sought to introduce interval meters to reduce consumption when wholesale prices were high would also reduce peak network use, thereby benefiting the distributor (ESC 2004b).

The ESC also argued that mandating the roll out of meters would increase net benefits by speeding up the adoption of meters by high energy users. Under current practices, residential and small business customers are billed according to an 'average' load profile. High-cost energy users, who are cross-subsidised in their load profile by low-cost energy users, have an incentive to delay adopting interval meters. Requiring high-cost energy users to adopt meters quickly will increase the net benefits (ESC 2004b).

AGL was less convinced that a mandated roll out of interval meters was desirable:

> Currently there is [a] view among policy makers that energy efficiency price signals could be more finely tuned by the wide spread use of interval meters. AGL maintains that the cost–benefit of a rollout of Type 5 interval meters to customers using less than 160MWh annually has not been proven and should not be mandated. The market place should be left to work out the most efficient metering solutions rather than have potentially inefficient solutions mandated. Retailers are already researching new technical solutions, including two way communications, that could create better price signals and be cost effective. (sub. 66, pp. 3-4)

The ACA warned of the limits to interval metering:

> Metering does not equal billing, and it is misleading to state that metering of any variety will send a price signal to consumers. … Displaying the actual price being billed to the consumer in real time with predictive costs for the next consumption periods, along with a cumulative amount for the billing period might be a desirable state of affairs ... (sub. 52, p. 2)

The Energy and Water Ombudsman New South Wales also argued that interval meters did not provide for sufficient immediacy to influence consumers' consumption. It also said that an alternative would be to introduce prepayment meters:

> Prepayment meters should be one of a range of options to assist customers with energy management and payment of accounts. If the Tasmanian experience is any indication, prepayment meters would suit customers who want to closely manage their consumption, as well as customers who need to budget carefully. (sub. 48, p. 9)

In the Commission's view, while there may be net benefits in a widespread roll out of interval metering, it is not clear that governments should prescribe either the device or the provider. Prescription has the potential to limit the roll out of alternative technologies and inhibit the adoption of alternative demand management strategies. A mandatory roll out of meters should be limited to setting the minimum standards of the features to be included in smart meters.

DRAFT RECOMMENDATION 13.1

Any mandated roll out of interval metering devices should be subject to a comprehensive benefit–cost analysis. Mandated roll out of technologies should not preclude choice in the device or competition between service providers.

13.3 Imperfect competition in electricity generation

The principle of cost-reflective pricing implies that wholesale energy prices must also be economically efficient. Yet imperfect competition in the wholesale electricity market has the potential to increase retail prices, thereby distorting the end users' incentives for using energy efficiently.

Participants to this inquiry have not identified any barriers and impediments to the adoption of energy efficiency improvements in the electricity generation sector — apart from the fixed nature of generation assets (ESAA sub. 68). The Australian Government introduced the Generator Efficiency Standards program to increase energy efficiency by fossil-fuel electricity generators (box 13.5).

Sources of imperfect competition

Factors that may contribute to imperfect competition in electricity markets include the horizontal aggregation of electricity generators, the level of interconnection between regional markets and the vertical reintegration taking place in the electricity industry.

Aggregation of electricity generators

The COAG Energy Markets Review (the Parer Review) was concerned that there was insufficient competition among electricity generators. The Review reported that the concentration ratios for the three largest generators were consistent with the presence of market power. For example, the concentration ratio for New South Wales was 96.4 per cent (COAG 2002).

The Parer Review argued that generators in some jurisdictions were able to exercise market power at certain times. This power had the effect of increasing average electricity prices and exacerbating pool price volatility. High average retail prices increase the incentives for energy efficiency — albeit for the wrong reasons. High spot price volatility increases the risk and uncertainty associated with current and future NEM pool prices, thereby discouraging investment in energy-efficient technologies.

Box 13.5 **Generator Efficiency Standards program**

The *Efficiency Standards for Power Generation* was launched in the Prime Minister's 1997 *Safeguarding the Future* statement and subsequently incorporated into the National Greenhouse Strategy. The guidelines were subsequently renamed as the Generator Efficiency Standards and the program commenced on 1 July 2000.

The standards apply to new, refurbished and existing fossil fuel power plants. This includes grid-connected power stations, off-grid plant and auto-generators. The minimum threshold is 30 megawatt capacity, and 50 gigawatt-hours of electrical output, and a capacity factor of 5 per cent or more in each of the last three years.

The Australian Government sets best practice standards for thermal efficiency (for example, in terms of higher heating values) and emission efficiency standards (for example, in terms of tonnes of carbon dioxide per megawatt hour dispatched) for each fossil fuel type.

Generators and the Australian Government entered into a Deed of Agreement which committed generators to identify an undertake agreed actions to meet the best practice standards. Generators have five years to implement the agreement.

Generators must monitor their performance and report to the Australian Greenhouse Office annually. The standards are reviewed every five years. It is expected that the Generator Efficiency Standards program will be reviewed every three years.

The objective of the program is to 'achieve movement towards best practice' generation performance and therefore to reduce greenhouse gas emissions (ESPGWG 2000, p. 7). Even though there is a presumption that the energy efficiency gains are cost effective, the types of barriers and impediments the program is attempting to address are not made explicit.

The Australian Government does not offer any financial incentive to generators. The benefits to generators from participating in the program have been cited to include:

- a greener image for the power generation industry as a whole and for individual businesses
- potential fuel saving from increased efficiency in the operation of plants
- best practice in measuring the performance of plants
- strategic information to assist businesses in determining the medium- and longer-term energy efficiency opportunities
- early positioning in the event of an emissions trading scheme.

Sources: AGO (2000a); Andrews (2000); ESPGWG (2000).

The Parer Review made a number of recommendations, many of which were included in the MCE's energy market work program. However, the MCE has adopted only part of the package of reforms recommended by the Review. The MCE has emphasised a role for expanding regional interconnections but did not address the key recommendation of structurally disaggregating government-owned generation businesses.

The Commission considers that, due to the cost to the community, there is scope for further disaggregation of publicly-owned generation assets. This represents the most cost effective means of reducing generator market power in a region (PC 2004a).

Insufficient regional interconnection

A contributing factor to the imperfect competition in electricity markets is the insufficient capacity of regional interconnection. Regional electricity interconnectors are high voltage transmission lines that connect the regions of the NEM and provide capacity for the interstate trade of electricity. By increasing the size of the markets in which electricity is traded, regional interconnectors effectively increase the level of competition among generators.

The Parer Review examined the capacity of regional interconnection and found that current interconnectors did not provide sufficient capacity for generators in one region to adequately respond to peak demands in other regions. As a result, the NEM cannot effectively off-set the market power that generators possess in their own region. According to the International Energy Agency:

> During periods of peak demand, the network can become congested and the NEM separates into its regions, potentially exacerbating reliability problems and market power of regional utilities. (IEA 2001, p. 67)

The Commission notes that the MCE released an energy market reform package in 2003 that includes policy principles and directions for the investment in new transmission assets including regional interconnectors (MCE 2003).

Vertical reintegration

The Commission in its review of the National Competition Policy Reforms reported on the vertical integration between electricity generators, transmission networks and retailers. The Commission has argued that such merger activity can have the effect of stifling competition, particularly in the generation sector, and raised concerns regarding the adequacy of current institutional arrangements necessary for determining the appropriate levels of merger activity (PC 2004a).

The Commission considers it is important to have effective institutional arrangements in place to deal with potentially anticompetitive mergers between generators and transmission operators (PC 2004a). The Commission notes that there is an opportunity to examine whether existing economywide regulatory safeguards are sufficient to protect against this activity (PC 2004a).

In the Commission's view, imperfect competition in the electricity industry increases both average electricity prices and their volatility. These can have differing and countervailing effects on energy efficiency. Increasing competition (whether through horizontal disaggregation or increased regional interconnection) may lower electricity prices. Reduced prices could decrease incentives to invest in greater energy efficiency. Increasing competition may also decrease price volatility, which could decrease risk and uncertainty of future electricity prices. This in turn could enhance the economic viability of a range of energy efficiency investments.

13.4 Unpriced environmental externalities

The third important influence on the costs of energy is the costs of pollution and other negative externalities associated with its production and use. An externality occurs when an action by one person affects the wellbeing of others without being reflected in market prices. Negative externalities in the market for energy include greenhouse gas emissions from fossil fuel powered electricity generators and local pollution ranging from car exhaust fumes to the visual impact of wind turbines and the environmental impact of hydroelectric schemes.

Ideally, energy prices would reflect all of the costs of production and consumption including these external costs. At the moment, energy prices by-and-large exclude these costs, meaning that energy users are encouraged to consume more energy, and invest less in energy efficiency, than might be desirable from a communitywide perspective.

Participant comment

There was widespread acknowledgement of these costs among participants. For example, Origin Energy noted:

> Energy prices do not reflect the environmental cost associated with consumption and production of energy. (sub. 25, p. 10)

TransGrid observed that current wholesale prices in the NEM did not take into account the environmental costs. As a result, there were incentives to install open-cycle gas-fired generators rather than combined-cycle gas fired generators, which emitted relatively more greenhouse gases and were relatively less energy efficient (sub. 62, p. 4).

Several inquiry participants said that, as a result, energy-efficient and renewable technologies were uncompetitive. For example, TransGrid stated:

> Like renewable energy sources, energy efficiency technologies tend to have a smaller impact on the environment and human health than conventional supply of energy. Since these 'external costs' of supply are not fully incorporated in the market price of energy, the resource conserving and other environmental benefits of improving energy efficiency are not reflected as a relative cost saving advantage. (sub. 62, p. 3)

Several inquiry participants noted that if the prices of fossil fuels were raised in relation to their carbon content, there would be greater incentive to adopt energy-efficient alternatives. According to Origin Energy:

> It is clear however that any valuation of greenhouse gas emissions is likely to cause energy prices to increase, which is likely to raise the potential of cost-effective energy efficiency improvements across the economy. (sub. 25, p. 10)

The Australian Conservation Foundation said:

> Carbon levies and emissions trading are two ways to change the price of energy in a way that drives emission abatement and hence supports energy efficiency actions. It makes little sense to exclude energy intensive industry from such arrangements as they are amongst the most likely to respond to price. However, for many decision makers energy prices alone are insufficient to drive enhanced energy efficiency and other policies will be required. (sub. 24, pp. 10–11)

TransGrid commented that the wholesale electricity prices could be augmented with:

> … a universal Australian carbon fuel tax or greenhouse gas emissions tax (or permit charge) which would tend to highlight the inefficiency of a poor conversion choice (even in a gas fuelled plant) … (sub. 62, p. 5)

But there were also warnings that such approaches should be comprehensive, across all sources of greenhouse gas emissions and abatement activities. Origin Energy argued:

> … it is Origin's strong contention that the long term interests of the community are best served by a comprehensive climate change policy. Such a policy would establish a national framework for creating a clear, long term carbon signal across the economy. By making the environmental cost of energy transparent, a carbon signal provides an incentive for consumers to conserve energy and for producers to invest in cleaner energy technologies. This incentive is essential to achieving an appropriate balance between the economic benefits of energy and its environmental costs. The policy would also balance international competitiveness concerns with environmental outcomes. (sub. 25, p. 11)

The Australian Aluminium Council warned of the effects of addressing greenhouse gas externalities for export-oriented producers:

> Inappropriate policy interventions at the national level to address externalities with an international reach or impact could be extremely detrimental to national economic performance where similar or equivalent action is not taken in a broadly global manner. (sub. 29, p. 13)

Commission assessment

Pricing of environmental externalities is fraught with problems. For one thing the costs of those externalities would need to be assessed and causality firmly established. In particular, the challenges of setting an economically efficient price for carbon — whether through emissions trading or carbon taxes — are formidable. There is little agreement on the extent of the costs (and benefits) of increases in the concentration of greenhouse gases in the atmosphere, thus making it difficult to settle on the right volume of emissions permits or carbon tax. And the information requirements and administrative logistics could make it costly to implement.

Greenhouse gas issues are, above all, global issues and require a global response. Any country that takes unilateral action must weigh up world leadership against some more immediate economic cost and the risk of having some investment in energy-intensive industry migrate to countries that do not have such policies (Industry Commission 1991).

Although environmental externalities are difficult to measure and incorporate in the price of energy, improvements in energy efficiency will result in environmental dividends. While rebound effects may diminish the size of the dividend, they would not extinguish it altogether. The Commission considers that energy price reform should be pursued.

A Conduct of the Inquiry

The following pages outline the inquiry process and list the organisations and individuals that have participated to date. The Commission is to provide a final report to the Australian Government on 31 August 2005.

Following receipt of the terms of reference on 31 August 2004, the Commission placed a notice in the press inviting public participation in the inquiry and released an issues paper to assist inquiry participants in preparing their submissions. The Commission received 85 submissions before releasing the draft report. Those who made submissions are listed in section 1.

The Commission also held informal discussions with organisations and government departments and agencies. This visit program assisted the Commission to obtain a wide understanding of the issues and the views of inquiry participants. Organisations visited by the Commission are listed in section 2.

In November 2004, the Commission held public hearings in Sydney, Brisbane, Canberra and Melbourne. In addition, public hearings were held via telephone conference with participants from Canberra. Hearings were attended by 39 individuals and organisations (section 3).

Section 1 Submissions received

Participant	*Submission no.*
AGL	66
Alternative Technology Association	13
Australasian Energy Performance Contracting Association	47
Australian Aluminium Council	29
Australian Building Codes Board	7
Australian Business Council for Sustainable Energy	50
Australian Conservation Foundation	24
Australian Consumers’ Association	52
Australian Electrical and Electronic Manufacturers’ Association	85
Australian Gas Association	2
Australian Glass and Glazing Association	16
Australian Industry Greenhouse Network	57
Australian Liquefied Petroleum Gas Association	37
Australian Meat Processor Corporation	12
Australian Plantation Products and Paper Industry Council	82
Australian Trucking Association	74
Australian Window Association	59
Beal, Jeff	64
Bell, Graham	73
Blanchard, Clive	72
BP Australia	60
Building Products Innovation Council	44
Cement Industry Federation	39
Central West Environment Council Inc NSW	9
Ceramic Fuel Cells Limited	23
Climate Action Network Australia	19
Conservation Council of Western Australia	54
CSR Bradford Insulation	15
Department of Agriculture WA	36
Department of Energy Qld	38
Department of the Environment and Heritage	30, 69

(continued on next page)

Section 1 (continued)

Participant	*Submission no.*
Energy and Water Ombudsman NSW	48
Energy Retailers Association of Australia Inc	26, 55, 71
Energy Supply Association of Australia	68
Energy Systems and Services	33
Energy Users Association of Australia	84
Environment Victoria	67
Exergy Australia Pty Ltd	40
Federated Chamber of Automotive Industries	77
Ford Motor Company of Australia Ltd	76
Foster, Bob	11
Friends of the Earth Australia	20
George Wilkenfeld and Associates Pty Ltd	10
Gipton, Sara	34
Green Building Council of Australia	41
GridX Power	5
Housing Industry Association	27
Institute of Public Affairs	6
Insulation Council of Australia and New Zealand	14
Jameson, Allan	31
Johnson, Harry, Kingfisher Centre, Aspley Special School	21
Laird, Philip	1, 56
Lincolne Scott Australia Pty Ltd	53
McGregor and Associates	22
Moreland Energy Foundation Ltd	18
Mushalik, Matt	4, 75
National Generators Forum	65
Nicolosi, Fred	32
Origin Energy	25
Parker, Alan	35
Penny, John	8
Plastics and Chemicals Industries Association	49

(continued on next page)

Section 1 (continued)

Participant	*Submission no.*
Public Transport Users Association	63
Railway Technical Society of Australasia	45
Rheem Australia Pty Ltd	46
Rowden-Rich, Murray	61
Royal Australian Institute of Architects	42
South Australian Government	79, 80
SPI Electricity Pty Ltd	51
Steam Link	43
Sustainable Projects Pty Ltd	3
Sustainable Transport Coalition	70
Total Environment Centre	81
TransGrid	62
Western Australian Government	58
Western Australian Sustainable Energy Association	17
Williamson, Terry	28, 78
Zorbas, Angelo	83

Section 2 Visits

Organisation
AMCOR
Australasian Railways Association
Australian Electrical and Electronic Manufacturers' Association
Australian Greenhouse Office
Australian Industry Greenhouse Network
Australian Industry Group
Australian Trucking Association
BP
Bureau of Transport and Regional Economics
Business Council for Sustainable Energy
Centre for Energy and Greenhouse Technology

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Section 2 (continued)

Organisation
Climate Action Network of Australia
Department of the Environment and Heritage
Department of Industry, Tourism and Resources
Department of Transport and Regional Services
Energetics
Energy Retailers Association of Australia
Energy Supply Association of Australia
Energy Users Association of Australia
Engineers Australia
Essential Services Commission (Victoria)
Exergy Australia Pty Ltd
Federal Chamber of Automotive Industries
Foster’s Group Limited
National Electricity Code Administrator
National Generators Forum
New South Wales Government
Origin Energy
Department of the Prime Minister and Cabinet
Property Council of Australia
South Australian Government
Sustainable Energy Authority Victoria
The Treasury (Australian Government)
Victorian Government

Section 3 Public hearing participants

Sydney 15 November

Sustainable Projects Pty Ltd

Penny, John

GridX Power Pty Ltd

McGregor and Associates

Housing Industry Association

World Wide Fund for Nature Australia and Climate Action Network Australia

Australian Consumers' Association

Centre for Energy and Environmental Markets, University of NSW

Sydney 16 November

Australian Meat Processor Corporation

Energy Retailers Association of Australia

Railway Technical Society of Australasia and University of Wollongong

George Wilkenfeld and Associates Pty Ltd

Brisbane 17 November

Queensland Government

Department of Energy (Qld)

Steam Link

Friends of the Earth Australia

Johnson, Harry, Kingfisher Centre, Aspley Special School

Lincolne, Scott

Little, Phil

Canberra 22 November

Australian Trucking Association

Royal Australian Institute of Architects

Department of the Environment and Heritage

Plastics and Chemicals Industries Association

Exergy Australia Pty Ltd

Ocean Research Pty Ltd

(continued on next page)

Section 3 (continued)

Melbourne 24 November

Australian Business Council for Sustainable Energy

Australasian Energy Performance Contracting Association

Institute of Public Affairs

Moreland Energy Foundation Ltd

Williamson, Terry, School of Architecture, University of Adelaide

Lavoisier Group

Timber Promotion Council

Energy Advice

Melbourne 25 November

Energy Supply Association of Australia

Parker, Alan

Rheem Australia

Building Products Innovation Council

B Government energy efficiency programs

This appendix provides information on government energy efficiency programs that currently operate in Australia and recent programs that ceased operation after 1 July 2001. Programs whose main aim is to reduce greenhouse gas emissions or encourage the adoption of alternative sources of energy, but that have a component aimed at improving energy efficiency, have been included. The appendix has been compiled primarily from information provided to the Commission by the Australian, State and Territory Governments.

The Commission thanks jurisdictions for their assistance in providing information on their energy efficiency programs. Any additional or updated information that would improve this appendix for the final report would be appreciated.

Table B.1 **Abbreviations used in this appendix**

Acronym	*Agency name*	*Jurisdiction*
ABCB	Australian Building Codes Board	Australian Government
DAIS	Department for Administrative and Information Services	South Australia
DBIRD	Department of Business, Industry and Resource Development	Northern Territory
DEH	Department of the Environment and Heritage	Australian Government
DEUS	Department of Energy, Utilities and Sustainability	New South Wales
DHS	Department of Human Services	Victoria
DHW	Department of Housing and Works	Western Australia
DIER	Department of Infrastructure, Energy and Resources	Tasmania
DIPE	Department of Infrastructure, Planning and Environment	Northern Territory
DIPNR	Department of Infrastructure, Planning and Natural Resources	New South Wales
DITR	Department of Industry, Tourism and Resources	Australian Government
DLGPSR	Department of Local Government, Planning, Sport and Recreation	Queensland
DNR	Department of Natural Resources	Queensland
DOE	Department of Energy	Queensland
DOH	Department of Housing	Queensland
DOI	Department of Infrastructure	Victoria
DPW	Department of Public Works	Queensland
DSD	Department of State Development	Queensland
DTUP	Department of Transport and Urban Planning	South Australia
EPA	Environmental Protection Agency	Queensland
MCE	Ministerial Council on Energy	All jurisdictions
NAEEEC	National Appliance and Equipment Energy Efficiency Committee	All jurisdictions
SAHT	South Australian Housing Trust	South Australia
SEAV	Sustainable Energy Authority Victoria	Victoria
SEDA	Sustainable Energy Development Authority	New South Wales
SEDO	Sustainable Energy Development Office	Western Australia

Table B.2 **Energy efficiency programs that are jointly administered by all jurisdictions**

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Building Code of Australia	ABCB	Commenced 1990; ongoing	Building industry, property industry, owners of houses and commercial buildings, government building agencies	The Building Code has been adopted by each State and Territory as a technical standard for the design and construction of buildings. In January 2003, energy efficiency standards were introduced into the Building Code. The standards cover new houses and additions to existing houses. Further information on the Building Code is included in appendix C.	• The objective of the energy efficiency standards for houses is to reduce greenhouse gas emissions by efficiently using energy.	Mandatory standards
National Appliance and Equipment Energy Efficiency Program (NAEEEP)	NAEEEC	Commenced 1992; ongoing	State and Territory Government agencies, appliance manufac-turers	NAEEEP is a collection of coordinated end-use energy efficiency programs relating to household appliances and equipment and commercial and industrial equipment. The main policy instruments used are minimum energy performance standards, mandatory energy efficiency labelling and voluntary measures including endorsement labelling, and training. Further information on NAEEEP is included in appendix D.	• Improve the energy efficiency of appliances and equipment more rapidly than the market has in the past. • Deliver nationally consistent regulation of appliances and equipment. • Assist State and Territory Governments to work consistently and in a manner that minimises cost and inconvenience to industry.	Mandatory standards, labelling, information provision

Table B.3 **Australian Government energy efficiency programs**

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Challenge Plus - Industry Partnerships	DEH	Commenced 2005; ongoing (to 2007-08)	Commercial and industrial sector	Encourages participants to demonstrate corporate greenhouse performance through emissions inventory reporting and the development and implementation of action plans to achieve cost-effective abatement. Certifies products and/or services with zero net greenhouse gas emissions and provides for collaboration between government and industry to identify technical best practice for reducing greenhouse gas emissions in key sectors. Successor to the Greenhouse Challenge program.	• Reduce greenhouse gas emissions. • Accelerate the uptake of energy efficiency. • Integrate greenhouse issues into business decision making. • Provide more consistent reporting of emissions levels.	Voluntary arrangements, to be made compulsory for large energy resource development projects and recipients of fuel excise credits in excess of $3 million.
Cities for Climate Protection Australia	DEH	Commenced September 1998; Incorporated in Local Greenhouse Action from July 2004	Local government, businesses, community groups	Encourages local councils to reduce their greenhouse gas emissions. Provides participating councils with funding and information on emission abatement strategies including energy efficiency.	• Reduce greenhouse gas emissions through changes in council's own operations and through action with the wider community.	Funding, information
Energy Efficiency Best Practice	DITR	Commenced 1998; discontinued June 2003	Commercial and industrial energy users	Practical demonstrations and advice in delivering innovative energy savings projects in parallel with improvements in productivity and energy management systems.	• Demonstrate that even when energy is managed closely, significant and additional energy efficiency savings and productivity gains can still be achieved in a range of businesses.	Information provision, energy consultants

(Continued next page)

Table B.3 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy Efficiency Opportunities Assessment	DITR	Commenced June 2004; ongoing	Large energy users	Large energy users will be required to complete an energy efficiency opportunities assessment and report publicly on the outcomes. While the assessment and public reporting are mandatory, all decisions on investments in energy efficiency opportunities will be at the discretion of the business.	• To improve the uptake of commercial energy efficiency opportunities by large energy users.	Mandatory audits and public reporting (legislative regime to be introduced in 2005-06)
Generator Efficiency Standards	DEH	Commenced July 2000; ongoing as part of Greenhouse Challenge Plus	Electricity generation industry	Requires electricity generators to sign agreements with the Australian Government which commit them to reducing the greenhouse gas intensity of their generation. The agreed actions must be implemented within five years. Applies only to electricity generation facilities that exceed stated size levels. Now incorporated into Greenhouse Challenge Plus program.	• Encourage electricity generators using fossil fuels to adopt energy efficiency best practice in their generation.	Mandatory reporting, enforceable contracts
Greenhouse Challenge	DEH	Commenced 1995; discontinued 2005	Commercial and industrial energy users	Provides technical advice to firms about measures they could take to reduce their greenhouse gas emissions. Often these are measures to encourage energy efficiency in building design or use. Incorporated into Challenge Plus program in 2005.	• Reduce greenhouse gas emissions through cooperative partnerships with businesses and industry.	Technical assistance, voluntary arrangements

(Continued next page)

Table B.3 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Greenhouse Gas Abatement Program	DEH	Commenced May 1999; ongoing	Industrial energy users, electricity generation industry	Provides funding for programs that will lead to large scale, sustainable, cost-effective abatement of greenhouse gas emissions. Funding is based on a competitive process under which applicants must demonstrate that their proposed project will provide cost-effective greenhouse gas abatement. Funded projects have included subsidies for the replacement of industrial equipment with more energy-efficient technologies.	• Assist Australia to meet the 108 per cent Kyoto Protocol target.	Financial incentives
Local Greenhouse Action	DEH	Ongoing	Commercial and industrial energy users, government and the community	Previous versions of this program: provided grants for projects and research on approaches to reduce emissions of greenhouse gases from the residential sector; and, with non-government conservation organisations, provided assistance to households. In 2004, the new program was introduced, drawing on elements of the previous versions and the Cities for Climate Protection program, to engage a larger number of Australians in actions to reduce household emissions.	• Reduce greenhouse gas emissions from the household sector through effective and sustainable partnerships. • Increase the demand for, and the effective use of, greenhouse efficient goods and services.	Financial incentives, partnerships
Mandatory disclosure of the energy performance of residential & commercial buildings	DEH	Forthcoming	Owners, purchasers and tenants of residential and commercial property	A NFEE Stage One measure that will oblige residential and commercial property owners to disclose the energy rating of their property at the time of sale, lease or rental.	• Reduce energy demand from buildings by providing energy performance information at the point of sale. • Reduce Australia’s greenhouse gas emissions.	Regulation

(Continued next page)

Table B.3 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Measures for improving energy efficiency in Common-wealth operations	DEH	Commenced 1997; ongoing	Australian Government agencies	Specified targets for reductions in energy intensity by Australian Government departments and budget-dependent agencies. Annual reporting on energy use is required.	• Reduce energy costs for the Australian Government. • Demonstrate leadership in energy efficiency performance.	Energy intensity targets, reporting requirements
Motor Solutions Online	DEH	Ongoing	Users of electric motors	Provides users of electric motors with information that allows them to compare motors with case studies demonstrating the efficiency gains to be made by choosing more efficient motors.	• Encourage users of electric motors to consider the energy efficiency of their motors and adopt best practice when choosing motors. • Reduce greenhouse gas emissions.	Information provision
Solar Cities	DEH, DITR	Commenced June 2004; ongoing (to 2012-13)	Electricity generation industry, residential and commercial energy users	Will involve the large scale implementation of energy efficiency initiatives, smart meters, cost-reflective pricing and new technology in urban sites. Four or more discrete trials in urban centres will be supported. The first trial will take place in Adelaide. The program will bring together interested parties from both the electricity supply and demand sides.	• Support the exploration of new sustainable models for energy production and use.	Financial incentives, technology trials, information provision

(Continued next page)

Table B.3 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Voluntary Building Industries Initiative	DEH	Commenced 2000; ongoing	Building industry, households, consumers, businesses, Australian, State and Territory Government building agencies	Provides information through printed and electronic materials and public seminars. Offers professional development training programs through industry organisations.	• Encourage industry and the community to voluntarily adopt better energy and environmental sustainability practices in buildings.	Information provision

Table B.4 **New South Wales Government energy efficiency programs**

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Australian Building Greenhouse Rating Scheme	DEUS	Commenced 1999; ongoing	Commercial building owners, managers and tenants	Enables commercial office building owners, managers and tenants to voluntarily rate the greenhouse impact of their buildings on a scale of one to five. The program is coordinated nationally by DEUS with Australian and State Government funding, and implemented locally through State and Territory Government agencies and nationally accredited assessors.	• Provide a nationally consistent benchmark for commercial office building energy use and greenhouse performance, against which owners and managers can compare and improve their facilities' operation.	Energy efficiency rating scheme
Building Sustainability Index (BASIX) Certification	DIPNR	Commenced 1 July 2004; ongoing	Residential building industry, home renovators	Requires all new homes in Sydney to have a BASIX certificate. To receive a BASIX certificate, dwelling design must offer the potential for a 25 per cent reduction in greenhouse gas emissions compared to the average house of the same type in New South Wales. This requirement will be strengthened to 40 per cent in July 2006. Mains water consumption must be potentially 40 per cent lower than the average. The scheme will be extended to include new residential buildings (including multi-unit buildings) from 1 July 2005 and alterations to existing dwellings anywhere in New South Wales from 1 October 2005.	• Reduce water consumption and greenhouse gas emissions and thereby reduce the demand on existing infrastructure and increase affordability of energy and water to consumers.	Regulation *(Environmental Planning and Assessment Amendment (Building Sustainability Index: BASIX) Regulation 2004* and the *State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004)*

(Continued next page)

Table B.4 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Cogeneration Development	SEDA	Commenced 2000; discontinued 2004	Industrial and commercial energy users, energy generation sector	Cofunded feasibility studies to assess the viability of small-scale gas fired cogeneration at sites in NSW, at no cost to the site owner. In return, the site owner committed to calling for expressions of interest if the project was found to be viable. Private companies cofunded the studies, which were carried out by private consultants under contract to SEDA. Communications activities were undertaken to raise awareness of cogeneration in industry, and to provide information and advice to those investigating cogeneration.	• Encourage the uptake of cogeneration technologies.	Financial incentives, voluntary arrangements
Energy Smart Business	DEUS	Commenced 1997; ongoing	Commercial, industrial and government sectors	Assists businesses that have energy bills of over $300 000 per year to identify and implement cost-effective energy efficiency measures. Participating businesses pay a fee to join the program and receive technical advice and assistance with marketing and communication.	• Assist businesses to reduce energy consumption and greenhouse gas emissions.	Voluntary agreements, technical assistance
Energy Smart Government	DEUS	Commenced 1997; ongoing	NSW Government agencies	Assists NSW Government agencies to meet energy reduction targets by implementing cost-effective energy efficiency upgrades. Promotes the uptake of Energy Performance Contracting as a tool for financing large energy efficiency upgrades and the Government Energy Efficiency Investment Program for smaller projects.	• Reduce the energy consumed by NSW Government facilities by 25 per cent by 2005-06 (from 1995-96 levels).	Energy use reduction targets, financial incentives, information provision

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Table B.4 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy Smart Home Rating	DEUS	Commenced 2002; ongoing	Households	Offers two options for rating the energy performance of existing homes. The first is a web-based self-assessment tool. The second is an official rating with a home energy audit conducted by accredited assessors. This enables home owners to rate and improve their greenhouse gas performance.	• Provide a consistent and credible greenhouse performance benchmark for existing homes. Deliver energy savings through behaviour change and informed product purchases.	Energy efficiency rating scheme
Energy Smart Homes for Councils	SEDA	Commenced 1997; discontinued 2004	Local councils and households	Assisted NSW Councils to implement a model energy-efficient housing policy by providing reliable and consistent energy rating tools, design alternatives and minimum energy performance standards for new homes.	• Assist NSW Councils to implement energy-efficient housing policy.	Voluntary arrangements
Energy Smart Information Centre	DEUS	Commenced 1998; ongoing	Households and consumers	Provides practical advice on residential energy efficiency and renewable energy applications to consumers, home builders, renovators, appliance purchasers, and primary and secondary school students. Offers a telephone information service and appointments with consultants to provide advice on household energy use.	• Provide consumers with commercially-independent advice about sustainable energy.	Information provision
Energy Smart Zone	DEUS	Commenced 2002; ongoing	Schools (year 5 and 6 students and teachers)	Operates a website that teaches school students in years 5 and 6 to 'live energy smart'. This includes interactive exercises that encourage students to adopt energy efficiency practices in their homes and schools.	• Support the NSW 'Human Society and its Environment' syllabus, the 'NSW Science & Technology' syllabus and the 'Environmental Education Policy for Schools'.	Teaching materials

(Continued next page)

Table B.4 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Live Energy Smart	SEDA	Commenced 2000; discontinued 2004	Producers and consumers of sustainable energy products	Assisted manufacturers of sustainable energy technologies, including manufacturers of energy efficiency products. Membership entitled firms to use the Energy Smart logo on packaging and in marketing material. Information was disseminated through local governments, retailers, financial institutions, installers and builders' associations.	• Assist consumers to adopt sustainable energy technologies.	Information provision, voluntary arrangements
NSW Sustainable Energy Research and Development Fund	DEUS	Ongoing	Commercial and industrial sectors, research organis-ations, universities	Provides funding for research and development initiatives in energy efficiency, renewable energy, low greenhouse emission transport fuels and enabling technologies.	• Assist the development of new technologies in the field of sustainable energy.	Financial incentives

Table B.5 **Victorian Government energy efficiency programs**

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Business Energy Innovation Initiative	SEAV	Commenced November 2003; ongoing	Businesses, particularly manufac-turing	Provides support for projects that invest in new and innovative energy efficiency solutions, or in solutions that combine energy efficiency with sustainable industry practices. This can involve: identifying and assessing new technology options; performing detailed technical and commercial appraisals; installing and commissioning new solutions and securing local and international expertise for energy efficiency initiatives. The focus is on productivity improvement through innovative demonstrations of sustainable energy supply, design and operation of state-of-the-art production facilities, and the development of new energy efficient or renewable energy products. SEAV may contribute up to $150 000 matched dollar for dollar with the business partner.	• Demonstrate commercially viable energy efficiency and sustainable energy projects to manufacturers and potential new investors in manufacturing in Victoria.	Financial incentives

(Continued next page)

Table B.5 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Centre for Energy and Greenhouse Technologies	Public private partnership	Ongoing	Developers and providers of low greenhouse gas emission technologies	Provides investment funds and support services for the development of new sustainable energy technologies. Facilitates investment in new sustainable energy and greenhouse pollution reduction technologies to capitalise on Australia's specific energy sector requirements and existing global export opportunities. Focuses exclusively on driving energy technology towards commercialisation in sectors such as: energy-efficient processes and products; demand management; greenhouse pollution reduction; renewable and fossil fuel energy generation; energy transmission and distribution systems.	• Promote energy efficiency practices and technology uptake. • Function as a source of expertise and knowledge to the energy, greenhouse gas emitting and investment sectors. • Successfully coinvest in new sustainable energy technologies and technologies that reduce greenhouse gas emissions.	Financial incentives, information provision, technical assistance
Commercial Office Building Energy Innovation Initiative	SEAV	Commenced 2003; ongoing	Commercial building developers, builders and owners	Makes resources available to property industry leaders to support the development of projects that demonstrate high quality and energy efficiency in commercial property. It is estimated that within 15 years, the demonstration projects will influence 30 per cent of office building activity.	• Stimulate greater investment in high quality, energy-efficient commercial property. Demonstrate innovation in the design and application of sustainable energy in new and existing office buildings. • Apply a broad range of other sustainability measures, such as water conservation and waste reduction to Victoria's commercial buildings. • Improve the quality and value of Victoria’s commercial buildings and reduce greenhouse gas emissions.	Information provision, financial incentives

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Table B.5 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy Efficient Government Buildings Policy (15 per cent target)	SEAV	Commenced 1999; ongoing	Victorian Government agencies	Obliges agencies within the general government budget sector to reduce their energy use by 15 per cent by 2005-06 against their 1999-2000 consumption and purchase 10 per cent of their electricity from 'green power' sources. Agencies appoint an energy manager and develop action plans for meeting the targets. SEAV assists agencies to meet these targets, but agencies have the flexibility to determine and pursue the most cost-effective options for reducing energy use within their operations. No additional funding is provided for meeting the target, however, agencies retain the revenue saved from the reduced energy use.	• Reduce Victorian Government energy consumption by 15 per cent and to purchase 10 per cent of the electricity consumed by Government agencies from 'green power' sources by 2005-06. • Assist in expanding the market to support the development of a sustainable energy industry.	Mandatory reporting, targets
Energy efficiency standards for new homes (5 star standard)	SEAV, Building Commission, Plumbing Industry Commission	Commenced July 2004; ongoing	Residential builders and new home buyers	Requires that all new homes and multi-unit housing built in Victoria achieve one of: • a 5 Star energy rating on the building fabric; or • a 4 Star energy rating on the building fabric plus the installation of either a solar hot water service or a rain water tank. From 1 July 2005 all new housing must achieve a minimum 5 star energy rating and have installed either a solar hot water service or a rain water tank.	• Reduce emissions of greenhouse gases from residential buildings. • Improve the quality of Victoria's housing stock. • Divert resources from the capital-intensive energy sector to the more labour-intensive building sector, generating new jobs and stimulating economic growth.	Regulation *(Building Code of Australia, Plumbing (Water and Energy Savings) Regulations 2004)*

(Continued next page)

Table B.5 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy Smart Advisory Centres	SEAV	Commenced 1999; discontinued 2002	Households and consumers	Provided information and advice to consumers through six centres in Melbourne and regional Victoria. Areas covered include: energy-efficient appliances, energy-efficient buildings, energy-saving practices with the potential to reduce energy costs, renewable energy technologies and promotion of other SEAV services.	• Improve the efficiency of energy use in the community through increased access to information and expertise.	Information provision
Energy Smart Builders and Estates	SEAV	Commenced 2000; discontinued 2002	Builders and residential developers	Provided builders with support in designing and marketing 4 and 5 Star energy rated homes. The Energy Smart Builders program was aimed at the largest builders in Victoria. Five builders – including the largest builder in Victoria – joined the program. The SEAV provided building companies with technical support and training to assist in the redesign and marketing of energy-efficient homes. The Energy Smart Estates program required all houses built on the estate to achieve a minimum 4 Star energy rating. Participating builders were permitted to use Energy Smart Estate branding.	• Increase the number of energy-efficient homes offered to new home buyers. • Increase the capacity of builders and developers to design, build and market energy-efficient homes.	Information provision, training and accreditation, voluntary arrangements, marketing
Energy Smart Business	SEAV	Commenced 2000; discontinued 2002	High energy users in the manufact-uring, education & commercial sectors	Developed partnerships with organisations and offered financial assistance to help them undertake energy audits and prepare plans for implementing energy-saving actions. Replaced by the Business Energy Innovation Initiative.	• Reduce energy use and carbon dioxide emissions and achieve ongoing energy management in line with the Victorian Government's Greenhouse Policy.	Financial incentives, information provision and voluntary arrangements

(Continued next page)

Table B.5 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy Smart Cascade	SEAV	Commenced 1998; discontinued 2000	Commercial and industrial sectors	Provided information on energy management and energy efficiency to 'hosts' such as large companies and industry associations. It was intended that the concepts would then 'cascade' to smaller companies from their industry peers. Participants were expected to establish an energy management program and an energy policy and action plan for improving energy efficiency.	• Assist large companies to establish energy management programs. • Reduce Victoria's greenhouse pollution through energy management in business.	Information provision, voluntary arrangements, training
Energy Smart Living Campaign	SEAV	Commenced September 2000; discontinued 2001	Households and consumers	Promoted changes in the home energy-use habits of Victorian households and consumers. Used television, radio, daily newspapers, magazines, seminars and displays to raise awareness of the benefits of energy saving. In addition, energy-saving tips were incorporated into commercial radio weather bulletins and newsletters mailed to retail energy consumers by energy supply companies AGL, Origin and Pulse.	• Raise awareness and facilitate the uptake of energy efficiency by Victorian households. • Promote energy saving measures to Victorians with an emphasis on reducing energy use for cooling.	Information provision

(Continued next page)

Table B.5 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy Smart Schools	SEAV	Commenced 2000; discontinued 2002	Schools, architects	Provided a range of technical, advisory and information support services to schools to assist them to introduce improved energy management in school facilities. Member schools were provided with a resource kit, software for monitoring and benchmarking school energy use, and ongoing communication and technical support. Three training seminars for school energy managers were conducted. Casual relief teacher grants were provided to enable classroom teachers to implement the program's initiatives. Subsidies were delivered to 13 schools for minor energy efficiency works. Additional funding was also provided for the Schools Low Energy Challenge initiative to highlight energy savings achievable in schools.	• Facilitate improved energy efficiency in the design, construction and operation of school facilities. • Encourage schools to establish energy management programs that would lead to sustained reductions in energy consumption, energy costs and greenhouse pollution.	Financial incentives, information provision, technical advice
Energy Task Force	SEAV, DHS, Office of Housing	Commenced 2003; ongoing	Low income households	Offers energy retrofitting to low income households to improve the comfort of their homes and reduce their energy bills. Energy efficiency retrofits managed by local community organisations are conducted by a number of small mobile work teams that are engaged and trained as part of a government-funded labour market program.	• Provide opportunities for unemployed Victorians to gain skills in energy auditing and retrofitting and to increase people's participation in their local community. • Reduce energy consumption. • Foster the development of community-based enterprises to undertake energy efficiency improvements in public, low income and other housing. • Engage energy utilities in the energy efficiency retrofit projects, & encourage them to explore energy efficiency improvements.	Financial incentives, information provision, training, voluntary arrangements

(Continued next page)

Table B.5 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Five Star Renovator's Service	Moreland Energy Foundation Ltd	Commenced 2004; ongoing	Home renovators	Provides residents of the Moreland City Council with a free one hour consultation on how to make their home renovations more energy efficient.	• Encourage home owners to consider energy efficiency when renovating.	Information provision
High Efficiency Gas Heater Rebate	SEAV	Commenced April 2004; ongoing (to March 2006)	Households	Provides rebates of up to $1000 to concession card holders, and $600 to others for the purchase of highly energy-efficient gas heaters. The rebates are only available to consumers living in certain rural and outer metropolitan areas and are only available to subsidise the purchase of energy-efficient gas heaters to replace electricity or wood as the household's main source of heating. Houses built after 1 January 2002 are not eligible to receive the rebate.	• Assist regional and outer metropolitan Victorians to convert to an energy source that causes lower greenhouse gas emissions and is more cost effective. • Provide access to affordable and sustainable energy supplies for all Victorians. • Address the shortages of firewood in some country areas of Victoria.	Financial incentives
Local Energy Efficiency Demonstration Initiative	SEAV, Moreland Energy Foundation Ltd	Commenced 2004; ongoing	Local government	Supports local governments in rural and regional areas to provide examples to their local community of what can be achieved by implementing energy efficiency measures in their own facilities. With the assistance of the Moreland Energy Foundation, participating councils will develop business and community awareness programs to facilitate the replication of demonstration projects across each municipality. Partnerships have been established with 15 rural and regional councils.	• Promote the benefits of specific energy efficiency investments. • Demonstrate how local residents and businesses can achieve similar energy savings. • Reduce energy consumption within council facilities.	Information provision, financial incentives

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Table B.5 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Solar Hot Water Rebate	SEAV	2000; ongoing	Households	Provides rebates for solar water heaters that replace conventional gas, wood, briquette or oil-fuelled water heaters. The amount of the rebate is up to $1500 depending on the performance and capacity of the system	• Reduce end-use energy consumption. • Promote the development of the solar water heater industry in Victoria.	Financial incentives
State Environment Protection Act (Air Quality Management) Greenhouse Program	EPA Victoria	Commenced January 2002; ongoing	Commercial and industrial sectors	Requires EPA licence holders to: consider their energy use and associated greenhouse gas emissions; conduct an energy audit if required by the Act; prepare an action plan including all audit recommendations with a payback period of three years or less; and complete implementation of the plan by 2006. They must then report annually to the EPA on their energy use, associated greenhouse gas emissions and progress with implementation of their action plan. Those applying for a works approval to construct or modify plant must demonstrate that the plant will be of world's best practice for energy efficiency.	• Reduce energy use and carbon dioxide emissions in line with the Victorian Government's Greenhouse Policy.	Regulation *(State Environment Protection Act (Air Quality Management))*, information provision
Sustainable Energy Centre	SEAV	Commenced September 2003; ongoing	Commercial, industrial, household, consumer, government and energy generation sectors	Provides a hub for the exchange of international, national and local information and expertise on sustainable energy. Operates a bookshop and resource centre offering a wide range of information on sustainable energy drawn from around the world. Hosts events and workshops and is equipped with video conferencing and multimedia equipment to facilitate exchange with experts from around the world.	• Provide external stakeholders with timely and accurate information on sustainable energy. • Bring together people from many different organisations to discuss and debate new ways to progress sustainable energy.	Information provision, seminars

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Table B.5 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Sustainable Energy Info Initiative Partnerships (Regional Information Partnerships)	SEAV	Commenced January 2004; ongoing	Small businesses, households, community groups	Involves developing closer working relationships with local and regional organisations that have strong connections, expertise, networks and knowledge and are well placed to provide independent information on sustainable energy in their local areas. Local organisations involved in the program provide information to residents, small businesses and community groups through a range of communication channels, such as physical information access points, workshops and regional events.	• Expand the reach of sustainable energy information to Victorian businesses and households. • Develop new and innovative information products, services and channels. • Reach consumers, small business and community organisations at a point where they are making key decisions in regard to energy use. • Encourage choice and action which has a significant impact on the uptake of sustainable energy products and practices.	Information provision
Sustainable Public Lighting Initiative	SEAV	Commenced 2004; ongoing	Local government, developers	Establishes partnerships between the SEAV, local government and other key stakeholders to identify opportunities to maximise the sustainability of public lighting. For example, by replacing mercury vapour lighting with other technologies that consume less energy and require the disposal of lower levels of heavy metals.	• Reduce the energy consumption of lighting, and to encourage the adoption of technologies that result in the disposal of lower levels of heavy metals. • Provide leadership to public lighting owners, managers and developers.	Information provision, financial incentives
TravelSmart Local	SEAV, DOI	Commenced January 2001; ongoing	Households and consumers	Works in cooperation with local governments to encourage changes in travel behaviour. A particular focus is to reduce dependence on cars and the associated greenhouse gas emissions.	• Achieve small scale, measurable changes in travel behaviour. • Develop the capacity of local government officers to deliver such programs in the future.	Voluntary arrangements, information provision, financial incentives

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Table B.5 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Victorian Solar Innovation Initiative	SEAV	Commenced 2003; ongoing	Local government and community groups	Encourages the innovative use of solar energy design and technology, and demonstrates its application in community facilities such as schools, kindergartens, childcare and community health centres. Most projects involve the incorporation of passive solar design features into the building shell, which decreases energy end use and increases energy efficiency.	• Showcase the application of solar technology and design in community buildings undergoing upgrade or renovation.	Information provision, financial incentives

Table B.6 **Queensland Government energy efficiency programs**

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Cleaner Production Partnerships	Queensland EPA	Commenced May 1999; discontinued December 2000	Businesses	Provides support to businesses in conducting 'eco-efficiency' assessments on their premises and assists in implementing recommendations. Participants receive a $1000 grant to support the appointment of a consultant to identify 'eco-efficiency' opportunities, with a possible follow up $9000 to support the implementation of the consultant's recommendations.	• Support businesses in the identification and implementation of 'eco-efficiency' opportunities.	Financial incentives
EcoBiz	Queensland EPA	Commenced July 2003; ongoing (3 year program)	Businesses (particularly the agribusiness and food processing sectors, and urban development projects)	Offers tools and extension services to support the establishment of the 'eco-efficiency' baseline of businesses and to assist with action planning. Offers financial incentives (rebates) to support the implementation of best practice technologies in 'eco-efficiency' action plans, and branding to capitalise on market influence as a 'green company'.	• Improve the capacity of individual companies to achieve improved business competitiveness through 'eco-efficiency' and brand differentiation. • Provide local company case studies that can be diffused to the wider sector through industry networks (via the Greenhouse Industry Partnerships program).	Information provision, financial incentives, branding
Energy Advisory Service	Queensland EPA	Ongoing	Households and consumers	Provides advice on energy efficiency in the home, access to information, resources and basic program information.	• Provide impartial, free advice on energy efficiency and renewable energy	Information provision

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Table B.6 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Government Energy Management Strategy	DPW on behalf of Queensland Treasury	Commenced November 2003; ongoing (to June 2008)	26 core Queensland Government departments and agencies	Encourages Queensland Government departments and agencies to adopt practices which contribute to efficiencies in energy use, reduce greenhouse gas emissions and generate financial savings. Assists agencies to tender for preferred suppliers to audit, design, install, monitor and guarantee energy savings. Assists agencies in implementing a generic smart metering program at key facilities to monitor electricity usage patterns, select the best available tariffs and position agencies to take advantage of potential savings from the bulk purchase of electricity.	• Improve the efficiency of energy consumption and unit acquisition values in Queensland Government departments and agencies. • Achieve annual savings of $20 million by June 2008. The first target of $2 million is to be achieved by 30 June 2005.	Energy use reduction targets, financial incentives, implementation assistance
Greenhouse Industry Partnerships	Queensland EPA	Commenced February 2001; discontinued June 2002	Queensland businesses, local governments and industry associations (focus on agri-business, food processing, manufac-turing, tourism and urban development projects)	Provided grants of up to $100 000 to support the identification of 'eco-efficiency' opportunities, implementation of findings and the diffusion of findings across the relevant sectors to encourage wider uptake. Offered 'eco-efficiency' assessments for businesses and local government facilities, and a regional sustainability project. The program included several components: • the Industry Partnerships Program • the Local Government Greenhouse Partnership Program • the Greenhouse Building Rating Tool was used to encourage 4 star standard buildings • the Gladstone Large Industry Program.	• Support energy efficiency in Queensland business, government and residential sectors.	Financial incentives, partnerships

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Table B.6 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Guidelines Toward a More Sustainable Subdivision	DPW	Commenced December 2002; ongoing	Building industry	Provides information on better practice site development; building and landscape design; material selection and energy efficiency (including building design and appliance selection).	• Encourage better practice site development, building and landscape design and material selection	Information provision
Industry Partnerships Program	Queensland EPA	Commenced July 2002; ongoing	Local government, commercial sector and peak industry associations	Offers firms training, workshops and education programs which support the diffusion of business-level innovations in 'eco-efficiency'. Provides grants of up to $100,000 to support the diffusion of innovative approaches across sectors to encourage wider uptake. Particular focus on agribusiness, food processing, and urban development projects.	• Improve capacity for sustainability within priority sectors. • Achieve improved business competitiveness through 'eco-efficiency' and brand differentiation.	Financial incentives, training
Power for a Sustainable Future	Queensland EPA	Commenced July 2000; ongoing	Schools (upper primary and lower secondary students)	Provides schools with material to enable upper primary and lower secondary students to explore ideas and issues relating to sustainable energy.	• Meet objectives in the Queensland Science and Studies of Society and Environment curriculum.	Teaching materials

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Table B.6 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Queensland Sustainable Energy Innovation Fund	Queensland EPA	Commenced May 1999; ongoing	Queensland-based businesses and research organis-ations	Provides grants of up to $200 000 to support the development of new sustainable energy products or technologies, new process improvements or the creation of centres of expertise. Funds are focused on innovative projects dealing with research, development, demonstration or commercialisation of energy efficiency or renewable energy. Part of the cost of each project is offset, with the applicant or project partners expected to provide a significant input of cash, expertise, facilities, intellectual property and/or other in-kind contributions.	• Promote innovation in energy efficiency and renewable energy technology and practices. • Establish Queensland as a market leader in energy innovation and sustainable energy. • Support the commercialisation of new sustainable energy products or technologies by Queensland-based companies. • Support wide adoption of process improvements that reduce energy consumption and environmental impacts. • Support expertise and capability to commercialise sustainable energy technologies. • Reduce adverse environmental impacts resulting from fossil fuel use.	Financial incentives
Smart Housing	DOH	Commenced July 2002; ongoing	Residential building industry, home buyers, renovators and investors	Offers good practice guidance to all stakeholders involved in the design and construction of residential dwellings. Energy efficiency measures, including site planning and orientation, building design and appliance selection, are included in the advice to those planning to build, buy or renovate a house.	• Advance a set of principles embodying good practice in housing design, building and renovation. • Establish a common understanding of sustainability in terms of the 'triple bottom line' and a shared vision across State and local government and the housing industry. • Ensure there is a consistent and complementary message across all arms of Government in regard to good practice housing design and construction. • Influence supply and demand, bringing about a change in practice.	Information provision, voluntary arrangements

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Table B.6 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Sustainable Housing	Queensland EPA, DLGPSR	Commenced 2003; ongoing (to 2005)	Residential building industry, households	Proposes measures (in addition to the energy efficiency standards in the Building Code of Australia) to make housing more sustainable. Proposals include mandatory measures to reduce energy and water use in new houses. A discussion paper on the proposed measures is to be made available for public comment.	• Reduce energy and water use in new houses.	Regulation (most likely to be included under the *Building Act 1975* and/or the *Plumbing and Drainage Act 2002)*
Towards Healthy and Sustainable Housing Research Project (Research House)	DPW, DOH	Commenced March 2001; ongoing (to June 2007)	Residential building industry, consumers, educators, students	Incorporates the design, construction, and public display of a four-bedroom family home in Rockhampton to demonstrate sustainable design. A family of two adults and three teenage children lives in Research House. Data is collected on: heating; cooling; performance of appliances, insulation, glazing and lighting technologies.	• Facilitate research in ecological building design and construction. • Demonstrate social sustainability principles such as universal design, safety and security.	Technology demonstration, information provision
TravelSmart	Queensland Transport	Commenced 1997; ongoing	Households, businesses, local government, schools	Encourages the use of environmentally-friendly transport such as public transport, cycling, walking and car pooling. Supports voluntary change in the behaviour of individuals and organisations. Uses awareness campaigns, providing tailored information and improving access to 'TravelSmart' modes of transport.	• Achieve a 14 per cent reduction in single-occupancy car use. • Reduce vehicle kilometres travelled. • Reduce carbon dioxide emissions in the period 2008–12.	Information provisions, incentives

Table B.7 **Western Australian Government energy efficiency programs**

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Australian Building Greenhouse Rating	SEDO	Ongoing	Commercial building constructors, architects, managers, owners and tenants	Provides training and accreditation for the use of energy rating software for new and existing commercial buildings.	• Increase the energy efficiency of commercial buildings.	Training and accreditation
Brochures	SEDO	Ongoing	Households, businesses and local government	Provides brochures dealing with energy efficiency themes in homes and commercial business, either online or in hard copy through the Energy Smart Line.	• Provide access to information on energy savings in homes and commercial businesses.	Information provision
Cogeneration	SEDO	Ongoing	Commercial and industrial sectors	Encourages industry to consider electricity cogeneration. Provides information, including reports on cogeneration and case studies of cogeneration projects.	• Contribute to the development of the Western Australian sustainable energy industry sector.	Information provision
Community Seminars	SEDO	Ongoing	Community groups	Invites industry experts to present seminars to the community. Seminars are designed around key areas of SEDO community programs and topics including energy efficiency.	• Enable easy access for the community to experts in the essential SEDO program areas of energy efficiency.	Information provision

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Table B.7 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy Smart Business Seminars	SEDO	Ongoing	Small to medium businesses	Provided seminars on a range of key topics on sustainable energy solutions for small to medium businesses, including lighting, air conditioning and energy audits.	• Provide the business community with easy access to information on key areas of energy efficiency.	Information provision
Energy Smart Directory	SEDO	Ongoing	Consumers and businesses	Provides a web-based search engine for finding Western Australian businesses that provide sustainable energy products and services.	• Facilitate access within Western Australia to sustainable energy products and services, for business and the community.	Information provision
Energy Smart Government	SEDO	Commenced June 2002; ongoing	Western Australian Government agencies, business and community	Obliges State Government agencies to reduce their energy consumption by 12 per cent by 2006-07 compared to their 2001-02 consumption. Sets incremental targets of 5, 6, 8, 10 and 12 per cent over five years. Provides grants ($350 000 each year) to fund energy audits and studies to encourage energy management projects, and capital advances ($16 million over four years) to fund identified financially viable energy efficiency projects. Applies financial penalties to agencies that fail to reach their reduction targets.	• Instil energy management as an ongoing element of the operation of Western Australian Government agencies. • Provide an example to businesses and the community of the potential of good energy management practices.	Mandatory audits, energy use reduction targets, financial incentives and penalties, information provision
Energy Smart Line	SEDO	Ongoing	Households	Provides expert energy efficiency and renewable energy advice via a telephone service which responds to more than 5000 calls each year and provides brochures on request.	• Provide access to independent, expert advice to facilitate the adoption of energy efficiency and renewable energy in the home.	Information provision

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Table B.7 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Government Office Accommo-dation Guidelines	DHW	Ongoing	Government property managers, commercial building developers, owners and managers	Sets energy performance requirements for government buildings and tenancies.	• Reduce government energy costs and greenhouse gas emissions. • Raise the profile of energy efficiency in the commercial building sector. • Drive market transformation and improve the energy efficiency of Western Australian commercial office building stock.	Government procurement policy
House Energy Rating Software program	SEDO	Ongoing	Residential building industry	Involves accredited assessors, who use house energy rating software to rate the relative thermal energy performance of house design, either during design and construction or for existing homes.	• Improve the energy efficiency of houses in Western Australia.	Training, house energy rating software
Reach for the Stars	SEDO	Ongoing	Producers, consumers and retailers of home appliances	Raises industry and consumer awareness of the energy rating label and the benefits of high efficiency appliances.	• Reduce energy costs and greenhouse gas emissions associated with the use of energy labelled appliances. • Increase the promotion and sale of energy-efficient appliances.	Information provision
Regional Energy Efficiency Pilot Project	SEDO	Commenced December 2004; ongoing (to June 2005)	Regional households, businesses and local government	Offers residents of regional towns: information on energy efficiency; free energy audits to business; free compact fluorescent lights to households; and rebates for the purchase of energy-efficient air conditioners, refrigerators, freezers and insulation.	• Reduce average and peak electricity demand in regional areas resulting in savings for consumers and government.	Information provision, voluntary audits, financial incentives

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Table B.7 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
SEDO Grants Committee	SEDO	Ongoing	Community groups, education institutions, businesses and local government	Provides grants for research, demonstration and education projects that increase the uptake and understanding of energy efficiency.	• Increase the uptake of energy efficiency and renewable energy measures. • Assist the development of the sustainable energy industry.	Financial incentives
Subiaco Sustainable Demonstration Home	SEDO, City of Subiaco	Construction commenced November 2002; open to public until 2006	Households and residential building industry	Uses a purpose-built house in the Perth suburb of Subiaco as a tool to educate the community about energy-efficient house design. For two years the house will be open to the public to demonstrate the technology behind such developments. During that time data on the thermal performance of the home will be collected.	• Show that an environmentally friendly and energy-efficient home can also be architecturally impressive, aesthetically pleasing and functional.	Technology demonstration, information provision

Table B.8 **South Australian Government energy efficiency programs**

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Building Tune Ups	Adelaide City Council, Office of Sustainability, DAIS and Energy SA	Commenced October 2003; ongoing (to late 2005)	Private and Government CBD office building owners and operators	Provides audits and ratings of energy and water use of 10 office buildings in the Adelaide CBD (three government and seven private sector buildings). Informs building owners of the results of the audits and of strategies to improve the performance of their buildings. Encourages building operators to achieve a one star Australian Building Greenhouse Rating (ABGR) improvement.	• Demonstrate cost-effective opportunities to improve the energy and water efficiency of commercial office buildings. • Reduce greenhouse gas emissions from the city of Adelaide.	Voluntary audits, information provision
Business energy efficiency opportunity identification	Energy SA	Ongoing	Small to medium businesses, government agencies	Provides 30 businesses in Adelaide with subsidised energy efficiency assessments and assists them to formulate action plans to reduce their energy consumption. Results from the first 19 energy audits show the potential to reduce energy use by an average of 10 per cent with an average payback of 3.3 years (including the audit costs).	• Reduce greenhouse gas emissions. • Improve SA business competitiveness.	Financial incentives
Cities for Climate Protection	Energy SA	Ongoing	Local government, businesses, community groups	Provides information and assistance to South Australian councils involved in the Australian Government Cities for Climate Protection program.	• Assist South Australian local councils to reduce greenhouse gas emissions in line with the 108 per cent Kyoto Protocol target.	Funding, information

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Table B.8 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Demonstration home SA Energy Home at Northfield	Energy SA, ETSA, AGL and Jennings	Commenced 2001; discontinued 2004	Home owners	Involved retrofitting a standard three bedroom house with energy-efficient appliances, high levels of insulation to walls and ceilings and other initiatives. The public were able to walk through the house to observe energy efficiency technologies, and collect information brochures about the products and services in the home.	• Demonstrate to the public the energy-saving techniques available for their own houses.	Technology demonstration, information provision
Eco-efficiency program	EPA South Australia	Commenced July 1998; ongoing	Small businesses	Involves the provision of information, voluntary agreements and assistance with funding and expertise for projects that demonstrate ecologically sustainable development principles. Addresses the objectives of the Environment Protection Act, 1993.	• Promote the benefits of 'eco-efficiency' to small business and to provide tools for implementing 'eco-efficiency' changes	Information provision, financial incentives, voluntary agreements
Eco-Renovation Home in Whyalla	SAHT, Whyalla City Council, Energy SA	Commenced July 2001; ongoing (to the end of 2006)	Whyalla residents and visitors	Involves the retrofit of one ‘double unit’, with one unit operating as an information centre open to the public. Information is available about the retrofit, and the energy and water use is monitored. The information is made available through the website.	• Demonstrate how the energy efficiency of existing housing can be improved.	Technology demonstration, information provision

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Table B.8 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Government Energy Management Plan	Energy SA, Department of Premier and Cabinet	Commenced 1998; ongoing	Government	Sets the South Australian Government's targets for reduced energy use by Government agencies and proposes strategies for achieving those targets. Sets a target of a 15 per cent reduction in energy use in Government buildings before 2010 (against 2000-2001 levels). This target has been extended to 25 per cent by 2014.	• Reduce energy use, energy costs and greenhouse gas emissions from public sector operations. • Maintain a comprehensive inventory of greenhouse gas emissions from public sector operations. • Provide leadership in addressing climate change issues.	Mandatory reporting, energy use reduction targets
Energy Efficiency Program For Low Income Households	Energy SA	Commenced January 2004; ongoing (to December 2005)	Low income households	Provides voluntary audits to identify opportunities for energy efficiency in the home. Following the audits, households receive energy-efficient light bulbs, a shower head and a draught-excluder, and may be eligible for buy-back schemes to 'retire' inefficient refrigerators. Some households receive interest-free loans to enable them to purchase energy-efficient appliances.	• Assist low income households reduce energy use and costs without reducing their comfort.	Voluntary audits, financial incentives, information provision
Energy Friends	Energy SA	Commenced 2002; ongoing	Community groups, households	Provides training to community groups to enable them to take action in their local community. The program may involve home energy audits, community forums or other information programs.	• Reduce house energy use and bills without reducing comfort. • Raise awareness of energy management at home	Training, voluntary audits, information provision

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Table B.8 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy SA Advisory Service	Energy SA	Ongoing	South Australian community (including households, businesses, schools and local government)	Provides information on greenhouse gas abatement and energy efficiency measures via visitor centres, telephone advice lines, the Energy SA website, literature distribution, seminars and workshops.	• Provide independent information, advice, and resources to motivate the target audience to implement sustainable energy practices.	Information provision
Energy Services Industry Development	Energy SA	Ongoing	Businesses, government	Operates an annual Energy Efficiency Conference and Trade Fair. Attendees include: representatives of the energy services industry from the commercial, industrial and residential sectors; government representatives; and interested members of the public. Attendees can visit trade booths to learn about specific energy efficiency related products and services.	• Provide an opportunity for companies involved in the energy services industry and potential customers in the commercial, industrial and domestic sectors to exchange information. • Highlight the key issues of relevance to the energy services industry such that attendees are up to date and informed, and appreciate where the industry can add value.	Information provision, awareness raising
Installation of LED Equipped Traffic Signals	DTUP	Ongoing	Government	Involves replacement of globes in traffic signals equipped with energy-efficient light emitting diodes (LEDs).	• Reduce energy use and greenhouse gas emissions associated with the operation of traffic signals across the Adelaide metropolitan area.	Technology and innovation

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Table B.8 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Local government support	Energy SA	Commenced January 2002; ongoing	Local government, residential, commercial and industrial sectors	Offers assistance to South Australian local governments to implement sustainable energy initiatives, both within their own operations and within their communities. Assistance includes: information provision; promoting Energy Performance Contracts and other energy management tools; and assistance with staff training.	• Assist local governments to reduce the energy use, energy bills and greenhouse gas emissions associated with their own operations and those of local businesses and households.	Information Provision
Mandatory 4 star energy performance homes	Planning SA	Commenced 1 January 2003; ongoing	Residential building industry and owner-builders	Requires that all new homes and home extensions built in South Australia meet the energy efficiency standards set out in the Building Code of Australia. To meet this target, they must meet certain standards of energy-efficient design and material selection. Currently homes must achieve a 4 star standard of energy efficiency. From May 2006 the standard will increase to 5 stars.	• Reduce greenhouse gas emissions. • Minimise peak electricity loads. • Reduce end-user heating and cooling costs.	Regulation (Standards in the South Australian Housing Code (includes reference to the *Building Code of Australia* as a technical standard))
Reach for the Stars	Energy SA	Commenced September 2002; ongoing	Consumers and retailers of appliances	Raises industry and consumer awareness of the energy rating label and the benefits of high efficiency appliances.	• Reduce energy costs and greenhouse gas emissions associated with the use of energy-labelled appliances. • Increase the promotion and sale of energy-efficient appliances.	Information Provision

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Table B.8 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Remote Area Energy Efficiency Rebates Scheme	Energy SA	Commenced February 2002; discontinued May 2003	Households and businesses in regional and remote South Australia	Provides targeted rebates on compact fluorescent lamps and insulation to households and businesses in off-grid communities in regional and remote South Australia.	• Assist off-grid communities to reduce their energy use, energy costs and greenhouse gas emissions. • Reduce Government expenditure on electricity subsidies provided to communities participating in the Remote Area Energy Scheme.	Financial incentives, information provision
Schools Program	Energy SA	Commenced January 2000; ongoing	Primary and secondary school students and teachers	Encourages a focus on sustainable energy in the South Australian school curriculum and provides field demonstrations using the Energy SA solar powered caravan and trailer.	• Provide teachers with resources to use in their sustainable energy curriculum in order to raise awareness of energy efficiency and sustainable energy generation.	Information provision
Small Business Energy Savers Kit	Energy SA	Ongoing	Small businesses	Provides information to small businesses advising them how they can save money and reduce greenhouse gas emissions by adopting energy efficiency measures. This may include recommending that businesses implement energy management programs and purchase energy-efficient appliances and equipment.	• Provide businesses with strategies to reduce their energy consumption and bills.	Information provision
Solar Hot Water Heater Rebates	Energy SA	Commenced July 2001; ongoing	Households	Provides rebates of up to $700 for the installation of solar hot water systems that meet eligibility criteria.	• Promote sustainability and reduce greenhouse gas emissions.	Financial incentives

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Table B.8 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
South Australian Housing Trust Environmental Management Framework	SAHT	Ongoing	Tenants of SAHT properties	Involves developing and promoting programs and initiatives in line with broader government directions in energy efficiency. Includes measures to: renovate and upgrade existing housing stock to improve energy efficiency; construct new properties with a minimum four star energy rating; develop and implement awareness programs for SAHT tenants on how to reduce energy use; identify opportunities to create energy efficiencies in properties where the SAHT provides landlord power; develop a low cost, low energy, roof integrated solar heating system; and install solar hot water systems in selected SAHT properties.	• Place clients of SAHT in energy-efficient housing which they can afford to run.	Information provision, housing retrofits, technology and innovation
Sustainable Energy Research Grants	SENRAC	Commenced 1994; ongoing	Industry, universities	Provides research and development grants to sustainable energy projects that have strong prospects of commercialisation, environmental benefits and the potential to reduce energy costs for South Australian consumers. Focuses on grants for sustainable and renewable energy technologies, and on demand-side management technologies.	• Enable more efficient use of energy, reduce peak energy demand and reduce energy-related greenhouse gas emissions.	Financial incentives
TravelSmart SA	DTUP	Ongoing	Schools, workplaces and households	Encourages voluntary travel behaviour change including increased walking, cycling and public transport use.	• Reduce energy use and greenhouse gas emissions by changing travel behaviour.	Information Provision

Table B.9 **ACT Government energy efficiency programs**

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
ACT Energy Wise	Office of Sustainability	Commenced December 2004; ongoing	Households	Provides audits to identify home energy efficiency improvements that will reduce household greenhouse gas emissions. Offers rebates of up to $500 to householders who make energy efficiency improvements identified in the audit. Subsidised products may include insulation, window treatments, weather stripping, pelmets, lined curtains or blinds, fluorescent lights and permanent external shading.	• Increase the energy efficiency of existing homes in the ACT and reduce their greenhouse gas emissions. • Leverage expenditure by homeowners in energy efficiency upgrades of their homes beyond normal maintenance and renovation programs. • Encourage the development of a local energy efficiency services sector. • Raise awareness among homeowners of the greenhouse issue and the potential to increase their home's energy efficiency. • Complement other residential greenhouse gas abatement measures. • Complement and eventually subsume the existing cavity wall insulation and solar hot water rebate programs.	Voluntary audits, financial incentives

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Table B.9 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
ACT House Energy Rating Scheme	ACT Planning and Land Authority	Commenced July 1995; ongoing	Residential building industry, home owners and buyers	Requires developers of new residential properties to use the energy rating software, FirstRate, to rate the energy efficiency of their proposed designs. New residential buildings must achieve a minimum 4 star energy efficiency rating. Requires vendors of existing homes to undertake an energy efficiency rating assessment and to disclose the rating in all advertisements for sale and to include the rating statement as part of the contract for sale.	• Increase the energy efficiency of all new homes in the ACT. • Foster awareness in the community and building industry of the benefits of energy efficiency.	Regulation (*Civil Law (Sale of Residential Property) Act 2003*)
Cavity Wall Insulation Subsidy	Office of Sustainability	Commenced February 2001; discontinued December 2004	Households	Provided a total of $360 000 in discounts to ACT residents over three years. A 25 per cent discount was offered to 900 households that installed cavity wall insulation. The subsidy was offered on a 'first come, first served' basis. Environment ACT asked those taking up the scheme to complete a survey to measure dollar and energy savings from installing cavity wall insulation.	• Increase the energy efficiency of existing homes in the ACT and reduce their greenhouse gas emissions. • Leverage expenditure by homeowners in energy efficiency upgrades of their homes, beyond normal maintenance and renovation programs.	Financial incentives
Ecobusiness	ACT NoWaste Urban Services, Office of Sustainability	Commenced 2002; ongoing	Commercial sector	Offers workshops which address waste management, energy efficiency and water efficiency in the commercial sector.	• Encourage commercial businesses to develop and implement water and energy conservation measures and minimise solid and liquid wastes via reuse and recycle systems. • Encourage businesses to implement environmental management systems.	Information provision

(Continued next page)

Table B.9 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy Performance in Commercial Buildings	Office of Sustainability, Chief Minister's Department	Commenced September 2002; discontinued	Commercial sector	Promotes the uptake of Energy Performance Contracts (EPCs) by ACT businesses, and provides limited subsidies. Participating owners and occupiers of commercial buildings enter into contracts with energy performance contractors. The contractors undertake energy efficiency improvements in the buildings and guarantee a level of energy savings over the project pay-back period. This reduces the risk to business that the energy efficiency measures will not be cost effective.	• Demonstrate the cost effectiveness of EPCs to the commercial sector. • Reduce greenhouse gas emissions from the commercial sector.	Information provision, financial incentives
Energy Use in ACT Government Operations	Greenhouse and Energy Policy, Office of Sustainability	Commenced July 2002; ongoing	ACT Government agencies	Collects energy use data from all ACT Government agencies (including electricity and gas use and transport fuel consumption) using an internet-based program called EDGAR (Energy Data Gathering And Reporting). Tracks progress against greenhouse targets set in the ACT Greenhouse Strategy 2000.	• Accurately measure energy use in ACT Government operations. • Enable abatement measures to be implemented where appropriate.	Government reporting requirements
Environment-ally Sustainable Procurement Guideline	ACT Procurement Solutions	Commenced June 2004; ongoing	ACT Government agencies	Mandates ACT Government agencies to consider environmental sustainability, including energy efficiency, in the procurement of goods, services and works.	• Add value to procurement outcomes through a number of requirements, including energy efficiency.	Government procurement policy

(Continued next page)

Table B.9 (Continued)

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Home Energy Advice Team	Office of Sustainability	Commenced 1998; ongoing	Households and consumers	Provides free advice on home energy efficiency, energy appliances, service providers and products. Provides the services of technical advisers for new home buyers and renovators.	• Increase the energy efficiency of existing homes in the ACT and reduce their greenhouse gas emissions. • Encourage the development of a local energy efficiency services sector. • Raise awareness among home owners of the greenhouse issue and the potential to increase their home's energy efficiency.	Information provision, technical assistance
Sustainable Infrastructure	ACT Treasury, ACT Procurement Solutions Branch	Commenced 2004-05; ongoing	ACT Government agencies	Allocates $4 million to supplement the ACT Government capital works program to enhance environmental performance (including energy efficiency).	• Provide supplementary funding to projects that have value as demonstrations of energy efficiency, but may not have been undertaken in the absence of the additional funding.	Government procurement policy
Water and Energy Savings in the Territory	Office of Sustainability, Essential Services Consumer Council, YWCA of Canberra	Commenced 2003; ongoing	Low income households	Trial program to provide energy audits, information, advice, refit work and access to no-interest loans for low income households having difficulty paying their utility bills.	• Raise household awareness of the key contributors to high energy and water use. • Assist low income households to address key issues around energy and water consumption. • Reduce energy and water consumption of low income households. • Reduce the potential of at-risk households to accumulate large utility debts. • Assist households to move out of utility debt.	Information provision, financial incentives

Table B.10 **Northern Territory Government energy efficiency programs**

Program name	*Agency*	*Start date and status*	*Target audience*	*Description*	*Objectives*	*Policy instrument*
Energy Management Services	DIPE	Commenced 1985; ongoing	Northern Territory Government agencies	Provides energy audits, building design advice, technical investigations, project brief and tariff analyses, energy efficiency and energy management advice and some implementation funding to NT Government agencies. Encourages reductions in government energy consumption, energy expenditure and associated environmental impact.	• Reduce NT Government energy expenditure and environmental impact. • Develop and implement whole-of-government energy management policies. • Provide professional energy management services and tools to NT Government agencies. • Promote energy-efficient and ecologically sustainable building infrastructure developments.	Information provision, audits

C Australian energy efficiency standards for buildings

C.1 The Building Code of Australia

Background

In Australia, the building industry has traditionally been regulated by State and Territory Governments, with some responsibility delegated to Local Governments. Since at least the 1960s, there have been moves toward cooperation and consistency of building regulation across jurisdictions. The main instrument used to encourage consistency is the Building Code of Australia (the Building Code) (PC 2004b).

The first edition of the Building Code was released in 1990 and the current edition was released in October 1996. Since then, it has been progressively refined and amended. The Building Code covers technical aspects of building design and construction, including building structure, fire safety and certain aspects of building amenity. The provisions in the Building Code have recently been extended to include energy efficiency standards for some classes of buildings.

Administrative arrangements

In 1994, the Australian, State and Territory Governments signed the Inter-Government Agreement to establish the Australian Building Codes Board (ABCB). This made the ABCB the peak body responsible for the development of nationally consistent building regulation through the Building Code. The ABCB seeks to maintain and upgrade the Building Code to ensure that its provisions are cost effective, easily understood and do not impose standards that go beyond the public interest.

The ABCB is made up of the chief executives responsible for building matters in the Australian, State and Territory Governments, one Local Government representative and four representatives of the building industry. A chair is appointed by the Australian Government minister responsible for building matters.

A number of project committees and working groups also exist to inform and assist the ABCB in its administration of the Building Code. Among them is an Energy Efficiency Steering Committee. The stated objectives of the Energy Efficiency Steering Committee are:

> … to assist the Australian Building Codes Board (ABCB) to develop cost-effective energy efficiency measures suitable for introducing under building law and in so doing, assist the Australian Governments reduce greenhouse gas emissions. (ABCB 2004c, p. 1)

The roles of the Energy Efficiency Steering Committee include:

- providing policy advice on cost-effective building energy efficiency standards to the ABCB, Australian Greenhouse Office (AGO) and Department of Industry, Tourism and Resources (DITR);
- coordinating and expediting the development of energy efficiency standards for inclusion in the Building Code;
- facilitating the communication, understanding, acceptance and adoption of proposed changes to the Building Code; and
- assisting the ABCB to facilitate the training of builders and energy rating practitioners (ABCB 2004c).

The Energy Efficiency Steering Committee consists of:

- a Chair nominated by the ABCB;
- the Executive Director of the ABCB;
- three representatives of State and Territory statutory bodies responsible for building regulation;
- a representative from the AGO;
- an ‘eminent person’ as a community advocate;
- a representative from the DITR;
- a representative from the Australian Local Government Association; and
- three industry representatives (ABCB 2004c).

Implementation of the Building Code

The Building Code is given legal effect only when it is adopted by the individual State and Territory Governments. It has been adopted by each State and Territory as a technical standard for the design and construction of buildings. For example, in Victoria, all building work must comply with the *Building Act 1993 (Vic.)* and the

Building Regulations 1994 (Vic.). The *Building Regulations 1994 (Vic.)* 'call up the BCA [the Building Code] as a technical reference, thereby giving it legal status' (Victorian Building Commission 2003, p. 2).

There is no compulsion for any State or Territory to adopt the Building Code in full, or as the exclusive instrument of building policy. In practice, State and Territory Governments adopt additional or alternative legislation and regulations relating to building matters.

The Building Code includes appendices for each State and Territory. The appendices detail any provisions that apply in individual jurisdictions. These may be in addition to the standards in the main text of the Building Code, or may override them. Energy efficiency is one policy area in which State and Territory Governments have made policies in addition or as an alternative to the main text of the Building Code. For example the Victorian appendix to volume two of the Building Code contains the energy efficiency requirements for new houses in Victoria, which are more stringent than the requirements in the main text.

Enforcement of building regulations is primarily the responsibility of State and Territory Governments, but they have delegated some of the regulatory tasks to local councils. The relevant administrative and compliance issues have tended to be a lower priority for the ABCB than the technical aspects of the Building Code, although the early 1990s saw the introduction of model building legislation that included reforms to administration and certification (PC 2004b). States and Territories have adopted the model legislation to varying degrees, leading to jurisdictional inconsistencies in the administration of the Building Code. In its review of building regulation, the Productivity Commission noted that:

> There are concerns that the current compliance and enforcement systems for building regulation may be deficient, to varying degrees across jurisdictions. (PC 2004b, p. 191)

Overview of the Building Code

The Building Code comprises two volumes, with each volume covering particular classes of buildings. In essence, volume one covers commercial and multiple-occupancy buildings while volume two deals with single dwellings (detached or attached). The contents of the Building Code specify minimum standards for both building practices and for building performance.

The Building Code is amended annually. Proposed amendments are subject to an extensive consultative process including regulatory impact assessments and public comment. Amendments are formally adopted on 1 May each year (ABCB, sub. 7, p. 4).

Following an extensive review of building regulations in 1991, the Australian, State and Territory Governments agreed that the ABCB should specify performance-based building codes (PC 2004b). Performance-based codes specify a desired outcome, rather than prescribing the means by which that outcome is to be achieved. Relative to more prescriptive codes, they allow for greater flexibility, innovation and potential cost savings.

C.2 The Building Code and energy efficiency of residential buildings

On 1 January 2003, the ABCB introduced energy efficiency standards into volume two of the Building Code. The standards cover new houses and additions to existing houses. The ABCB chose to incorporate energy efficiency standards for houses before commercial buildings because 'industry had expressed concern at the proliferation of residential "energy codes" being implemented at a regional level and called for the expedient development of mandatory measures in the BCA [Building Code]' (ABCB 2004b, p. C2).

The introduction of energy efficiency provisions into the Building Code followed an announcement in July 2000 that the Australian Government had reached an agreement with State and Territory Governments to 'develop suitable national energy efficiency provisions for domestic and commercial buildings, through the introduction of minimum mandatory requirements in the BCA [Building Code].' (ABCB 2004d, p. 4).

To progress the development of energy efficiency standards in the Building Code, the AGO provided $2.3 million to the ABCB from 2001 to 2005. The ABCB also financed the project from its own budget. Total funding amounts to $4.75 million to 30 June 2005 (PC 2004b).

The stated objective of the energy efficiency standards for houses is 'to reduce greenhouse gas emissions by efficiently using energy' (Building Code of Australia 2004 (volume 2), s.O2.6, p. 87). The standards cover the building fabric and domestic services. Domestic services are defined as the basic engineering systems of a house that use energy or control the use of energy. They include central heating water piping, and heating and cooling duct work. Water heaters, space heaters, air conditioners and cooking appliances are subject to mandatory appliance energy performance labelling schemes and minimum energy performance standards (MEPS) (appendix D).

Compliance with the energy efficiency standards

Buildings must meet performance requirements to satisfy the technical standards in the Building Code. The performance requirements relating to energy efficiency state that:

- a building must meet a level of thermal performance to 'facilitate the efficient use of energy for artificial heating and cooling' (Building Code of Australia 2004 (volume 2), s.P2.6.1, p. 87); and
- domestic services must have features that 'facilitate the efficient use of energy' (Building Code of Australia 2004 (volume 2), s.P2.6.2, p. 88).

Builders have a number of options available to meet the performance requirements:

1. use the 'deemed-to-satisfy' construction methods and materials prescribed in detail in the Building Code (box C.1); or
2. formulate an 'alternative solution' which:
   (a) complies with the performance requirements; or
   (b) is shown to be at least equivalent to the deemed-to-satisfy provisions; or
3. apply a combination of options 1 and 2 (Building Code of Australia 2004 (volume 2), s.1.0.5, p. 25).

Box C.1 **Deemed-to-satisfy provisions**

Although the Building Code is performance-based, it includes extensive 'deemed-to-satisfy' provisions. These provisions detail building techniques that are considered to be acceptable forms of construction that meet the legislative requirements for complying with the performance requirements. Builders who use these forms of construction are deemed to have met the requirements of the Building Code.

There is no obligation to adhere to these forms of construction. Other construction practices may be followed if they are preferred by the builder, provided they satisfy the performance requirements.

Proof that an alternative solution complies with the performance requirements can be demonstrated by:

- providing documentary evidence (for example, from an accredited testing authority or an appropriately qualified person) that the solution meets the performance requirement or a deemed-to-satisfy provision; or

- using a verification method such as:
  - the verification methods in the Building Code; or
  - some other verification method that is accepted by the appropriate State or Territory authority; or
- comparison with the deemed-to-satisfy provisions; or
- the judgement of a qualified expert that the solution satisfies the performance requirement (Building Code of Australia 2004 (volume 2), s.1.2.2, p. 41).

Deemed-to-satisfy provisions in the Building Code for house energy efficiency

Builders can satisfy the energy efficiency standards for houses if they adhere to the forms of construction prescribed in s.3.12 of the Building Code, which includes a range of 'acceptable construction practices' relating to the:

- building fabric (including insulation, roofs, walls and floors);
- external glazing (including shading);
- building sealing (including construction of roofs, walls, floors, windows, doors and chimneys);
- air movement; and
- services.

Builders who do not follow the deemed-to-satisfy provisions must use another method to demonstrate that their building complies with the energy efficiency standards. The Building Code allows two verification methods for builders to prove that their buildings meet the energy efficiency standards:

- use a software package to model the energy consumption of the building, which is compared to a regulated maximum energy consumption or star rating; or
- model a 'reference building' to which their proposed design is compared.

In practice, 'most building designers choose to develop a solution following the Deemed-to-Satisfy Provisions' (ABCB sub. 7, p. 3).

Verification using calculated building energy load

The two approved verification methods in the Building Code require that builders calculate the 'energy load' of the building. The energy load is the amount of energy that will be added to the building (by artificial heating) and removed from the building (by artificial cooling) in order to maintain the desired temperature.

The ABCB (2004e) has published a Protocol for House Energy Rating Software that details the method for calculating the house energy load. Currently, three software packages are considered to comply with the Protocol — NatHERS, BERS and FirstRate (box C.2). These packages calculate the annual energy load of the house. The energy load can be used to assign a star rating. The higher the star rating, the more energy efficient the building.

While the Building Code recognises NatHERS, BERS and FirstRate as complying with the Protocol:

> … the individual State and Territory jurisdictions take responsibility for the identification of suitable software and operator accreditation. While the BCA [Building Code] provides information about software options, it neither makes recommendations nor imposes requirements in that regard. (ABCB 2002, p. 7)

In Victoria, for example, two packages are in use — NatHERS and FirstRate (box C.2). The Victorian Government imposes restrictions on the use of the two packages. For example, FirstRate may not be used if:

- the total area of glazing is greater than 60 per cent of the net conditioned floor area; and
- the glazing of any one orientation is greater than 35 per cent of the net conditioned floor area.

Verification using a star rating or stated value

The energy efficiency standards introduced into the Building Code in January 2003 divided Australia into eight climate zones. One verification method requires that houses built in the northern zones (climate zones 1–3) achieve a 3.5 star rating, and houses built in the southern zones (climate zones 4–8) achieve a 4 star rating.

The Building Code allows builders of houses in the northern climate zones to use an alternative approach when using energy modelling software. Instead of being required to achieve a certain star rating, they may refer to a table of allowable house energy load. The table prescribes the allowable energy load (in megajoules per square metre of floor area per year). Energy load predicted by the energy modelling software must not exceed this value. The maximum allowable energy load is set at a level that is equivalent to the required star rating in each climate zone.

The allowable energy load depends on the location of the proposed house. Houses that install either solar or heat pump hot water systems are permitted to consume an additional 20 megajoules per square metre per year.

Box C.2 **Energy rating software**

NatHERS

The Nationwide House Energy Rating Scheme (NatHERS) is an Australian Government program administered by the Department of the Environment and Heritage. As part of the scheme, a NatHERS software package has been developed to rate the energy efficiency of residential buildings.

Assessors must input data relating to the building fabric, including building dimensions; insulation levels; roof and wall colour; window sizes; and overshading by buildings or trees. Building characteristics, hourly local climate data and user occupancy patterns are analysed to simulate the operational energy use in the home. From this information, the software generates energy ratings which range from 0 to 5 stars. The higher the star rating, the more energy efficient the building.

BERS

The Building Energy Rating Scheme (BERS) software package was developed by the Australian renewable energy consultancy firm Solar Logic. BERS is based on the same software engine as NatHERS, and like NatHERS, it uses hourly local climate data to simulate household energy use. The simulation data is used to calculate star ratings.

In addition, BERS allows the assessor to select whether mechanical cooling is to be used in the house, and can assess the performance of natural ventilation. These options are not available in NatHERS. BERS also uses a different method of data entry to NatHERS, which its authors claim is easier to use.

While BERS is designed for use in areas ranging from alpine to tropical, it is currently used mainly in Queensland.

Star ratings calculated by BERS are the same as those calculated by NatHERS, except when the house is located in Queensland. Ratings within Queensland are similar to NatHERS ratings, but not identical.

FirstRate

The FirstRate package was developed by the Sustainable Energy Authority of Victoria. FirstRate does not simulate household energy use. Instead it takes the energy use predictions in NatHERS and combines them with building element properties entered by the assessor. The software then assigns points for individual building elements. A star rating is calculated from the total points scored. FirstRate has been designed so its ratings are consistent with the ratings produced by NatHERS.

FirstRate is considered particularly useful at the sketch design stage because of its simplicity.

Sources: Reardon (2001); SEAV (2004a); Solar Logic (nd); WA Department of Housing and Works (nd).

The different requirements adopted in the 2003 edition of the Building Code for different climate zones reflected the inability of the then available energy rating software to adequately account for the benefits of natural ventilation in hot climates. Newer versions of energy rating software are being developed to overcome this problem.

Verification using a reference building

The second verification method set out in the Building Code requires builders to use energy modelling software to model the proposed building and a 'reference building'. The reference building is a hypothetical building that is similar to the proposed building, but is modelled with building features that may be different to the proposed design.

The building features that must be included in the modelled reference building do not necessarily represent the most energy efficient building features. Some features are based on the deemed-to-satisfy provisions. For example, roof insulation must be modelled to adhere to the deemed-to-satisfy provisions in table 3.12.1.1 of the Building Code. Other features are mandated in table V2.6.2 of the Building Code. For example, reference buildings must be modelled with a 2.4 metre high horizontal ceiling, regardless of the type of ceiling in the proposed design.

The builder must model the energy load of both buildings for heating and cooling. The proposed design will only be verified as compliant with the performance requirements if the predicted energy load of the proposed building does not exceed the predicted energy load of the reference building.

When calculating the energy loads of reference buildings, the requirements regarding energy modelling software are less restrictive. As stated previously, only three packages are currently approved for calculating a star rating or comparison with a stated value (NatHERs, BERS and FirstRate). When modelling a reference building, builders are not restricted to these three packages. Instead, the Building Code permits builders to use 'a broad range of Australian and international energy analysis software' (Building Code of Australia 2004 (volume 2), s.V.2.6.2, p. 89). The same calculation method must be used to model the proposed and reference buildings.

It is anticipated that the reference building method would be applied mainly to more complex designs.

Stringency of the energy efficiency standards for houses

When the ABCB first began considering including energy efficiency standards in the Building Code, Victoria, South Australia and the ACT already had energy efficiency provisions in their State and Territory building regulations. At that time, there were no explicit measures in the Building Code that dealt with energy efficiency.

The decision to adopt 3.5 stars as the minimum rating was based on the fact that the Energy Smart Homes policy adopted by some local councils in New South Wales set a minimum 3.5 star standard for energy efficiency (ABCB 2002). The ABCB considered it:

> … unreasonable to consider options that are weaker than those already implemented in some jurisdictions, given the policy direction from Government, which is to 'improve energy efficiency'. (ABCB 2002, p. vi)

Indeed, the regulatory impact statement undertaken for the current energy efficiency standards in the Building Code acknowledged that when developing the standards, the ABCB had not sought to calculate the star rating that would lead to the greatest ratio of benefits to costs. Rather, the ABCB stated that it 'relies on the expert judgement of its various technical committees to determine appropriate stringency levels' (ABCB 2002, p. vi).

The current residential energy efficiency provisions were introduced into the Building Code:

> … on the understanding that the stringency level of some of the provisions would be temporary to allow industry time to adjust, and that they would be reviewed in the future. (ABCB 2004d, p. 1)

By September 2003, Victoria had imposed a five star energy efficiency rating requirement on all new homes and apartments, exceeding the stringency of the Building Code energy efficiency standards. The New South Wales Government had announced requirements that new residential buildings meet certain sustainability criteria that included energy efficiency standards. In light of this and 'to facilitate a nationally consistent approach' (ABCB 2004d, p. 1), the ABCB agreed that the energy efficiency provisions in the Building Code should be reviewed and tightened where appropriate.

In November 2004, the ABCB released a regulatory proposal to raise the energy efficiency standards in the Building Code for houses. This did not constitute a change in the technical aspects of the energy efficiency standards, merely a proposal to increase their stringency to 5 stars on the NatHERS scale, and to provide greater consistency between the star rating approach and the deemed-to-satisfy provisions (ABCB 2004d). This would involve strengthening the deemed-to-satisfy provisions to meet the new, more stringent standards. The intention is to incorporate the changes into the 2006 version of the Building Code.

C.3 The Building Code and energy efficiency of commercial buildings

Energy efficiency standards for commercial buildings will be incorporated into the Building Code in two phases. Standards for multiple-occupancy buildings (class 2–4 buildings) such as apartment buildings, hotels and motels will be introduced into the main text of the Building Code on 1 May 2005. Regulations for all other commercial buildings (class 5–9 buildings) will be finalised during 2005 for inclusion in the 2006 version of the Building Code. Some jurisdictions (the Australian Capital Territory, New South Wales and Victoria) already have energy efficiency standards for class 2–4 buildings in their appendices to volume one of the Building Code.

A draft regulatory impact statement concluded that the energy efficiency standards proposed for multiple-occupancy buildings would have benefits to the economy with a net present value of $21.5 million over 40 years (ABCB 2004a). The costs and benefits were broken down as follows:

- energy cost savings valued at $31.2 million to building occupants;
- reduced capital costs valued at $14.5 million to building owners (from the reduced need to install heating, ventilation and air conditioning equipment);
- greenhouse gas abatement valued at $8.2 million; and
- capital costs estimated at $32.4 million (comprising the additional costs of insulation and glazing).

It was assumed that the costs of administration and compliance would be low, as compliance with the proposed energy efficiency standards would be incorporated into other inspection and compliance procedures (ABCB 2004a) The overall benefit–cost ratio of the proposed changes was calculated as being 1.66:1

Compliance with the energy efficiency standards

The proposed text of the 2005 edition of the Building Code includes standards for building fabric and building services of class 2–4 buildings. The standards for multiple occupancy buildings define building services as engineering systems that use energy for heating, cooling, water heating, lighting and vertical transport (ABCB 2004b). Lighting and vertical transport are not included in the definition of domestic services that applies to the existing energy efficiency standards for houses.

Energy efficiency standards for building services

Part I2 of the proposed text sets the energy efficiency standards for building services. The objective of this part is 'to reduce greenhouse gas emissions by efficiently using energy throughout the life of the building' (ABCB 2004b, p. A8). These provisions apply only to class 3 buildings and the communal areas of class 2 buildings. The section sets the performance requirement that:

> A building's services must continue to perform to a standard of energy efficiency no less than that which they were originally required to achieve. (ABCB 2004b, p. A8)

The deemed-to-satisfy provisions in the Building Code state that to satisfy this provision, services must be maintained in accordance with Australian and New Zealand Standard 3666.2 (Building Code of Australia 2004 (volume 1), s.I1.2, p. 428)

Energy efficiency standards for building fabric

Section JO1 of the proposed text of volume one of the Building Code states that the objective of the energy efficiency standards for class 2–4 buildings is 'to reduce greenhouse gas emissions by efficiently using energy' (ABCB 2004b, p. A10). The performance requirement is that:

> A building, including its services, must have, to the degree necessary, features that facilitate the efficient use of energy appropriate to:
>
> (a) the function and use of the building and service;
>
> (b) the internal environment;
>
> (c) the geographic location of the building;
>
> (d) the effects of nearby permanent features such as topography, structures and buildings;
>
> (e) solar radiation being:
>
> (i) utilised for heating; and
>
> (ii) controlled to minimise energy for cooling; and
>
> (f) the sealing of the building envelope against air leakage;
>
> (g) the utilisation of air movement to assist heating and cooling; and
>
> (h) the energy source of the service. (ABCB 2004b, p. A10)

The proposed text includes extensive deemed-to-satisfy provisions that builders may follow to meet the performance requirement. For builders proposing an alternative solution, three verification methods are available to demonstrate compliance with the performance requirement:

- a star rating scheme
- comparison to a maximum allowable energy consumption
- comparison to a reference building.

Verification using a star rating scheme

For class 2 buildings (buildings containing two or more separate dwellings) and class 4 parts of buildings (dwellings in commercial buildings, provided it is the only dwelling in the building), the star rating scheme will apply. For these buildings or parts of buildings, each unit must achieve a minimum 3 star rating and the average star rating for the building must be 3.5 stars in tropical areas and 4 stars in temperate zones (ABCB 2004b).

Verification using a stated value

Buildings in class 3 (a residential building which is a common place of long term or transient living for a number of unrelated persons, for example, boarding houses, hotels, motels, residential sections of schools or hospitals) must not exceed a maximum allowable annual energy consumption. The value is taken from a table which sets out the allowable energy consumption in megajoules per square metre of floor area. The allowable energy use depends on the:

- type of building
- location of the building
- energy source used for heating (gas or electricity).

The builder must prove that the energy use of the building under their proposed design will not exceed this target (ABCB 2004b).

Verification using a reference building

The reference building verification method that is available to builders of houses is also available to builders of class 3 buildings who choose not to use the stated value method. Builders must model the energy load of the proposed building and the hypothetical reference building. The reference building must be modelled according to a set of criteria set out in table JV3 of the proposed text of the Building Code.

If the predicted energy load of the proposed building does not exceed the predicted energy load of the reference building, the proposed design will be verified as compliant with the performance requirements.

It is anticipated that the reference building method will be of particular use for more complex designs.

Energy efficiency standards for class 5–9 buildings

Energy efficiency standards for class 5–9 buildings are currently under development. These building classes include buildings such as offices, retail outlets, industrial buildings and buildings of a public nature (such as health and aged care buildings). It is proposed that two verification methods will be approved to demonstrate compliance with the energy efficiency standards for class 5–9 buildings:

- the maximum allowable annual energy consumption method
- the 'reference building' method (ABCB 2004b).

The text of the proposed changes applies the same technical standards as are applied to class 2–4 buildings, but extends their coverage to class 5–9 of buildings.

C.4 State-based energy efficiency building schemes

The Building Code appendices for South Australia, Western Australia, Tasmania and the Northern Territory contain no provisions relating to energy efficiency beyond the energy efficiency provisions in the main text of the Building Code. In these jurisdictions, the energy efficiency provisions in the main text of the Building Code apply.

In New South Wales, Victoria, Queensland and the ACT, additional or alternative requirements are placed on builders of new homes, and in some cases, on those planning to sell or renovate existing homes. Some of these additional requirements are found in the State and Territory appendices to the Building Code. Others are applied without reference to the Building Code. These policies and their interaction with the Building Code are outlined below.

BASIX (NSW)

The NSW Building Sustainability Index (BASIX) is the sole set of guidelines relating to sustainability for residential development in New South Wales. From

1 July 2004, all new homes in Sydney have been required to have a BASIX certificate. The scheme will be extended to include new residential buildings (including multi-unit buildings) from 1 July 2005 and alterations to existing dwellings anywhere in New South Wales from 1 October 2005. At this stage, the scheme applies only to residential buildings.

BASIX covers a range of 'sustainability indices' for:

- energy use
- water use
- thermal comfort
- stormwater
- landscape.

Under the BASIX certificate application process, a proposed development is compared with a benchmark home. The benchmark home is a dwelling of the same type in the same area. For example, for a proposed three bedroom detached house in Sydney to receive a BASIX certificate, the water consumption and greenhouse gas emissions of the proposed house will be compared to the average water consumption and greenhouse gas emissions for all existing three bedroom detached houses in Sydney.

Average energy and water consumption information is obtained from local energy and water utilities. Greenhouse gas emissions are calculated using energy consumption data and greenhouse intensity factors provided by the AGO (NSW DIPNR 2004b).

BASIX permits builders to use the NatHERS energy rating software to show that the proposed building will not exceed stated maximum allowable heating and cooling loads. Alternatively, builders may adhere to a set of 'deemed-to-comply' provisions similar to the Building Code deemed-to-satisfy provisions.

Proposed buildings are then assessed against a list of criteria relating to the household fixtures, fittings and appliances. Points are awarded for the use of:

- energy efficient fittings, technologies and appliances
- technologies that use renewable energy (for example, solar hot water systems)
- energy sources that produce lower greenhouse gas emissions (for example, natural gas).

The energy use of the building compared to the average energy use is calculated from the points awarded.

To receive a BASIX certificate, greenhouse gas emissions resulting from the use of a dwelling must be 25 per cent lower than for average houses of the same type in New South Wales. This requirement will be strengthened to 40 per cent in July 2006 (NSW DIPNR nd). Mains water consumption must be 40 per cent lower than the average.

BASIX is enacted through the *Environmental Planning and Assessment Amendment (Building Sustainability Index: BASIX) Regulation 2004 (NSW)* and the *State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 (NSW)*. The Policy includes the condition that it 'prevails over any other environmental planning instrument, whenever made, to the extent of any inconsistency'.

A BASIX certificate may include obligations to:

- plant a certain area of indigenous vegetation;
- install a rainwater tank of a prescribed minimum size, and to configure the house's plumbing system to use the rainwater for prescribed tasks;
- use roofing materials of a prescribed colour;
- install certain types of fittings (for example, shower heads, taps, toilets);
- install prescribed areas of glazing and shading (for example, eaves);
- install prescribed types of insulation;
- install ceiling fans, and *not* install ducting that could be used to accommodate any other cooling system;
- install gas heating, and *not* install ducting that could be used to accommodate any other heating system;
- install fluorescent lighting; and
- install clothes drying lines (inside and outside) or drying cupboards (inside) (NSW DIPNR 2004c).

The BASIX program was justified by the New South Wales Government on the grounds that it would lead to significant reductions in water consumption and greenhouse gas emissions, and that this would reduce the demand on existing infrastructure and increase affordability of energy and water to consumers.

A benefit–cost study prepared by the Allen Consulting Group for the New South Wales Government concluded that implementing the BASIX scheme with targets of a 25 per cent reduction in energy use and a 40 per cent reduction in water use would lead to:

- a reduction in water consumption of 287 billion litres over 10 years (value estimated at $287 million);
- a saving of 9.5 million tonnes of greenhouse gases over 10 years (value estimated at $47.5 million);
- annual energy savings of $300–$600 for an 'average family in an electric household'; and
- estimated compliance costs of $8988 for a 3 bedroom, 2 bathroom detached house (NSW DIPNR 2004a).

The study concluded that the implementation of the BASIX scheme would lead to benefits to the community in net present value terms of between $193 million and $339 million over the first ten years of the program (NSW DIPNR 2004a). The size of the benefits would depend on the stringency of the program. The more stringent target was found to lead to higher benefits.

Energy rating and 5 star (Victoria)

Since July 2004, all new houses built in Victoria have had to achieve a 5 star energy rating for building fabric, or achieve a 4 star rating and incorporate water-saving measures and either:

- a solar hot water system
- a rain water tank

From July 2005, all new houses must have achieved a 5 star rating and have incorporated water-saving measures and have installed either a solar hot water system or a rain water tank.

The Allen Consulting Group (2002) conducted a benefit–cost analysis of the proposed regulations for the Sustainable Energy Authority of Victoria and the Victorian Building Commission. The MMRF-Green economic model was used to model the impact of the proposed measures on the Victorian economy.

The analysis relied on a number of assumptions about consumer behaviour. Two possible scenarios were modelled:

- a ‘forward-looking’ scenario that assumed that consumers are rational and that once they are aware of the net financial benefits of higher cost but more energy-efficient housing they will not reduce their level of consumption of housing; and
- a ‘myopic’ scenario under which buyers of houses react to the higher prices of more energy-efficient houses by consuming less. Such buyers would not take into account the potential benefits of more energy-efficient housing (Allen Consulting Group 2002).

The authors of the study asserted that their ‘forward-looking’ scenario was more realistic.

The study found that the introduction of 4 or 5 star energy efficiency standards would lead to gains in Victoria’s Gross State Product (GSP), and that these gains would be higher under the more stringent 5 star standard.

The size of the gains differed depending on how consumers were assumed to behave. Under the ‘forward-looking’ scenario, GSP increased by between $233 million and $566 million. Under the ‘myopic’ scenario, GSP increased by between $30 million to $67 million. These gains represent between 0.001 per cent and 0.016 per cent of Victoria’s GSP over the 15 year period 2002–2017. The gains were estimated by comparison with a base case under which the energy efficiency standards were not imposed (Allen Consulting Group 2002).

The study also concluded that the standards would lead to significant abatement of greenhouse gas emissions. Under the 4 star scenario, the reduction would amount to 500 kilotonnes of carbon dioxide equivalent by 2021. The imposition of a 5 star standard would lead to a reduction of 700 kilotonnes over the same period (Allen Consulting Group 2002).

The study recommended the adoption of a 5 star standard for new housing in Victoria, which it described as:

> … one of very few regulations designed to increase an individual’s consumption of a product in their own best interests. (Allen Consulting Group 2002, p. 21)

The Victorian Government has now adopted this standard (from July 2005), which is more stringent than the current Building Code energy efficiency provisions.

As well as welcoming the economic and greenhouse gas benefits identified in the Allen Consulting Group study, the Victorian Government justified the more stringent energy efficiency compliance program by claiming that houses that meet the new standard will be better quality, more comfortable and consume less energy, resulting in lower energy bills for households (SEAV 2004b).

ACTHERS (the ACT)

The ACT House Energy Rating Scheme (ACTHERS) has been operational since 1 July 1995. Under ACTHERS, anyone intending to build a new residential property in the ACT must obtain an energy efficiency rating assessment. All new residences must meet a minimum 4 star standard. The star rating is calculated using the FirstRate software model. This part of the scheme is consistent with the energy efficiency standards for new houses in the Building Code.

In addition to the requirements for new homes, ACTHERS places conditions on the sale of existing homes. From 31 March 1999, anyone wishing to sell an existing property has had to obtain an energy efficiency rating assessment. There is no minimum energy efficiency standard for existing dwellings, but sellers must disclose the energy rating of the home in all advertisements and the contract for sale. This element of the program was implemented by the *Energy Efficiency Ratings (Sale of Premises) Act 1997 (ACT)*.

The aim of the ACT Government in implementing ACTHERS was to adopt a scheme that would:

- encourage awareness in the community and building industry of the benefits of energy efficiency;
- demonstrate the Government's commitment to the National Ecologically Sustainable Development and Greenhouse Strategies, the COAG’s agreement on residential energy efficiency of 1993 and the ACT Greenhouse Strategy; and
- conform to the national benchmark program NatHERS.

Towards sustainable housing in Queensland

In December 2004, the Queensland Government released a discussion paper and a regulatory impact statement dealing with proposed changes to building regulations in Queensland. The changes were designed to encourage ‘sustainable’ housing development. The discussion paper defined sustainable housing as ‘planning, developing and building dwellings that are more socially, environmentally and economically sustainable’ (Queensland Government 2004b, p. 3).

The aims of the proposed policy changes are to increase water and energy efficiency and to reduce greenhouse gas emissions. These aims come in the context of concerns about potential water shortages (particularly in the rapidly growing south east of Queensland), the impact on peak electricity demand of air conditioning, and the desire to reduce greenhouse gas emissions. Intervention was justified by the Queensland Government on the grounds that the issue is 'too important to leave solely to market forces'(Queensland Government 2004a, p. 5).

In the regulatory impact statement, the Queensland Government confirmed that in September 2003 it had adopted the energy efficiency provisions in the Building Code, but noted that 'there is no nationally consistent approach to [the broader issue of] sustainable housing' (Queensland Government 2004a, p. 9). It then indicated its intention to go beyond the provisions of the Building Code (which deals only with the fabric of the building and indirectly with heating and cooling), and to introduce measures dealing with household fixtures and appliances.

This would be achieved by amending the *Standard Plumbing and Drainage Regulation 1993(Qld)* and the *Standard Building Regulation 1993 (Qld)* to incorporate mandatory energy and water efficiency measures. The proposed regulations would apply only to new residential buildings.

The regulatory impact statement included calculations of the net present value of the total costs and benefits of the various measures over a 15–20 year period. Below is a list of the proposed Queensland Government regulations and the net benefit of each measure as calculated in the regulatory impact statement (Queensland Government 2004a). The net benefits were estimated as changes from a base case of no change. They are expressed in net present value terms and benefits are assumed to accrue over 15 or 20 years. The value of the reduction in greenhouse gas emissions is included as a benefit. Proposals under consideration include requirements for the installation of:

- solar electric hot water heaters in all new homes (net benefit of $184 million);
- solar gas hot water heaters in all new homes (net cost of $375 million);
- energy efficient lighting in all new homes (net benefit of $18 million);
- AAA-rated shower roses in all new homes (net benefit of $92 million);
- dual-flush toilets in all new homes (net benefit of $2 million);
- require the installation of water pressure limiting devices in all new homes (net benefit of $52 million); and
- (under local council regulations) rain water tanks in all new homes (net cost of $28 million).

The regulatory impact statement also estimated that local councils would face recurrent annual costs of between $1 million and $3 million for administration of the scheme. The impact on Queensland industry was predicted to be neutral.

C.5 Self regulatory building energy efficiency schemes

In addition to the mandatory building energy efficiency standards, there are several energy efficiency programs currently operating that are based on self regulation. These programs include:

- voluntary building practice programs
- voluntary energy ratings for residential and commercial buildings
- policies to reduce energy use in government buildings.

Voluntary building industry initiatives (Australian Government)

The AGO sponsors a range of initiatives to encourage building and construction practitioners to adopt practices that will reduce the greenhouse gas emissions of buildings. Programs funded under this initiative include:

- Window Energy Rating Scheme — windows are rated on a 5 star scale. Windows that minimise unwanted heat gain or loss are awarded higher star ratings.
- Environmental Design Guides — the Australian Council of Building Design Professions Ltd (BDP), the peak body for architects, engineers, quantity surveyors, landscape architects and planners, produces a series called the BDP Environmental Design Guide. The AGO has assisted the BDP to produce a series dealing with greenhouse gas emission minimisation.
- BDP Making Energy Pay — the AGO has funded a series of seminars in which building design professionals were encouraged to reduce building energy use by applying new technologies and energy efficiency principles into building designs.
- BDAA Marketing Sustainable Design Workshops — the Building Design Association of Australia (BDAA) is the peak body for building designers. The AGO has funded a series of workshops to encourage over 700 building designers to incorporate good environmental design principles into their building designs.
- HIA Greensmart Professional Accreditation Course — The Housing Industry Association Limited (HIA) is Australia's peak building, renovating and development industry association. The AGO provided funding for the HIA’s

GreenSmart Training and Accreditation program. The program trains builders in energy efficiency, waste minimisation and soil and sediment pollution reduction.

- MBA Energy Wise–Dollar Wise Training Course — Master Builders Australia (MBA) is Australia's peak body for commercial and industrial builders. The AGO provides funding for a program to train commercial building contractors in energy efficiency practices.
- Lighting Best Practice Project — aims to reduce the amount of energy used for lighting by encouraging the use of natural light and energy efficient lighting products. (AGO nd)

Voluntary building energy efficiency schemes

Owners and tenants of residential and office buildings are able to use the voluntary schemes outlined below to rate the energy performance of their buildings, and to identify opportunities for reducing building energy use, including by improving energy efficiency. Two of the schemes operate nationally, one operates only in New South Wales.

Australian Building Greenhouse Rating scheme

The Australian Building Greenhouse Rating (ABGR) scheme promotes voluntary audits of office buildings to determine the greenhouse gas emissions resulting from energy consumption. The program promotes energy efficiency as one strategy to reduce building greenhouse gas emissions. The ABGR scheme was developed and is administered nationally by the New South Wales Department of Energy, Utilities and Sustainability (DEUS). In Victoria, the scheme is administered by SEAV; in Western Australia by SEDO; and in Queensland by the Queensland EPA. In other jurisdictions the scheme is administered by DEUS.

The scheme consists of two elements:

- Internet-based tools for calculating energy use and identifying opportunities to reduce energy consumption; and
- star ratings calculated by ABGR accredited assessors.

Buildings that have undergone accredited assessments are eligible to use the ABGR logo and star rating to advertise their greenhouse performance. The scheme promotes the ABGR logo and ratings as tools for attracting tenants who are concerned about the greenhouse performance of the buildings they occupy.

National Australian Built Environment Rating System

The Australian Government Department of the Environment and Heritage has developed a voluntary building rating scheme called the National Australian Built Environment Rating System (NABERS). NABERS can be used to rate the performance of existing commercial office buildings and residential buildings against a number of criteria. The system is based on self assessment using spreadsheets made available on a website by the Department of the Environment and Heritage. The spreadsheets use data on building usage to calculate performance in a number of areas and assign a rating out of five. Building characteristics assessed by NABERS are:

- energy use
- greenhouse gas emissions
- refrigerant use
- water use
- stormwater runoff
- stormwater pollution
- sewage outfall volume
- transport (including building location and modes of transport used)
- landscape diversity
- toxic materials
- waste
- indoor air quality
- occupant satisfaction.

It is possible to calculate building performance with respect to one or all of these characteristics.

Energy Smart Home Rating (New South Wales)

In New South Wales, DEUS runs the Energy Smart Home Rating website. Two tools are available on the program website — a star rating tool, and a virtual home audit. The star rating tool calculates a star rating (out of five) for existing houses, while the virtual audit compiles personalised ‘energy action plans’ which identify opportunities for reducing household energy use. Access to the tools is not restricted to New South Wales residents.

Energy efficiency schemes for government buildings

Governments in several jurisdictions have adopted policies to reduce the amount of energy consumed by government buildings. The stated objectives of such policies include:

- reducing government greenhouse gas emissions and energy bills
- leading by example to influence private sector behaviour.

These programs often involve setting specific targets for reductions in energy use or energy costs.

Government Energy Management Policy and Energy Smart Government (New South Wales)

Under the Government Energy Management Policy, the New South Wales Government committed to reduce energy usage in New South Wales Government buildings by 15 per cent of the 1995 level by 2001, and by 25 per cent of the 1995 level by 2005. The objective of this program is to reduce the New South Wales Government's energy bills and greenhouse gas emissions. The program commenced in 1998. By the end of financial year 2001-02, New South Wales Government departments and agencies had achieved a reduction in building energy use of 2.3 per cent.

The Energy Smart Government program assists New South Wales Government agencies and departments to meet the energy use reduction targets by implementing cost-effective energy efficiency upgrades. This program promotes the use of energy performance contracting to finance large energy efficiency upgrades, and the Government Energy Efficiency Investment Program for smaller projects.

Energy Efficient Government Buildings (Victoria)

The Victorian Government has committed to reduce the energy consumption of government buildings by 15 per cent of the 1999-2000 level by 2005-06. The policy was announced in 2001, and has yet to be evaluated.

Government Energy Management Strategy (Queensland)

The Queensland Government Energy Management Strategy aims to achieve reductions in annual energy bills valued at $20 million by June 2008. The program commenced in November 2003, and the first target is a saving of $2 million by June 2005. As yet there is no evaluation of the effectiveness of the program.

Energy Efficiency Action Plan (South Australia)

The Energy Efficiency Action Plan began in May 2002. It developed from the Greenhouse Targets program which had been operating since 1998. The aim of the program is to reduce the energy used in South Australian Government Buildings by 15 per cent by 2010 (compared to 2001-02 levels), and by 25 per cent by 2014. Energy use in Government buildings decreased by 2.4 per cent between 2000-01 and 2002-03 (South Australian Government 2004)

Energy Smart Government and Government Office Accommodation Guidelines (Western Australia)

The Energy Smart Government program obliges Western Australian Government agencies to reduce their total energy consumption by 12 per cent by 2006-07 against their 2001-02 energy consumption. This target includes reducing the energy used in government buildings, and for other purposes.

Grants totalling $350 000 each year are offered to fund energy audits and studies to encourage energy management projects. Funding of $16 million over four years is available to fund financially viable energy efficiency projects that have been identified in the audits. Agencies that do not meet the reduction targets may be liable for financial penalties.

The program commenced in June 2002. By the end of financial year 2002-03, government agencies had reduced their energy consumption by 2.7 per cent.

The Government Office Accommodation Guidelines set energy performance requirements for government buildings and tenancies. The objectives of the program are to reduce government energy costs and greenhouse gas emissions, and to influence the commercial office building sector to improve energy efficiency. As yet the program has not been evaluated.

Energy Management Services (Northern Territory)

The Energy Management Services program conducts energy audits of Northern Territory Government buildings, and advises the tenants on measures they can take to improve the energy efficiency of their buildings. The program does not involve any formal targets for reducing energy use.

The ACT Greenhouse Strategy and Energy Use in the ACT Government Operations

The ACT Greenhouse Strategy was released in 1999. It set a target of a 15 per cent reduction in the ACT Government building energy use by 2004 and a further 10 per cent by 2008.

The Energy Use in the ACT Government Operations program monitors energy use in the ACT Government operations to track performance against the Greenhouse Strategy targets. The program has yet to be evaluated.

D Appliance energy performance standards and labelling

Domestic and commercial appliances are subject to a range of energy performance standards, both mandatory and voluntary. Many of the current requirements evolved from those originally established by State and Territory Governments, and have been expanded so that their coverage is now national. Other programs were developed overseas and have been adopted in Australia.

D.1 National Appliance and Equipment Energy Efficiency Program

The National Appliance and Equipment Energy Efficiency Program (NAEEEP) is an initiative of the Australian, State and Territory Governments. The aim of the program is to develop and oversee measures to improve the energy efficiency of appliances and equipment used by households and firms. The program is administered by the National Appliance and Equipment Energy Efficiency Committee (NAEEEC), which is ultimately directed by the Ministerial Council on Energy (NAEEEC 2004c).

Currently, NAEEEP covers only electrical appliances. Gas appliances are regulated by an industry body, the Australian Gas Association (AGA), but the administrative arrangements are under review. The National Framework for Energy Efficiency (NFEE) Stage One measures include a commitment to broaden the scope of NAEEEP to incorporate mandatory energy performance labelling and minimum energy performance standards (MEPS) for gas appliances (Ministerial Council on Energy 2004).

Electrical appliances covered by NAEEEP are subject to mandatory labelling and/or MEPS.

Mandatory labelling schemes make it compulsory to affix energy performance rating labels to specific domestic appliances at the point of sale. The labels are designed to enable consumers to easily compare the energy performance of appliances. They include a star rating, which enables a comparative assessment of the model's energy efficiency and an estimated annual energy consumption of the appliance.

MEPS prescribe a minimum allowed energy performance for specific appliances. Appliances that are less efficient than the relevant standard are excluded from the market.

History

The origins of the NAEEEP labelling scheme can be traced to the late 1970s, when the New South Wales and Victorian Governments proposed energy labelling for appliances. The Australian Government first raised the issue in 1982, and met with considerable resistance from the appliance industry. The industry favoured a voluntary program over mandatory labelling and wanted any program introduced to be nationally uniform (AGO 2004a).

No such national program was established. In 1986, Victoria and New South Wales introduced their own labelling schemes. Initially, these schemes covered refrigerators and freezers. Room air conditioners were included in 1987, and dishwashers in 1988. Victoria introduced labelling requirements for clothes dryers in 1989 and clothes washing machines in 1990. In 1991, South Australia introduced labelling requirements for the five appliance types regulated in Victoria (AGO 2004a).

Two documents released by the Australian Government during the 1990s — the *National Greenhouse Response Strategy* (1992) and the *National Greenhouse Strategy* (1998) — included proposals to extend and strengthen the existing energy labelling and MEPS schemes. NAEEEC was established under the auspices of the *National Greenhouse Response Strategy* (IEA 2000).

In October 1999, nationally consistent MEPS and labelling schemes were adopted across Australia. Since then, mandatory labelling has been extended to include other classes of appliances (table D.1)

In 2000, rating scales for all electrical appliance labels were recalibrated, leading to most products receiving a lower star rating than they had previously. This was intended to provide an incentive for manufacturers to increase the efficiency of their appliances, and to avoid the problem of appliances clustering around the high end of the star ratings (thus making labels less useful for comparing appliances).

Table D.1 **Mandatory energy performance standards (MEPS) and labelling for electrical appliances**

	Date that requirements introduced	
Appliance / Equipment type	*Labelling*	*MEPS*
Household refrigerators	October 1999	October 1999
Household freezers	October 1999	October 1999
Clothes washers	October 1999	na
Clothes dryers	October 1999	na
Dishwashers	October 1999	na
Electric storage water heaters	na	October 1999
Three phase electric motors	na	October 2002
Three phase air conditioners up to 65kW cooling capacity	2001	October 2001
Fluorescent lamp ballasts	na	January 2003
Single phase air conditioners	October 2001	October 2004
Commercial refrigerators	na	October 2004
Linear fluorescent lamp ballasts	na	October 2004
Distribution transformers	na	October 2004

na Not applicable

Sources: Harrington and Holt (2002); AGO (2004a).

Administrative arrangements

NAEEEC is responsible for the administration of the mandatory energy performance labelling and MEPS programs, and reports to the Ministerial Council on Energy. The Ministerial Council on Energy was established by the Council of Australian Governments in June 2001. It comprises all Australian, State and Territory Government energy ministers, and a New Zealand representative.

Role of State and Territory legislation and regulation

NAEEEC has no regulatory powers of its own. For the regulations developed by NAEEEC to become mandatory, they must be adopted by State and Territory Governments. The State and Territory legislation is based on 'model regulation'. The relevant State and Territory legislation and regulations are detailed in table D.2.

Table D.2 **Legislation and subordinate regulations relating to appliance energy performance**

Jurisdiction	*Title of legislation and regulations*
New South Wales	*Electricity Safety Act 1945* *Electricity Safety (Equipment Efficiency) Regulation 1999*
Victoria	*Electricity Safety Act 1998* *Electricity Safety (Equipment Efficiency) Regulations 1999*
Queensland	*Electricity Act and Regulation 1994*
South Australia	*Electrical Products Act 2000* *Regulations under the Electrical Products Act 2000 (No. 224 of 2001)*
Western Australia	*Electricity Act 1945* *Electricity Regulations 1947*
ACT	*Electricity Act 1971* *Electricity Safety Regulations 1971*
Northern Territory	*Consumer Affairs and Fair Trading Act 2004* *Consumer Affairs (Product Information) Regulations 1993*
Tasmania	*Electricity Industry Safety and Administration Act 1997* *Electricity Industry Safety and Administration Regulations 1999*

Source: AGO (2004a).

Testing arrangements

Appliances that are required to carry an energy performance label or to meet MEPS must be registered before they can be sold in Australia. Manufacturers must apply to have their appliance (or family of similar models) registered in one of four jurisdictions:

1. New South Wales
2. Victoria
3. Queensland
4. South Australia.

A registration accepted in one of these jurisdictions is valid throughout Australia, and remains valid for up to five years, after which the product must be re-registered.

Applications for registration must include a test report or other data to demonstrate that the appliance meets the relevant Australian Standard. The Australian Standards for products that are required to carry energy-performance labels or meet MEPS generally consist of two parts:

- Part One relates to the testing procedure (including the test method, ambient conditions, performance measures and test materials).
- Part Two contains the detailed technical requirements for energy labelling and MEPS, including algorithms for the calculation of star ratings and comparative energy consumption that appears on the energy-performance label.

This approach to regulating the labelling and MEPS schemes has been operating since 1991 (AGO 2004a). Because the testing procedures and technical requirements for appliances are incorporated into the applicable Australian Standards, the texts of State and Territory legislation simply refer to the relevant Australian Standards. This approach simplifies the State and Territory legislation, and makes it relatively straightforward to maintain national consistency of appliance and equipment energy efficiency standards, even when standards are continually being revised.

Australian Standards are developed by committees that are part of Standards Australia, and must be jointly approved by State and Territory regulatory agencies before they are published. When adopting Australian Standards for appliance energy efficiency, State and Territory Governments:

> … support a policy of adopting international standards and contributing to international standards development wherever appropriate. This support is intended to minimise the prospect of Australian Standards becoming unintended trade barriers and to reduce business compliance costs in meeting differing standards in differing markets for the same appliance. (AGO 2004a, p. 7)

The Department of the Environment and Heritage noted:

> … the Australian approach is to match, for each appliance regulated, best practice levels imposed by Australia's major trading partners. This approach overcomes arguments regarding the technical feasibility of meeting the proposed MEPS levels and avoids elaborate and expensive testing procedures being conducted locally. (sub. 30, p. 15)

NAEEEC plays an active role in the development of standards. In 2002, NAEEEC committed over $350 000 to standards development work, including:

- funding of testing designed to develop industry competency with a new or developing standard;
- funding of testing programs designed to inform the process of the setting of MEPS levels;

- commissioning of round robin testing programs designed to ensure that enforcement programs are based on robust and reproducible test methods;
- provision of technical expertise to Standards Australia's standards committees;
- assistance to Standards Australia to maintain representation on key international standards committees;
- assistance in the development and maintenance of the supply of materials used in testing; and
- providing (with Standards Australia) financial support to Australian delegates attending international standards meetings (AGO 2003c).

Evidence that an appliance meets the requirements set out in the relevant Australian Standard can be obtained from a laboratory that is accredited by the National Association of Testing Authorities (NATA), or another body that is recognised by NATA, or by an independent third-party laboratory.

Check testing

Check testing is a quality assurance measure that:

> … provides consumers with confidence that performance characteristics are correctly identified and protects the investments made by manufacturers in developing more energy-efficient products. (SEAV 2003, p. 27)

Appliances that have been registered and are available for sale are purchased anonymously. NATA accredited laboratories are then commissioned to test that the appliances meet the claims made on the energy-performance label and that they satisfy any applicable MEPS.

Failing a check test can lead to a range of consequences:

- The laboratory that conducted the pre-registration tests may be barred from preparing test reports in the future.
- The registration holder may have to show cause why the appliance should not be deregistered.
- The registration holder may be required to pay for further testing.
- The model may be withdrawn from sale, either permanently or until the registration holder can demonstrate that alterations have been made to all units to ensure compliance with the relevant standards (AGO 2004a).

In 2003, NAEEEC conducted check tests on eight appliance models, all of which were found not to meet the claims made on the energy performance labels. Two products were deregistered, one was found to have not been registered, and action was pending on the remaining five products (AGO 2003b).

Other regulatory actions undertaken in 2003 included fines of $3000 and $8000 against two Western Australian retailers who were found to have sold appliances without energy performance labels. Queensland and Victorian retailers received infringement notices and fines totalling $10 000 (AGO 2003b).

Planned future changes to NAEEEP labelling and MEPS

Stage One of NFEE included a commitment to expand the scope of NAEEEP:

> … through the introduction of new or more stringent MEPS for residential, commercial and industrial products, with a key focus on increasing the number of commercial and industrial products regulated. (Ministerial Council on Energy 2004, p. 2)

The NAEEEC work program includes plans to regulate some classes of appliances that are not currently subject to MEPS or mandatory labelling, and to revise the regulations on some appliances that are already covered. Table D.3 outlines the planned changes.

Regulatory impact statements

Proposed revisions to mandatory labelling requirements and MEPS for electrical appliances have to be accompanied by a regulatory impact statement that specifies the likely benefits and costs of the proposal. These are prepared for, and must be formally approved by, the Ministerial Council on Energy. The cost–benefit assessments have often been undertaken by consultants that have relevant expertise in appliance energy performance (for example, George Wilkenfeld and Associates and Energy Efficient Strategies 1999; Syneca Consulting 2003, 2004).

D.2 Energy efficiency standards for gas appliances

The current MEPS and labelling requirements for gas appliances are administered by the AGA. The administrative arrangements are currently being revised to meet the NFEE Stage One commitment to broaden the scope of NAEEEP to include mandatory energy-performance labelling and MEPS for gas appliances.

Table D.3 **Planned changes to NAEEEP mandatory energy performance standards (MEPS) and labelling**

Appliance/equipment type	*Labelling*	*MEPS*
Small mains pressure electric storage water heaters (<80L) and low pressure and heat exchanger type water heaters		To be introduced October 2005
Oil-fired boilers	Investigated but no action to be taken	Investigated but no action to be taken
Single phase air conditioners		Revised MEPS to be introduced October 2007
Three phase air conditioners up to 65 kW cooling capacity		Revised MEPS to be introduced October 2007
Televisions	Mandatory labelling proposed for introduction October 2006	MEPS proposed for introduction April 2006
Digital set top boxes		MEPS proposed for introduction April 2006
Computers		MEPS under consideration for possible introduction in 2007
Computer monitors		MEPS proposed for introduction April 2006
		Revised, more stringent MEPS proposed for introduction April 2008
External power supplies		MEPS proposed for introduction April 2006
		Revised, more stringent MEPS proposed for introduction April 2008
Swimming pool and spa equipment	Further investigation proposed	Further investigation proposed
Ice makers and ice storage bins		MEPS proposed for introduction October 2006
Wine storage cabinets	Investigated but no action to be taken	Investigated but no action to be taken
Three phase electric motors		Revised MEPS proposed for introduction April 2006

Sources: AGO (2002a, 2004b, 2004c, 2004d, 2004e, 2004f, 2004g, 2004h, 2004i).

History

In 1981, the Gas and Fuel Corporation of Victoria introduced energy labelling for gas water heaters. This was the first labelling scheme for gas appliances in Australia, and was taken over by the AGA in 1985. In 1988, a six star energy-performance label was introduced. This label was intended to be visually consistent with the star rating labels already familiar to consumers of electrical appliances.

Domestic nonducted gas heaters have been subject to labelling since 1993, and domestic ducted heaters since 1994 (SEAV 2003). Currently, only gas water heaters and domestic space heaters (ducted and nonducted) are subject to mandatory energy labelling.

As with electrical appliances, labelling schemes for gas appliances are reviewed from time to time. Water heater label scales were revised in 1988 and modified in 1999 to include half star rating increments. The labels for domestic space heaters (ducted and nonducted) were reviewed in 1998 and 2003 (SEAV 2003).

Gas appliances have been subject to MEPS since the 1960s. Currently, gas water heaters, gas space heaters and gas cookers are subject to MEPS. The current MEPS levels were set in 1983 and 'the majority of models currently on the market appear to exceed current requirements by a comfortable margin' (SEAV 2003, p. 23).

Administrative arrangements

The greatest difference between the MEPS and labelling programs for gas and electrical appliances is that the gas appliance scheme is administered by an industry body. Before any mass-produced gas appliance can be made available for sale or installation in any State or Territory, it must receive AGA certification. To receive certification, the appliance must meet certain standards of safety, reliability and energy efficiency.

As is the case with electrical appliances, the technical standards that define MEPS and energy labelling requirements are incorporated into Australian Standards. In 2000, the AGA gained accreditation as a Standards Development Organisation, meaning that it was permitted to write Australian Standards for gas appliances (SEAV 2003). Since July 2003, the section of the AGA responsible for developing gas appliance standards has been incorporated into Standards Australia.

Planned changes to gas appliance labelling and MEPS

The administrative arrangements for the regulation of gas appliances are currently under review. The *National Greenhouse Strategy*, released in 1998, included a commitment to:

> … working with industry to improve gas appliance minimum energy performance standards (MEPS) and labelling programs. (AGO 1998, p. 48)

The AGA (2004a, pp. 1–2) recognised that 'there is a clear need for a nationally consistent approach [to gas appliance MEPS and energy labelling]', and that the existing scheme 'is in need of updating and the Standards and MOTs [methods of test] need to be updated and modernised'. The AGA proposed that any new scheme, if it is mandated through legislation, should be nationally consistent and should be based on the existing MEPS and labelling schemes administered by the AGA, rather than being completely new schemes.

The NFEE Stage One measures announced in August 2004 included plans for NAEEEP to be:

> … broadened in scope to include mandatory minimum energy performance standards (MEPS) and labelling for gas products. (MCE 2004, p. 2)

In December 2004, the Australian Greenhouse Office (AGO) published a proposed work program for changes to gas labelling and MEPS — summarised in table D.4 (AGO 2004j).

It is proposed that the new arrangements will:

> … steadily incorporate those products already subject to energy labelling and standards under the existing industry scheme. It will expand to include any product that consumes mains pressure natural gas or LPG gas within the domestic, commercial and industrial sectors, subject to economic analysis and community consultation. (AGO 2004j, p. 5)

The proposed scheme will go beyond the current standards and:

> … will match, or where viable and economically feasible, lead the world in regulatory standards. (AGO 2004j, p. 5)

This contrasts with the approach taken to the regulation of electrical appliances, which is to match the best practice of Australia's trading partners but not to 'lead the world in regulatory standards' (Department of the Environment and Heritage, sub. 30, p. 15).

Officials from the AGO, Sustainable Energy Authority of Victoria (SEAV), and Victorian Office of Gas Safety have taken key roles on the Implementation Committee charged with establishing the new gas labelling and MEPS arrangements. In the longer term, representatives from all jurisdictions will be involved in maintaining, updating and administering the arrangements (George Wilkenfeld and Associates 2004a).

Table D.4 **Proposed changes to gas appliance mandatory energy performance standards (MEPS) and labelling**

Appliance/equipment type	*MEPS*	*Labelling*
Domestic gas water heaters and space heaters (ducted and nonducted)	New MEPS proposed for introduction October 2006 (water heaters) and October 2008 (space heaters)	Currently under review — revisions to be introduced 2008–11
Domestic gas cookers (ovens and cook tops)	New MEPS and/or labelling standards to be developed 2008–11 and introduced 2012–15	
Commercial gas water heaters		
Commercial gas space heaters		
Industrial gas boilers		
Gas clothes dryers	MEPS and/or labelling standards to be developed 2012–15 for introduction at a later date	
Some priority gas catering equipment		

Sources: SEAV (2003); AGO (2004j).

Testing and compliance

Manufacturers of gas appliances must submit a specification of their appliance to the AGA. The AGA then develops a test program for the appliance, and it is tested at an independent laboratory that is accredited by NATA and registered with the AGA. If the laboratory report indicates that the appliance is compliant with the relevant Australian Standard, the manufacturer receives a certificate that permits them to affix the AGA Maker's Warranty Badge to the appliance, and make it available for sale and installation.

The requirement for the test to be conducted at a laboratory accredited by NATA is similar to the requirements for electrical appliances (which also permit testing at laboratories accredited by bodies recognised by NATA).

Product verification audits

Certified gas appliances are periodically subject to product verification audits (PVAs). The audit program typically involves annual product inspections, although inspections may be more or less frequent. The aim of PVAs is to help confirm that an appliance adheres to the currently certified design specifications and regulatory requirements (AGA 2004b). If the audit identifies noncompliance with the relevant standard, the product's certification may be cancelled.

The aim and potential consequences of PVAs are similar to those for check testing of electrical appliances, although the process is slightly different. Whereas check testing is conducted on appliances purchased anonymously, PVAs are conducted on the manufacturer's premises. In addition, check testing is carried out on only a few products annually, whereas all gas appliances are subject to periodic PVAs.

D.3 Voluntary programs

In addition to the mandatory energy performance labelling and MEPS requirements that apply to some gas and electrical appliances, there are voluntary labelling and standards programs operating in Australia. The Energy Star and Top Energy Saver Award programs use voluntary endorsement labels to identify appliances and equipment that meet particular standards of energy efficiency. The Standby Power program focuses on reducing the energy consumed by appliances when they are not in use.

Energy Star

Energy Star is a voluntary endorsement labelling program developed by the US Environmental Protection Agency (US EPA). It has been operating since 1992, and has been adopted by a number of countries, including Australia. Energy Star sets voluntary standards for reducing the electricity consumption of electronic equipment when it is not performing its core function. This can be accomplished by:

- switching the appliance into a 'sleep' mode after a period of inactivity; and/or
- reducing the amount of electricity consumed by the appliance in 'standby' mode (box D.1).

In 1996, the New South Wales Sustainable Energy Development Authority implemented part of the Energy Star program under licence from the US EPA. In 1999, the Authority was commissioned by NAEEEC to expand its scheme into a national program to cover home entertainment and office equipment (AGO 2002c).

State and Territory environment and energy agencies now promote Energy Star in their jurisdictions.

Box D.1 **Standby power**

Standby power is the energy drawn by an electrical appliance when it is not performing its core function. Many appliances consume energy constantly, including when they are not in active use. In this mode they may be performing non-core functions such as sensing remote control signals or keeping the appliance's internal clock running. These non-core functions are valued by many consumers.

In 2000, standby power was estimated to constitute 11.6 per cent of Australia's residential energy use, costing households over $500 million and leading to the emission of over 5 million tonnes of carbon dioxide equivalent (AGO 2002c). Holt and Harrington (2004) estimated that standby power consumption in Australia could be reduced by 56 per cent by 2020.

Currently, the Australian Energy Star program covers:

- photocopiers
- printers and fax machines
- scanners
- multi-function devices (combined photocopying, fax and scanner functions)
- computers and monitors
- consumer audio products
- consumer DVD products and VCRs
- televisions.

Manufacturers of appliances that comply with the technical requirements of the Energy Star program are permitted to use the Energy Star logo on their products and in promotional material. Retailers are encouraged to sell and promote the benefits of Energy Star compliant appliances. Australian, State and Territory Government agencies promote the purchase of appliances that meet the requirements of Energy Star. In addition, Australian Government departments and agencies:

> … are required to purchase only office equipment that complies with the US EPA Energy Star standard, where it is available and fit for purpose. (DISR 2000, p. 477)

The US Energy Star program has been extended beyond electronic appliances and currently covers over 40 categories of products, including:

- heating and cooling products

- refrigerators and freezers
- water coolers
- clothes washers
- lighting products
- commercial food preparation equipment
- insulation
- windows, doors and skylights (US EPA 2005).

Many of these products are not covered by the Australian Energy Star program, although some are subject to mandatory energy performance labelling or MEPS, and others are covered by other voluntary programs, such as the Window Energy Rating Scheme (appendix C). The US EPA has agreed in principle to the extension of the Australian Energy Star program to cover products included in the US program (AGO 2002c).

Standby power program

In addition to their support for the Energy Star program, the Australian, State and Territory Governments have agreed to adopt the International Energy Agency's One Watt program. The One Watt initiative was first mooted in 1997. Its aim is to reduce the standby power consumption of all appliances to less than one watt by 2010 (IEA 2002).

In 2000, the Ministerial Council on Energy agreed to:

> … pursue efficiencies in standby power consumption of energy-consuming products, through support for the International Energy Agency's One Watt program, and endorse its incorporation into the … program of work. (AGO 2002b, p. 7)

Australia was the first country in the world to endorse the initiative (IEA 2002). Since then, Australia has actively participated in international forums on standby power, and has funded work done by the International Electrotechnical Commission on the measurement of standby power consumption (Holt and Harrington 2004).

Currently, the standby power program is based on voluntary compliance and information. To further the program, NAEEEC has developed product profiles that assess the standby power performance of particular classes of appliances and equipment. The profiles include targets for the standby power consumption of the product (generally expected to be in line with the Energy Star levels of consumption). The profile is circulated for comment, and the voluntary target is then included in the relevant Australian Standard, to ensure industry familiarity. NAEEEC collects data on standby power consumption, and these data will be monitored to assess the performance of the industry against the voluntary target (AGO 2002b).

If the voluntary targets do not accomplish the desired reductions in standby power use, mandatory measures, including MEPS, may be considered. This would only be done with the approval of the Ministerial Council on Energy, and would be accomplished by changing the relevant Australian Standard to incorporate a mandatory target for standby power use (AGO 2002b).

Top Energy Saver Award

The Top Energy Saver Award program awards manufacturers of specific models of electrical and gas appliances that meet high standards of energy efficiency. Each year NAEEEC releases documents developed in consultation with manufacturers that set benchmarks for electrical and gas appliance energy efficiency (for example, a certain star rating). Appliances that meet or exceed this level of efficiency are awarded a Top Energy Saver Award (AGO 2004k). Electrical appliances are automatically assessed for eligibility when they are registered. Manufacturers of gas appliances must apply to the AGA for consideration.

Winners of the awards are permitted to use the Top Energy Saver Award label on the appliance and in promotional material for one year. They may then reapply for the award, and the appliance will be assessed against the revised energy efficiency benchmark for that year.

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