Response to the Issues Paper

Barriers to Effective Climate Change Adaptation

A submission by

The Australian Academy of Technological Sciences and Engineering (ATSE)

to

Productivity Commission

December 2011

Australian Academy of Technological Sciences and Engineering
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Barriers to Effective Climate Change Adaptation
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The Australian Academy of Technological Sciences and Engineering (ATSE)[1] welcomes the opportunity to respond to the Issues Paper on *Barriers to Effective Climate Change Adaptation*.

Executive Summary

This Academy of Technological Sciences and Engineering (ATSE) submission addresses some key issues considered by previous Academy activities in climate change adaptation. Issues addressed include: uncertainty and resilience, demand management, urban design, education and training, and monitoring and analysis.

The key points in this submission are:

- Technological innovation is a key driver for implementation of the systems required for effective climate change adaptation. Further, the technological framework needed to ensure that Australian cities adapt to and mitigate climate change will have to incorporate a risk management approach to ensure balance between robustness and optimisation of systems. Long term planning, particularly investment planning and resourcing, will be key for successful adaptation to climate change.

- Because Australia is highly urbanised, urban design and planning have a critical role to play in coordinating and managing the general response to climate change. Innovative demand management strategies will be required to reduce demand for energy and water. A well defined and consistent policy framework is needed to increase investment certainty in order to support the development and deployment of new technologies.

- The implementation of required changes will not be straightforward. Communication, in the form of education and training will be needed to achieve the substantial changes in understanding required in order to design, implement and maintain required systems, particularly in the built environment.

- Sustained and consistent measurement of environmental and socio-economic indicators is needed so that progress can be monitored and long-term trends can be distinguished from natural variability. The data need to be quality controlled, securely archived and readily accessible, and measurements need to be carried out within a national (or international) framework.

1The Australian Academy of Technological Sciences and Engineering (ATSE) is an independent body of 800 eminent Australian engineers and scientists driving technological solutions for a better Australia. ATSE was established in 1976 with the mission to promote the application of scientific and engineering knowledge to the future benefit of Australia. ATSE is one of four learned national Academies, which have complementary roles and work together both nationally and internationally. www.atse.org.au

The Academy is committed to providing independent, evidence-based advice on climate change adaptation on an ongoing basis.

Background

The Australian Academy of Technological Sciences and Engineering (ATSE) is an independent, non-government organisation of over 800 eminent Australian engineers and scientists driving technological solutions for a better Australia. The Academy promotes the development and adoption of existing and new technologies to improve and sustain Australian society and economy. ATSE was established in 1976 with the mission to promote the application of scientific and engineering knowledge to the future benefit of Australia. ATSE is one of four learned national Academies, which have complementary roles and work together both nationally and internationally. ATSE provides a national forum for discussion and debate of issues critical to Australia's future, especially the impact of technology, science and engineering on our quality of life.

Recognising that adaptation to climate change relates to almost all facets of our lives, the Academy has climate change impact and adaptation as one of its cross-cutting themes that intersect with its programs on water, energy, health, urban environment, and education; through its subsidiary company, The Crawford Fund, ATSE also maintains a program on food and agriculture research. Many of the activities carried out by ATSE over the last few years provide guidance on the questions raised by the Productivity Commission Issues Paper.

An ATSE study in 2008 on the impacts of climate change on Australia's physical infrastructure (http://www.atse.org.au/resource-centre/func-startdown/48/) found that the impacts of current climate change projections have the potential to significantly challenge the capacity of elements of our infrastructure and that actions at the national level are needed to ensure that appropriate adaptation measures can be implemented to meet these challenges.

The ATSE symposium in 2009 was on Future-Proofing Australia – Rising to the Challenge of Climate Change. Findings of that meeting included the need for governments to adopt an integrated approach in response to climate change to ensure that food and water security, as well as other impacts, are considered comprehensively. It was also found that governments should consider special incentives to encourage and support early entrants into capital-intensive new technology areas.

As Australia is one of the most urbanised countries in the world, with more than 90% of the population living in cities, the adaptation of the urban environment to climate change is a key issue for the nation. An ATSE workshop in 2009, involving national and overseas experts, produced a report *Climate Change and the Urban Environment:* (http://www.atse.org.au/resource-centre/func-startdown/240/) that *inter alia* called for actions to ensure that our cities remain resilient and sustainable while adapting to climate change. Findings from the workshop included the topics of

- climate extremes and vulnerability thresholds

- urban landscape
- systematic observation and modelling
- water and uncertainty
- water-related hazards
- water security and resource management
- climate-adaptive buildings
- built-environment education, training and research
- urban form and transport
- retro-fitting cities
- human health, including mental health.

In collaboration with the Shanghai Association for Science and Technology, ATSE organised a similar meeting in Shanghai in July 2010 involving experts from Australia and China. Despite the differences in population and economic development, it was found that there are many common problems associated with urbanisation, and so international cooperation should be a continuing strategy as we adapt to climate change.

In 2010 ATSE held a seminar on City to Cape 2100 Sea-Level Rise, aimed at raising understanding of projected sea-level rise and its impacts on the coastal region of Western Australia. A finding of that meeting was that at least nine approving bodies and three levels of government are involved in the approval of projects and developments which relate to climate change effects. It was also noted that approving bodies will likely become the target of insurance claims as a result of losses due to flooding, inundation and severe storm damage.

Some issues considered by ATSE activities and relevant to the Productivity Commission Issues Paper (uncertainty and resilience, demand management, urban design, education and training, and monitoring and analysis) are discussed in more detail below.

Uncertainty and resilience

While the Intergovernmental Panel on Climate Change is unequivocal about the basic science of climate change, the future state of the climate at a particular location remains uncertain. Indeed, for a country like Australia with high natural variability in its climate, climate change introduces a further degree of uncertainty. Planning and management of urban water in Australia in recent years provide clear examples of the development of strategies that are more flexible and that utilise a diverse portfolio of responses to ensure resilience in a changing climate.

In the face of prolonged dry spells and growing populations, each major coastal city in Australia now has or is building a desalination capability to provide assurance of fresh water for urban communities. State agencies are also developing a range of sources for water including dams, groundwater, and recycling; for example, “Water Forever”, WA Water Corporation 2011. In essence there is growing consideration of water supply,

sewerage and drainage, and waterways as elements of a broader urban water cycle; that is, the integration of systems is a strategy to secure resilience in order to manage uncertainty. Indeed there is a growing concept around the world of cities as water supply catchments, in which potential sources include groundwater, urban storm water, rain water (roof run-off), recycled waste water and desalinated water.

There are a range of new developments where integrated delivery of water, sewerage and drainage services is being implemented (for example, the Aurora Sewage Treatment Plant and Recycled Water Treatment Plant near Melbourne). There has also been greater private uptake of non-traditional water sources (for example, rainwater tanks and grey water systems) in response to drought and water restrictions in many cities. The mix of sources allows for a balance of resilience, reliability, cost, and environmental impact. However, the detailed planning and implementation of non-traditional systems can be constrained by factors such as a lack of relevant research and data on their short and long-term performance, unknown economics, and planning and institutional constraints.

In many sectors and the broader community, the uncertainties associated with climate change projections can lead to inaction. However, recognising the uncertainties associated not only in future climate but also in future societal conditions, the scientific community can develop long-term trajectories of future climate as guides for planning purposes; for example, “Guidelines for the Development of a Water Supply-Demand Strategy” (Victoria Department of Sustainability and Environment, 2011) aims to assist water corporations in preparing water supply-demand strategies that account for climate variability and change.

While science provides the basic knowledge for understanding and predicting future scenarios, the means for implementation of the required systems inevitably depends upon technological innovation and change. The technological framework needed to ensure that our cities adapt to and mitigate climate change will have to incorporate a risk management approach so that there is a balance between robustness and optimisation of systems. This process will be informed by carefully quantified assessment of the options for action; in particular, it will be important to ensure the resilience of our cities so that there is allowance for ‘economic headroom’ in decision making.

Demand management

The demand for energy and water in Australian cities has traditionally been met by a predict-and-provide approach. With the privatisation of energy supply and policy uncertainty on greenhouse gas emissions, there has been limited investment in capital-intensive energy technology. Early stage investment is risky and may require special incentives to support early entrants into new technology areas. Moreover, a well-defined and consistent policy framework is needed to increase investment certainty.

For water, the natural sources of rainwater can no longer provide a secure supply for our cities. In addition to the development of a more robust supply system, part of the response needs to be the reshaping of demand. The reductions in urban water use

across Australia in recent years have demonstrated the effectiveness of innovative demand management; for example, since 2001 Perth's average water use per person has decreased by almost 30% ("Water Forever", WA Water Corporation, 2011). Such strategies will need to be continued and enhanced in the future across Australia.

Urban design

As a consequence of its size and location, Australia is subject to large spatial and temporal variations in climate. Its cities are located within tropical, sub-tropical, Mediterranean, semi-arid and temperate climates, making many northern hemisphere observations and understandings poorly applicable here.

The urban heat island effect, in which a metropolitan area is warmer than its surrounding rural area, is caused by traditional urban designs using materials that essentially retain heat. Urban design can also influence local wind and rainfall patterns. In addition to the energy implications of the urban heat island, there are impacts on human health and well-being through extreme temperatures and poor air quality.

Urban planning and design involve a multitude of actors and agencies, including the millions of transport users and householders in making choices about where they should live and work, the thousands of developers and builders deciding what they will build, the many thousands of businesses making commercial decisions, and agents that move people and freight across the urban system. In addition, planning involves a consideration of both private and public actions and decisions. Thus urban design and planning have a critical role to play in coordinating and managing the general response to climate change.

While Australian city governments are taking action on climate change, many of these activities are largely uncoordinated across the levels of government, with little analysis of how the different interventions interact (especially between mitigation and adaptation policy). Integration and coordination of policy initiatives are needed to optimise the overall impact on the built environment within Australian cities.

It is extremely unlikely that Australian cities will be able to build their way to adaptation, because the lifetime of both housing stock and commercial building stock is decades. Work is needed on how existing building stock and existing suburbs can be built or retrofitted to suit the climate change challenges. Planning policies to make our cities more fit for purpose will also need to tackle the issue of neighbourhood design as well as the issue of the buildings.

The required changes in urban design and planning will require policy frameworks and incentives for the commercial market. To minimise the costs of implementation on a national scale, these frameworks and incentives should have national consistency and should involve coordination across city agencies.

Education and training

It is clear that urban systems are increasing in complexity, especially as steps are taken to adapt to and mitigate climate change impacts. In order to design, implement and

maintain the required systems, there will need to be substantial changes in understanding and even culture by people at all levels in government, building professions and the general community. Thus communication, in the forms of education and training as well as research, will need to be a major element in the overall policy required to achieve the changes associated with adaptation to and mitigation of climate change impacts. The changes in understanding are needed to avoid continuation of the unsustainable practices currently used in building design and construction and currently accepted by government and the community.

The building industry is currently not trained to deliver climate-adaptable and zero-carbon buildings as either renovations or new buildings. In addition, professional education generally does not sufficiently prioritise or effectively deliver curricula that will empower graduates to shape a zero-carbon and climate-adaptable urban environment. Reform and expansion of built-environment education and training with climate change mitigation and adaptation as a primary focus should occur over the next decade to ensure that the Australian workforce develops the needed expertise in a reasonable time frame.

Implementation of the required changes across the community will not be straightforward. Fundamental to the implementation of adaptive options are embedded values, cultural or otherwise, that dominate how Australians perceive the future, what they value, what they deem to be success and what they desire for themselves and future generations. Most often these are subconsciously held values that impact on decisions about acceptance or otherwise of change. There are belief structures that themselves impact on why this problem exists and why there is a struggle to respond to it. For example, as said by President J F Kennedy: "*The great enemy of the truth is very often not the lie - deliberate, contrived and dishonest, but the myth, persistent, persuasive, and unrealistic. Belief in myths allows the comfort of opinion without the discomfort of thought*". This idea has been explored by some behavioural and social science disciplines but requires further examination in Australia, as it describes what could be said to be one the many barriers to effective climate change adaptation in Australia.

Monitoring and analysis

It is not possible to effectively manage a system or process without measurement of appropriate indicators. Adaptation policies need to be monitored and assessed through the measurement of environmental and socio-economic indicators. For example, city temperatures and air quality, as well as hospital admissions, are indicators of the effectiveness of policies to improve human health.

In the past, many of the measurements of natural and built assets have been *ad hoc* and short-term. Sustained and consistent monitoring is needed so that long-term trends can be distinguished from the background 'noise' of natural variability. The data need to be quality controlled, securely archived and readily accessible. To allow comparison of systems across the country, measurements need to be carried out within a national (if not international) framework.

An international framework for such monitoring is provided by the Global Climate Observing System (http://gcos.wmo.int), which prepares regular reports to the UN Framework Convention on Climate Change on the adequacy of the global observing system, and a national framework could be built on the National Plan for Environmental Information (http://www.environment.gov.au/npei).

Consideration could also be given to the advantages of a system of national Environmental Accounts being trialled by ten Natural Resource Management (NRM) regions using a model developed by the Wentworth Group of Concerned Scientists in assisting decision makers adapt to climate change (http:/www.wentworthgroup.org). Managers of key infrastructure of national significance, such as airports and sewerage facilities near the coast, should also establish monitoring systems using indicators that will alert managers to adverse impacts of climate change.

Conclusions

The Academy of Technological Sciences and Engineering (ATSE) recognises climate change adaptation as a key issue that cuts across most facets of Australian life, and ATSE has carried out a number of studies in recent years that have identified barriers to effective adaptation. Given the inherent uncertainties associated with estimation of future climate on a local level and the inherent community attitudes, education, training and communication will be key features needed to develop the national capabilities to plan and manage adaptation to climate change. Consistency of regulation and planning will be needed to ensure that our infrastructure is resilient enough to efficiently manage uncertainties in both social and environmental factors. As Australia is highly urbanised, there should be a focus on increasing the resilience and efficiency of our urban areas.
The Academy would be pleased to provide further detail on any aspect of this submission.

Further Information

For further information, please visit www.atse.org.au.