

Commonwealth of Australia 2013

**ISSN 1447-1329  
ISBN 978-1-74037-435-4 (Volume 1)**

**ISBN 978-1-74037-436-7 (Volume 2)**

**ISBN 978-1-74037-436-1 (Set)**

This work is copyright. Apart from any use as permitted under the *Copyright Act 1968*, the work may be reproduced in whole or in part for study or training purposes, subject to the inclusion of an acknowledgment of the source. Reproduction for commercial use or sale requires prior written permission from the Productivity Commission. Requests and inquiries concerning reproduction and rights should be addressed to Media and Publications (see below).

*This publication is available from the Productivity Commission website at www.pc.gov.au. If you require part or all of this publication in a different format, please contact Media and Publications.*

**Publications Inquiries:**

Media and Publications

Productivity Commission

Locked Bag 2 Collins Street East

Melbourne VIC 8003

Tel: (03) 9653 2244

Fax: (03) 9653 2303  
Email: maps@pc.gov.au

**General Inquiries:**

Tel: (03) 9653 2100 or (02) 6240 3200

**An appropriate citation for this paper is:**

Productivity Commission 2013, *Electricity Network Regulatory Frameworks*, Report No. 62, Canberra.

The Productivity Commission

The Productivity Commission is the Australian Government’s independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long term interest of the Australian community.

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.

Further information on the Productivity Commission can be obtained from the Commission’s website (www.pc.gov.au) or by contacting Media and Publications on (03) 9653 2244 or email: maps@pc.gov.au

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | PC_inline | |
| 9 April 2013 | | | ***Melbourne Office***  Level 12, 530 Collins Street  Melbourne VIC 3000  Locked Bag 2 Collins Street East  Melbourne VIC 8003  Telephone 03 9653 2100  Facsimile 03 9653 2199  ***Canberra Office***  Telephone 02 6240 3200  www.pc.gov.au |

The Hon David Bradbury MP  
Assistant Treasurer

Parliament House

CANBERRA ACT 2600

Dear Assistant Treasurer

In accordance with Section 11 of the *Productivity Commission Act 1998*, we have pleasure in submitting to you the Commission’s final report into Electricity Network Regulatory Frameworks.

Yours sincerely

|  |  |  |
| --- | --- | --- |
| Philip Weickhardt  Presiding Commissioner | Wendy Craik AM  Commissioner |  |

# Terms of reference

I, Wayne Swan, Deputy Prime Minister and Treasurer, pursuant to Parts 2 and 3 of the Productivity Commission Act 1998, hereby request that the Productivity Commission undertake an inquiry into electricity network frameworks, focussing on benchmarking arrangements and the effectiveness of the application by network businesses of the current regulatory regime for the evaluation and development of interregional network capacity in the National Electricity Market (NEM).

*Background*

Australia’s electricity sector is facing a number of challenges over the coming years. This includes a large investment requirement for networks to replace ageing assets, meet growing levels of peak demand, reliability requirements and to facilitate the transition towards Australia’s clean energy future.

Recent increases in network expenditure, and the resultant flow on to increases in electricity prices for end users, have highlighted the need to ensure networks continue to deliver efficient outcomes for consumers. Network regulation is a complex task requiring difficult and technical judgements. This inquiry will inform the Australian Government about whether there are any practical or empirical constraints on the use of benchmarking of network businesses and then provide advice on how benchmarking could deliver efficient outcomes, consistent with the National Electricity Objective (NEO). In addition, a second stream of this inquiry will examine if efficient levels of transmission interconnectors are being delivered, to inform the Australian Government about whether the regulatory regime is delivering efficient levels of interconnection to support the market.

*Scope of the Inquiry*

The Commission is requested to assess the use of benchmarking as a means of achieving the efficient delivery of network services and electricity infrastructure to meet the long term interests of consumers, consistent with the NEO. In addition, the Commission is requested to assess whether the current regulatory regime, as applied to interconnectors, is delivering efficient levels of network and generation investment across the NEM.

In undertaking the review, the Commission should:

* examine the use of benchmarking under the regulatory framework, incorporating any amendments introduced in the review period, in the National Electricity Rules and provide advice on how different benchmarking methodologies could be used to enhance efficient outcomes; and
* examine whether the regulatory regime, with respect to the delivery of interconnector investment in the NEM, is delivering economically efficient outcomes.

In undertaking the inquiry, the Commission should consider and take into account the work that is currently being progressed through the Standing Council on Energy and Resources, the Australian Energy Market Commission (AEMC) and the Australian Energy Regulator (AER). The Commission should have particular regard for the AEMC reviews into transmission frameworks, power of choice (demand side participation) and the suite of rule changes relating to network regulation currently under consideration by the AEMC in accordance with its statutory obligations.

The Commission should engage with the AEMC, the AER and the Australian Energy Market Operator in undertaking the review. In addition, the Commission should consult with Australian Government agencies, state and territory government agencies and other key stakeholders in undertaking the review.

The Commission will report within 15 months of receipt of this reference and will hold hearings for the purpose of this inquiry. The Commission is to provide both a draft and a final report, and the reports will be published. 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 final report.

WAYNE SWAN

9 January 2012

# Disclosure of interests

The *Productivity Commission Act 1998* specifies that where Commissioners have or acquire interests, pecuniary or otherwise, that could conflict with the proper performance of their functions during an inquiry they must disclose the interests.

Dr Craik has advised the Commission that she is the beneficiary of subsidised solar PV panels.

Contents

The Commission’s report is in two volumes. **This volume 1 contains the Overview, the Recommendations and findings and chapters 1 to 8.** Volume 2 contains chapters 9 to 21, Appendix A and the References. Appendices B to F will only be available on the Commission’s web site (http://www.pv.gov.au). Below is the table of contents for both volumes.

Volume 1

Terms of reference v

Disclosure of interests vii

Acknowledgments xvi

Abbreviations and explanations xvii

Overview 1

Recommendations and findings 43

1 About the inquiry 65

1.1 What are the perceived problems? 65

1.2 Overview of the regulatory framework and its institutions 68

1.3 The Commission’s approach to its terms of reference 71

1.4 A guide to the report 77

2 The structure and performance of the National Electricity Market 83

2.1 The structure of the National Electricity Market 84

2.2 The scale of the network and its costs 95

2.3 The nature of demand 98

2.4 Prices have been rising 104

2.5 The proximate reasons for higher network charges 110

2.6 Reliability 113

2.7 What is at stake? 114

3 The rationale for regulation of electricity networks 121

3.1 The characteristics of electricity networks 122

3.2 Evidence about the costs of market power 125

3.3 The case for regulating monopolies 126

3.4 Are deadweight losses passé? New theories of why monopolies should be regulated 139

3.5 The alternative policy implications of different theories of monopoly regulation 144

3.6 In summary 145

4 A framework for benchmarking 147

4.1 Benchmarking managerial efficiency and performance 148

4.2 Benchmarking techniques 156

4.3 What should be benchmarked? 160

4.4 The use of benchmarking for Australian electricity networks 162

4.5 Criteria for judging benchmarking 163

4.6 Validity — does the measure test what it claims to? 168

4.7 Other scientific criteria for judging benchmarking 178

4.8 Testing the credibility of results 182

4.9 No perfect measure is possible 185

5 Incentive regulation and benchmarking 187

5.1 Incentive regulation 188

5.2 Incentive regulation and the electricity sector 192

5.3 Ensuring effective incentives 201

5.4 The AER’s ability to determine expenditure forecasts 221

6 Empirical evidence of network efficiency 227

6.1 Existing evidence and arguments 228

6.2 The relative impacts of the WACC, capex and opex 238

6.3 Demand driven augmentation 242

6.4 What does the RAB tell us? 248

6.5 Expenditure, allowances and timing 254

6.6 Public and private ownership 257

6.7 Conclusions 260

7 Ownership 263

7.1 A framework for considering ownership 264

7.2 Incentive regulation and state-owned corporations 267

7.3 Non-commercial imperatives and interference 270

7.4 The productivity and performance of state-owned network businesses 279

7.5 The perceived risks of privatisation 284

7.6 The bottom line on private ownership 287

7.7 The transition to privatisation 290

8 How should the Australian Energy Regulator use benchmarking? 295

8.1 Should benchmarking be used in a mechanistic role to set revenue allowances? 298

8.2 Benchmarking the effectiveness of the regulatory regime 305

8.3 Could more targeted analysis act as a filter? 308

8.4 Benchmarking could be a trigger for negotiated settlements 316

8.5 Information and ‘moral suasion’ 322

8.6 The long-run application of benchmarking 323

8.7 The regulator’s benchmarking practices 325

8.8 Conclusion 334

Volume 2

9 Peak demand and demand management 335

9.1 What is peak demand and why is it a problem? 336

9.2 A roadmap for how this report addresses peak demand management 339

9.3 Facets of the peak demand problem 341

9.4 What is demand management and how can it provide a solution? 353

9.5 Demand management is not widely implemented 360

9.6 Why is the uptake of demand management so low? 366

9.7 Gauging the prospective benefits and costs of demand management 367

10 Technologies to achieve demand management 377

10.1 Understanding smart meters 380

10.2 Rolling out smart meters involves major challenges 386

10.3 Creating the optimal incentives for deploying demand management technologies 391

10.4 A hybrid approach that blends a market-based and regulated approach 399

10.5 There must be a role for other parties 411

10.6 Control of the information hub 419

10.7 Direct load as an alternative or complementary option 421

11 Moving to time-based pricing for the distribution network 427

11.1 Introduction 428

11.2 How do distribution businesses currently price? 430

11.3 Do the National Electricity Rules facilitate time-based and other efficient pricing approaches? 433

11.4 Designing time-based prices for distribution networks 435

11.5 A supervising role for SCER is a first step in implementing time-based pricing 442

11.6 A NEM-wide licensing regime for network providers 443

11.7 Tightening and augmenting aspects of the Rules 447

11.8 Guidelines to support methodological development and data collection 450

11.9 Addressing affordability and equity issues 451

11.10 The nature of the transition to time-based pricing 455

11.11 The importance of effective engagement and customer education 460

12 Complementary reforms to support demand management 465

12.1 Choice of revenue control mechanism — revenue caps versus weighted average price caps 466

12.2 The incentives of network businesses to undertake demand management 479

12.3 Retailers’ incentives and price regulation 483

12.4 The AEMC’s proposed ‘demand response mechanism’ in the Power of Choicereview 498

13 Distributed generation 501

13.1 What is distributed generation? 502

13.2 Scale of distributed generation in Australia 504

13.3 Potential benefits of distributed generation 505

13.4 Effects of distributed generation on network costs 506

13.5 Obstacles to efficient network investment 511

13.6 Benchmarking to achieve efficient levels of network use of distributed generation 522

14 Building a reliability framework in order to benchmark 525

14.1 What issues does reliability raise? 527

14.2 Reliability under incentive regulation 529

14.3 The costs of reliability for network businesses 530

14.4 What level of reliability is efficient? 533

14.5 Measuring the value of reliability 534

14.6 Concluding comments 545

15 Distribution reliability 547

15.1 Introduction 548

15.2 Reliability performance of distribution businesses in the National Electricity Market 549

15.3 Reliability settings for distribution networks in the National Electricity Market 552

15.4 An efficient and effective distribution reliability framework — a bolstered STPIS 570

16 Transmission reliability and planning 581

16.1 Introduction 582

16.2 The special characteristics of transmission networks 583

16.3 The broader planning context and economic regulation 586

16.4 An efficient transmission framework? 588

16.5 The way forward 596

16.6 Delivering reliability in the shorter term 611

16.7 Changes to transmission reliability 614

16.8 Contestability in new connections and other separable transmission investments 617

17 The Regulatory Investment Test for Transmission 627

17.1 The current framework 628

17.2 Issues with the current RIT‑T 632

17.3 The future role of the RIT-T 636

17.4 Other potential improvements 646

18 The role of interconnectors 653

18.1 Background and perceived problems 654

18.2 Some conceptual considerations 663

18.3 Evidence of the efficiency of interconnection 668

19 Efficient use of interconnectors 681

19.1 The spot market 682

19.2 Disorderly bidding 684

19.3 Potential solutions 696

19.4 More fundamental reforms 718

19.5 The hedging market 724

20 Merchant interconnectors 733

20.1 The role of merchant interconnectors in the National Electricity Market 734

20.2 Regulatory biases 745

20.3 Beneficiary pays 753

21 Governance 759

21.1 Governance and performance of the Australian Energy Regulator 762

21.2 Reform of Australian Energy Regulator governance 776

21.3 What about AEMO, the AEMC and other NEM bodies? 786

21.4 Consumer engagement and representation 787

21.5 Processes for amending electricity network regulation 797

21.6 Merits review processes 809

Appendices

A Conduct of the inquiry 811

References 819

Online Appendices

B The hold-up problem

C Hedging in the electricity market

D Modelling indirect effects in the RIT-T

E International regulators’ approach to merchant transmission investment

F Current transmission reliability and planning frameworks

# Acknowledgments

The Commission engaged the services of Dr John Tamblyn, a well-known expert on the National Electricity Market (who has recently been involved in two other independent reviews of aspects of the electricity industry) to review some chapters and the overview for the draft of this report. Dr Tamblyn provided valuable feedback to the Commission, for which we are most grateful. However, the views and judgements in this report are those of the Commission alone, and should not be attributed to Dr Tamblyn or any other participant, except where clearly stated.

# Abbreviations and explanations

Abbreviations

AATSE Australian Academy of Technological Sciences and Engineering

ABS Australian Bureau of Statistics

ACCC Australian Competition and Consumer Commission

ACT Australian Competition Tribunal

AEMC Australian Energy Market Commission

AEMO Australian Energy Market Operator

AER Australian Energy Regulator

AEMA Australian Energy Market Agreement

ASU Australian Services Union

ATA Australian Technology Association

CAIDI Customer average interruption duration index

CALC Consumer Action Law Centre

CAPEX or capex Capital expenditure

CBA Cost-benefit analysis

CDF Customer Damage Functions

COAG Council of Australian Governments

CPI-x Consumer Price Index minus a benchmark productivity rate (x)

CPP Critical Peak Price

CSIRO Commonwealth Scientific and Industrial Research Organisation

DANCE Dynamic Avoidable Network Cost Evaluation model

DG Distributed generation

DLC Direct load control

DM Demand management

DMEGCIS Demand Management and Embedded Generation Connection Incentive Scheme

DNSP Distribution Network Service Provider

DPI Department of Primary Industries (Victoria)

DRED Demand Response Enabling Device

DSP Demand side participation

EBSS Efficiency Benefit Sharing Scheme

ENA Energy Networks Association

ERAA Energy Retailers Association of Australia

esaa Energy Supply Association of Australia

ESC Essential Services Commission (Victoria)

ESCOSA Essential Services Commission of South Australia

ETC Electricity Transmission Code

EU European Union

EUAA Energy Users Association of Australia

FCAS Frequency control ancillary services

GDP Gross Domestic Product

HV High voltage

IPART Independent Pricing and Regulatory Tribunal (NSW)

IRSR Inter-regional settlement residue

kV kilovolt

kVA kilovolt ampere

kW kilowatt

kWh kilowatt hour

LRIC long-run incremental cost

LRMC long-run marginal cost

LV Low voltage

LYMMCo Loy Yang Marketing Management Company

MAIFI Momentary average interruption frequency index

MAR Maximum annual revenue

MCE Ministerial Council on Energy

MDMS meter data management system

MED Major event days

MEU Major Energy Users

MFP Multifactor productivity

MNSP Market network service provider

MW Megawatt

MVA Megavolt amperes

MWh Megawatt hour

NECA National Electricity Code Administrator

NECF National Energy Customer Framework

NEM National Electricity Market

NEMMCO National Electricity Market Management Company Limited

NEO National Electricity Objective

NEL National Electricity Law

NER National Electricity Rules

NGF National Generators Forum

NGL National Gas Law

NMS Network management systems

NPV Net present value

NSP Network service provider

NTNDP National Transmission Network Development Plan

NTP National Transmission Planner

N-x Measure of redundancy in network (with higher x being higher levels of redundancy)

OFA Optional firm access

Ofgem Office of Gas and Electricity Markets (UK)

Ofwat Office of Water Services (UK) (On 1 April 2006, the functions of Ofwat were replaced by the Water Services Regulation Authority)

OPEX or opex Operating expenditure

PC Productivity Commission

PIAC Public Interest Advocacy Centre

PSCR Project Specification Consultation Report

PV Photovoltaic

QTC Queensland Treasury Corporation

QUT Queensland University of Technology

RAB Regulatory asset base

RET Renewable Energy Target scheme

RIT-D Regulatory Investment Test for Distribution

RIT-T Regulatory Investment Test for Transmission

SAIDI System average interruption duration index

SAIFI System average interruption frequency index

SCER Standing Council on Energy and Resources

STPIS Service Target Performance Incentive Scheme

SOC State-owned corporation

TEC Total Environment Centre

TNSP Transmission network service provider

TOU Time of use (electricity tariffs)

VCEC Victorian Competition and Efficiency Commission

VCR Value of Customer Reliability

WACC Weighted average cost of capital

WAPC Weighted average price cap

Explanations

|  |  |
| --- | --- |
| Billion | The convention used for a billion is a thousand million (109). |
| Findings | *Findings in the body of the report are paragraphs high­lighted using italics, as this is.* |
| Recommendations | ***Recommendations in the body of the report are high­lighted using bold italics, as this is.*** |