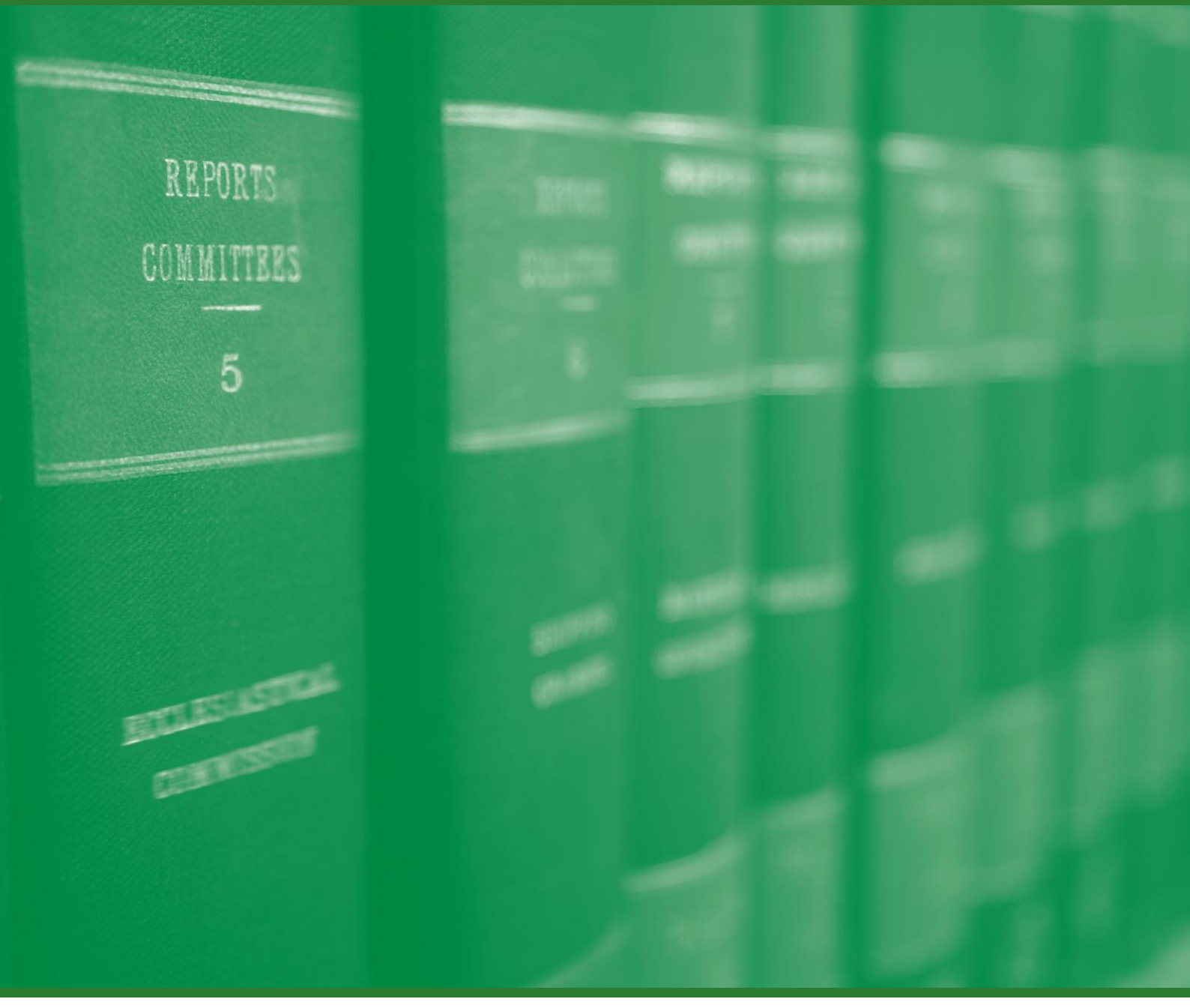
LEGISLATIVE ASSEMBLY OF NEW SOUTH WALES

PUBLIC ACCOUNTS COMMITTEE

REPORT 6/55 – NOVEMBER 2012

THE ECONOMICS OF ENERGY GENERATION



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The motto of the coat of arms for the state of New South Wales is "Orta recens quam pura nites". It is written in Latin and means "newly risen, how brightly you shine".

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Membership

CHAIR	Mr Jonathan O'Dea MP, Member for Davidson
DEPUTY CHAIR	Dr Geoff Lee MP, Member for Parramatta
MEMBERS	Mr Bart Bassett MP, Member for Londonderry Mr Michael Daley MP, Member for Maroubra Mr Richard Torbay MP, Member for Northern Tablelands Mr John Williams MP, Member for Murray-Darling
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Terms of Reference

That the Committee inquire into and report on the comparable economics of energy generation in New South Wales. In particular, the Committee will consider:

i) the mix of energy sources used in New South Wales;

ii) a comparison of NSW's energy mix with other jurisdictions both in Australia and overseas;

iii) issues relating to long term energy security in New South Wales;

iv) the potential for NSW sourcing energy interstate;

v) the potential for, and barriers to, development of alternative forms of energy generation (e.g. tidal, geothermal) in New South Wales; and

vi) best practice in alternative energy generation in other jurisdictions.

Chair's Foreword

Energy economics has become increasingly relevant to people over recent years as they have opened envelopes and emails to discover continually rising electricity bills.

Ironically, the price paid for wholesale electricity generation has fallen in recent years and now represents only 25 per cent of the retail price that consumers pay for electricity. The 'poles and wires' component represents 50 per cent of the overall price, while electricity retailers contribute a further 10 per cent, and the carbon tax and other green schemes account for 15 per cent (8 per cent and 7 per cent respectively).

There is no shortage of potential electricity supply for NSW. However, the notion of energy or electricity 'security' extends beyond availability of supply to include elements of reliability, sustainability and affordability. Electricity generation policy should be based on the principles of open markets, transparency, consistency and economic efficiency. Such an approach should provide competitive outcomes that will best serve the interests of NSW residents and other consumers, as well as a positive climate for investment and economic growth.

There is considerable scope for a sharper focus from government on demand management, as opposed to supply management. It is an area that needs a stronger champion. Sensibly reducing peak and total demand will reduce costs to consumers and the environment. Demand management was a major theme of the feedback received from the innovative Citizens' Policy Jury process, which informed the Committee's deliberations. Demand management became a key focus of this Inquiry, with ten of the report's 24 recommendations addressing this area.

While the NSW Government needs to oversee consistent and fair regulation relating to areas such as planning and safety, this should not extend to providing preferential treatment to particular energy sources. The recognition of environmental costs as part of a market price has been addressed at a Federal level, particularly through the carbon tax and Renewable Energy Target. The NSW Government should not attempt to duplicate this role, nor be further involved in the commercial supply or subsidy of particular forms of electricity generation, as this interferes with competition and distorts the market, including for renewable energy.

However, the NSW Government does have a role in promoting and encouraging greater innovation, research and development relating to all energy solutions, including energy storage, especially where NSW has a competitive economic advantage. There is real value in promoting diversity of energy sources and keeping future energy options open, as technologies continue to emerge and develop. This includes gas and nuclear options. However, the Government must be wary of 'picking winners' in a changing marketplace.

For those who have been confused by the complex area of electricity in NSW (and Australia), this report provides a highly intelligible explanation of the context and key issues surrounding various energy sources and challenges. The Committee has attempted to provide balanced observations based on the substantial evidence presented to it by a range of stakeholders, who we thank. Among these were the participants of the Citizens' Policy Juries, whose involvement was facilitated by the NewDemocracy Foundation. This innovative process of 'deliberative democracy' was highly valued by the Committee and should serve as a pilot for similar future public engagement and consultation by governments of all levels. The process

also demonstrated the value of consumer education, which is a further important role of government.

The Public Accounts Committee staff have been outstanding in contributing to this report's creation and I especially acknowledge the excellent work of Dr Abigail Groves and Mr John Miller.

Finally, I thank the Public Accounts Committee members, Mr Geoff Lee MP, Mr Bart Bassett MP, Mr Michael Daley MP, The Hon Richard Torbay MP and Mr John Williams MP, who have all worked constructively and co-operatively to deliver a report that will hopefully prompt better and more efficient public outcomes as part of a secure energy future in NSW.

Mr Jonathan O'Dea MP
Chair

Executive Summary

The Inquiry into the Economics of Energy Generation was referred to the NSW Parliament Public Accounts Committee by the Hon Chris Hartcher, Minister for Resources and Energy, in November 2011.

The Committee subsequently adopted formal Terms of Reference, which asked it to inquire into and report on the mix of energy sources currently used in New South Wales, make comparisons with other jurisdictions, and examine issues relating to long term energy security for the State and the potential for New South Wales to source energy interstate. The Terms of Reference also asked the Committee to consider the potential for, and barriers to development of alternative sources of energy generation, and examine best practice in alternative energy generation. The Terms of Reference are listed in full on page xi.

The Committee then called for submissions to the Inquiry, and eventually received 34 formal submissions, with a variety of stakeholders providing submissions. These included key government agencies such as the Australian Energy Market Commission and the Australian Energy Market Operator, as well as large private companies such as Origin Energy, TRUenergy and AGL Energy. A number of alternative and renewable energy companies also made submissions, as did private individuals with an interest in the energy security of New South Wales. Environmental groups such as Greenpeace Australia and the Total Environment Centre were likewise represented.

The Committee conducted two public hearings, in March and May of 2012, where it heard evidence from key stakeholders. The public hearings provided a crucial opportunity for Committee members to meet with stakeholders and ask questions about this complex area of policy, and to hear the concerns of stakeholders directly. Committee members conducted two visits of inspection: to the Vales Point and Colongra Power stations on the Central Coast, and to Capital Wind Farm in the State's southeast, near Bungendore.

The Committee was keen to hear directly from consumers. To do this, the Committee worked with the NewDemocracy Foundation to conduct an innovative consultation process. The NewDemocracy Foundation formed two Citizens' Policy Juries, with one group based in Sydney and the other in Tamworth. The Citizens' Policy Juries comprised of randomly-selected citizens who volunteered their time. The methodology adopted by the NewDemocracy Foundation in this process is detailed in Chapter One. The groups subsequently each provided a report, and these are included as Appendices to this Report. Their views informed the Committee's deliberations, and are also referred to in the main body of this Report. The Committee was particularly impressed by the commitment which the participants showed to the process, and the generosity they showed in giving their time. The Committee has recommended that the NSW Government consider adopting similar processes in other areas of policy where appropriate.

The Committee was keenly aware of the prescience of its Inquiry, and also of the range and complexity of policy issues surrounding energy generation and the electricity market. New South Wales is a key part of the inter-connected network that forms the National Electricity Market, and works in partnership with other states to regulate this market. New South Wales, and indeed the whole of Australia, is affected by energy policies implemented at a federal level. The Commonwealth's carbon pricing scheme, which is explicitly designed to effect a

fundamental restructure of the electricity industry, commenced during the course of the Committee's Inquiry. The Committee is well aware of the debate surrounding the carbon tax and indeed, of other environmental measures, but decided not to use this Inquiry as a forum to replay this debate, or to speculate on alternative policies that may be implemented at a Commonwealth level.

Similarly, the Committee was aware of the controversy involved in privatisation of electricity assets in New South Wales, with the Electricity Generator Assets (Authorised Transactions) Bill being passed by the NSW Parliament during the course of this Inquiry. The Committee did not seek to repeat the debate surrounding electricity asset sales in NSW. The Committee does not consider that asset sales pose a threat to energy security in NSW. Rather, the Committee supports the decision of the current Government to privatise remaining electricity generation assets, and does not support the Government's re-entry into the wholesale electricity market through further investment in generation.

The Committee was also aware of the range of work being conducted on energy policy by different agencies. During the course of this Inquiry, several other key agencies have conducted inquiries which are directly relevant to the Committee's deliberations, including reports by the Australian Energy Market Commission, the Productivity Commission, and the Senate Select Committee on Electricity Prices, among others. The Committee sought to avoid duplication where possible and acknowledges that other agencies may be better placed to consider the detail of some issues. As a result, the Committee has endorsed recommendations made by other agencies on some issues, or chosen to await outcomes of other processes.

The Committee was conscious that the issues raised by the Terms of Reference are inter-related, and the Committee's report is therefore organised thematically, with the first four chapters providing the context for this Inquiry and background information about the electricity industry. Chapters Five, Six and Seven address energy security in New South Wales, while Chapters Eight and Nine discuss alternative energy generation and Chapter Ten, demand management. A detailed summary of the report is provided below.

Chapter One details the conduct of the Inquiry, including the referral of the Inquiry, submissions, public hearings and visits of inspection. It also details the Committee's work with the NewDemocracy Foundation and the methodology used in the Citizens' Policy Jury process.

Chapter Two details the history of the electricity network in New South Wales, and current trends in supply and demand in the market. The purpose of this chapter is to provide an overview of the electricity industry in NSW, addressing items (i) and (ii) in the Terms of Reference. It includes discussion of the mix of energy sources currently used, in terms of the amount of energy supplied and different fuel types (i.e. coal, gas, hydroelectricity, wind and solar energy), an overview of the transmission, distribution and retail sectors, and an overview of demand for electricity, and trends in demand. The Committee found that there is no shortage of supply in NSW, and that the state has ample supplies of black coal available to meet current and future demand.

Chapter Three provides an overview of the National Electricity Market, including its structure and rules, the government agencies that operate and regulate the market, and movement of electricity between different states. The National Electricity Market, of which New South Wales is part, is central to meeting the State's energy needs, both now and in the future. As a national structure comprised of interconnected networks, the National Electricity Market (NEM) is the primary mechanism for sourcing energy interstate. The Committee found that the

National Electricity Market is an effective mechanism for allocating resources, and supports New South Wales' continued participation in the market.

Though the Terms of Reference did not explicitly address electricity pricing, the Committee took the view that any examination of the economics of energy generation must include reference to pricing. Rising retail prices directly affect consumers and the Committee received considerable evidence about the causes of recent price rises. Chapter Four therefore discusses prices, at both the wholesale and retail level. It considers various factors influencing prices, including rising network costs and green schemes initiated by government, as well as competition in the retail market.

Chapter Five addresses energy security, which refers both to the availability and cost of energy. This chapter directly addresses item (iii) in the Terms of Reference, examining issues relating to long term energy security in New South Wales. It considers energy security in the context of the National Electricity Market (NEM) and NSW's commitment to the NEM, the likely impact of carbon pricing on future energy investment, and the possible impact of rising fuel prices – particularly gas prices, which is expected to play a bigger part in electricity generation in the coming decade. This chapter also canvasses the views of various stakeholders in relation to the role of government in ensuring energy security, and summarises the findings of the Citizens' policy juries convened by the NewDemocracy Foundation.

Chapter Six examines carbon capture and storage (CCS), a technology to reduce the carbon emissions associated with burning coal. This technology has particular significance for New South Wales, which is dependent on black coal both for electricity generation and export. The chapter details how carbon capture and storage works, the potential of the technology, current and proposed projects, and the economics of carbon capture and storage. The location of potential storage sites is critical to the viability and economics of carbon capture and storage, and the Committee considered that there is a role for government to be involved with this research.

Similarly, Chapter Seven discusses coal seam gas, which has particular significance for New South Wales. While New South Wales does not have significant resources of conventional gas, it does have large reserves of coal seam gas which are yet to be developed. Coal seam gas therefore has significant potential to improve New South Wales' energy security. However, coal seam gas development has been the subject of considerable public concern.

Chapter Eight discusses the major renewable forms of energy – hydro, wind and solar – already in use in New South Wales. It focuses on those forms of renewable energy which are currently part of the energy mix in NSW, including hydroelectricity, which is concentrated in the Snowy Hydro scheme, and the rapidly growing wind and solar industries. The chapter considers the advantages and disadvantages of these forms of energy, as well as the potential for, and barriers to, further development of these industries. Best practice in other jurisdictions is also briefly canvassed, as are energy storage technologies, which are of particular importance to the expansion of the wind and solar industries.

Chapter Nine also addresses alternative forms of energy generation, focusing on those which are yet to be implemented in New South Wales. There are a number of alternative forms of energy generation which have the potential to provide significant amounts of energy, including nuclear power and various renewable sources such as bio-mass, geothermal, tidal and wave. The Committee considered that no form of energy generation should be ruled out arbitrarily.

However, there are significant barriers to the development of the alternative forms of energy generation discussed in this chapter.

Finally, Chapter Ten examines measures to better manage demand for electricity. Although not explicit in the Terms of Reference, these measures are relevant to the Inquiry because improved use of energy can reduce the need for costly additions to electricity generation capacity and network infrastructure. This chapter considers a number of measures that are designed to manage or reduce energy consumption, including smart meters and time of use pricing, as well as improved information and education for consumers. Distributed generation, which de-centralises electricity generation across the grid and energy efficiency measures, which are designed to reduce the amount of electricity used in buildings, are also considered.

In total, the Committee has made 24 recommendations. These recommendations go to a range of areas, including support for the NSW Government's policy of selling generation assets and avoiding duplication in the implementation of sustainable energy schemes. The Committee urges the NSW Government to continue its support for the National Electricity Market and to allow the market to operate freely wherever possible. To this end, the Committee recommends that the NSW avoid further investment in electricity generation and avoid subsidising alternative energy generation at commercial scale. However, the Committee did consider that there is a role for government to invest in and encourage research and development of new industries. The Committee also recommends the Minister for Resources and Energy continues his active participation in the Standing Council on Energy and Resources, and promotes some issues through his role on the Council. A full list of recommendations is included at page xiii.

The Committee made ten recommendations relating to demand management, distributed generation and energy efficiency. The Committee considered that these areas offer consumers an opportunity to participate more actively in the energy market, and warrant increased attention from government.

List of Findings and Recommendations

List of Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ALCALET	Australian Coal Association Low Emissions Technology Ltd
ANA	Australian Nuclear Association
ANSTO	Australian Nuclear Science and Technology Organisation
AWEFS	Australian Wind Energy Forecasting System
BCSE	Australian Business Council for Sustainable Energy
BREE	Bureau of Resources and Energy Economics
CCGT	Closed cycle gas turbine
CCS	Carbon capture and storage
c/KWh	Cents per kilowatt hour
CO_2	Carbon dioxide
CO2CRC	Cooperative Research Centre for Greenhouse Gas Technologies
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSG	Coal seam gas
DNSP	Distribution Network Service Provider
DR	Demand Response
EGS	Enhanced Geothermal Systems
ESS	Energy Savings Scheme
GGAS	Greenhouse Gas Reduction Scheme
GWh	Gigawatt hour
IPART	Independent Pricing and Regulatory Tribunal
IES	Intelligent Energy Systems
LCOE	Levelised cost of energy
LNG	Liquid natural gas
LRC	Low Reserve Condition
LRET	Large-Scale Renewable Energy Target
MW	Megawatt
MWh	Megawatt hour

NEM	National Electricity Market
NESA	National Energy Security Assessment
OCGT	Open cycle gas turbine
PCC	Post combustion capture
PIAC	Public Interest Advocacy Centre
PJ	Petajoule
PV	Photovoltaic
REC	Renewable Energy Certificate
RET	Renewable Energy Target
RIT-T	Regulatory Investment Test for Transmission
SCER	Standing Council on the Energy and Resources
SMR	Small Modular Reactor
SRES	Small-scale Renewable Energy Scheme
TOU	Time of use

Chapter One – Conduct of the Inquiry

1.1 On 9 November 2011 the Hon Chris Hartcher MP, Minister for Resources and Energy, wrote to the Chair of the Public Accounts Committee, requesting that the Committee conduct a review of the comparable economics of energy generation in New South Wales. Mr Hartcher suggested that the Committee could consider the current energy mix in NSW in comparison to other jurisdictions, energy security issues, and the potential for alternative forms of energy generation.

1.2 At its meeting on 23 November 2011, the Committee resolved to adopt terms of reference for an inquiry into the economics of energy generation, and call for submissions by 10 February 2012. The Terms of Reference for the Inquiry are listed in full on page vi.

Submissions

1.3 The Committee placed an advertisement in the *Sydney Morning Herald* on 7 December 2011, calling for submissions to the Inquiry by 10 February 2012. The closing date for submissions was subsequently extended until 30 March 2012.

1.4 The Committee received 34 formal submissions to the Inquiry, which were published on its website. Four organisations made supplementary submissions and three of these were not published by the Committee, at the request of the authors. A full list of submissions is included at Appendix Four.

Public hearings

1.5 The Committee held two public hearings, on 26 March and 11 May 2012, at Parliament House in Sydney. Representatives of the following organisations appeared to give evidence at these hearings:

- Department of Trade and Investment, Regional Infrastructure and Services
- Australian Energy Market Operator (AEMO)
- Australian Coal Association
- NSW Minerals Council
- TRUenergy
- Energy Supply Association of Australia (esaa)
- Clean Energy Council
- TransGrid
- Infigen Energy Limited
- CSIRO Energy Transformed Flagship
- Pacific Hydro
- National Generators Forum
- Public Interest Advocacy Centre

- Australian Nuclear Association
- Australian Energy Regulator
- Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC)
- Global Carbon Capture and Storage Institute
- AGL Energy Ltd.

1.6 A full list of witnesses in included at Appendix Five.

Briefings

1.7 The Committee also received a briefing from Mr Andrew Lewis, Executive Director, Energy, NSW Department of Trade, Investment, Regional Infrastructure and Services, on 23 February 2012.

Visits of inspection

1.8 The Committee visited the Vales Point and Colongra power stations on 17 February 2012. Vales Point is a coal-fired power station, while Colongra is a gas-fired power plant. Both are owned by Delta Electricity, and the Committee met with representatives of Delta Electricity before touring the power stations.

1.9 The Committee visited Capital Wind Farm on 17 August 2012. Capital Wind Farm is a 140 megawatt wind farm located near Bungendore in south east NSW. It is operated by Infigen Energy, and the Committee met with Mr Jonathan Upson, Senior Development and Government Affairs Manager and Mr Chris McGrath, Development Manager from Infigen Energy, during the visit.

Liaison with the NewDemocracy Foundation

1.10 At its meeting on 23 November 2011, the Committee resolved to invite Mr Iain Walker, Executive Director of the NewDemocracy Foundation, to address the Committee. The NewDemocracy Foundation is an independent, non-partisan research organisation which aims to identify improvements in the democratic process.

1.11 Mr Walker attended the Committee's following meeting on 1 December 2011 and provided a briefing about the work of the NewDemocracy Foundation. The Committee asked Mr Walker to provide a project proposal to include deliberative democracy processes as part of the Committee's consultations with stakeholders for the Inquiry. This proposal was subsequently received and endorsed by the Committee at its meeting on 16 February 2012. A copy of the proposal is included at Appendix One.

1.12 The proposal asked the Citizens' Policy Jury to reach agreement on 'the order of preference, level of interest and the preferred funding model for alternative forms of energy generation (e.g. tidal, geothermal) in NSW.'[1] The Committee

[1] NewDemocracy Foundation, 'Process design overview: identifying the view of an informed public; energy economics and security in NSW', p. 3. See Appendix One.

agreed that the Jury's recommendations would be provided to the NSW Government as part of the Committee's final report.[2]

1.13 The proposal provided for two Citizens' Policy Juries to be convened for a ten-week deliberative process. The first group was based in Sydney. In order to gain the views of people living in non-metropolitan areas, a second group was convened in Tamworth.

Methodology

1.14 The NewDemocracy Foundation distributed 8,000 invitations to people living in Sydney and in the Tamworth region. Names were selected at random from a database provided by Telstra. From replies received, the Foundation selected approximately 45 participants for each group. The final number of participants was 54 across both groups. Composition of the groups was intended to represent as much as possible the demographic composition of the general population, though the Foundation advised that it was unable to recruit participants aged 18 to 25 for its Sydney group.[3]

1.15 Each group met four times over a period of ten weeks, with the Sydney group voting to meet a fifth time.[4] The deliberations of the groups were conducted by independent facilitators. Participants were provided with copies of submissions made to the Inquiry, and the groups also invited relevant experts to appear and provide further information. A number of experts did so, with most appearing via Skype.

1.16 Participants also had access to an online forum hosted by the NewDemocracy Foundation, to provide information and documents to them. Mr Walker observed that 54 participants accessed a total of 2,089 documents via the online forum.[5]

1.17 Mr Jonathan O'Dea MP, Chair, and Dr Geoff Lee MP, Deputy Chair, met with participants from the Citizens' Policy Jury in Sydney on 16 June 2012, and Mr O'Dea and other members of the Committee met with participants from the Citizens' Policy Jury in Tamworth on 21 July.

1.18 Mr Walker advised that both groups reached a unanimous consensus to support the reports that they had each produced. Consensus decision-making is one of the aims of deliberative democracy processes.

1.19 The NewDemocracy Foundation forwarded the reports produced by the two groups on 3 September 2012. These were tabled at the Committee's meeting on 6 September 2012.

1.20 Both reports provided clear recommendations to the Committee. These recommendations and other comments made by the Citizens' Policy Juries are

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2 NewDemocracy Foundation, 'Process design overview: identifying the view of an informed public; energy economics and security in NSW', p. 3. See Appendix One.

3 Mr Iain Walker, Executive Director, NewDemocracy Foundation, Correspondence to Chair, 3 September 2012, p. 1.

4 As above.

5 Mr Iain Walker, Executive Director, NewDemocracy Foundation, Correspondence to Chair, 3 September 2012, p. 2.

included in this report where appropriate. The two reports are included in full at Appendix Two and Appendix Three.

Focus and structure of this report

1.21 The Committee decided to focus on electricity generation, rather than 'energy generation' in the broader sense. This decision reflected the content of submissions received. Further, though the Committee recognised the importance of reliable and affordable electricity supplies to industry, this report focuses on the effects of the electricity market on residential and small business consumers, rather than on industry and other major users.

1.22 The Commonwealth Government's carbon pricing scheme was introduced during the Inquiry, and the Committee was cognisant that the Liberal/National Party has undertaken to abolish the scheme in the event that it comes into government. It is possible that the carbon pricing scheme may be affected by lower international carbon pricing levels or replaced by a different scheme to recognise environmental costs. However, this report cannot properly address hypothetical future situations.

1.23 Chapter Two details the history of the electricity network in New South Wales, and current trends in supply and demand in the market. By examining the mix of energy sources used in New South Wales and making comparisons with other jurisdictions, this Chapter addresses items **(i)** and **(ii)** in the Terms of Reference.

1.24 Chapter Three details the structure and operations of the National Electricity Market, of which New South Wales is part. The National Electricity Market is central to meeting the State's energy needs, both now and in the future. As such, this Chapter addresses items **(iii)** and **(iv)** in the Terms of Reference.

1.25 Chapter Four discusses prices, both at the wholesale and retail level. It considers various factors influencing prices, including rising network costs and green schemes initiated by government, as well as competition in the retail market.

1.26 Chapter Five addresses energy security, which refers both to the availability and cost of energy. While New South Wales has large reserves of coal available to meet its energy needs, the cost of coal and other forms of energy generation are likely to increase in the future. This Chapter is primarily designed to address item **(iii)** in the Terms of Reference.

1.27 Chapter Six examines carbon capture and storage, a technology to reduce the carbon emissions associated with burning coal. This technology has particular significance for New South Wales, which is dependent on black coal both for electricity generation and export. Chapter Seven discusses coal seam gas, which has been the subject of considerable public concern. New South Wales has significant reserves of coal seam gas. Both carbon capture and storage and coal seam gas have important implications for energy security in New South Wales.

1.28 Chapter Eight discusses the major renewable forms of energy – hydro, wind and solar – currently in use in New South Wales, while Chapter Nine canvasses possible alternatives, including nuclear energy and various other forms of renewable energy yet to be deployed on a commercial scale, such as geo-thermal

and tidal energy. Chapters Eight and Nine address item **(v)** of the Terms of Reference, examining the potential for, and barriers to, development of alternative forms of energy generation. Chapter Eight also addresses item **(vi),** canvassing best practice in alternative energy generation in other jurisdictions, though the Committee received comparatively little evidence in relation to practice in other jurisdictions.

1.29 Chapter Ten examines measures to better manage demand for electricity. Demand is the relatively neglected side of the energy equation, and the Committee heard evidence that improved management of demand has the potential to both reduce costs for consumers and delay the need for new electricity generation.

Committee comment

1.30 While recognising the importance of energy supply in the broader sense, the Committee determined to focus on electricity and, in particular, the implications of the electricity market and future energy security for residential and small business customers.

Chapter Two – Electricity supply in NSW

Introduction

2.1 The purpose of this chapter is to provide an overview of the electricity industry in NSW, addressing items (i) and (ii) in the Terms of Reference. The chapter includes discussion of:

- the history of the electricity network in NSW,
- the mix of energy sources currently used, in terms of the amount of energy supplied and different fuel types (i.e. coal, gas, hydroelectricity, wind and solar energy),
- an overview of the transmission, distribution and retail sectors, and
- an overview of demand for electricity, and trends in demand.

2.2 The Committee found that there is no shortage of supply in NSW, and that the state has adequate, affordable supplies of black coal available to meet future demand.

HISTORY OF THE ELECTRICITY NETWORK IN NSW

2.3 The electricity supply industry in NSW was shaped by the Electricity Commission of NSW, a statutory authority established by the *Electricity Commission Act 1950*. Following an international trend toward centralisation of electricity generation and transmission, the Electricity Commission acquired local transmission networks (most of which were operated by local councils) and power stations to form a monopoly.

2.4 The Electricity Commission operated until the early 1990s, adopting the trading name of Pacific Power in 1992. During that period both generating capacity and transmission networks expanded rapidly. For example, between 1955 and 1982 the Electricity Commission added 8,000 megawatts of generating capacity and transmission and distribution lines increased from 3,901 to 16,919 kilometres.[6]

2.5 Generating capacity was, and remains, concentrated in several large coal-fired power stations located close to NSW coalfields in the Hunter Valley, on the Central Coast, and west of the Blue Mountains near Lithgow. Most of the coal-fired power stations now operating were built in the 1970s and 1980s, with the last completed in 1993.

2.6 The Snowy River Hydro scheme, built between 1949 and 1974, also contributes a proportion of NSW's total generating capacity – 16 per cent in 2010. However, while this capacity is located in NSW, almost half of it is classified as being in the

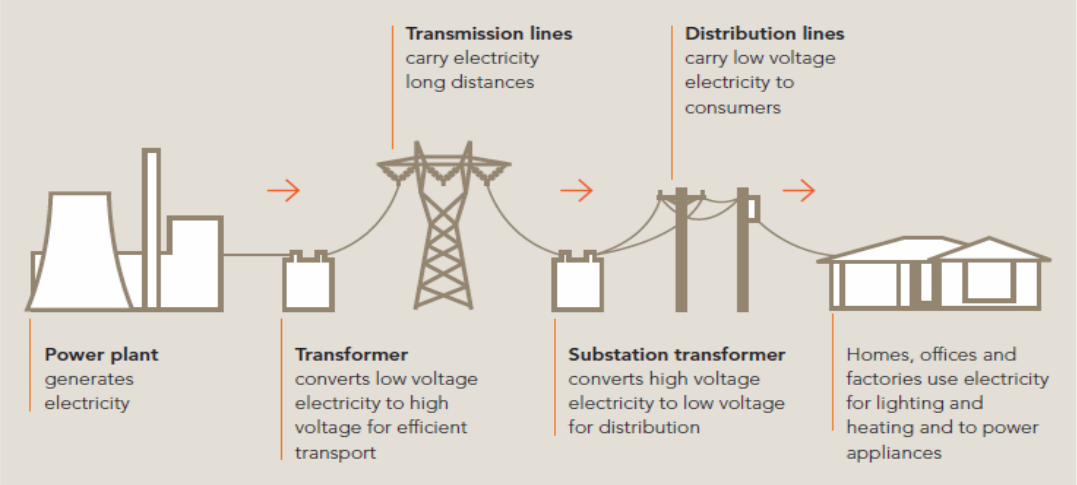
[6] Smith, S. 'Electricity and Privatisation', NSW Parliamentary Library Research Service, Briefing Paper 17/97, p. 10.

Victorian region of the National Electricity Market. Hydroelectricity accounted for just five per cent of electricity generated in NSW in 2010.[7]

2.7 During the 1990s, the NSW government began re-structuring the electricity supply industry. This was intended to improve the efficiency of the industry and introduce competition. Changes in NSW coincided with the beginning of co-operation between the states to develop a National Electricity Market. NSW passed the *National Electricity (New South Wales) Act 1997*, and the National Electricity Market (NEM) commenced operation in 1998. Chapter Two details the structure and operations of the NEM.

2.8 The Electricity Commission of NSW was first corporatised and then disaggregated into a number of smaller corporations, separating the functions of generation, transmission, distribution and retailing. Figure 1 explains the different parts of the electricity network.

Figure 1: Electricity supply



Source: AEMO, 'An introduction to Australia's National Electricity Market', July 2010, p. 3.

2.9 Control of transmission assets was transferred to a new state-owned corporation, TransGrid. The TransGrid network now comprises over 12,600 kms of high voltage overhead transmission lines, 45 kilometres of underground cables, 91 substations. TransGrid also controls interconnectors between networks in New South Wales, Victoria and Queensland.

2.10 Between 1996 and 2003, Pacific Power's generation assets were divided between three new state-owned corporations: Delta Electricity, Macquarie Generation and Eraring Energy. Together these three companies controlled most of the electricity generation capacity in NSW. Pacific Power was formally dissolved in 2003.

2.11 Electricity distribution in NSW was controlled by another three state-owned corporations: Energy Australia, Integral Energy and Country Energy. These distributors were also retailers, with Energy Australia providing electricity to

[7] New South Wales Auditor-General's Report, 'Financial Audit Volume Four 2012: focusing on electricity', p. 15.

customers in the greater Sydney region, Integral in western Sydney and southern NSW, and Country Energy serving most of rural and regional NSW.

The Gentrader transactions

2.12 In 2010, the then NSW Government decided to sell trading rights to the wholesale electricity produced by state-owned generators. This was the 'gentrader option', which retained generation assets in State ownership while privatising trading rights to the electricity produced by generators. Gentrader companies purchased exclusive rights to trade wholesale electricity, paying capacity charges to generators.

2.13 Two gentrader 'bundles' were sold, with Eraring being purchased by Origin Energy and Delta West by TRUenergy. TRUenergy also purchased two development sites owned by Delta Electricity and one owned by EnergyAustralia. However, a second tranche of gentrader sales did not proceed, and rights to the state's largest generator, Macquarie Generation, and to Delta Central Coast were not sold. Generation produced in the SnowyHydro scheme was not part of the gentrader transactions and also remains in State ownership.

2.14 The retail arms of government-owned distribution companies were also sold, with Country Energy and Integral Energy being purchased by Origin Energy, and EnergyAustralia by TRUenergy. The remaining distribution arm of EnergyAustralia subsequently changed its name to Ausgrid, while Country Energy became Essential Energy and Integral Energy became Endeavour Energy. Ausgrid, Essential Energy and Endeavour Energy now operate solely as distributors.

2.15 In 2011 the O'Farrell Government announced its intention to sell generation assets but retain TransGrid in public ownership. The *Electricity Generator Assets (Authorised Transactions) Bill* was passed in the Legislative Council in May 2012. In its submission to the Commonwealth Government Draft Energy White Paper, the NSW Government expressed its aims in the following terms:

> The NSW Government is seeking parliamentary approval to sell the State's electricity generator assets because it wants to free up funds for infrastructure spending, see more competition in energy markets, encourage private sector investment in generation and help put downward pressure on power prices for consumers and businesses.[8]

2.16 The sale of generation assets is not expected to impact on the security of electricity supply in NSW. For instance, the National Generators Forum, which represents electricity generators around Australia, expressed the view that:

> the planned sale of the NSW Government's generation assets will have no impact on supply reliability in New South Wales. Private participants have invested significantly in new generation projects over recent years in response to spot and contract prices.[9]

2.17 The New England Citizens' Policy Jury recommended that the NSW Government should conduct a review of public/private ownership of generation, network and

[8] NSW Government, 'Draft Energy White Paper: NSW Government Submission', April 2012, p. 9.

[9] Submission 30, National Generators Forum, p. 2.

retail functions to 'ensure operators are accountable and consumer needs are met.'[10]

The NSW Government

2.18 Following the establishment of the National Electricity Market in 1998, the role of the NSW Government in the electricity supply market diminished. Although the NSW Government still owned generation assets, electricity supply was to be determined by the market. For example, in its Energy Directions Green Paper in 2004, the then NSW Government expressed the view that:

> It is not the New South Wales Government's intention to centrally determine the technology, location or timing of new investment. The National Electricity Market was established, in part, as a means of providing price signals to investors to develop new generation capacity at the appropriate time.[11]

2.19 The Gentrader transactions in 2010 followed a lengthy debate within the former Government about energy policy and privatisation. In its submission, Vestas made the following observation about NSW Government policy:

> It is not controversial to point out that the attempted exit of the NSW government from electricity has been messy and troubled. Initial attempts during the late 1990s were unsuccessful. A proposal to privatise Snowy Hydro Limited in 2004 also failed. In 2008-9, the previous NSW Government attempted to sell parts of the electricity industry to the private sector again, which was also unsuccessful and culminated in the resignation of the Premier at the time…
>
> How does government ownership of energy businesses make a difference to investment attraction? It does so due to an inherent conflict, namely that the NSW Government not only expects to derive a return on its assets but it also has the power to set policy and take regulatory decisions that will not only have an impact on its own investments but will also affect the fortunes of those private sector investors who compete with government owned businesses or rely upon them for a service.[12]

2.20 The Gentrader transactions and subsequent decisions to privatise generation assets have reduced the role of the NSW Government in the electricity market. In evidence, Mr Mark Duffy, Deputy Director General, Resources and Energy, Department of Trade, Investment, Regional Infrastructure and Services, explained that this provides a clear signal to private investors about government policy in regard to the energy market:

> The Government has now determined it will look at the ownership of the remaining generation, so combined with that and the retail you have the competitive sides of the business in the private sector and the Government is not seeking to regulate the generation market in any way …
>
> ..we should be putting nothing in the way of sensible development. Obviously any environmental or planning policies should be consistent and applied even-handedly

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10 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 11.

11 New South Wales Government, 'Energy Directions Green Paper', December 2004, p. 12.

12 Submission 24, Vestas Australian Wind Technology, pp. 4-5.

> to the private sector. Secondly, the Government needs to signal very strongly to the private sector that it is out of the business and that the next spaces available for generation investment are solely to be filled by the private sector, not by the public sector.[13]

2.21 Mr Duffy also argued that privatisation would not affect the security of electricity supply and outlined the Department's role in the new policy environment:

> The State will always have an interest in following the security of the electricity sector and in developing new policies as the market develops. I do not think the ownership of the generators makes it any less secure because they are doing it within a very tightly oversighted and professionally operated electricity market. Our issues relate to the policy frameworks for the development of investment in transmission and distribution and also ensuring the correct investment signals are there for the private sector in the generation market to decide where it should be, what sort of fuel it should be and when it should happen. We should be concerned with creating the regulatory framework to provide the best signals to the private sector.[14]

2.22 In its report, the New England Citizens' Policy Jury observed that, 'The state of NSW no longer runs its power generation facilities. Consequently, it is no longer a state responsibility to dictate the technology to be used.'[15] The Jury felt that the role of government in this environment is to 'ensure that whichever technology is used does not create an unhealthy working environment for the employees or the citizens of the state; now or in the future.'

2.23 However, the NSW Government continues to play a role in regulation of the market, at both a state and national level. The National Electricity Market is regulated by a number of Commonwealth agencies (these are detailed in the Chapter that follows) and policy oversight is provided by the Standing Council on Energy and Resources, a Standing Committee of the Council of Australian Governments (COAG), of which the NSW Minister for Resources and Energy is a member.

2.24 The Resources and Energy Division of the NSW Department of Trade and Investment, Regional Infrastructure and Services supports the Minister in his role on the Standing Council on Energy and Resources. The Department also has responsibility for managing mineral resources and promoting secure, affordable, clean and competitive energy markets for NSW. It also administers NSW Government programs relating to energy, including:

- the Solar Bonus Scheme (which closed to new applicants in July 2011)
- the NSW Energy Savings Scheme
- the NSW Greenhouse Gas Reduction Scheme (closed on 1 July 2012)

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13 Mr Mark Duffy, Deputy Director General, Resources and Energy, Department of Trade, Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 7.

14 Mr Mark Duffy, Deputy Director General, Resources and Energy, Department of Trade, Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 10.

15 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 5.

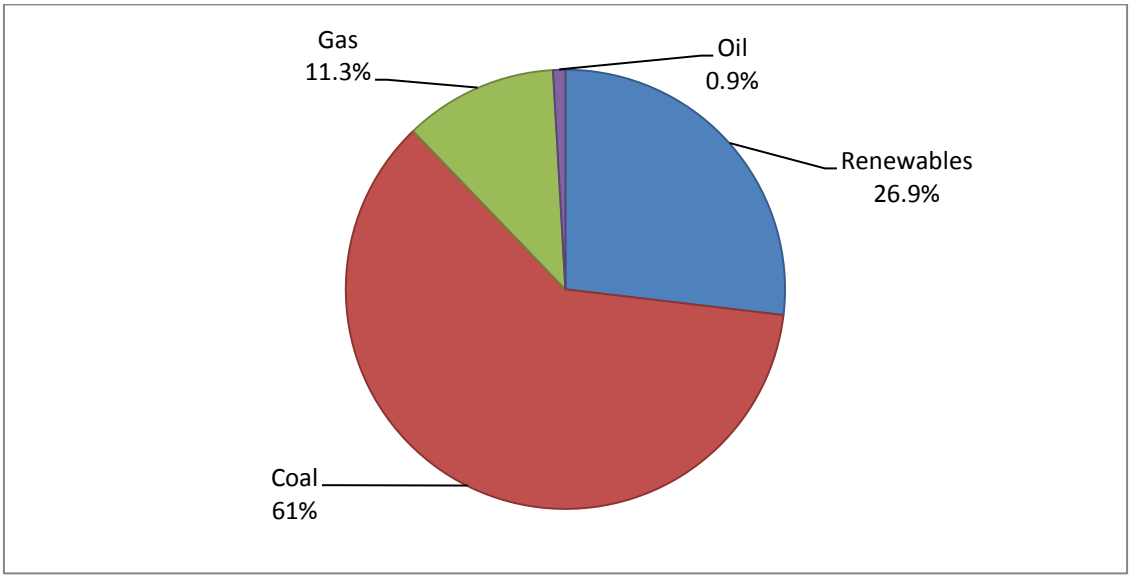
- GreenPower, and
- National Minimum Energy Performance Standards and labelling.

2.25 The Independent Pricing and Regulatory Tribunal (IPART) regulates gas and electricity prices for residential and small business customers in NSW. IPART's role is set out in the *Independent Pricing and Regulatory Tribunal Act 1992*, the *Gas Supply Act 1996*, the *Electricity Supply Act 1995* and the *National Electricity (NSW) Law 1997*. In addition to its regulatory and licensing functions, IPART also conducts reviews and investigations to advise the NSW government on a range of economic and policy issues such as pricing, efficiency, industry structure and competition.

GENERATION CAPACITY IN NSW

2.26 According to the Department of Trade and Investment, Regional Infrastructure and Services, NSW currently has about 18,000 megawatts (MW) of installed generation capacity.[16] This is the largest capacity of any state, accounting for about 30 per cent of Australia's capacity as a whole. The second largest is Queensland, followed by Victoria. The figure below shows the relative proportion of generation capacity supplied by different fuel sources.

Figure 2: NSW generation capacity by fuel



Source: NSW Trade and Investment, Regional Infrastructure and Services, Division of Resources and Energy

2.27 Generation capacity or 'plant' is divided is typically divided into baseload generation or plant, and peaking plant. Baseload plant operates continuously, or for sustained periods. In Australia, baseload plant has historically been provided by coal-fired power stations, and this remains the case. 'Peaking' plant or generation operates during periods of peak demand. Intermittent generation may operate at any time, according to the availability of energy.

16 http://www.trade.nsw.gov.au/energy/electricity/generation, accessed 3 September 2012.

2.28 Generation capacity is greater than output, as not all generators operate continuously. Demand for electricity fluctuates rapidly according to the time of day and weather conditions. Because electricity cannot be stored in large quantities, supply (and therefore capacity) must be available to meet demand at all times.

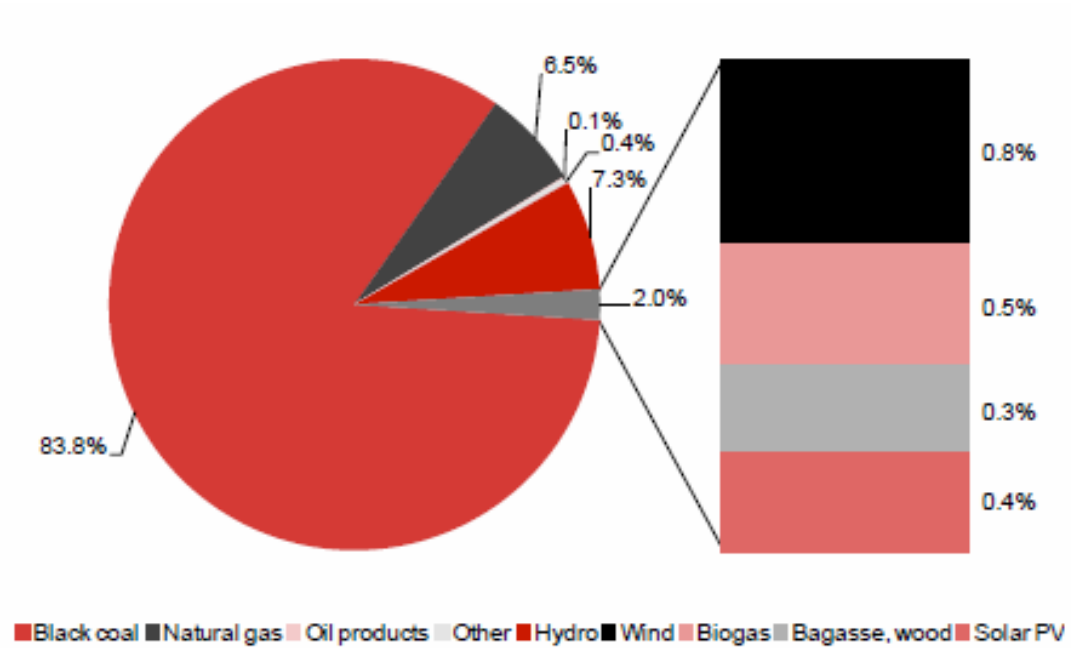
2.29 Mr Tim Nelson, Director, Economic Policy and Sustainability, AGL Energy, explained the difference between capacity and output in the following terms:

> The Australian generation plant mix is vastly different when considered on a capacity and output basis. In output terms, Australian power generation is dominated by coal with around 81 per cent of all output being produced by black and brown coal-fired generators. Renewables produce around 7 per cent of output but comprise 16 per cent of capacity. Similarly, gas produces 12% of output but has 26% of total NEM capacity … As electricity cannot be stored economically, production must match consumption on a real-time basis. Accordingly, as electricity demand increases, additional generation capacity must be brought online.[17]

2.30 Different fuel types are suited to different modes of generation. Large coal-fired power stations, for instance, take some time to commence operations and are unsuited to meeting sudden large increases in demand for electricity. However, gas-fired generators can commence operations more quickly. Open cycle gas and hydroelectric power plants are typically used to meet extra peak demand.

2.31 Large coal-fired baseload plants make up about two thirds of generation capacity installed in New South Wales, but 83.8 per cent of electricity generated in 2011. This is because the overwhelming proportion of baseload demand is met by electricity generated at coal-fired power stations.

Figure 3: Electricity generation in NSW from all sources 2010-11



Source: NSW Auditor-General's Report, 'Financial Audit Volume Four 2012; focusing on electricity'.

17 Submission 14, AGL Energy Ltd, p. 2.

Table 1: Major existing power stations in NSW[18]

Power station	Location	Owner	Technology	Capacity
Bayswater	Hunter	Macquarie Generation	Steam/Coal	2720 MW
Eraring	Lower Hunter	Eraring Energy	Steam/Coal	2720 MW
Tumut	Snowy	Snowy Hydro	Hydro	2116 MW
Liddell	Hunter	Macquarie Generation	Steam/Coal	2080 MW
Murray*	Snowy	Snowy Hydro	Hydro	1500 MW
Mount Piper	Central West	Delta Electricity	Steam/Coal	1400 MW
Vales Point	Central Coast	Delta Electricity	Steam/Coal	1320 MW
Wallerawang	Central West	Delta Electricity	Steam/Coal	1000 MW
Colongra	Central Coast	Delta Electricity	OCGT	668 MW
Uranquinty	Wagga Wagga	Origin Energy	OCGT***	648 MW
Tallawarra	Wollongong	TRUenergy	CCGT****	435 MW
Shoalhaven	Nowra	Eraring Energy	Hydro	240 MW
Smithfield	Smithfield	Marubeni	Gas Cogen	160 MW
Redbank	Hunter	Redbank Project	Coal Tailings	145 MW
Capital Wind Farm	Tarago	Renewable Power Ventures	Wind	141 MW
Blowering	Snowy	Snowy Hydro	Hydro	80 MW
Guthega	Snowy	Snowy Hydro	Hydro	60 MW
Appin Mine	Illawarra	EDL Group	CSM	56 MW
Warragamba	Sydney	Eraring Energy	Hydro	50 MW
Woodlawn Wind Farm	Tarago	Woodlawn Wind Pty Ltd	Wind	48 MW
Gunning Wind Farm	Walwa	Acciona Energy	Wind	47 MW
Tower Mine	Illawarra	EDL Group	CSM**	41 MW
Broadwater	North Coast	Delta Electricity	BaGasse	30 MW
Condong	North Coast	Delta Electricity	BaGasse	30 MW
Cullerin	Upper Lachlan	Origin Energy	Wind	30 MW

* In Victorian region of the National Electricity Market
** Coal seam methane
*** Open Cycle Gas Turbine
**** Closed Cycle Gas Turbine

2.32 NSW's reliance on coal-fired generation is a product of what one Inquiry participant called 'legacy fuel strengths' - that is, the resources that have historically been the most readily available and least expensive.[19] For example,

18 www.trade.nsw.gov.au/energy/electricity/generation#Major-existing-NSW-power-stations, accessed 20 August 2012.

19 Submission 26, TRUenergy, p. 1.

the Energy Supply Association of Australia observed that similar choices to use the most readily available energy source were made in other jurisdictions:

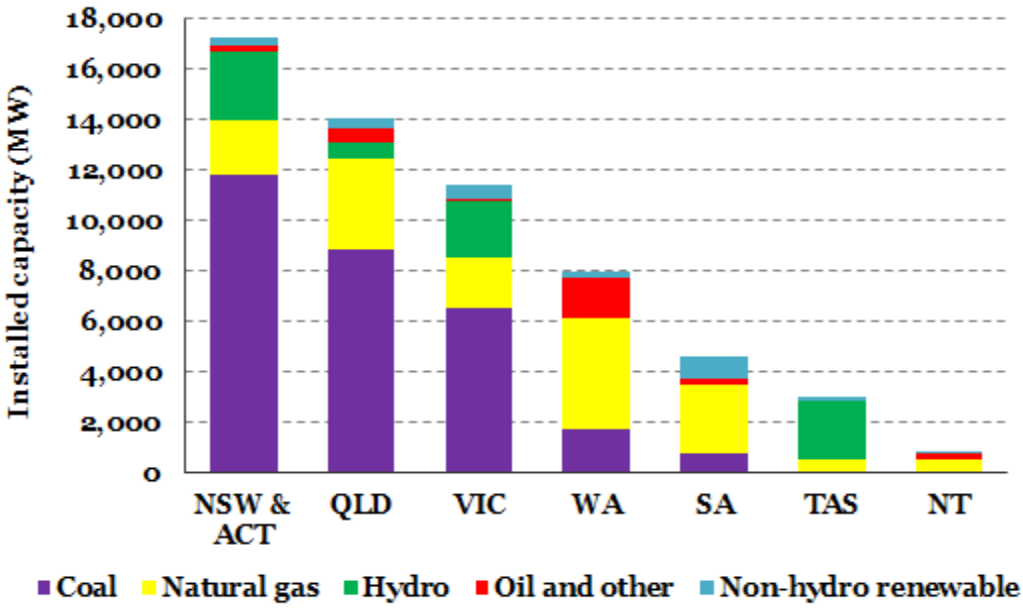
> Sourcing over 90% of energy from black coal implies a heavy reliance on one type of fuel. However, other states in Australia also tend to have one dominant fuel source which represents the most readily available and lowest cost form of electricity generation.[20]

2.33 Similarly, TRUenergy observed that the fuel mix used by different jurisdictions tends to reflect what is most available in that jurisdiction:

> Whether in Australia or overseas a country's fuel mix tends to be a function of locally available natural resources. Hence the dominant use of black coal is completely expected in NSW compared with brown coal in Victoria. Overseas countries that have a different fuel resource mix will have a generation mix that reflects to some extent that particular resource distribution. For example hydro is a significant generation source in New Zealand, Norway and Chile and natural gas is dominant in the Texas market. Countries that are not blessed with local energy resources are reliant on overseas imports and these countries tend to have fuel mixes dominated by transportable fuels such as coal, and LNG as well as nuclear power.[21]

2.34 The figure below provides a comparison of the energy mix in different states. NSW, Queensland and Victoria are heavily reliant on coal, but in NSW and Queensland this is black coal, whereas Victoria has large reserves of brown coal. By contrast, Tasmania is heavily reliant on local hydro-electric resources.

Figure 4: Installed capacity by fuel type (as at June 2010)



Source: Electricity Supply Association of Australia, Electricity and Gas Statistics 2011.

[20] Submission 15, Energy Supply Association of Australia, p. 1.

[21] Submission 26, TRUenergy, p. 2.

2.35 Some Inquiry participants pointed out that NSW's strong history of state investment in coal-fired generation provided an ongoing advantage to coal-fired generators. For example, Epuron Pty Ltd, a renewable energy development company, argued that with this same level of government investment, alternative forms of energy generation would be more competitive:

> When coal mining and power generation were state-owned monopolies it was logical to integrate these assets with rail infrastructure that was also state-owned. As a result in the present day, after the privatisation of many of these assets, coal fired power generation continues to enjoy the benefits of low cost capital, subsidised supporting infrastructure, and the low coal prices established in contracts that were written in some cases many years ago. Wind farms could generate power at substantially lower costs today if this same cost of capital was available and if the same subsidies were provided for transmission connections, for example.[22]

2.36 Similarly, the New England Citizens' Policy Jury noted that the existing network had been built to satisfy the needs of a system based on centralised coal-fired power generation.[23] The group argued that the State's subsidisation of coal-fired electricity generation created a market distortion that needs to be corrected.[24]

The coal industry in New South Wales

2.37 NSW has abundant reserves of black coal, with 44 per cent of Australia's known reserves (equivalent to 16.64 gigatonnes) located in this state.[25] In its submission to the Inquiry, the Australian Coal Association observed that 'coal has played a fundamental role in the NSW economy for many decades'.[26]

2.38 In 2010 there were 63 coal mines operating in NSW. These mines produced over 145 million tonnes of black coal in 2009-2010, of which NSW electricity generators consumed 28.66 million tonnes. [27] The coal industry directly employs over 20,000 people in NSW, mostly in the Hunter and Gunnedah regions.[28]

2.39 Coal is NSW's largest export industry, with more than three quarters of coal produced exported.[29] Exports of NSW coal were valued at $14.1 billion in 2010-2011.[30]Newcastle is the largest coal exporting port in the world. Coal exports also provide an important source of revenue for the NSW Government, with $1.2 billion in mining royalties paid in 2010-2011. Mining royalties declined by over

22 Submission 18, Epuron Pty Ltd, p. 1.

23 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 6.

24 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 3.

25 Submission 28, Australian Coal Association and NSW Minerals Council Ltd, p. 4.

26 Submission 28, Australian Coal Association and NSW Minerals Council Ltd, p. 4.

27 Montoya, D., Wales, N., 'Key issues in energy', Background paper No. 4/2011, NSW Parliamentary Library Research Service, p. 17.

28 Submission 28, Australian Coal Association and NSW Minerals Council Ltd, p. 4.

29 Australian Government Department of Resources, Energy and Tourism, 'Energy in Australia 2011', p. 40.

30 As above.

$500 million from 2009-2010, due to the rising value of the Australian dollar and declining demand from Japan.[31]

2.40 Mr Greg Sullivan, Deputy Chief Executive Officer of the Australian Coal Association, emphasised the importance of coal to the NSW economy:

> Coal is not just an export industry. It also supplies almost 90 per cent of electricity in New South Wales. It provides industry and the New South Wales community with secure, reliable and relatively affordable energy. This underpins a traditional source of the State's comparative advantage in energy intensive manufacturing and the jobs that flow from that.[32]

Gas

2.41 The next largest source of electricity was from gas-fired generators, which provide 2,200 MW or 16 per cent of NSW generation capacity. However, gas-fired generation provides only 6.5 per cent of electricity actually generated.[33] This is because gas-fired generation is not currently used for baseload electricity generation.

2.42 NSW does not have large reserves of natural gas. The Department of Trade and Investment, Regional Infrastructure and Services notes that 'NSW is unique among the mainland states of Australia with no commercially viable reserves of natural gas within its borders or in adjacent waters at this time'.[34] NSW does have significant reserves of coal seam gas, but this is not used in electricity generation at present.

2.43 There has been significant investment in gas-fired generation capacity in the last ten years in NSW.[35] This investment has focused on producing electricity to meet rising peak demand. For example, the Committee visited the Delta Electricity facilities on the Central Coast and inspected the Vales Point power station, a coal-fired power station. The Committee also visited the nearby Colongra Power Station, an open cycle gas generation plant which was built by Delta Electricity for the purpose of meeting peak demand and opened in 2009.

2.44 In answers to questions on notice, the Department of Trade and Investment, Regional Infrastructure and Services, suggested that the growth in gas-fired generation in NSW is a successful example of market-driven investment:

> If success is defined as delivered by the market without Government subsidy or direction, then in NSW gas fired generation is the most successful with three new

31 Montoya, D., Wales, N., 'Key issues in energy', Background paper No. 4/2011, NSW Parliamentary Library Research Service, p. 17.

32 Mr Greg Sullivan, Deputy Chief Executive Officer, Australian Coal Association, Evidence, 26 March 2012, p. 19.

33 NSW Auditor-General's Report, 'Financial Audit Volume Four 2012; focusing on electricity', p. 15.

34 http://www.trade.nsw.gov.au/energy/gas, accessed 6 August 2012.

35 Australian Energy Regulator, 'State of the Energy Market 2011', p. 43.

power stations being built in recent years namely Tallawarra, Uranquinty and Colongra.[36]

2.45 The growth in gas-fired generation is expected to continue. For example, the Commonwealth Draft Energy White paper predicts that gas production in Australia will treble by 2020.[37] In its submission to the Commonwealth Government Draft Energy White Paper, the NSW Government noted that domestic demand for gas in NSW is expected to treble in the next twenty years.[38]

2.46 The table below shows generation projects that have received development approval in NSW. Several of the largest projects involve gas-fired generation.

Table 2: Projects with development approval in NSW

Power Station	Location	Owner	Technology	Capacity
Bayswater B	Bayswater Power Station	Macquarie Generation	CCGT or Ultra-supercritical Coal	2000 MW
Mount Piper Power Station Extension	Mount Piper Power Station	TRUenergy	CCGT or Ultra-supercritical Coal	2000 MW
Dalton Power Project	Dalton	AGL Energy	Gas	1000 MW
Silverton Wind Farm	Broken Hill	Epuron	Wind	1000 MW
Tomago	Newcastle	Macquarie Generation	OCGT/CCGT	790 MW
Munmorah Power Station Rehabilitation	Munmorah Power Station	Delta Electricity	Coal and/or Gas	700 MW
Wellington	Wellington	NewGen Power	OCGT	660 MW
Marulan	Marulan	TRUenergy	OCGT/CCGT	450 MW
Bamarang Stage 1	Nowra	Infratil	OCGT	400 MW
Bamarang Stage 2	Nowra	Infratil	conversion to CCGT	Base load
Eraring Upgrade	Lower Hunter	Eraring Energy	Coal	360 MW
Leafs Gully	Appin	AGL	Gas	360 MW
Marulan	Marulan	TRUenergy	OCGT	350 MW
Tallawarra Stage B	Wollongong	TRUenergy	Gas	300-450 MW
Boco Rock	Monaro	Wind Prospect	Wind	270 MW

36 Department of Trade and Investment, Regional Infrastructure and Services, Answers to questions on notice taken in evidence, 26 March 2012, p. 6.

37 Commonwealth of Australia, 'Draft energy white paper: strengthening the foundations for Australia's energy future', December 2011, p. 86.

38 NSW Government, 'Draft Energy White Paper: NSW Government Submission', April 2012, p. 4.

Power Station	Location	Owner	Technology	Capacity
		CWP		
Gullen Range	Goulburn	Epuron subsidiary	Wind	241 MW
BlueScope Cogeneration Plant	Port Kembla Steelworks	BlueScope	Cogeneration	225 MW
Taralga Wind Farm	Taralga	RES Southern Cross	Wind	183 MW
Buronga	Mildura	International Power Australia	Distillate/ OCGT	150 MW
Moree BP Solar Farm	Moree	BP Solar	Solar	150 MW
Kyoto Energy Park	Upper Hunter	Pamada	Wind Solar Hydro	102 MW 10 MW 1 MW
Nyngan Solar Farm	Nyngan	Infigen Suntech	Solar	100 MW
Crookwell II	Southern Highlands	Union Fenosa	Wind	92 MW
Glen Innes	Glen Innes	Babcock & Brown / National Power	Wind	81 MW
Capital II Wind Farm	Tarago	Capital II Wind	Wind	60-80 MW
Capital Solar Farm	Tarago	Infigen Suntech	Solar	50 MW
Manildra Solar Farm	Manildra	Infigen Suntech	Solar	50 MW
Conroy's Gap Wind Farm	Yass	Epuron	Wind	30 MW
Richmond Valley	Richmond Valley	MetGasco	CSM	30 MW
Wilga Park	Narrabri	Eastern Star	CSM	29-40 MW
Gloucester Gas Project	Gloucester	AGL Energy	CSM	15 MW

Source: Department of Trade, Investment, Regional Infrastructure and Services, see: www.trade.nsw.gov.au/energy/electricity/generation

2.47 In the future, gas is expected to play an increasingly important role in meeting demand for baseload electricity, as well as peak demand. The NSW Government observed that gas-fired generation is expected to play a key role in the future:

> Increasing levels of gas fired generation will be needed to support the transition to a low carbon economy. This is occurring in two ways. Firstly, base load (combined cycle) gas fired generation as a standalone form of electricity is less emissions intensive than coal whilst still being a reliable form of electricity generation.

> Secondly, peaking (open cycle) gas fired generation is required to back up intermittent renewable energy generation.[39]

2.48 Gas is considered an important 'transitional' fuel source in moving toward a low-carbon economy.[40] Gas is less carbon-intensive than coal but is nonetheless a mature technology which can be deployed before renewable energy technologies become cost-competitive. Gas generation can also provide 'back-up' to intermittent renewable forms of energy generation. In its submission to the Inquiry, TRUenergy explained the advantages of gas-fired generation:

> The main reason to support this increase in gas fired generation is that the technology is mature, can be deployed in short time frame (relative to other technologies) and can be located relatively close to major demand centres (thus reducing losses via the transmission system). Gas fired generation also seeks to mitigate against the increasing levels of intermittent renewable generation.[41]

2.49 However, the gas consumed at power stations in NSW is imported from other states – in particular from the Cooper Basin in Queensland and Gippsland Basin off the coast of Victoria. The lack of domestic resources creates potential energy security issues for NSW in relation to gas. Energy security issues will be discussed in more detail in Chapter Five.

Hydroelectricity

2.50 Various forms of renewable energy provided 9.3 per cent of electricity generation in NSW in 2011.[42] Most of this came from hydro-electric power, which represents the bulk of renewable energy generation in NSW and around Australia.[43]

2.51 The overwhelming proportion of hydroelectric power in NSW is sourced from generators in the Snowy Hydro scheme. The scheme is operated by Snowy Hydro Ltd, a company jointly owned by the Commonwealth (13 per cent), New South Wales (58 per cent) and Victorian (29 per cent) governments. Snowy Hydro Ltd is both a generator and retailer of electricity.

2.52 The scheme comprises seven power stations, mostly in the Kosciuszko National Park. As a whole, it has a generation capacity of 3,800 MW, although almost half of this capacity is classified as being in the Victorian region of the National Electricity Market. In 2010 power from Snowy Hydro represented 15% of installed generation capacity in NSW[44], and 4.6 per cent of electricity used.[45] Other hydro stations – primarily operated by Sydney Water – represent a smaller proportion of generating capacity.

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39 NSW Government, 'Draft Energy White Paper: NSW Government Submission', April 2012, p. 4.

40 Commonwealth of Australia, 'Draft energy white paper: strengthening the foundations for Australia's energy future', December 2011, p. 85.

41 Submission 26, TRUenergy, p. 1.

42 NSW Auditor-General's Report, 'Financial Audit Volume Four 2012; focusing on electricity', p. 15.

43 As above.

44 Australian Energy Regulator, 'State of the energy market 2011', Melbourne, p. 32.

45 Department of Trade and Industry, Regional Infrastructure and Services, (2011) 'NSW solar & renewable energy summit fact sheet', p. 5.

2.53 Hydroelectricity has the advantage of being a mature technology which produces clean, renewable energy. It is widely used in many countries and accounted for 16 per cent of the world's electricity generation in 2007.[46] However, capacity for further development of hydroelectric resources in Australia is limited due to the scarcity of water.[47] Potential for expansion of hydro power is focused on upgrading existing facilities or development of small-scale hydroelectric projects. With limited opportunities for growth in the hydroelectric industry, the proportion of hydro-electricity as a total of electricity generated in NSW is declining.

Wind energy

2.54 NSW has 370 MW of wind power generating capacity, which provided just 0.8 per cent of electricity generated in NSW in 2011.[48]

2.55 The wind industry has grown rapidly in recent years. According to the Clean Energy Council, the industry has grown by approximately 30 per cent each year since 2005.[49] This growth has been most marked in South Australia, where wind energy now represents almost a quarter of the state's energy production,[50] but to a lesser extent in NSW as well. At present there are four commercial-scale wind farms in NSW: Capital and Woodlawn near Bungendore, Cullerin Range near Gunning, Blayney near Bathurst, and Crookwell. As can be seen in Table 2, several other wind farm projects in NSW have received development approval.

Solar energy

2.56 Solar electricity is generated by two main technologies: solar photovoltaic (PV) cells and solar thermal power systems. The bulk of installed solar electricity capacity in NSW is generated from rooftop PV cells, which produced 0.4 per cent of electricity generated in NSW in 2011.[51] The solar PV industry grew rapidly as a result of the NSW Government's Solar Bonus Scheme, which operated between 2010 and 2011. The scheme provided a feed-in tariff to householders who installed solar PV cells and fed electricity back into the grid.

2.57 The 60 cent per kilowatt feed-in tariff was abolished in 2011, after higher than expected uptake of the scheme led to a blow-out in costs. In late 2008 there were approximately 3,000 solar PV systems installed in NSW, but by 2010 there were 50,000. In evidence, Mr Russell Marsh, Policy Director, Clean Energy Council, commented on the effects of the solar bonus scheme:

> Putting aside whether you think that was a good idea or not, it certainly ensured that a lot of solar PV was deployed across New South Wales. In terms of it setting out to

46 Geoscience Australia and ABARE (2010) 'Australian Energy Resource Assessment', Canberra, p. 225.

47 As above.

48 New South Wales Auditor-General's Report, 'Financial Audit Volume Four 2012: focusing on electricity', p. 15.

49 Clean Energy Council, 'Review of the Australian Wind Industry 2011', p. 3.

50 http://www.sa.gov.au/subject/Water,+energy+and+environment/Energy/Renewable+energy/Wind+energy/Wind+energy+in+South+Australia, accessed 28 August 2012.

51 New South Wales Auditor-General's Report, 'Financial Audit Volume Four 2012: focusing on electricity', p. 15.

> achieve its objective, I think you can certainly say there was a lot of solar PV deployed in New South Wales as a result of that policy.[52]

2.58 No large commercial-scale solar generation projects have yet been built in NSW, though several projects have received development approval. In March 2012 the federal Minister for Energy and Resources, Mr Martin Ferguson, announced approval of a 150 MW solar farm to be built near Broken Hill and Nyngan. The $450 million project is a joint venture between the Commonwealth and NSW Governments and two private companies, AGL Energy and First Solar. The NSW Government will provide a grant of $64.85 million. According to the Office of Environment and Heritage, it is expected that via the project 'around 485 regional jobs would be supported during construction, in addition to new permanent positions providing ongoing economic benefits to western NSW.'[53] Construction of the solar farm is expected to begin in 2014.[54]

TRANSMISSION AND DISTRIBUTION

2.59 The high voltage electricity transmission network in NSW and the ACT is owned and operated by TransGrid, a state owned corporation. Mr Peter McIntyre, Managing Director, TransGrid, described its role:

> TransGrid owns and operates the electricity grid in New South Wales. This network comprises some 12,600 kilometres of transmission lines and stretches across the State. It also connects with transmission networks in Queensland and Victoria. Our mission is to provide safe, reliable and efficient transmission services within New South Wales and the Australian Capital Territory and the National Electricity Market … I cannot emphasise enough that the reliability and security of New South Wales electricity supply, both now and in the future, depends upon New South Wales' transmission network.[55]

2.60 TransGrid has retained control of transmission assets while other aspects of the electricity supply industry have been privatised. Mr Mark Duffy, Deputy Director General, Resources and Energy, Department of Trade and Investment, expressed the view that operation of the transmission network is a 'natural monopoly' :

> the sale of the generators and obviously the sale of retail has created a situation now where the Government provides the transmission and distribution infrastructure—in a sense the natural monopoly aspects of the market are supplied by government-owned entities—and the competitive side of the market is going to be supplied by the private sector.[56]

2.61 However, as Mr McIntyre pointed out, while TransGrid is a monopoly it operates in a highly regulated environment.[57] In its submission, Origin Energy argued that 'in the case of electricity networks which are natural monopolies, regulation is

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52 Mr Russell Marsh, Policy Director, Clean Energy Council, Evidence, 26 March 2012, p. 49.

53 http://www.environment.nsw.gov.au/climatechange/solarflagship.htm, accessed 5 November 2012.

54 The Hon Martin Ferguson, Minister for Energy and Resources, 'Go ahead for large scale solar plant in NSW', Media Release, 9 June 2012.

55 Mr Peter McIntyre, Managing Director, TransGrid, Evidence, 26 March 2012, p. 55.

56 Mr Mark Duffy, Deputy Director General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 7.

57 Mr Peter McIntyre, Managing Director, TransGrid, Evidence, 26 March 2012, p. 55.

required as a proxy for competition.'[58] TransGrid is required to comply with a range of NSW legislation such as the *State Owned Corporations Act 1989* and the *Electricity Supply Act 1995,* as well as the National Electricity Law and the National Electricity Rules which regulate the operations of the National Electricity Market.

2.62 According to its most recent Annual Report, TransGrid made an operating profit of $243.5 million in 2010-2011. Its asset base is valued at over $6 billion.[59] Mr McIntyre explained TransGrid's funding structure by saying that:

> TransGrid is a commercial State-owned corporation. It does not fund activities from the State's balance sheet. It derives its revenues through a process where we justify its OpEx [operating expenditure] and its CapEx [capital expenditure]. It gets a return on those investments and it pays appropriate dividends to government as well.[60]

2.63 TransGrid values its capital investment program over the five-year period from 2009-2014 at $2.6 billion. Transmission network investment projects are subject to a regulatory investment test which is designed to assess the costs and benefits associated with each project.[61]

Distribution

2.64 In NSW, distribution is managed by three state owned corporations, which were re-structured and re-named as a result of the Gentrader transactions in 2011. With the retail functions sold, Ausgrid, Endeavour Energy and Essential Energy now operate solely as distribution companies. These three companies manage different regions of the electricity distribution network in NSW.

2.65 Ausgrid is the largest of the distribution companies, with more than 1.6 million customers. Its network covers the greater Sydney, Central Coast and Hunter regions. Ausgrid reported a profit of $325.9 million in 2010-2011, with total company assets valued at $11.27 billion.[62]

2.66 In terms of the geographic coverage of its services, Essential Energy operates the largest network, with more than 200,000 kilometres of power lines. Essential Energy delivers services to more than 800,000 homes across most of NSW. In 2010-2011 it reported a profit of $464.1 million before tax.[63]

2.67 Endeavour Energy manages a $3.3 billion distribution network for another 870,000 customers in western Sydney, the Blue Mountains, Illawarra, Southern Highlands and Shoalhaven regions. It reported a profit of $244 million in 2010-2011.[64]

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58 Submission 17, Origin Energy, p. 2.

59 TransGrid, 'Annual Report 2011: Connecting Energy', pp. 20-21.

60 As above, p. 63.

61 TransGrid, 'Annual Report 2011: Connecting Energy', pp. 20-21.

62 Ausgrid, 'Annual Report 2010/11'

63 Essential Energy, 'Annual Report 2010/11', p. 11.

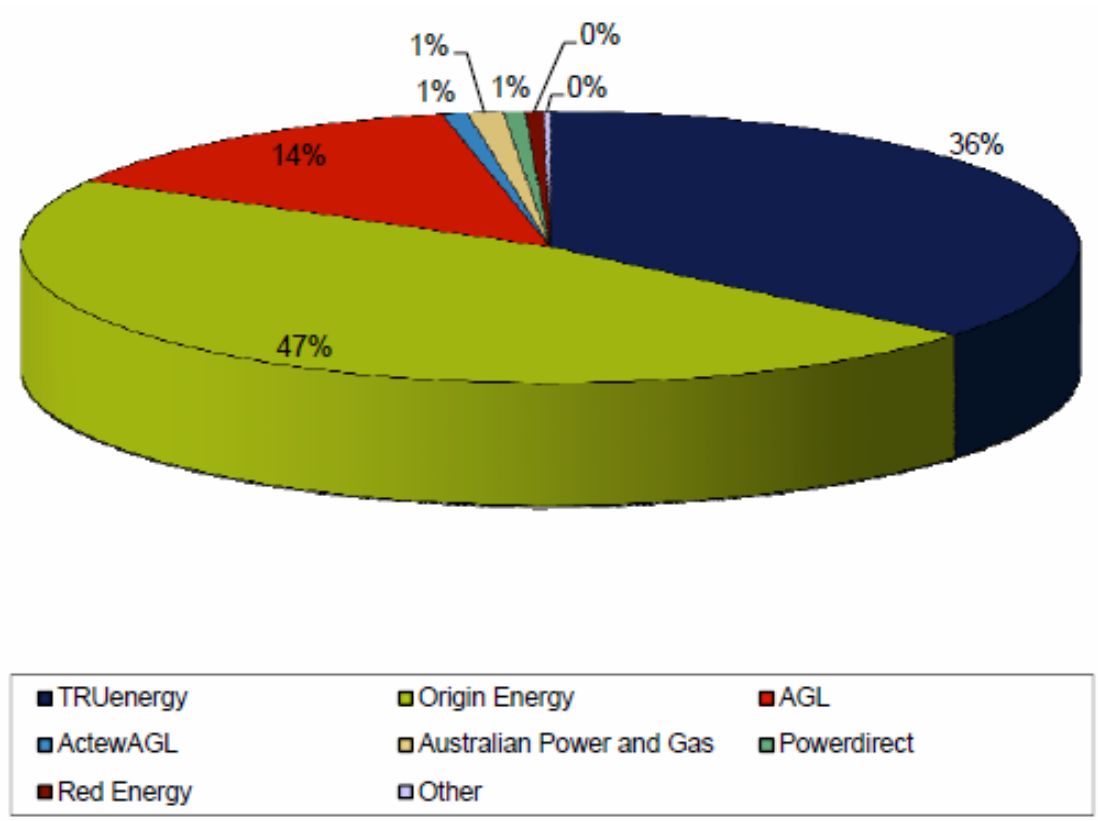
64 Endeavour Energy, 'Annual Performance Report 2010/11: Improving customer value', pp. 2-3.

2.68 In 2011 the incoming NSW Government began re-structuring distribution companies. In 2012 it announced its intention to merge the three distribution companies into a new body, to be called Networks NSW.[65]

Retail

2.69 By June 2011 there were 27 licensed electricity retailers operating in NSW; twelve of these provide services to residential and small business customers. However, Origin Energy and TRUenergy dominate the market, with over 85 per cent of retail customers between them.[66] Retail prices and pricing are discussed in more detail in Chapter Two.

Figure 5: Retail market shares of small customers in NSW (as at 30 June 2011)



Source: Independent Pricing and Regulatory Tribunal, 'Solar feed in tariffs', March 2012, p. 133.

DEMAND

2.70 Demand for, and consumption of, electricity in NSW grew steadily through the twentieth century. This growth in demand was driven by the growth of industry and population, as well as changes in energy use. In its submission, Delta Electricity noted that this continuing growth in demand was, in fact, accompanied by falling prices:

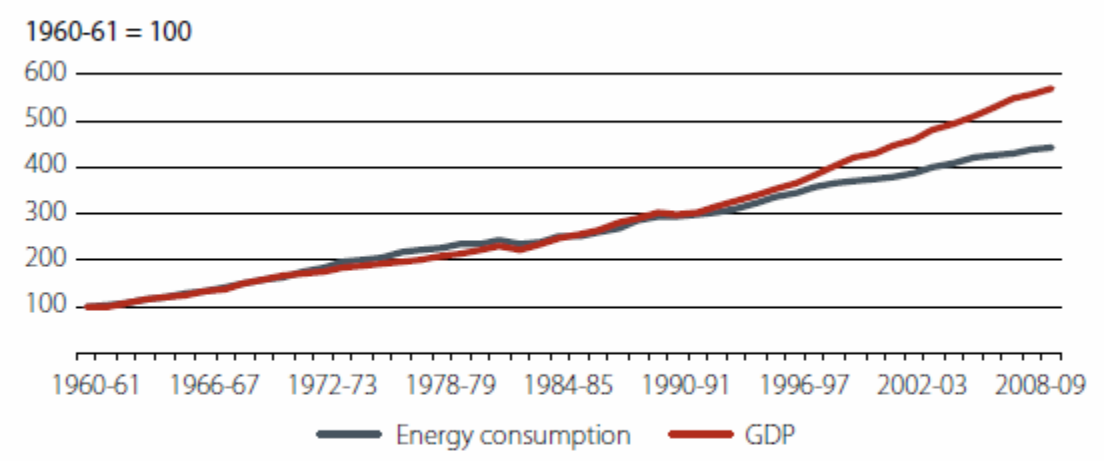
> by the 1980s the electricity sector in NSW operated with among the lowest prices in the world, bettered only by countries or states with considerable hydroelectric

65 The Hon Chris Hartcher MP, Minister for Resources and Energy, Media Release, 18 March 2012.

66 Australian Energy Regulator, 'State of the Electricity Market 2011', p. 104.

> resources. As a result, NSW was able to attract more energy intensive industries that played an important part in economic and employment growth. Increasing population growth further stimulated electricity demand and, until recent years, electricity demand grew in line with GDP. All the while electricity prices were falling in real terms.[67]

Figure 6: Annual growth in Australia's energy consumption



Source: Bureau of Resources and Energy Economics, Australian Energy Statistics, 2011.

2.71 However, as several participants in the Inquiry noted, this pattern of continuous growth in demand has been interrupted in recent years. Over the last few years electricity consumption has levelled off and even fallen, both in NSW and nationally. In its 2012 Electricity Forecasting Report, the Australian Energy Market Operator (AEMO), noted that:

> Annual energy increased on average by only 0.7% per year from 2000–01 to 2011–12, underpinned by a slowdown in economic activity, increasing electricity prices, and industrial sector weakness. Historical annual energy peaked in 2007–08, and shows a negative average annual growth of 1.5% over the last 4 years.[68]

2.72 The slowing of growth in demand has been attributed to a number of factors, including the effects of the Global Financial Crisis, the rising Australian dollar and its corresponding impact on demand in the manufacturing sector, increasing uptake of residential solar PV systems, rising electricity prices and changes in customer behaviour. Mr Tim Reardon, Executive Director, National Generators Forum, explained that the changes in demand are determined by a range of factors:

> Energy demand and peak demand have risen consistently in the NEM [National Electricity Market] in line with economic growth and in the order of 2 per cent or 3 per cent a year over the past three decades. That was up until about 2008; over the past four years there has been a flattening and progressively a fall in demand. This fall in demand is caused by a fundamental shift in the demand and supply balance in the market. The reasons for this are multi-faceted and include increases in price, changes in economic growth, changing industrial mix, distribution, generation, and

67 Submission 10, Delta Electricity, p. 2.

68 AEMO (2012) 'National Electricity Forecasting Report', p. 4-2.

> better generation and energy efficiency programs. There is, however, very limited detail and publicly available data on the relative contribution of each of those factors to the decline in electricity demand.[69]

2.73 The increased uptake of residential solar PV is listed as a factor in decreasing demand because AEMO's forecasts of electricity demand do not include the electricity generated by rooftop solar PV systems. This exacerbates the appearance that demand is falling, when in fact some of the reduction in demand, as projected by AEMO, is due to the replacement of one type of generation with another.

2.74 While solar PV still only makes up a small percentage of the electricity generated in the NEM, it has grown strongly in recent years and further growth is expected in future years. As a result, increases in system installations are expected to offset a large amount of energy that would have otherwise been provided by the NEM. In response to the growing impact that solar PV will have on demand, AEMO published a Rooftop PV Information Paper as part of its 2012 Forecasting process, and has committed to publishing 'its analysis of existing and forecast levels of rooftop PV (installed capacity, annual energy generation and the impact on maximum demand)' in future annual forecasting reports.[70]

2.75 Despite falling demand, retail electricity prices have risen over the same period. Electricity prices will be discussed in more detail in Chapter Four. However, rising prices also influence demand as customers seek to reduce their electricity use. In evidence, Mr David Swift, Executive General Manager, Corporate Development, AEMO, observed that customer demand is influenced both by installation of solar PVs and rising prices:

> Electricity consumption patterns are showing significant change at the moment in response to own use generation, and particularly I guess the growth of small-scale photovoltaic generation, and to increases in energy price, which have had an impact on people's consumption and their patterns of consumption. Further increases in price are expected, including those relating to the Clean Energy Future plan, which will have more effect on customer load.[71]

2.76 Further, Inquiry participants observed that while growth in demand has slowed, the changes have not been uniform. Peak demand has grown faster than demand at other times. To complicate matters, peak demand also fell during the summer of 2011-12, though this was the mildest summer in NSW since 1983-84.[72] The figure below shows maximum demand for electricity in summer and winter.

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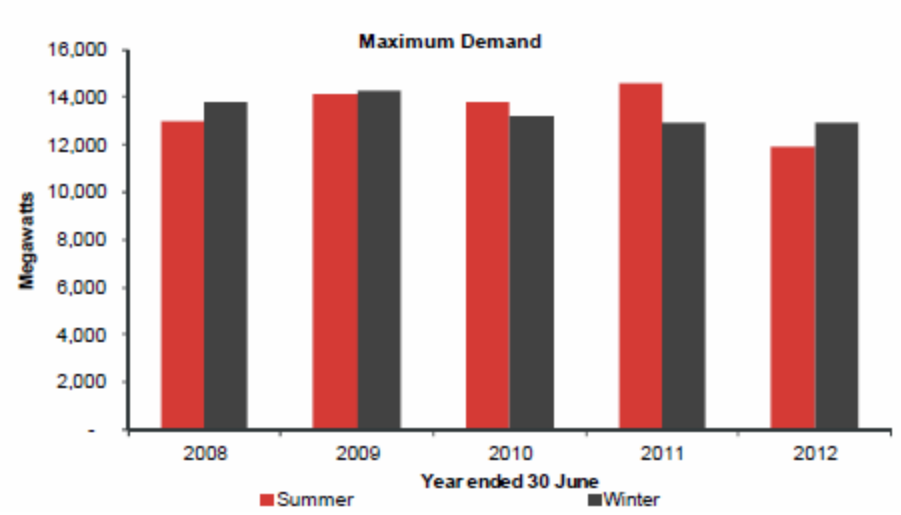
69 Mr Tim Reardon, Executive Director, National Generators Forum, Evidence, 11 May 2012, p. 17.

70 AEMO 'Rooftop PV Information Paper 2012', p. iii.

71 Mr David Swift, Executive General Manager, Corporate Development, AEMO, Evidence, 26 March 2012, p. 12.

72 TransGrid, 'New South Wales Annual Planning Report 2012,' p. 32.

Figure 7: Maximum demand in NSW, summer and winter



2.77 The growth in peak demand has been driven by growth in use of energy-intensive appliances, particularly in the use of residential air conditioning.[7374] In its submission, Delta Electricity observed that the pattern of base and peak demand has changed:

> The last five years have seen a measurable change in both electricity demand and the generation mix. The demand for electricity at peak times, typically late afternoon and early evening, has increased relative to the base-load or underlying demand. The peak in electricity demand in NSW is also in the process of shifting from a winter peak to a summer peak and the growth in electricity load has slowed. As a consequence, there has been an increase in peak-load generation plant that can start within minutes and respond quickly to rapid changes in demand.[75]

2.78 As Delta Electricity point out, this growth in peak demand has important implications for the industry because supply – and therefore generating capacity – must be available to meet it. It is increasing peak demand that has driven growth in wind and gas-fired generation in NSW in recent years. Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, explained that growing peak demand also helps to drive investment in electricity networks:

> Peak demand is the single biggest cause of network investment in this State. The fact that you have rising peak demand, and falling average demand, means that you actually need to build the networks bigger and bigger to charge them over a smaller number of hours because you actually charge over average use not over maximum demand. The analogy that I find useful is it would be like building the Sydney Harbour Bridge big enough that no car ever had to pause in peak hour.[76]

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73 Submission 10, Delta Electricity, p. 2.

74 Mr Greg Sullivan, Deputy CEO, Australian Coal Association, Mr Peter Morris, Director, Economic Policy, Australian Coal Association, Ms Sue-Ern Tan, Deputy CEO, NSW Minerals Council, Answers to questions on notice taken in evidence, 26 March 2012, p. 2.

75 Submission 10, Delta Electricity, p. 2.

76 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence, 26 March 2012, p. 43.

2.79 Demand forecasting is particularly important in the electricity supply industry as decisions relating to the investment in new electricity generation are made on the basis of demand forecasts. Historically, TransGrid has developed forecasts for NSW in conjunction with AEMO, but from 2012 AEMO is to assume this role.[77] AEMO produces the annual Electricity Statement of Opportunities primarily to provide market information to potential investors.

2.80 According to AEMO forecasting, demand for electricity in NSW will continue to rise over the long term. For example, Mr Ross Edwards, General Manager, Business Development, TRUenergy, agreed that the current downturn in demand is likely to be temporary:

> We have had economic slowdown with the exchange rate and the dollar impacting plants like Port Kembla and others. They are major energy users that come out of the market, and unless an equal and opposite amount of supply comes out of the market you end up with an oversupplied market. We are seeing a lot of pressure on those manufacturing and major energy users, so that is a consideration—a lot of solar PV in New South Wales. Also the temperature in recent times. We have seen a real change. It is the first time in 30 years where we have had demand falling. We do not see that being it for energy demand and it is on a downhill slope from here, I think it is just a bit of a blip, but we will wait and see how that pans out.[78]

2.81 In its annual forecasts, AEMO offers different demand scenarios based on high, medium and low levels of economic growth. A number of other factors such as carbon reduction targets and possible technological changes are also taken into account.[79]

2.82 However, some Inquiry participants were critical of the demand forecasting conducted by AEMO, on the grounds that these forecasts tend to over-estimate likely demand for electricity and therefore the need for investment in generating capacity. For example, in its submission Delta Electricity argued that the AEMO forecasts over-estimate demand:

> It should be noted, however, that even the supply-demand outlook….is likely to be overly pessimistic, in the sense that it is likely to overestimate (possibly significantly so) the need for new generation capacity in New South Wales. This is because the AEMO has historically systematically over-forecast demand and energy in New South Wales, and has correspondingly systematically forecast supply shortfalls that have not materialised in practice.[80]

2.83 There is some evidence to support Delta Electricity's assessment, as AEMO forecasts have been revised downward in recent years. For instance, the Owen Inquiry commissioned by the NSW Government in 2007 found that 'New South Wales needs to prepare for baseload supply by 2013-14'.[81] This finding was based on trends in demand at that time. However, in its 2011 forecasts, AEMO predicted that demand in NSW demand would exceed generating capacity from

77 Mr Peter McIntyre, Managing Director, TransGrid, Evidence, 26 March 2012, p. 57.

78 Mr Ross Edwards, General Manager, Business Development, TRUenergy, Evidence, 26 March 2012, p. 35.

79 AEMO (2012) 'National Electricity Forecasting Report', p. 2-9.

80 Submission 30, National Generators Forum, p. 31.

81 Owen, A., 'Inquiry into electricity supply in NSW', September 2007, p. 1-7.

about 2018 or 2019, depending on the forecast used.[82] In its 2012 forecast, this date was revised again, with AEMO predicting that demand was unlikely to exceed supply until at least 2022.[83]

2.84 Mr Peter McIntyre, Managing Director, TransGrid, acknowledged that the shifting patterns of demand means that forecasting is becoming more complex:

> From our latest 2011 forecast published in late June last year, we have seen a reduction in energy use in New South Wales, whilst peak demand in certain areas of the State continues to rise. This is in contrast to what we have seen, which has been steady energy growth in New South Wales over the past 50 years ... It is clear that energy and demand forecasting over the coming years will be a very difficult process as we have identified the actual impact of these changes. It is clear they are occurring and it is far less clear to what degree we can forecast on the basis of the observed range in recent years.[84]

Committee comment

2.85 There is no shortage of electricity supply in NSW. NSW has been well-served by a history of strong state investment in electricity supply and distribution which, combined with more recent private investment, continues to provide the state with adequate electricity generation capacity. Moreover, it is unlikely that further supplies of baseload generation will be required before the end of the current decade, as previous estimates of demand such as those used in the Owen Report in 2007 have proved to be excessive.

2.86 The Committee notes that the vast majority of electricity generated in NSW is sourced from coal-fired generators, and black coal continues to have a competitive advantage in NSW with abundant reserves located within the State.

2.87 The Committee supports the NSW Government's decision to sell generation assets and believes that this will provide a clear signal to investors that the NSW Government is no longer a direct participant in the electricity generation market. Instead, the appropriate role of Government is to regulate the market and to create an enabling environment for investment and development of new technologies.

2.88 The Committee also commends the NSW Government for its current work in reforming transmission and distribution businesses. This will help to minimise future increases in the retail price of electricity.

2.89 One of the key functions of the National Electricity Market is to facilitate transmission of electricity across state borders. While NSW regularly imports electricity from other states, this provides NSW consumers with cheaper electricity.

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82 Ms Lana Stockman, Manager, Wholesale Regulation, TRUenergy, Answers to Questions on Notice taken in evidence, 26 March 2012, p. 1.

83 AEMO, '2012 Electricity statement of opportunities', p. iii.

84 Mr Peter McIntyre, Managing Director, TransGrid, Evidence, 26 March 2012, p. 57.

Chapter Three – The National Electricity Market

Introduction

3.1 As a national structure comprised of interconnected networks, the National Electricity Market (NEM) is the primary mechanism for sourcing energy interstate. This chapter therefore addresses item (iv) in the Inquiry's Terms of Reference. It provides an overview of the NEM, including its structure and rules, the government agencies that operate and regulate the market, and movement of electricity between different states. The Committee also heard evidence about the advantages and disadvantages of the NEM, and this evidence is canvassed here.

3.2 The Committee found that the NEM is an effective mechanism for allocating resources, and supports NSW's continued participation in the market.

STRUCTURE AND RULES OF THE NATIONAL ELECTRICITY MARKET

3.3 The National Electricity Market (NEM) is a wholesale market through which generators sell electricity in eastern Australia. The NEM was established in 1998 and combined the electricity networks of New South Wales (including the ACT), Queensland, Victoria and South Australia. Tasmania joined the NEM in 2005, leaving Western Australia and the Northern Territory as the only jurisdictions in Australia that are not part of the NEM.[85]

3.4 Today the NEM is the largest interconnected power system in the world, covering a distance of around 5,000 kilometres – from Port Douglas in Queensland to Port Lincoln in South Australia.[86] Figure 8 on the following page shows the transmission network which transmits electricity throughout the NEM.

Terminology: the National Electricity Market (NEM)

While the National Electricity Market is technically the name of the market which is used to sell wholesale electricity throughout eastern Australia, in practice the term is often also used for the infrastructure (generators, transmission networks and distribution networks) that comprise the electricity system of eastern Australia.

3.5 The NEM is comprised of five separate regions - each associated with a different state - which are connected by cross-border interconnectors that allow electricity to flow between the states. The NEM supplies over nine million residential and business customers, with a generating capacity across the entire network of approximately 50,000 megawatts (MW). In 2010-11 the NEM generated approximately 204,000 gigawatt hours (GWh) of electricity.[87]

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85 Western Australia and the Northern Territory are not part of the NEM, primarily because of the vast distances between the major population centres of those jurisdictions and the rest of the NEM network.

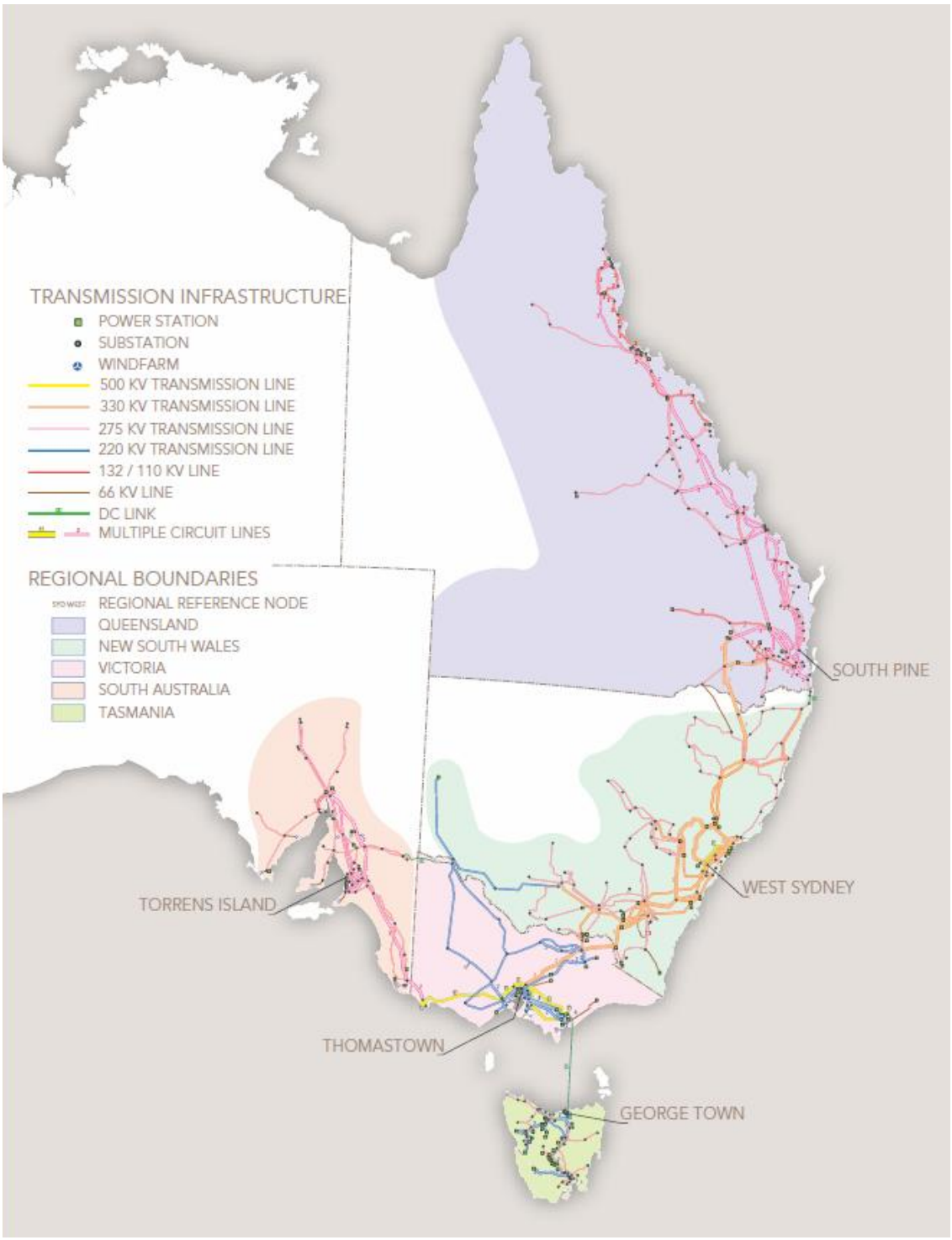
86 AEMO (2010) 'An Introduction to Australia's National Electricity Market', p. 4.

87 Australian Energy Regulator, 'State of the Energy Market 2011', p. 25.

3.6 The purpose of the NEM is to have a single wholesale market for the supply of electricity to retailers and end-use customers. The main participants in the market are electricity generators, e.g. Macquarie Generation, and electricity retailers, e.g. Origin Energy.[88] The market is operated by the Australian Energy Market Operator (AEMO) and regulated by a number of federal agencies including the Australian Energy Regulator (AER) and the Australian Energy Market Commission (AEMC). Policy oversight is provided by the Standing Council on the Energy and Resources (formerly the Ministerial Council on Energy).

88 The recent Gentrader transactions, along with the vertical integration of some electricity generators and retailers, means that in some cases the generators and retailers are now part of the same business.

Figure 8: The National Electricity Network [89]



Operation of the National Electricity Market

3.7 AEMO operates the wholesale spot market for electricity, in which output from generators is pooled, scheduled and dispatched to meet demand.

89 AEMO (2010) 'Introduction to Australia's National Electricity Market', p. 25.

3.8 Generators participating in the NEM submit bids (offers to supply a certain amount of electricity for a certain price, measured in $ per MWh) to AEMO. AEMO then arranges the bids in merit order (from the cheapest bids to the most expensive) and dispatches the required amount of generation to meet demand.

Terminology: scheduling and dispatch

Scheduling refers to ranking the bids from generators, matching these against the prevailing demand and identifying the amount of electricity required from each generator.

Dispatch is the process of issuing instructions to generators to generate a set amount of electricity.

3.9 As demand for electricity changes constantly throughout the day, the bidding and dispatch process is repeated every five minutes throughout the day. This ensures that additional electricity can be dispatched in times of peak demand or that electricity generation can be reduced when there is lower demand – so that electricity is not wasted unnecessarily.

3.10 As noted by AEMO, this complex process of matching bids from hundreds of generators around the country with the ever changing demand from consumers is underpinned by sophisticated information technology systems and processes:

> The market uses sophisticated systems to send signals to generators instructing them how much energy to produce each five minutes so that production is matched to consumer requirements, spare capacity is kept ready for emergencies, and the current energy price can be calculated.[90]

The spot market

3.11 While generators submit bids to AEMO for every five minute period of a day, the amount they get paid is calculated on a half hourly basis. Generators are not paid the value of their bid, but rather the spot price for the half hour period in which they generate electricity.

3.12 For each five minute period, the bids received by AEMO are arranged in merit order and then matched against demand. The highest accepted bid for a five minute period is known as the dispatch price. For each half hour trading period, there will be six dispatch prices. The spot price is calculated as the average of those six prices. Any generator whose bid is accepted is paid the spot price for the amount of electricity they generate in the half hour period.

3.13 While generators can make bids within a range of prices, there are price caps and floor prices set by the rules of the NEM. The market price cap is currently set at $12,500 per megawatt hour (MWh), while the floor price is set at -$1,000 per MWh.

3.14 The market price cap is the maximum amount that a generator can bid for any five minute period. The floor price is the minimum amount that a generator can bid. Note that the floor price is a negative number (-$1000/MWh), which means that a generator that bid this amount would have to pay to generate electricity (if their bid was the highest accepted bid for that period). This may seem

90 www.aemo.com.au/en/About-AEMO/About-the-Energy-Industry/The-energy-markets, accessed 28 August 2012.

counterintuitive, however the market is structured in this way because some generators (for example, coal-fired power stations) take a long time to restart once stopped. These generators prefer to operate (at least at their minimum capacity) continually throughout the day; therefore it can be more economic for them to occasionally receive a negative price for a short period, rather than to stop and restart.

3.15 Each different region of the NEM has its own spot price which may vary from the spot price in other regions. The major reasons for this are the different levels of supply and demand, along with different costs of fuel in different regions; as well as the fact that there is a limit to how much electricity can be transferred from one region to another via interconnectors. Interconnectors will be discussed further later in this chapter.

3.16 Almost all electricity generated in the eastern states of Australia is dispatched and settled through the NEM. Settlement is the process of determining the amount that wholesale market customers (i.e. electricity retailers) must pay and how much generators will receive. However, while almost all electricity is dispatched through the NEM, many retailers and generators enter into future contracts to supply specific amounts of electricity at fixed prices. They do this to avoid some of the risk and variability of the market. Wholesale contracts in the NEM are discussed further in Chapter Four.

AEMO forecasts

3.17 In order to effectively manage the operation of the NEM, AEMO conducts a variety of forecasts of expected electricity demand.[91] The range of these forecasts varies greatly from very short-term pre-dispatch forecasts of the expected demand in five or 30 minutes time,[92] through to short and medium-term Projected Assessments of System Adequacy which forecast demand over the next seven days or two years. [93] Beyond these, the long-term National Electricity Forecasting Report, first published in June 2012, forecasts demand over the next ten years.[94]

3.18 The National Electricity Forecasting Report is now the major long-term forecasting report produced by AEMO and informs its long term planning documents. These include the Electricity Statement of Opportunities (which provides an assessment of supply adequacy and future opportunities for generation and demand-side investment in the NEM over the next ten years) and the National Transmission Network Development Plan (which provides information to assist with transmission planning).[95]

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91 AEMO (2010) 'Introduction to Australia's National Electricity Market', p. 9.

92 www.aemo.com.au/en/Electricity/Market-and-Power-Systems/Dispatch/Five-Minute-Electricity-Demand-Forecasting, accessed 29 August 2012; and, www.aemo.com.au/en/Electricity/Market-and-Power-Systems/Dispatch/State-of-the-art-demand-forecasting-system-goes-live, accessed 29 August 2012.

93 AEMO (2010) 'Introduction to Australia's National Electricity Market', p. 17.

94 www.aemo.com.au/en/Electricity/Forecasting/2012-National-Electricity-Forecasting-Report, accessed 29 August 2012.

95 AEMO (2010) 'Introduction to Australia's National Electricity Market', p. 18., and www.aemo.com.au/en/Electricity/Planning/Electricity-Statement-of-Opportunities, accessed 29 August

Rules of the National Electricity Market

3.19 The operation of the NEM is governed by the National Electricity Law and the National Electricity Rules.

3.20 The National Electricity Law was first enacted in South Australia as a schedule to the *National Electricity (South Australia) Act 1996*. After this, other participating jurisdictions passed the law in their own parliaments, referring back to the South Australian Act. In New South Wales, the *National Electricity (New South Wales) Act 1997* was adopted to establish the national law in New South Wales, which is referred to as the *National Electricity (NSW) Law*.

3.21 The National Electricity Law outlines the functions and powers of the major government bodies including the Australian Electricity Market Operator, the Australian Electricity Market Commission and Australian Energy Regulator. The National Electricity Law also establishes the National Electricity Rules, which govern the day to day operation of the NEM and which have the force of law.

3.22 In addition, the National Electricity Law also articulates the National Electricity Objective, which is the guiding principle that must be considered when making or amending National Electricity Rules. The National Electricity Objective is set out in section 7 of the National Electricity Law, as follows:

> **7 National electricity objective**
>
> The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to—
>
> (a) price, quality, safety, reliability and security of supply of electricity; and
>
> (b) the reliability, safety and security of the national electricity system.[96]

3.23 While the National Electricity Objective indicates the purpose and guiding principles of the NEM, the National Electricity Rules govern its day to day operations. The National Electricity Rules are not legislation that is passed by parliament, but rather a set of rules which are made and amended by the AEMC. The Rules govern most aspects of the electricity system in participating regions, including:

- registration of participants in the market;
- structure of regions;
- spot market operation, including prudential requirements, scheduling and dispatch processes, price determination, price caps, settlements, market information and ancillary services;
- power system security and performance standards;

2012; and www.aemo.com.au/en/Electricity/Planning/National-Transmission-Network-Development-Plan, accessed 29 August 2012.

96 *National Electricity (NSW) Law*, s7.

- network connections;
- national transmission planning;
- economic regulation of transmission and distribution services;
- retail markets;
- metering; and
- administrative functions, such as dispute resolution, monitoring and reporting, and consultation processes.

3.24 Throughout the Committee's Inquiry, the fact that New South Wales is part of a national electricity system was highlighted and stakeholders stressed the importance of taking into account the State's position in the NEM before considering State based policies and initiatives that could affect the market. For example, Mr Mark Duffy, Deputy Director-General, Resources and Energy, Department of Trade and Investment, made the following comment in response to a question about whether there was a role for the NSW Government to develop and sell discounted coal to generators:

> The first thing we ought to do, consistent with our commitments going into the national market and the ethos of it, is to provide the private sector with fair rules, to trade fairly and not get into policies that somehow favour a particular region over another, because to start in that direction risks the cooperative approach to the whole thing. [97]

3.25 Mr Tim Nelson, Director, Economic Policy and Sustainability, AGL Energy similarly noted the national framework when responding to a question about whether there was a role for the NSW Government in encouraging emerging generation projects:

> In terms of the role the State Government has; it has a significant role around the facilitation of planning and all of the things which allow investors to make investment decisions within a nationally consistent framework that is set by the Commonwealth. We are in a national electricity market so it is hard to justify State-based initiatives.[98]

3.26 Mr Andrew Lewis, Executive Director, Energy, Department of Trade and Investment, Regional Infrastructure and Services, commented that the role of the NSW government was to support the NEM and to facilitate investment within that national framework:

> I think part of the role of the New South Wales Government is to support both the national frameworks and the domestic policy settings that encourage and support that investment to come from the private sector to ensure that there is minimal regulatory burdens, the appropriate regulatory regimes in place and to facilitate the investment that we are aware of, that there is interest in investing in these assets,

97 Mr Mark Duffy, Deputy Director-General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 8.

98 Mr Tim Nelson, Director, Economic Policy and Sustainability, AGL Energy, Evidence, 11 May 2012, p. 62.

> and we allow the market to determine when those investments will be made. So the role of Government is to facilitate and ensure that that investment comes in a timely and effective fashion.[99]

Government bodies involved in the operation and regulation of the NEM

3.27 The policy and governance framework of the NEM is comprised of a number of different agencies. These agencies and their respective roles are explained below.

Australian Energy Market Operator (AEMO)

3.28 The Australian Energy Market Operator is the operator of the National Electricity Market. The main function of AEMO is to operate the wholesale spot market for electricity that dispatches generators according to the price they offer. Its responsibilities include:

- Day to day management of wholesale electricity market operations. Market operations include a range of functions from systems operation, maintenance of system security, metering and settlements, through to market performance reporting, incident analysis, emergency management and the promotion of market improvements.
- Long term market planning through demand forecasting and scenario analysis.
- Ongoing market development required to incorporate new rules, infrastructure and participants.[100]

3.29 In addition to its role as operator of the NEM, AEMO also has functions relating to the short term trading market for gas in New South Wales and South Australia and the wholesale gas market in Victoria.

Australian Energy Market Commission (AEMC)

3.30 The Australian Energy Market Commission is responsible for making and amending the National Electricity Rules and conducting reviews of the energy markets.[101] AEMC reports to and provides policy advice to the Standing Council on Energy and Resources (see below).

3.31 AEMC's role involves managing the rule change process for the National Electricity Rules. This includes consulting stakeholders and deciding on proposed rule changes. AEMC also conducts reviews at the request of the Standing Council on Energy and Resources or at its own volition on the operation and effectiveness of the Rules or any matter relating to them.[102]

Australian Energy Regulator (AER)

3.32 The Australian Energy Regulator is responsible for regulating the wholesale electricity market. It monitors compliance with the National Electricity Rules and

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99 Mr Andrew Lewis, Executive Director, Energy, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, pp. 4-5.

100 Submission 5, AEMO, p. 1.

101 Submission 8, Australian Energy Market Commission (AEMC), p. 1.

102 AEMO (2010) 'Introduction to Australia's National Electricity Market', p. 23.

has responsibility for the enforcement of the Rules. The AER is also responsible for the regulation of transmission and distribution networks in the NEM.[103] This includes setting the prices charged for using electricity networks (poles and wires) to transport electricity to customers, and revenues earned by network businesses. AER also has a number of responsibilities relating to the regulation of gas transmission and distribution networks.

3.33 In short, with regard to the NEM and the National Electricity Rules, a simplified description of the roles of these three bodies is as follows:

- AEMO operates the market,
- AEMC recommends and makes rule changes,
- AER regulates the market.

Standing Council on Energy and Resources (SCER)

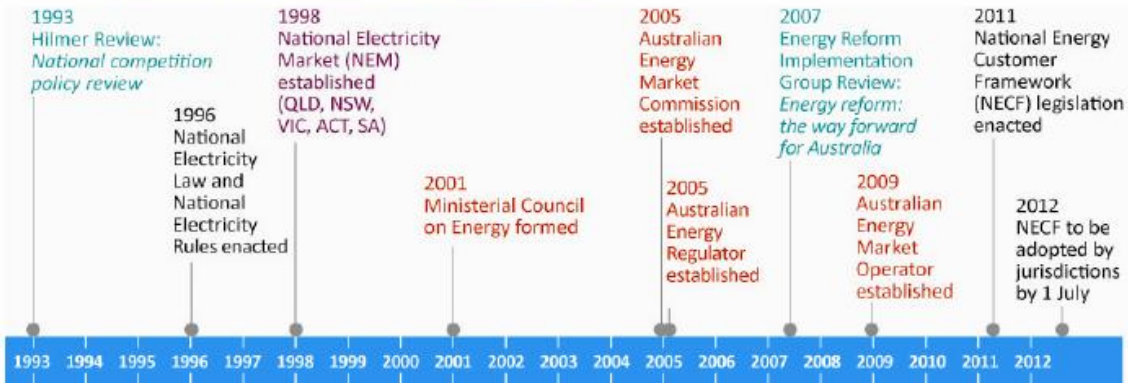
3.34 The Standing Council on Energy and Resources was established in 2011 by the Council of Australian Governments (COAG) and is chaired by the Commonwealth Minister for Energy, Resources and Tourism. SCER's other members consist of the state and territory ministers for energy and resources throughout Australia, as well as the New Zealand Minister for Energy and Resources.

3.35 SCER replaced the previous Ministerial Council on Energy, and is responsible for the oversight of the National Electricity Market, as well as progressing changes to the legislative and policy framework. SCER provides high level direction to the AEMC and directs AEMC to conduct reviews on particular aspects of the National Electricity Market.

History of Australian electricity market reform

3.36 The figure below is a timeline showing a brief history of some of the major market reforms that have occurred in the national electricity market over the past 20 years.

Figure 9: History of Australian electricity market reform[104]



103 Department of Energy, Resources and Tourism, 'Draft Energy White Paper: Strengthening the foundations for Australia's energy future', December 2011, p. 25.

104 Department of Energy, Resources and Tourism, 'Draft Energy White Paper: Strengthening the foundations for Australia's energy future', December 2011, p. 25.

INTERCONNECTORS AND THE MOVEMENT OF ELECTRICITY BETWEEN STATES

3.37 The transfer of electricity from one state/region of the NEM to another occurs via interconnectors. Interconnectors are high voltage transmission lines that connect adjacent regions of the NEM, combining the five separate regions into a single electricity network.

3.38 Interconnectors are used to import electricity to a region when the demand is higher than can be met by local generators, or when the price in the adjoining region is low enough that it becomes more efficient to import electricity (alternatively electricity may be exported from a region, if there is excess supply in the local region and high prices in an adjoining region). TransGrid explained how interconnectors can make electricity production in the NEM more efficient:

> Interconnection between jurisdictions allows lower cost generation in one region to supply demand in other regions and enables reserve sharing between regions, lowering the overall cost of meeting electricity demand.[105]

3.39 There are six interconnectors in the NEM, three of which can import energy into, and export from, New South Wales. Two interconnectors – known as QNI and Terranora – connect the New South Wales region to Queensland and one - known as VIC-NSW – connects the Victorian region to New South Wales.

3.40 The following table and figure show the location and capacity of interconnectors in the NEM.

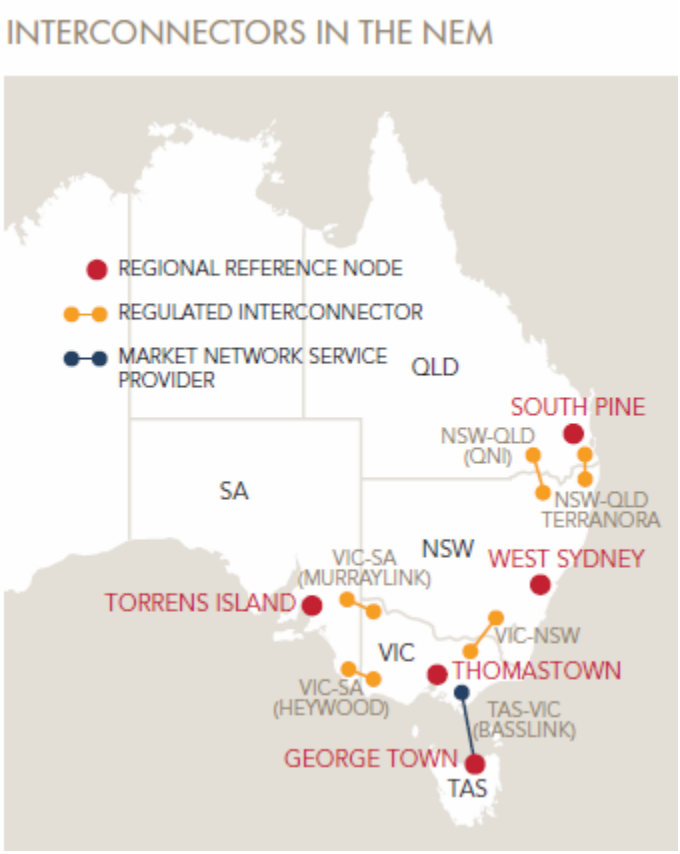
Table 3: Interconnectors in the NEM [106]

Interconnector	Location	Forward capability (MW)	Reverse capability (MW)
NSW to Qld (QNI)	Armidale to Braemar	300	900
NSW to Qld (Terranora)	Terranora to Mullumbimby	122	220
Vic to NSW	Buronga to Dederang	983	456
Vic to SA (Heywood)	Heywood to Tailem Bend	360	400
Vic to SA (Murraylink)	Red Cliffs to Berri	220	136
Tas to Vic (Basslink)	Seaspray to Georgetown	594	390

105 Submission 22, TransGrid, p. 6.

106 Bureau of Resource and Energy Economics, 'Energy in Australia 2012', p. 38.

Figure 10: Interconnectors in the NEM [107]



3.41 Over the past five years NSW has been a net importer of electricity, importing over 6,000 GWh of electricity from Queensland in 2010-11 and over 3,500 GWh from Victoria in 2010-11.[108]

Increasing the capacity of interconnectors

3.42 Proposals to increase the capacity of an interconnector, or to build a new interconnector, are subject to a Regulatory Investment Test for Transmission (RIT-T). The test, which is administered by the Australian Energy Regulator, is carried out to determine whether the benefits of a new interconnector outweigh the costs and whether there is another more economically viable option, such as investing in new local generation. The submission from TransGrid provided this overview of the RIT-T:

> All augmentation investments, including upgrades to, or construction of, interconnectors, are required to be assessed under the RIT-T.
>
> In the case of additional interconnector investment, the market benefits would primarily be expected to relate to:
>
> - a reduction in the costs of generator dispatch to meet demand (as the interconnector would allow cheaper generation in one region to be exported to meet demand in the neighbouring region); and

107 AEMO (2010) 'Introduction to Australia's National Electricity Market', p. 15.

108 AEMO, '2012 Electricity Statement of Opportunities', pp. A3-18.

- a reduction in the costs associated with new generation investment to meet peak demand (as the interconnector enables generating capacity to be shared across regions, provided that the timing of peak demand is different in each region).

> Where these benefits (plus any other market benefits identified in the case of a particular investment) exceed the capital and operating costs associated with the interconnector upgrade, and provide a greater overall market benefit than any alternative investment option (network or non-network) then the investment would satisfy the RIT-T. In some cases, additional investment in interconnector capacity will not be economic, compared to alternative options such as additional local generation. [109]

3.43 TransGrid further noted that there are a number of upgrades to interconnectors currently being considered through the RIT-T process. These include:

- The South Australia – Victoria (Heywood) Interconnector Upgrade. A Project Specification Consultation Report has been issued (reflecting the first consultation stage in the RIT-T process), following an earlier Feasibility Study;
- Powerlink and TransGrid are currently investigating an upgrade to the Queensland New South Wales Interconnector (QNI), with a Project Specification Consultation Report expected to be released in 2012; and
- AEMO and TransGrid have undertaken preparatory work and are intending to investigate the benefits of upgrading the Victoria to New South Wales Interconnector.[110]

3.44 A number of submissions to the Inquiry expressed the view that expanding interconnectors between states is not justified at this point in time. For example, Delta Electricity claimed that there is no evidence to support increasing the capacity of interconnection into NSW:

> Imports of electricity from Queensland and Victoria vary greatly from year to year. Congestion on the transmission interconnectors is relatively low and past assessments of major capacity increases have not been shown to be economic. There is no evidence to suggest there is a case for further increasing the capacity of transmission interconnection into NSW. Development of new generation capability across the NEM regions has ensured ample supply is available within each region and there is no trend of increasing utilisation of interconnector capacity.[111]

3.45 Delta further argued that the significant coal seam gas reserves found in New South Wales, along with findings that gas transmission is cheaper than electricity transmission, suggest that in the future alternatives to interconnectors should be carefully considered:

> Any future development of interstate energy sourcing should carefully consider the costs of this development against the alternative of sourcing energy from within NSW. As AEMO identifies in its 2011 National Transmission Network Development

109 Submission 22, TransGrid, pp. 9-10.

110 Submission 22, TransGrid, pp. 9-10.

111 Submission 10, Delta Electricity, p. 13.

> Plan, gas transmission infrastructure is much cheaper and has lower impact than electrical transmission infrastructure. This being the case, and with the discovery of substantial CSG [Coal Seam Gas] resources within NSW, it is more efficient for gas generation to be located closer to demand centres in NSW with gas pipelines built to accommodate the increased gas demand.[112]

3.46 The Total Environment Centre and the Nature Conservation Council of NSW were also opposed to increasing interconnectors and sourcing more energy from interstate, arguing that importing electricity from other states is more expensive both in economic and environmental terms:

> We are of the opinion that sourcing energy from other states is not the most economically or environmentally beneficial option for NSW. The interconnectors between states have limited capacity and there are significant transmission losses involved in the transportation of electricity over long distances, resulting in higher costs and higher greenhouse gas emissions than intrastate transmission.[113]

3.47 The Total Environment Centre and the Nature Conservation Council indicated a preference for the greater use of renewable energy resources and distributed generation within NSW as an alternative to importing energy from interstate.[114]

ADVANTAGES AND DISADVANTAGES OF THE NATIONAL ELECTRICITY MARKET

3.48 The National Electricity Market has been in effect since 1998 and has successfully provided for the efficient supply of electricity and investment in generation since its inception. While a number of stakeholders considered that there could be improvements in some aspects of the structure and objectives of the NEM, there was no evidence to suggest that New South Wales should abandon the national market.

3.49 Delta Electricity described how the introduction of the NEM improved the economics of energy generation by sharing capacity and supply of electricity between states:

> The formation of the National Electricity Market (NEM) in the late 1990s saw generators across four states competing to supply electricity into the NEM. This market-based approach to electricity generation saw further price reductions as generators competed to supply. Over the following decade or so, excess base-load generation capacity in the NEM was progressively taken up with increases in electricity load and the retirement of older, less efficient power stations. This further improved the economics of electricity generation and kept prices low. At the same time the historically high reliability of electricity supply was maintained.[115]

3.50 The Australian Energy Market Commission explained that the NEM is able to supply electricity at a lower cost and with greater reliability than would be available if each state within the NEM operated as a separate system:

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112 Submission 10, Delta Electricity, p. 13.

113 Submission 11, Total Environment Centre and the Nature Conservation Council of NSW, p. 9.

114 Submission 11, Total Environment Centre and the Nature Conservation Council of NSW, p. 10.

115 Submission 10, Delta Electricity, p. 2.

> These arrangements ensure that energy is sourced from the lowest cost generation across the five regions to meet demand in each state, subject to the limitations of the transmission network across and within regions…. This approach focuses on the lowest delivered total cost of energy and allows demand to be met at a lower cost than if demand and supply had to be balanced within each state, and also improves reliability of supply.[116]

3.51 In a similar vein, Origin Energy stated that the NEM has been 'highly successful in attracting investment in electricity generation and providing an efficiently priced and reliable supply to customers.' Origin further maintained that the design of the NEM 'is effective in driving the most efficient investment choices including technology and location.'[117]

3.52 Since its introduction there have been a number of changes in the environment in which the NEM operates, including the changes in demand discussed in Chapter Two, changes to government policy and an increased number of renewable generators. However, the Committee was advised that the NEM has continued to evolve since its inception and has successfully adapted to these changes. For example, Mr Mark Wilson, Director, Wholesale Markets Branch, Australian Energy Regulator, explained amendments made to market rules in recent years to take account of the increasing amount of wind generation:

> The market rules have been modified over the past several years to take account of increasing amounts of wind generators, whose outputs are intermittent in nature, and I think it is fair to say that the market rules manage the operation of those intermittent generators quite successfully. Quite a lot of work was done in preparation for wind generation coming into the market, because that was quite correctly regarded as a different technology and a very different generator as far as being able to dictate the output of the generator. That was seen as a problem, and there are now obligations for all of the wind generators to offer into the market and for the market operator to use the automatic wind energy forecasting system. That all works quite well. [118]

3.53 Mr Jonathan Upson, Senior Development and Government Affairs Manager, Infigen Energy, indicated that his organisation believed the NEM worked well though there was room for improvement in some areas. He said that their view 'is that the electricity market operates pretty well today with the existing framework,' before further adding, 'There are some things that could be improved.'[119] Mr Upson considered that for his organisation the most important issue was that of connecting new generators and the associated negotiations with transmission network service providers.[120]

3.54 Other stakeholders to the Inquiry criticised the objectives of the NEM, claiming that the NEM is biased against renewables and demand side participation, or

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116 Submission 8, Australian Energy Market Commission (AEMC), pp. 1-2.

117 Submission 17, Origin Energy, p. 1.

118 Mr Mark Wilson, Director, Wholesale Markets Branch, Australian Energy Regulator, Evidence, 11 May 2012, p. 42.

119 Mr Jonathan Upson, Senior Development and Government Affairs Manager, Infigen Energy, Evidence, 26 March 2012, p. 7.

120 Mr Jonathan Upson, Senior Development and Government Affairs Manager, Infigen Energy, Evidence, 26 March 2012, p. 74.

suggested that the current method of pricing of electricity fails to adequately incorporate the cost of externalities.

3.55 Pacific Hydro noted that the objectives of the NEM do not include any environmental factors, and claimed that this created a divergence between the drivers of the energy market and policy goals to reduce carbon emissions:

> The NEM does not (yet) acknowledge the environmental imperative to reduce greenhouse emissions within the legislation. This fundamentally creates a divergence in the constitution of energy market investment signals to deliver on climate change and emissions reduction outcomes.[121]

3.56 It was Pacific Hydro's view that the National Electricity Objective should be amended to include an additional objective of 'meeting greenhouse gas emissions reduction targets as set by the Commonwealth.'[122]

3.57 The Total Environment Centre and the Nature Conservation Council of NSW contended that 'the National Electricity Market, National Electricity Objective and National Electricity Rules are biased against small-scale renewables and demand side participation.' They urged the Committee to:

> Request that the Standing Committee on Energy and Resources to make changes to the National Electricity Rules and the National Electricity Objective to favour demand side participation, lower cost energy solutions and improved environmental performance. [123]

3.58 Similarly, EnerNOC Australia argued that there are barriers in the NEM to the implementation of demand response options 'due to the current NEM rules being biased to supply side solutions.'[124]

3.59 Ms Penelope Crossley, a lecturer in Energy and Resources Law at the University of Sydney, considered that electricity pricing failed to 'accurately reflect the cost of electricity generation due to the presence of externalities and information asymmetries.' Ms Crossley suggested that the 'pricing of coal based electricity generation fails to adequately price the externalities associated with its use including air pollution, high greenhouse gas emissions and higher rates of asthma suffered in communities surrounding coal fired generation plants.'[125]

3.60 A number of these issues will be considered in further detail in later chapters of the report. Renewable energy generation will be discussed in Chapters Eight and Nine, while demand management is considered in Chapter Ten.

3.61 While the National Electricity Law and the National Electricity Rules govern the operation of the NEM, there are a number of state and federal policies that affect the generation of electricity within the national market. These include the carbon

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121 Submission 21, Pacific Hydro, p. 3.

122 Pacific Hydro, Answers to questions taken on notice in evidence, 11 May 2012, p. 2.

123 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 2.

124 Submission 7, EnerNOC Australia, p. 3.

125 Submission 3, Ms Penelope Crossley, p. 4.

tax, the Renewable Energy Target, GreenPower and the NSW Renewable Energy Action Plan, each of which will be considered later in the report.

Committee comment

3.62 The Committee found that the National Electricity Market is an effective mechanism for the allocation of energy resources. Since its inception in 1998 the NEM has provided consumers with competitive wholesale electricity prices. The Committee supports NSW's continued participation in the National Electricity Market, subject to appropriate regulation.

3.63 While the evidence before the Committee suggested that the development of new interconnectors may not be justified at this point in time, the Committee considers that the Regulatory Investment Test for Transmission administered by the Australian Energy Regulator provides an appropriate instrument for the assessment of future investment in interconnectors.

3.64 The Committee has confidence in the regulatory mechanisms established by the Standing Council on Energy and Resources, but believes that there are areas for improvement, such as greater transparency and consumer representation. The Committee therefore urges the Minister for Resources and Energy to maintain active participation in the Council, mindful of potential improvements.

3.65 The Committee urges the NSW Government to continue to endorse the principles of the National Electricity Market. The Government should not participate directly in the market by investing further in energy generation. The appropriate role of the NSW Government is to ensure the safety of electricity supply, facilitate investment and, in partnership with other jurisdictions, ensure adequate competition and transparency in the National Electricity Market.

RECOMMENDATION 1

That the NSW Government continue to support the National Electricity Market to operate freely, subject to appropriate regulation. The NSW Government should not seek to invest further in electricity generation.

Chapter Four – Electricity Prices

Introduction

4.1 The retail price of electricity has risen significantly in recent years, and this has been the subject of considerable attention from the media and the public. The purpose of this chapter is to outline how prices are determined, and the factors influencing prices.

4.2 Wholesale prices are determined through the interaction of supply and demand in the National Electricity Market, though direct contracts between generators and retailers also play a part. Wholesale prices are unregulated, though the Australian Energy Market Operator imposes 'ceiling' and 'floor' prices. Retail prices in NSW are regulated by the Independent Pricing and Regulatory Tribunal (IPART), which takes into account a number of costs in making its price determinations. These include wholesale costs, transmission and distribution costs, costs imposed by government such as the carbon pricing scheme, and retailer costs.

4.3 The Committee found that while wholesale costs are stable, increasing network investment and costs associated with implementing government 'green' schemes have driven retail price increases. The Committee supports de-regulation of retail prices when competition is found to be effective. However, the Committee does not support imposition of further sustainable energy schemes that may add further costs for consumers.

WHOLESALE PRICES

4.4 Wholesale prices in the National Electricity Market (NEM) are not regulated, though the National Electricity Rules do impose 'floor' (-$1,000 per megawatt hour) and 'ceiling' ($12,500 per megawatt hour) prices.[126] Within this range, generators bid into the market 'pool' to supply electricity.

4.5 The Australian Energy Market Operator (AEMO) matches bids from generators to demand, with the aim of meeting demand in the most cost-efficient way possible. The AEMO therefore calls for bids to supply electricity from NEM generators continuously in five minute intervals throughout the day. In its submission, the National Generators Forum explained how the market works:

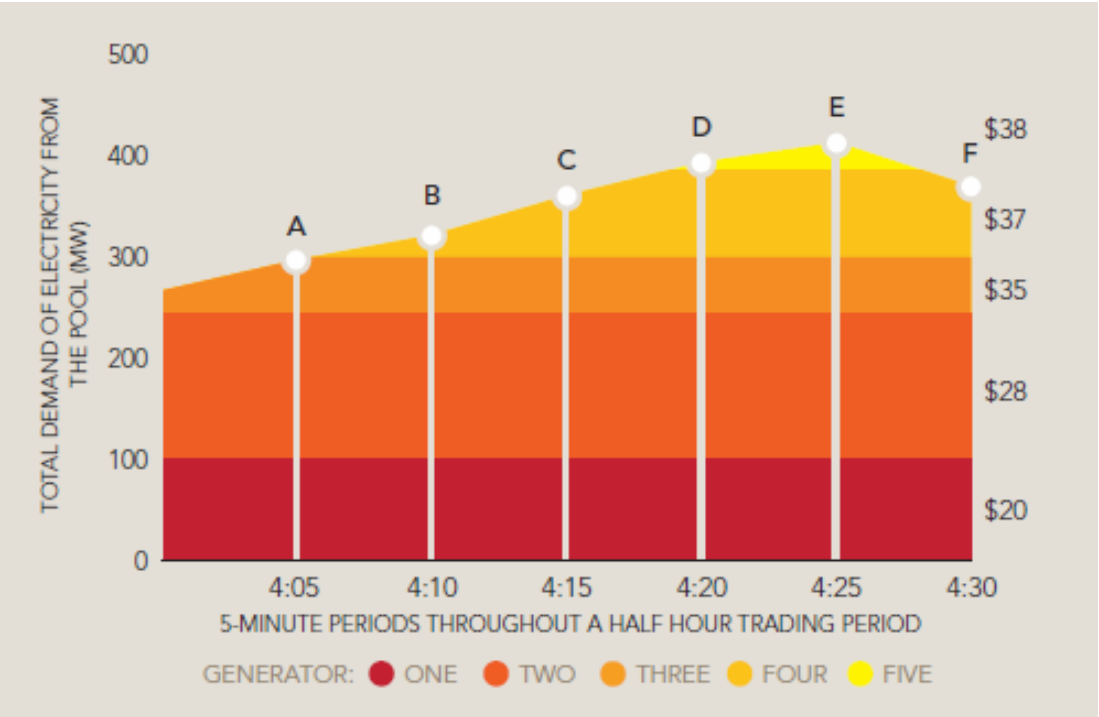
> The AEMO … calls for competitive offers to supply electricity from NEM generators continuously in five-minute intervals. In each interval, the AEMO stacks all price offers to produce electricity in ascending order, and progressively schedules generators into production to meet prevailing demand, starting with the least-cost generation option. The use of a rising price-stack for generator offers, also referred to as the 'merit order', means that power stations offering to supply electricity at lower cost (in $/MWh) are dispatched more often, while more expensive power

126 The price ceiling cap is indexed according to the Consumer Price Index (CPI).

stations are scheduled and dispatched only when the total demand for electricity is higher than the available capacity of the lower cost power stations.[127]

4.6 Figure 10 on the following page provides an illustrative example of scheduling generators and setting the spot price in the NEM over a hypothetical 30 minute period.

Figure 11: Market design and price setting in the NEM



Bids to produce electricity received by AEMO are stacked in ascending price order for each dispatch period. Generators are then progressively scheduled into production to meet prevailing demand, starting with the least-cost generation option.

A. In order to supply demand for power at 4:05 pm, Generators 1 and 2 are dispatched to their full bid capacity, and Generator 3 is only partly dispatched. The price is $35 per MWh.

B. At 4:10 pm, demand has increased: Generators 1, 2 and 3 are fully dispatched, and Generator 4 is partly dispatched. The price is $37 MWh.

C. At point C (4:15 pm) demand has increased a further 30 MW. Generators 1, 2, 3 and 4 continue producing power and the price remains at $37 MWh.

D. By 4:20pm, demand has increased to the point that Generator 5 is just required to meet demand, and the price increases to $38 per MWh.

E. At 4.25 pm, Generators 1-4 are fully dispatched and Generator 5 partly dispatched. The price remains at $38 per MWh.

F. By 4:30 pm, demand has fallen. Generator 5 (the most expensive generator) is no longer required, and Generator 4 is only partly dispatched. The price returns to $37 per MWh.

The spot price for the trading period is calculated as the average of the six dispatch prices. That is, $(35+37+37+38+38+37) per MWh divided by six, or $37 per MWh. This is the price all generators receive for production during this period, and the price market customers pay for electricity they consume from the pool during this period.

Source: AEMO, 'An introduction to Australia's National Electricity Market', July 2010.

127 Submission 30, National Generators Forum, pp. 3-4.

4.7 This dispatch system applies to all 'scheduled' generators with a generating capacity of over 30 megawatts. Smaller generators and some renewable energy generators are classed as 'unscheduled'. In 2009, the National Electricity Rules were amended to introduce a third class of generators known as 'semi-scheduled' generators, which applies to new intermittent generators with a capacity over 30 megawatts. Semi-scheduled generators are required to bid into the wholesale market and must limit their output whenever the central dispatch process directs them to.

4.8 Because the demand for electricity fluctuates so rapidly, the price of wholesale electricity can also change very quickly. Prices from each five minute period are averaged over a 30 minute period to determine the price that generators actually receive. The Australian Energy Regulator explained how this process works:

> The dispatch price for a 5 minute interval is the offer price of the highest (marginal) priced MW of generation that must be dispatched to meet demand. A wholesale spot price is then determined for each half hour (trading interval) from the average of the 5 minute dispatch prices. This is the price that all generators receive for their supply during the half hour, and the price that wholesale customers pay for the electricity they use in that period.[128]

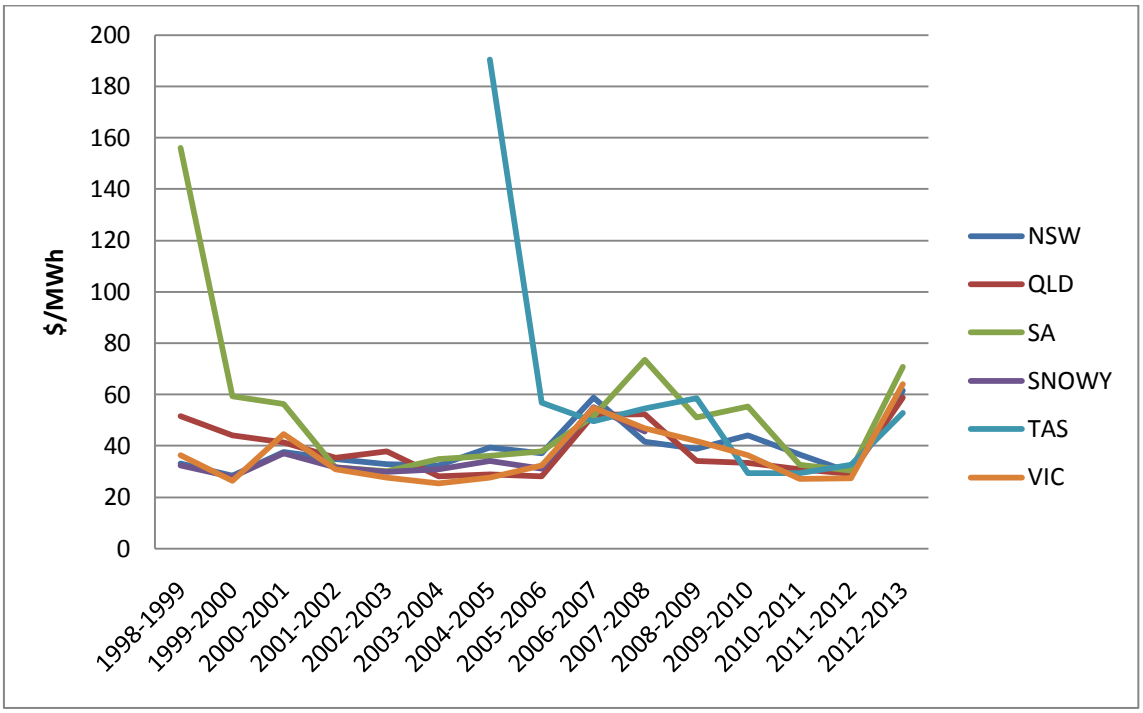
4.9 In general, prices rise with demand. As a result, prices at peak times – particularly on very hot summer days - can be high. It is these high prices that provide the incentive for the market to invest in peak generation capacity. However, at times of low demand, generators of baseload electricity may sell electricity at a loss.

4.10 However, on average, wholesale prices have not risen substantially since the introduction of the National Electricity Market in 1998. In its 2010 Inquiry into the NSW Electricity Network and Prices, for example, Industry and Investment NSW found that there were no distinct trends in wholesale electricity prices in recent years, and that increased spot prices had been caused by extreme weather events rather than an underlying trend toward increasing costs.[129]

128 Australian Energy Regulator, 'State of the energy market 2011', p. 33.

129 Industry and Investment NSW, 'NSW Electricity Network and Prices Inquiry', December 2010, p. 38.

Figure 12: Average annual electricity prices in the NEM (per financial year)



Source: www.aemo.com.au/Electricity/Data/Price-and-Demand/Average-Price-Tables

4.11 Participants in the Inquiry generally agreed that the wholesale electricity market is efficient and competitive. For example, in evidence, Mr David Swift, Executive General Manager, Corporate Development, AEMO, expressed this view:

> The evidence suggests that the National Electricity Market has generally delivered competitive wholesale prices and driven efficiency in the generation sector here, particularly around the time of market start when there were dramatic improvements. The market provides a competitive dispatch process for today's suppliers and an open access regime that allows new generators to connect and supply where they see a customer need that they consider they can competitively meet. There has been significant entry of new generating plant in New South Wales and increases to the existing capacity here over the time that the market has been operating.[130]

4.12 Similarly, Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, argued that the competitive nature of the National Electricity Market had actually driven down prices at the wholesale level:

> The wholesale market is a gross wholesale market, which is managed by the Australian Energy Market Operator, and generators bid into that market. There is a high degree of transparency around those prices. We have actually seen falling prices in recent years. If you talk to some of the generation businesses they are crying poor these days.[131]

130 Mr David Swift, Executive General Manager, Corporate Development, AEMO, Evidence, 26 March 2012, p. 12.

131 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence, 26 March 2012, p. 40.

Wholesale contracts

4.13 As the Australian Energy Regulator notes, the volatility of prices in the wholesale electricity market presents a significant financial risk to both generators and retailers.[132] In order to manage risk, market participants enter into hedging contracts that offer fixed prices for electricity that a generator plans to produce (or a retailer to buy) in the future. For example, Ms Lana Stockman, Manager, Wholesale Regulation, TRUenergy, explained the risks of high wholesale prices to a retailer who must purchase the electricity:

> If you are exposed to high prices you could go bankrupt virtually within hours. I was involved when AGL went bankrupt in New Zealand. That is the situation it was in. Effectively within four days it was out of the market, and it was the major retailer. If you have to pay a little more on your purchase price by over-hedging you are protecting yourself from a catastrophic failure.[133]

4.14 Although not directly related to the generation of electricity, these forward contracts form a significant (and growing) part of the market, because they help market participants to manage risk and therefore affect their bidding behaviour. There are essentially two types of electricity-related financial market: Over-the-Counter markets, which are bilateral contracts between generators and retailers, and futures and options which are traded on the stock exchange.[134] Some suggest that up to 80 per cent of electricity generated in NSW is hedged with forward contracts.

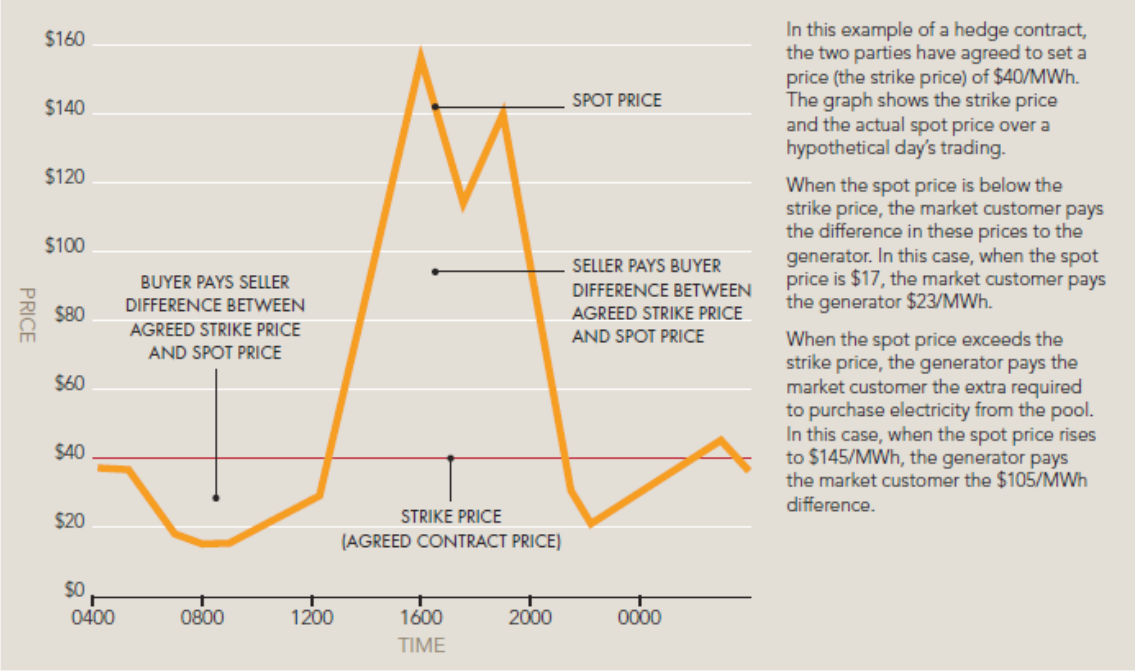
4.15 The figure below provides an example of how such contracts may work in the NEM.

132 Australian Energy Regulator, 'State of the energy market 2011', p. 39.

133 Ms Lana Stockman, Manager, Wholesale Regulation, TRUenergy, Evidence, 26 March 2012, p. 31.

134 Australian Energy Regulator, 'State of the energy market 2009', p. 91.

Figure 13: Hedge contracts in the NEM [135]



Vertical integration

4.16 According to Inquiry participants, the vertical integration of retail and generation is another mechanism used by market participants to manage the risks associated with price volatility. Vertical integration refers to retail and generation companies combining, so that a retail company has its own sources of generation available. These companies are sometimes referred to as 'gentailers'. The Australian Energy Regulator, for example, noted that the three largest private energy retailers – Origin Energy, AGL Energy and TRUenergy are all moving towards vertical integration. This results in increasing concentration of the market, with these three gentailers now supplying over 80 per cent of small customers between them, as well as almost 30 per cent of generation capacity in the NEM.[136]

4.17 This trend toward vertical integration of electricity supply is contrary to the NSW Government's policy when the Electricity Commission of NSW was disaggregated, which aimed to split the different elements of the energy supply industry and maximise competition. At the public hearing on 26 March 2012, Mr Jonathan O'Dea MP, Chair, Public Accounts Committee, asked Mr Ross Edwards of TRUenergy about the effects of vertical integration on competition in the electricity market:

> CHAIR: It has been suggested that the vertical integration of generation and retailing of electricity somewhat inhibits competition in the electricity market. What is your view on that?[137]
>
> Mr EDWARDS: I do not think so. I think people have moved to a vertically integrated model to deal with the risks of the wholesale market. There are very few stand alone

135 AEMO (2010) 'Introduction to Australia's National Electricity Market', p. 20.

136 Australian Energy Regulator, 'State of the energy market 2011', p. 106.

137 Mr Jonathan O'Dea MP, Chair, Public Accounts Committee, 26 March 2012, p. 30.

> generators in the market today that are not under some form of financial distress. Most of them are negotiating with their banks around work-out arrangements because the reality is that the wholesale electricity market has been very volatile. It was high at the time of the drought, but this summer it has been very low. We have had a lot of demand come off. Whilst you have still got a lot of supply in the market, I think we have had some of the lowest prices over summer that we have had for some time. The way in which companies such as ourselves have attempted to deal with the risks and that volatility is to vertically integrate so that we have retail offsetting what would otherwise probably be a challenging environment for a pure generator.[138]

4.18 Similarly, the National Generators Forum explained that vertical integration was essential for retail companies to manage the financial risks involved in the wholesale market:

> Electricity market price volatility is also a key driver behind the emergence in the NEM and in many other electricity markets of vertically integrated electricity generation and retailing businesses ('gentailers'). Gentailers are able to manage wholesale price risks internally, since losses that the generation part of the business may incur if prices are low tend to be offset by gains to the retailing business from lower purchasing costs (and vice versa). Gentailers are also in a better position to underwrite the financing of long-term power station investments, particularly in the current economic environment where investors tend to be risk averse. Vertical integration in the electricity sector is therefore a reflection of the need to manage the considerable financial risks that arise in wholesale electricity markets.[139]

4.19 However, the New England Citizens' Policy Jury expressed concerns about the integration of generation and retail functions, arguing that this restricts access to the wholesale market for alternative energy generators. The Citizens' Jury recommended that the Government:

> Separate electricity generation from retail sectors to remove the monopoly that at present restricts access at the wholesale levels of alternative energy. The areas of energy generation, the wholesale market and the retail energy market need to be totally independent from each other.[140]

4.20 Barriers to the development of alternative forms of energy generation are discussed in Chapters Eight and Nine.

RETAIL PRICES

4.21 As noted in Chapter Two, retail electricity prices have increased significantly in recent years, despite the suppression of wholesale prices. However, while there have undoubtedly been significant retail price rises in recent years, the figure below shows that, in real terms, electricity prices are lower than they were in the 1950s when the NSW Government first established the Electricity Commission. As can be seen in the graph below, electricity prices were at historically high levels in

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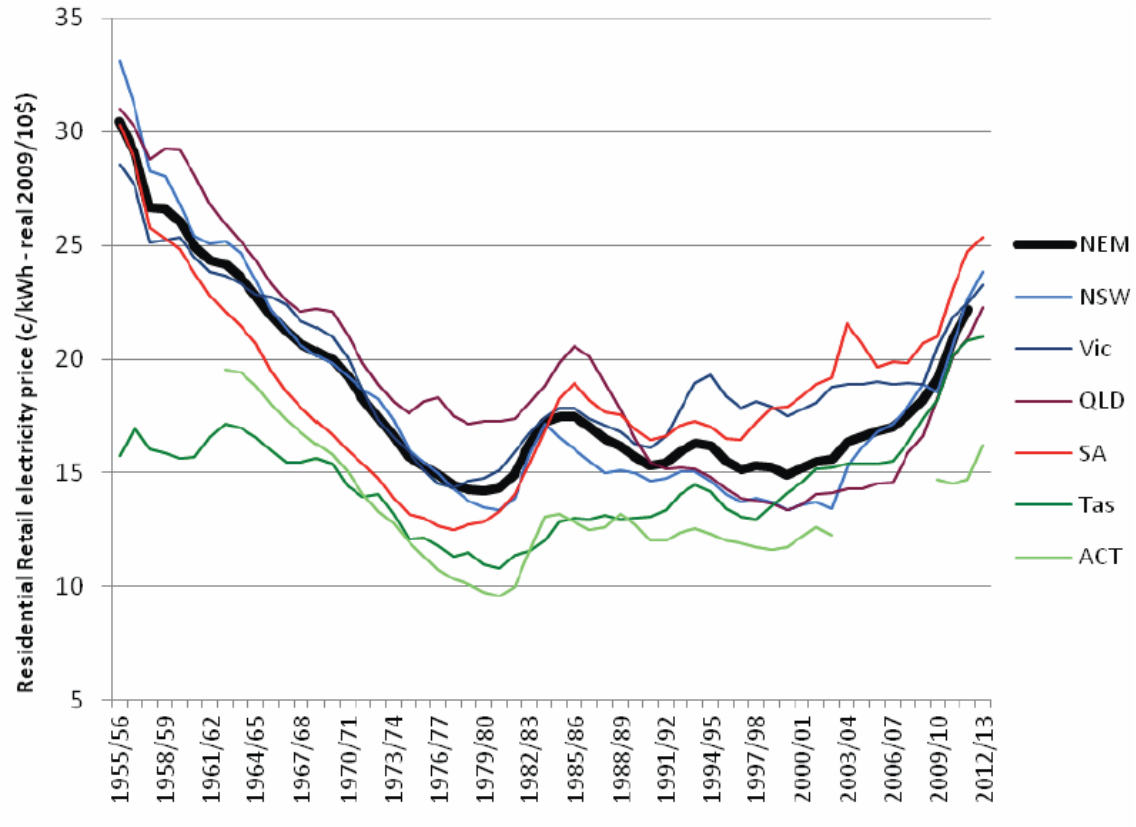
138 Mr Ross Edwards, General Manager, Business Development, TRUenergy, Evidence, 26 March 2012, p. 30.

139 Submission 30, National Generators Forum, pp. 5-6.

140 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 11.

the mid-1950s, but reduced dramatically and remained relatively steady from the mid-1970s until the early 2000s, before increasing again in recent years.

Figure 14: Residential electricity price in NEM states (1955-2013)[141]



4.22 Wholesale prices make up only one part of the retail price of electricity; other components of the retail price include network costs, the cost of green schemes and the carbon tax, as well as retail costs.

4.23 According to the Auditor-General, retail costs and margin make up about 10 per cent of a typical electricity bill (see Figure 15 below). For example, in its '2010 State of the Electricity Market' report, the Australian Energy Regulator (AER) observed that:

> In electricity, wholesale energy costs account for around 37 – 45 per cent of retail bills, while network tariffs account for 43 – 51 per cent. Retailer operating costs have a range of around 4 – 8 per cent, and retail margins have a range of 3 – 5 per cent.[142]

4.24 In New South Wales, the Independent Pricing and Regulatory Tribunal (IPART) determines a retail cost allowance, which is based on based on historic cost data and benchmarked against other regulatory decisions. In addition, IPART

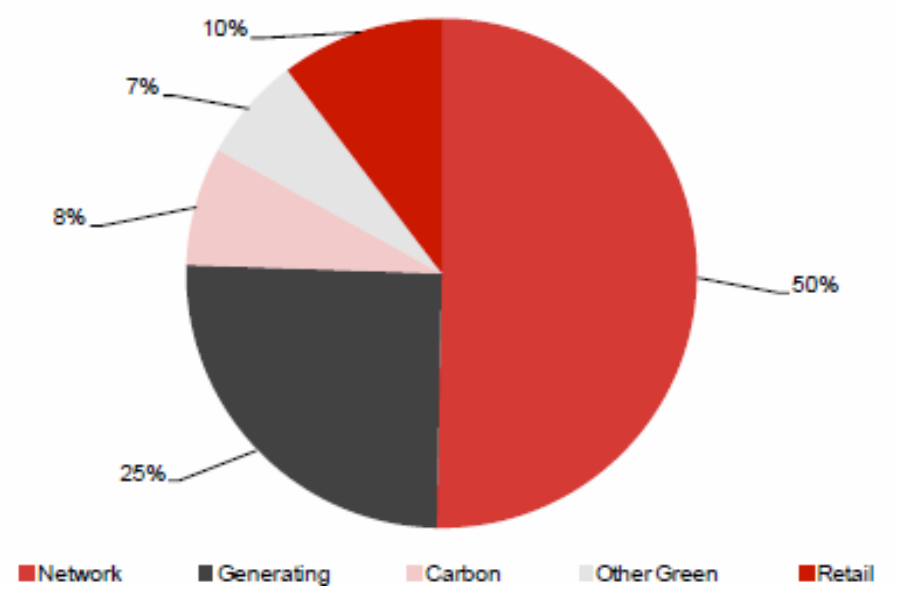
141 Ison, N; Usher, J; Cantley-Smith, R; Harris, S and Dunstan, C. (2011) 'The NEM Report Card: How well does the National Electricity Market serve Australia?' Prepared by the Institute for Sustainable Futures and the Monash University Faculty of Law for the Total Environment Centre, p. 46.

142 Australian Energy Regulator, 'State of the energy market 2010', p. 98.

determines a maximum retail margin allowance. In its most recent determination, IPART fixed the maximum retail margin at 5.4 per cent.[143]

4.25 The Auditor-General found that transmission and distribution costs make up the largest proportion of retail prices, constituting about 50 per cent. Wholesale prices comprise about 25 per cent of the cost of an average residential electricity bill, retail costs 10 per cent, and 'green' schemes instituted by government add a further 15 per cent. This section will therefore examine the recent price rises in retail electricity prices, and the effect of each of these components.

Figure 15: Composition of an indicative annual bill for customers in all NSW supply areas, 2012-13



Source: New South Wales Auditor-General's Report, 'Financial Audit Volume Four 2012; focusing on electricity'.

4.26 The Independent Pricing and Regulatory Tribunal (IPART) regulates the retail price of electricity in NSW. IPART's terms of reference require it to ensure that prices reflect efficient costs of supplying electricity, the market remains competitive, and that retailers are able to finance their operations. As a result, IPART has approved significant increases in the retail price of electricity. The regulated price of electricity in NSW rose by an average of 10 per cent in 2010-11, 17.2 per cent in 2011-12, and a further 18.1 per cent from 1 July 2012.[144]

4.27 IPART notes that the introduction of a carbon pricing mechanism, combined with the cost of other green schemes, accounts for just over half of the 2012 increase of 18.1 per cent. Increased network costs account for the other half. Neither wholesale nor retail costs were significant contributors to retail price increases; indeed, wholesale prices actually declined as a proportion of electricity bills.[145]

143 Independent Pricing and Regulatory Tribunal, 'Review of regulated retail tariffs and charges for electricity, 2010 – 2013', March 2010, pp. 15-16.

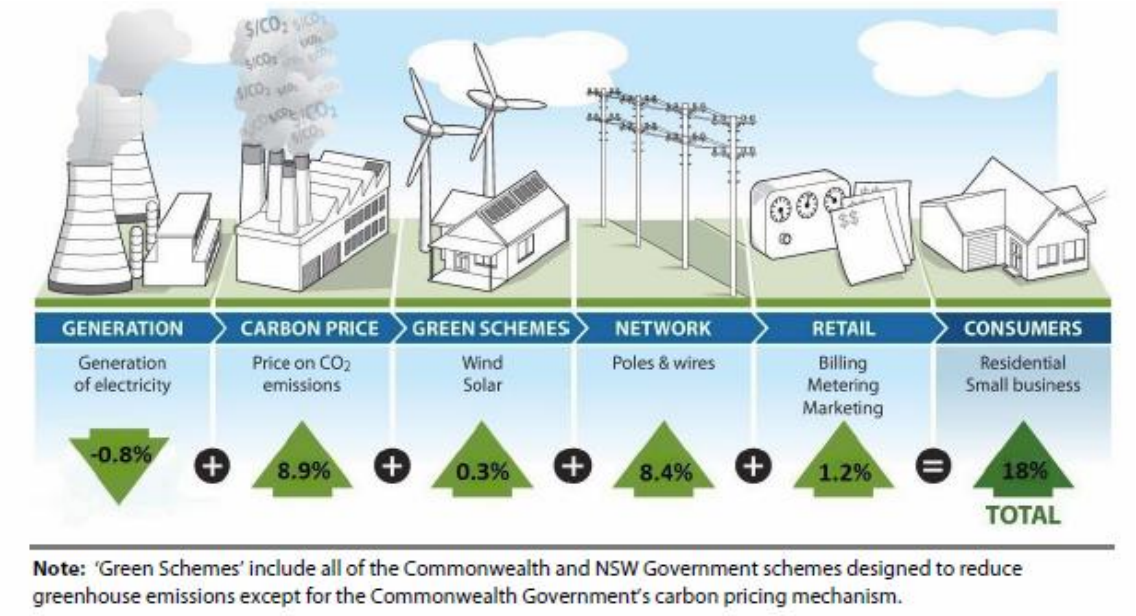
144 Independent Pricing and Regulatory Tribunal, 'Changes in regulated electricity prices from 1 July 2012', June 2012, p. 1.

145 Industry and Investment NSW, 'NSW Electricity Network and Prices Inquiry', December 2010, pp. 38-39.

Network costs

4.28 Increased network costs account for the bulk of retail price increases in recent years. In evidence, Mr David Swift, Executive General Manager, Corporate Development, AEMO, remarked that, 'I think the reports would generally show the largest single component of price rises over recent rises has been the increasing cost of networks.'[146] The figure below shows that network costs accounts for 8.4 per cent of the 18 per cent increase in 2012, while the carbon price, together with the cost of implementing other 'green schemes', accounts for 9.2 per cent.

Figure 16: Drivers of increase in average regulated retail electricity prices in NSW on 1 July 2012 (nominal %)



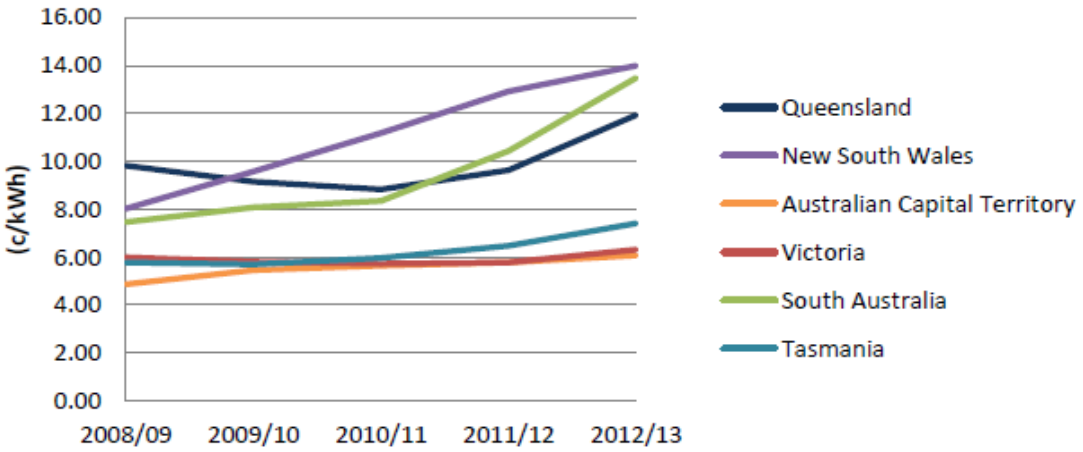
Source: IPART, 'Changes in regulated electricity retail prices from 1 July 2012', Draft report, April 2012, p. 1.

4.29 Network costs are regulated by the AER, and these costs are passed on by IPART in its price determinations, leading to increased retail prices. In its 'State of the Energy Market 2011' report, the AER observed large increases in network investment across Australia in recent years. The regulatory cycle is five years, which is designed to offer investors some certainty in the development of large projects.[147] The figure below shows increases in total network charges in different states since 2008-2009.

146 Mr David Swift, Executive General Manager, Corporate Development, AEMO, Evidence, 26 March 2012, p. 14.

147 Australian Energy Regulator, 'State of the energy market 2011', p. 57.

Figure 17: Total network charges, real 2008/09 – 2012/13



Source: Australian Energy Market Commission[148]

4.30 Investment in transmission networks around Australia is valued at $7 billion over the current five year cycle, and in distribution networks at $35 billion. This represents an increase of 82 per cent in transmission costs and 62 per cent in distribution investment over the previous period.[149]

4.31 However, increases are more marked in the distribution sector than in transmission.[150] The Australian Energy Market Commission (AEMC) estimates that capital expenditure by distribution businesses in NSW (Ausgrid, Essential Energy and Endeavour Energy) will reach $14.4 billion over the current five-year regulatory period from 2008-2009 to 2013-2014, an increase of 80 per cent over the previous period.[151]

4.32 The Australian Energy Regulator observed that factors driving increased network investment vary between states, with NSW requiring increased investment due to ageing assets and growing peak demand.[152] High levels of expenditure to replace ageing assets were noted by the Australian Energy Market Commission, which observed that Ausgrid (the largest of the NSW distributors) is expected to spend 46 per cent of its capital expenditure on replacing equipment over the regulatory period. Essential Energy and Endeavour energy are both expected to spend over 20 per cent of their capital expenditure on replacements.[153] The figure below shows the growth in capital expenditure allowance determinations in NSW.

148 Australian Energy Market Commission, Submission to Senate Select Committee on Electricity Prices, 14 September 2012, p. 5.

149 Australian Energy Regulator, 'State of the energy market 2011', p. 62.

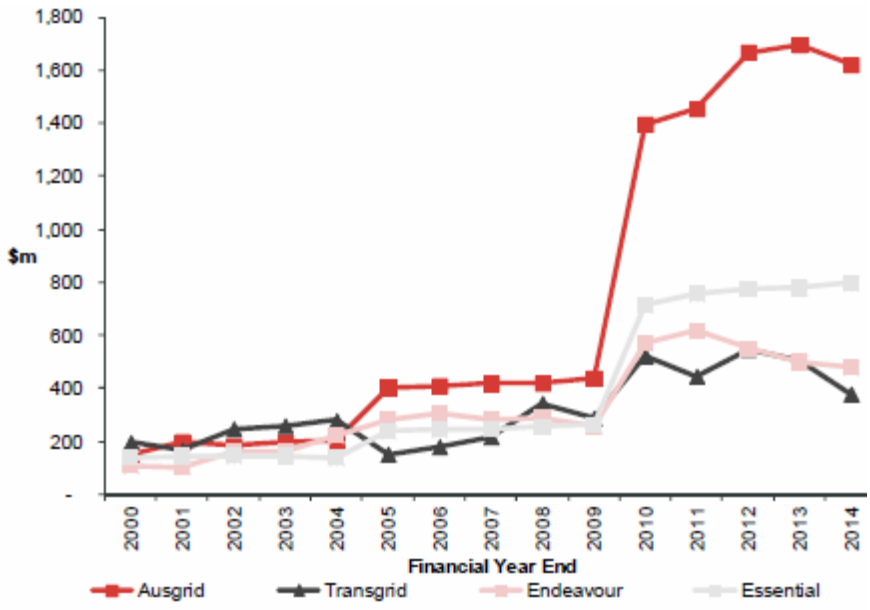
150 Australian Energy Regulator, 'State of the energy market 2011', p. 62.

151 Australian Energy Market Commission, 'Final Report: Possible future retail electricity price movements', 25 November 2011, p. 31.

152 Australian Energy Regulator, 'State of the energy market 2011', p. 63.

153 Australian Energy Market Commission, 'Final Report: Possible future retail electricity price movements', 25 November 2011, p. 31.

Figure 18: Capex Allowance Determinations



Source: NSW Auditor-General's Report, 'Financial Audit Volume Four 2012; focusing on electricity'.

4.33 The need to invest in order to replace ageing assets was observed by participants in the Inquiry, including Mr Peter McIntyre, Managing Director, TransGrid, who commented on the 'lumpy' nature of transmission network investment:

> The transmission sector has developed a network. It has been maintained prudently and has never had costs cut out of it to the point where it was of concern, and it is now investing what is required. On transmission only, you have to appreciate that these assets are long-life assets that last 50 years ... Most of the transmission network in New South Wales was built in the 1960s … That network provided a lot of capacity for a number of years and over several decades you have not needed to invest or have not just poured money in, you have had a lot of capacity. That capacity gets eroded as loads increase and there comes a time when that capacity is eroded and you need to make your next cycle of investment. Transmission people talk very much around investments being large and lumpy, and we are at the stage of doing some large investments. They are necessarily lumpy investments, but when they are completed we will go back to a far lower investment cycle again for some years.[154]

4.34 Similarly, in his 2012 audit report, the NSW Auditor-General found that increased network charges have been caused by significant capital investment on the part of transmission and distribution companies. This capital investment is necessary for three reasons: to cope with growing loads and rising peak demand, to replace ageing assets, and to meet network reliability standards, which are discussed below.[155]

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154 Mr Peter McIntyre, Managing Director, TransGrid, Evidence, 26 March 2012, p. 60.

155 New South Wales Auditor-General's Report, 'Financial Audit Volume Four 2012: focusing on electricity', p. 8.

Reliability standards

4.35 The Reliability Standard established by the Australian Energy Market Commission currently specifies that no more than 0.002 per cent of energy should be unserved (meaning that networks should be 99.998 per cent reliable).[156]

4.36 Licence conditions for NSW distributors were also amended in 2005, to improve standards for reliability, design and performance.[157] This also required further expenditure from distributors to meet revised standards. The Australian Energy Regulator estimated that enhancements to reliability and quality of service comprise about 10 per cent of total capital expenditure by NSW distributors over the current regulatory period.[158]

4.37 Reliability standards have been criticised by some sectors of the electricity supply industry as being too high, and therefore too expensive to meet. For example, in evidence to the Committee, Mr McIntyre observed that: 'It is certainly true that the reliability standards on distribution have led to other cost increases … It is open to the Government to look at that trade-off between reliability and cost.'[159] The Energy Network Association estimates that new standards in NSW have led to an estimated $2.75 billion in capital expenditure.

4.38 At the Standing Council on Energy and Resources meeting in 2011, ministers noted that distribution network investment was a large contributor to rising retail prices, and directed the Australian Energy Market Commission to review distribution reliability standards.[160]

4.39 The Australian Energy Market Commission completed its review of distribution reliability outcomes and standards in NSW in 2012. In its comments on the draft report of that review, IPART expressed the view that:

> The AEMC draft report provides evidence that the current distribution reliability standards in NSW may be too high … Having reliability standards that are too high means that unnecessary capital investments are undertaken to meet these standards. This imposes costs on electricity consumers through higher electricity prices and bills.[161]

4.40 The Productivity Commission, in its 2012 report on 'Electricity Network Regulatory Frameworks', also argued that reliability standards are too high. It

156 AEMO, 'Electricity Statement of Opportunities 2011', p. 6-1.

157 Australian Energy Market Commission, 'Final Report: Possible future retail electricity price movements', 25 November 2011, p. 31.

158 Australian Energy Market Commission, 'Final Report: Possible future retail electricity price movements', 25 November 2011, p. 31.

159 Mr Peter McIntyre, Managing Director, TransGrid, Evidence, 26 March 2012, p. 63.

160 Energy and Resources Ministers' Meeting Communiqué, June 2011. See: http://www.ret.gov.au/Documents/mce/_documents/2011bulletins/Meeting-Communique-10-June-2011.pdf, accessed 4 September 2012.

161 Peter Boxall, Chairman, Independent Regulatory and Pricing Tribunal, 'Submission on draft report of Australian Energy Market Commission Review of distribution reliability standards and outcomes – NSW Workstream', 13 July 2012, p. 2.

estimated that $1.1 billion in capital expenditure in distribution networks could be deferred in NSW if different reliability standards were used.[162]

4.41 However, the Australian Energy Market Commission estimated that reducing reliability standards in NSW would result in only modest savings for consumers, as costs relating to reliability standards form only a small driver of distribution costs which are, in turn, only one factor in driving electricity prices.[163] The AEMC estimated that a modest reduction in reliability standards could provide a saving of $3 a year per customer, and an extreme reduction a saving of $15 a year.[164] Further, these savings would not appear for some time, as investment to meet reliability standards has already occurred.

Over-investment

4.42 Some critics also argue that the current regime of market regulation provides unintended incentives to transmission and distribution companies to over-invest in network infrastructure. For example, in its submission to the Productivity Commission Inquiry into electricity network regulation, AEMO expressed the view that:

> Revenue regulation rewards TNSPs [Transmission Network Service Providers] for building transmission assets, rather than the services those assets provide. Despite a major overhaul of the NER [National Electricity Rules] in 2006 to drive network businesses to provide services for their returns the revenue setting calculation, known as the building block approach, a significant proportion of their revenue is based on the cost of new investments.[165]

4.43 As explained in the previous Chapter, electricity transmission and distribution businesses (such as TransGrid and Ausgrid in NSW) must apply to the Australian Energy Regulator (AER) to assess their revenue requirements. The AER makes a number of decisions, principally in relation to the rate of return on capital to apply to the network service provider's asset base for the next regulatory period, and capital and operating expenditure allowances and incentives to apply for the next period.

4.44 AEMO argues that the 'building block approach', by which the revenue of network business is assessed, rewards the building of assets. Because the revenue of transmission network service providers is based on the value of their assets, these providers have an incentive to invest in building further assets. Similarly, the Productivity Commission also found that 'the incentive regulation regime encourages businesses to build too much'.[166]

4.45 In its report, the Productivity Commission also found that the regulatory regime provides unintended incentives for network businesses to invest:

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162 Productivity Commission, 'Electricity Network Regulatory Frameworks – Draft Report', October 2012, p. 3.

163 Australian Energy Market Commission, 'Final Report – NSW Workstream: Review of distribution reliability outcomes and standards', 31 August 2012, p. iii.

164 Australian Energy Market Commission, 'Final Report – NSW Workstream: Review of distribution reliability outcomes and standards', 31 August 2012, p. iii.

165 AEMO, 'Electricity network regulation: AEMO's response to the Productivity Commission's Issues Paper', May 2012, p. 21.

166 Productivity Commission, 'Electricity Network Regulatory Frameworks – Draft Report', October 2012, p. 3.

> Several aspects of the regulatory environment – one a function of the Rules, and the other a consequence of state-ownership of businesses – may collectively have unwittingly frustrated the purpose of incentive regulation. Some businesses have spent much more than the regulator's revenue allowance. Any excess capital spend (capex) is rolled into a business's Regulatory Asset Base at the next regulatory determination. While it cannot recover revenue to meet the cost of this additional capex during the relevant regulatory period, the business can earn a return on that excess capex for the remaining (usually long) life of the assets.[167]

4.46 The Productivity Commission considered that there is 'reasonable concern' that the weighted cost of capital used to determine returns may have been too high.[168] Australian Energy Market Commission observed that the rate of return on capital investments is currently set at 10.02 per cent. This figure is higher than the previous regulatory period, due to the higher costs of borrowing following the Global Financial Crisis.[169]

4.47 The relatively high rate of return on capital investments was also observed by Professor Ross Garnaut, who noted that the problem appears to be greater among government-owned providers:

> There is an unfortunate confluence of incentives that has led to significant overinvestment in network infrastructure. It is clear from market behaviour that the rate of return that is allowed on network investments exceeds the cost of supplying capital to this low-risk investment. The problems are larger where the networks continue to be owned by state governments. State government owners have an incentive to overinvest because of their low cost of borrowing and tax allowance arrangements.[170]

4.48 Similarly, in evidence to the Committee, Mr Edward Santow, Chief Executive Officer, Public Interest Advocacy Centre, observed that research indicates that distribution networks owned by government have higher costs than those that are privately owned:

> Government-owned distribution network service providers, as we have in New South Wales and Queensland, currently charge almost twice as much as privately-owned distribution network service providers, and that gap has been getting bigger and bigger since 2001 and is projected to increase even further until at least the middle of the current decade.[171]

4.49 The Productivity Commission, in its report, recommended privatisation of state-owned transmission and distribution businesses.[172]

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167 Productivity Commission, 'Electricity Network Regulatory Frameworks – Draft Report', October 2012, p. 24.

168 Productivity Commission, 'Electricity Network Regulatory Frameworks – Draft Report', October 2012, p. 24.

169 Australian Energy Market Commission, 'Final Report: Possible future retail electricity price movements', 25 November 2011, p. 31.

170 Garnaut, R., 'The Garnaut Review 2011', Cambridge University Press, p. 155.

171 Mr Edward Santow, Chief Executive Officer, Public Interest Advocacy Centre, Evidence, 11 May 2012, pp. 26-27.

172 Productivity Commission, 'Electricity Network Regulatory Frameworks – Draft Report', October 2012, p. 3.

4.50 The Australian Energy Market Commission is currently proposing a number of changes to the National Electricity Rules which govern the rate of return, capital expenditure incentives and capital and operating expenditure allowances for electricity distribution businesses.[173] These include:

- The AEMC is proposing to introduce a common framework that requires the AER to make the best possible estimate of the rate of return at the time a regulatory determination is made, taking into account market circumstances, estimation methods, financial models and other relevant information. The rate of return is a key determinant of network prices.

- The AEMC also proposes changes to the National Electricity Rules to provide new tools such as capital expenditure sharing schemes and efficiency reviews, so that the AER can provide incentives for network businesses to invest capital efficiently. The objective is that only capital expenditure that is efficient should form part of a distribution business's regulated asset base. This rule change was proposed in response to two concerns: that the power of the incentive to incur capital expenditure efficiently declines during a regulatory period, and capital expenditure above the allowance is not subject to any regulatory scrutiny.

- The AEMC proposes rule changes to clarify the powers of the AER to interrogate, review and amend capital and operating expenditure allowances. As part of the proposed rule changes, the AER will be required to publish benchmarking information used to assess reasonable expenditure.

- Finally, the regulatory determination process will be longer, to allow greater stakeholder consultation. Accountability and transparency will also be improved by a requirement that network businesses provide reasons for any claims of confidentiality, and evidence of consumer engagement.[174]

Consumer advocacy

4.51 There is opportunity for a greater role for consumer advocacy in the National Electricity Market. In its 2012 report on 'Electricity Network Regulatory Frameworks' the Productivity Commission commented on consumer advocacy in the NEM, noting that there are a variety of consultative bodies and mechanisms in place for consulting with consumers.[175] However, the Commission's report identified several weaknesses with current consumer advocacy in energy markets, including:

> a lack of a national voice; insufficient coordination; insufficient research and data (such as the lack of a national research base on energy consumer issues and inadequate access to relevant data); a too narrow focus on particular consumer

173 Australian Energy Market Commission, 'Draft determination information sheet: Economic regulation of networks', 23 August 2012, p. 3.

174 Australian Energy Market Commission, 'Draft rule determinations: Draft National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012', 23 August 2012, pp. ii – vii.

175 Productivity Commission, 'Electricity Network Regulatory Frameworks – Draft Report', October 2012, p. 706.

> groups; insufficient resources and funding; insufficient skills or access to the right technical expertise; failure by decisions makers to consult adequately; and a lack of attention given to the overall regulatory framework. [176]

4.52 The Productivity Commission considered there were grounds for strengthening consumer engagement and representation in electricity network regulation and supported the creation of a single national consumer body, funded by market participants, to more effectively represent the interests of consumers in NEM policy, regulatory and merits review processes. The Productivity Commission recommended that:

> There should be adequate ongoing funding of a single but broadly representative consumer body with expertise in economic regulation and relevant knowledge and understanding of energy markets. This body would:
>
> - represent the interests of all consumers during energy market policy formation, regulatory and rule-making processes, merit reviews, and negotiations with providers of electricity networks and gas pipelines
> - subsume the role of the existing Consumer Advocacy Panel into its broader functions
> - be funded through a levy on market participants, drawing on the approach used to currently fund the Consumer Advocacy Panel
> - have a governance structure that involved a board of members appointed on merit, and an advisory panel to give the board advice on the needs of the mix of customers concerned. [177]

Cost of sustainable energy schemes

4.53 The costs of complying with government 'green' or sustainable energy schemes are passed on to consumers. Sustainable energy schemes have also contributed to rising retail electricity prices, though to a lesser extent than network costs. There are a number of different schemes that impact on the retail price of electricity. Some of these have now been phased out, while the carbon price began on 1 July 2012. The impact of the carbon price will be discussed separately in the next chapter.

Renewable Energy Target (RET)

4.54 The most significant of the sustainable energy schemes is the federal government's Renewable Energy Target (RET). The original Mandatory Renewable Energy Target (MRET) was introduced in 2001, and required wholesale buyers of electricity to purchase a portion of their energy from renewable sources through the purchase of Renewable Energy Certificates. Certificates are produced by renewable energy generators, and the scheme is administered by the federal government's Clean Energy Regulator.

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176 Productivity Commission, 'Electricity Network Regulatory Frameworks – Draft Report', October 2012, p. 710.

177 Productivity Commission, 'Electricity Network Regulatory Frameworks – Draft Report', October 2012, p. 715.

4.55 In 2009 the MRET was increased from 9,500 GWh by 2010 to the current 45,000 GWh, or 20 per cent, by 2020. In 2011, the scheme was further re-structured, and divided into the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES).

4.56 To date, most of the new renewable energy produced under the LRET has come from wind and bio-mass.[178] The Small-scale Renewable Energy Scheme assists households and businesses with the cost of installing small-scale renewable energy systems – typically solar PVs.

4.57 Uptake of small-scale renewable systems was low for several years. However, the introduction of the Commonwealth Solar Credits program in 2009, combined with feed-in tariffs in several states (including the Solar Bonus Scheme in NSW), led to a large increase in uptake of small-scale systems. This meant that large numbers of Renewable Energy Certificates were produced, which in turn drove down their price and discouraged investment.[179] In evidence, Mr Lane Crockett, General Manager, Pacific Hydro, described the problems created by the SRES:

> The intention [of the Renewable Energy Target] is to build industry capacity in renewables so that there is capacity within the country to efficiently deliver renewable energy throughout Australia, thereby providing clean energy and emissions reduction. That is the basic tenet of the legislation … putting a 5:1 ratio on solar created a lot more certificates than anyone expected and at the expense of the large-scale infrastructure. I have to say, possibly being undiplomatic for a moment, that the State-based policies also played a hand in that as well. So that 5:1 ratio plus some State-based incentives caused it to just go crazy.[180]

4.58 In its 2012 review of electricity regulation networks, the Productivity Commission was also critical of the Small-scale Renewable Energy Scheme – and similar state-based schemes – arguing that these are inefficient and should be abolished:

> Current subsidies to particular forms of distributed generators have had few benefits for the network and, in the face of carbon pricing, now play a redundant (and inefficient) role as a measure for reducing emissions. Governments should therefore phase out as quickly as practicable subsidies for rooftop photovoltaic units, other forms of distributed generation delivered via feed-in tariffs, and the small-scale component of the Renewable Energy Targets Scheme.[181]

4.59 The Renewable Energy Target is currently being reviewed by the Climate Change Authority. The *Renewable Energy (Electricity) Act 2000* (Cth) requires the Commonwealth to review the scheme every two years. Pricing of solar power is addressed in Chapter Eight, while distributed generation is discussed in more detail in Chapter Ten.

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178 Australian Government Climate Change Authority, 'Renewable Energy Target Review: Issues Paper,' August 2012, p. 20.

179 Australian Government Climate Change Authority, 'Renewable Energy Target Review: Issues Paper,' August 2012, p. 32.

180 Mr Lane Crockett, General Manager, Pacific Hydro, Evidence, 11 May 2012, p. 16.

181 Productivity Commission, 'Electricity Network Regulatory Frameworks – Draft Report', October 2012, p. 15.

4.60 Estimates of the costs of complying with the RET vary. In its report on possible future retail electricity price movements from 2011 – 2014, the Australian Energy Market Commission estimated that the 'enhanced' RET comprises approximately 2.2 to 3.4 per cent of a residential electricity bill.[182] Similarly, in its Electricity Network and Prices Inquiry in 2010, the NSW Department of Industry and Investment estimated an increase of around 4 per cent in retail tariffs from 2011 as a result of changes to the RET scheme.[183]

NSW sustainable energy schemes

4.61 The NSW Climate Change Fund was established by the *Energy and Utilities Administration Act 1987*. It funds rebates for installation of energy and water saving systems. To pay for the fund, the government levies a Climate Change Fund Levy on electricity distribution businesses, and the cost of this levy is passed on to consumers. In 2010-2011, for example, distribution companies were required to contribute a total of $150 million to the Climate Change Fund. This accounts for approximately 1 per cent of retail electricity prices.[184]

4.62 The NSW Solar Bonus Scheme is designed to encourage householders to install solar photovoltaic (PV) systems, by providing a feed-in tariff for systems which are connected to the grid. Distribution companies purchase the electricity fed into the grid from these systems. The NSW government reimburses retailers for this cost, largely from the Climate Change Fund. The Scheme commenced on 1 January 2010. It has since been closed to new customers, but will continue to operate until 2016.[185] The Solar Bonus Scheme is discussed further in Chapter Eight.

4.63 The NSW Greenhouse Gas Reduction Scheme (GGAS) was an emissions trading scheme which required NSW electricity retailers and large energy users to meet targets for reduction of greenhouse gases. IPART estimated that the net effect of the scheme on the retail price of electricity was small.[186] The GGAS was closed on 1 July 2012, with the introduction of the federal carbon price.

4.64 The NSW Energy Savings Scheme is designed to create a financial incentive to reduce electricity consumption by encouraging energy saving activities. Organisations participating in the scheme implement energy saving projects (e.g. replacing or modifying equipment, or installing high efficiency equipment) and through this, create certificates based on the amount of energy saved. Each certificate is equivalent to one tonne of CO_2 emissions avoided. Certificates can then be sold, usually to electricity retailers. The Scheme is administered by IPART.[187]

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182 Australian Energy Market Commission 'Possible future retail electricity price movements: 1 July 2011 to 30 June 2014', 25 November 2011, p. 15.

183 Industry and Investment NSW, 'NSW Electricity Network and Prices Inquiry', December 2010, p. 37.

184 Industry and Investment NSW, 'NSW Electricity Network and Prices Inquiry', December 2010, p. 21.

185 New South Wales Auditor-General's Report (2011) 'Special Report: Solar Bonus Scheme', p. 27.

186 Independent Pricing and Regulatory Tribunal, 'Modelling options for improving GGAS: A report to the GGAS taskforce on stage 1 modelling', November 2010, p. 4.

187 Independent Pricing and Regulatory Tribunal, 'Energy Savings Scheme Fact Sheet', p. 3, www.ess.nsw.gov.au, accessed 8 October 2012.

GreenPower

4.65 The GreenPower scheme is also designed to encourage investment in renewable energy, but is consumer-driven. Through the GreenPower scheme, electricity retailers provide consumers with the option to purchase 'GreenPower' (i.e. electricity generated from renewable sources) products. GreenPower was introduced by the NSW Government in 1997 and has since been expanded across Australia, with most major electricity retailers offering some form of GreenPower product. In its most recent report, GreenPower indicates that almost 750,000 customers are currently using GreenPower products.[188]

COMPETITION IN THE RETAIL MARKET

4.66 At the Council of Australian Governments (COAG) meeting in 2006, the NSW government agreed to phase out regulation of retail electricity pricing. All states and territories were party to this agreement, which was conditional upon effective competition being demonstrated in the retail market.

4.67 According to the Australian Energy Market Agreement, each state or territory is required to submit its retail energy market to the Australian Energy Market Commission (AEMC) for review, to determine whether competition is sufficiently effective to allow removal of price controls. For example, the AEMC completed a review of the ACT market in 2011 and found that competition in that market was not effective. At present, the only state which does not regulate retail prices is Victoria. The AEMC is scheduled to conduct a review of the NSW market in 2012.

4.68 Mr Mark Duffy, Deputy Director-General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, advised that, if competition is effective, de-regulation is unlikely to have a negative impact on price outcomes for consumers:

> if competition is effective, and that is what will be determined for you because the AEMC is looking at that issue, and it looked at it in Victoria, if you are satisfied that competition is effective then the answer would be that the price would be roughly the same or a little bit better than they are now for consumers.[189]

4.69 Some participants in the Inquiry argued in favour of price de-regulation. For example, Ms Clare Savage, Executive General Manager, Electricity Supply Association of Australia, argued that:

> you cannot continue to regulate retail prices because for as long as you sit on that end price signal that runs through to customers, the ability of prices to actually reflect cost is in the hands of someone other than the business. So from the perspective of a market, if you have a competitive market, which the review will look at this year in New South Wales, there is no reason why you need to continue to regulate retail prices.[190]

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188 GreenPower, 'National GreenPower Accreditation Program Status Report: Quarter 1: 1 January – 31 March, 2012', NSW Department of Trade and Investment, Regional Infrastructure and Services, p. 4.

189 Mr Mark Duffy, Deputy Director General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 9.

190 Ms Clare Savage, Executive General Manager, Electricity Supply Association of Australia, Evidence, 26 March 2012, p. 38.

4.70 The National Generators Forum also favoured price de-regulation, though for different reasons. Mr Greg Everett, Director, National Generators Forum, argued that de-regulation would encourage competition among retailers and therefore benefit generators:

> because there would be more competition and more players. To be honest, that is a fairly basic economic principle. What we are seeing at the moment from a wholesaler's perspective is that the Independent Pricing and Regulatory Tribunal rates allow roughly $70 per megawatt hour as the wholesale cost of electricity and the actual market purchase price is about $40. So there is a margin for retailers of roughly $30 per megawatt hour at the moment just on that purchase. It is fairly common knowledge that if you seek a discount on your electricity price you can achieve about 10 per cent, and 10 per cent of the new rate of about $300 is about $30. That is a simplified approach, but it is not difficult to come to the conclusion that the discounts being offered at the moment are the difference between the regulated price for electricity versus what they actually pay rather than discounting their own margin.[191]
>
> Mr JOHN WILLIAMS: So you are absorbing the discount as generators?[192]
>
> Mr Everett: Yes.[193]

4.71 However, Inquiry participants expressed a range of different views about whether the current level of competition in the electricity market is effective. Mr Ross Edwards, General Manager, Business Development, TRUenergy, expressed the view that competition in the retail market is strong:

> we face strong competition in the retail market which I think is generally a good thing. It is on us to ensure that we meet our customers' requirements and maintain our customers. I think that is a positive but always a focus for our business.[194]

4.72 Ms Savage also felt that the competition currently operating in the retail market is very effective:

> I think after TRUenergy won the EnergyAustralia customers AGL said they would make it their life's work to win every single one of them off TRUenergy. I do not know how they are going but it certainly is a fairly vicious sort of market. I think that from some perspectives customers find the door-to-door sales techniques and some of the other things difficult, so as an industry we have to look at how we manage that. It is definitely a very competitive market.[195]

4.73 However, some participants expressed concerns about market concentration; that is, that the retail electricity market is dominated by a small number of very large companies. For example, Mr Lane Crockett, General Manager, Pacific Hydro, expressed concerns about the effects of market concentration on competition:

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191 Mr Greg Everett, Director, National Generators Forum, Evidence, 11 May 2012, p. 23.

192 Mr John Williams MP, 11 May 2012, p. 23.

193 Mr Greg Everett, Director, National Generators Forum, Evidence, 11 May 2012, p. 23.

194 Mr Ross Edwards, General Manager, Business Development, TRUenergy, Evidence, 26 March 2012, p. 30.

195 Ms Clare Savage, Executive General Manager, Electricity Supply Association of Australia, Evidence, 26 March 2012, pp. 40-41.

> One of the concerns we have, and this has been talked about in New South Wales and at a Federal level, is the size of three major retailers and the fact they have a significant proportion of the market—New South Wales and the national electricity market. I am not sure I have a suggestion about how to deal with that. That is a reality since New South Wales sold off their retailers. It just means there are now three very large retailers who control that market. We do not necessarily see that as good for competition but I am not really able to suggest what you might do about that. I just know that is a concern in the industry.[196]

4.74 Further, Mr Edward Santow, Chief Executive Officer, Public Interest Advocacy Centre, argued that the NSW retail market is not ready for price de-regulation:

> Many of the questions in relation to price deregulation remain unresolved and, so far at least, I do not think that a clear, compelling case has been made that the time is now right for deregulation – at least, it has not been, I think, properly established.[197]

Assistance to disadvantaged consumers

4.75 The NSW Government provides a number of rebates to disadvantaged consumers to assist with electricity costs.[198] These are:

- The Low Income Household Rebate, which replaced the Energy Rebate in 2011. The rebate is available to pensioners and others with a Health Care Card. It provides assistance of $200 a year and is paid in instalments as a credit on a consumer's electricity bill.
- The Family Energy Rebate provides a further $75 a year in assistance to families eligible for the Family Tax Benefit. Families need to apply once they have lodged a tax return, and the rebate is paid as a credit on the household's electricity bill.
- The Medical Energy Rebate provides assistance of $215 a year to low-income consumers with certain medical conditions that make them unable to self-regulate body temperature (such as Parkinson's disease or multiple sclerosis). The Medical Energy Rebate can be paid in addition to other assistance such as the Low Income Household Rebate.
- The Life Support Electricity Rebate provides assistance of up to $600 a year for consumers who need to use certain medical equipment (such as dialysis machines or ventilators) at home. The rebate paid varies according to the type of machine and level of use.
- The Energy Accounts Payment Assistance Scheme provides assistance to disadvantaged consumers who are unable to pay their energy bills. Assistance is provided in the form of vouchers (each voucher is worth $30) which are issued by eligible community organisations such as the Salvation Army.

196 Mr Lane Crockett, General Manager, Pacific Hydro, Evidence, 11 May 2012, p. 14.

197 Mr Edward Santow, Chief Executive Officer, Public Interest Advocacy Centre, Evidence, 11 May 2012, p. 25.

198 http://www.trade.nsw.gov.au/energy/customers/rebates, accessed 1 November 2012.

Committee comment

4.76 The Committee acknowledges substantial community concerns about increases in the retail price of electricity. A number of factors have contributed to these price increases, including the cost of maintaining networks and the implementation of various sustainable energy schemes.

4.77 The Committee was surprised by the volatility of the wholesale electricity market and notes that wholesale prices have not contributed to price increases. However, the carbon tax and other green schemes account for over half of the retail price increase in NSW in 2012. The Committee notes that coal-powered generation is the cheapest form of electricity generation in NSW, and further notes that green schemes, including subsidies for renewable energy generation, account for 15 per cent of retail electricity prices.

4.78 Increasing costs of transmission and distribution networks have contributed significantly to rising retail prices. The Committee recognises the importance of capital investment to maintain the high levels of service that NSW customers deserve. However, the Committee is concerned that the current regulations governing investment may create unintended incentives for transmission and distribution network service providers to invest.

4.79 The Committee recognises the importance of regulating transmission and distribution service providers who operate an effective monopoly. However, the Committee is concerned that the current regulations may not provide the Australian Energy Regulator with effective powers to scrutinise proposed expenditure by network service providers. The Committee therefore supports the rule changes currently proposed by the Australian Energy Market Commission in relation to the rate of return, capital expenditure incentives, capital and operating expenditure allowances, and the regulatory determination process.

4.80 The Committee notes that the possibility of selling NSW transmission and distribution businesses has been canvassed extensively in other forums, and makes no recommendation in relation to this issue. However, the Committee does note that privatisation of transmission and distribution assets would allow the NSW Government to perform its role as a regulator of the market without any conflict of interest.

4.81 The Committee does not support a reduction in reliability standards in NSW, unless it can be demonstrated that such a reduction will lead to substantial savings for consumers. However, this is an issue that the NSW Government should continue to monitor.

4.82 The Committee considers that there is a role for greater consumer advocacy in the regulation of the National Electricity Market. The Committee therefore endorses the recommendation of the Productivity Commission to establish a single consumer body, funded by market participants, which is able to represent the interests of all consumers during energy market policy formation, regulatory and rule-making processes, merit reviews, and negotiations with providers of electricity networks.

4.83 The Committee believes that the Commonwealth Government's carbon pricing scheme and Renewable Energy Target provide an adequate framework to encourage investment in alternative forms of energy generation. The Committee therefore supports the closure of the NSW Greenhouse Gas Abatement Scheme and does not support implementation of further sustainable energy supply schemes in NSW that may add further costs for consumers.

4.84 The Committee appreciates the advantages of maintaining the Large-scale Renewable Energy Target until its expiry date. However, the Committee is concerned by the Small-scale Renewable Energy Scheme (SRES). The Committee looks forward to the outcomes of the comprehensive review of the RET scheme being conducted by the Climate Change Authority.

4.85 In view of the Commonwealth's imposition of the Renewable Energy Target and the Carbon Pricing Scheme, the Committee believes that the Commonwealth, rather than the States, should provide assistance to disadvantaged consumers. Income support is a Commonwealth responsibility.

4.86 The Committee believes that effective competition will provide the best outcomes for electricity consumers and that both wholesale and retail markets should be allowed to operate freely wherever reasonably possible. The Committee received some evidence in favour of retail price de-regulation in New South Wales and believes that price regulation is an impediment to future investment in energy generation. However, this was not the focus of our Inquiry.

4.87 The Committee therefore urges the NSW Government to maintain its existing commitment to price de-regulation in accordance with the National Electricity Agreement. The Committee looks forward to the outcomes of the Australian Energy Market Commission inquiry into the effectiveness of competition in the retail electricity market in NSW, which is scheduled to commence in December 2012.

RECOMMENDATION 2

That the NSW Government not consider further implementation of sustainable energy supply schemes that add further costs to consumers.

RECOMMENDATION 3

That the Minister for Resources and Energy, through his position on the Standing Council on Energy and Resources, support the rule changes proposed by the Australian Energy Market Commission to increase the powers of the Australian Energy Regulator.

RECOMMENDATION 4

That the NSW Government remove price regulation when competition is found to be effective in NSW by the Australian Energy Market Commission.

Chapter Five – Energy Security

5.1 This chapter directly addresses item (iii) in the Terms of Reference, examining issues relating to long term energy security in New South Wales. It considers:

- different definitions of energy security,
- energy security in the context of the National Electricity Market (NEM) and NSW's commitment to the NEM,
- the likely impact of carbon pricing on future energy investment,
- the effect of rising fuel prices, particularly gas prices, and,
- the role of government in ensuring energy security in an environment where it is no longer a direct participant in the wholesale electricity market.

5.2 The chapter also summarises the findings of the Citizens' policy juries convened by the NewDemocracy Foundation as they relate to energy security.

5.3 The Committee found that the appropriate role of Government is to regulate the market, rather than to participate in it. The Committee therefore found that the NSW Government should expedite the sale of generation assets and the Cobbora coal mine. However, the Committee also found that there is a role for government to support and encourage innovation and development of new industries.

Definitions of energy security

5.4 The concept of 'energy security' can be defined in different ways. These different definitions commonly focus on three inter-related elements: adequacy, reliability and affordability. For instance, the European Commission defines energy security as 'the uninterrupted physical availability of energy products on the market at a price which is affordable for all consumers'.[199] From a consumer perspective, the New England Citizens' Policy Jury expressed as one of its key principles the view that 'NSW consumers expect a reliable and continuous uninterrupted energy supply.'[200]

5.5 In its National Energy Security Assessment, the Australian Government defines energy security as:

> The adequate, reliable and competitive supply of energy to support the functioning of the economy and social development, where: adequacy is the provision of sufficient energy to support economic and social activity; reliability is the provision of energy with minimal disruptions to supply and competitiveness is the provision of

199 European Commission (2000) 'Green Paper: Towards a European strategy for the security of energy supply', p. 3.

200 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 4.

> energy at an affordable price that does not adversely affect the competitiveness of the economy and that supports continued investment in the energy sector.[201]

5.6 These dimensions of adequacy, reliability and competitiveness are inter-related. For example, NSW has enormous reserves of black coal and its energy supplies are secure if security is considered purely in terms of the availability. However, there is an environmental cost to the use of black coal. The Commonwealth Government's introduction of the carbon pricing mechanism is an attempt to recognise this environmental cost in economic terms, and will negatively affect the affordability of energy supplies. Similarly, increasing use of renewable forms of energy will add further costs.

5.7 Ms Penelope Crossley, Lecturer, Sydney University Law School, noted in her submission that some energy experts argue that sustainability or environmental priorities should also be considered in definitions of energy security.[202] For example, one international report on energy security argues that energy must meet the 'energy-related environmental challenge' and that energy systems need to operate 'within the constraints of "sustainable development"'.[203]

5.8 Ms Crossley further noted that energy security may be measured in various ways. Commonly the level of dependence on imports is considered important, as imports are vulnerable to interruption or price increases; most commonly these concerns relate to imports of petroleum products.[204] The National Energy Security Assessment produced by the Australian Government in 2011 found that Australia's energy security situation is meeting national economic and social needs, albeit with some policy and market uncertainties that may have energy security implications in the future.[205]

ENERGY SECURITY IN THE NATIONAL ELECTRICITY MARKET

5.9 In Australia, energy security must be considered in the context of the National Electricity Market (NEM), which integrates the electricity markets of the eastern states. In its submission, the Australian Energy Market Commission (AEMC) explained that the NEM framework 'sets out a number of mechanisms directed to the ongoing security and reliability of supply of electricity across the interconnected regions'.[206] As the Sydney Citizens' Policy Jury pointed out, 'As NSW is part of the National Electricity Market, it is understood that any future changes to NSW's energy supply and distribution will affect the NEM.'[207]

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201 Australian Government Department of Resources, Energy and Tourism, 'National Energy Security Assessment 2011', p. 2.

202 Submission 3, Ms Penelope Crossley, p. 8.

203 Martin, W., et al. (1996) 'Maintaining energy security in a global context: A report to the Trilateral Commission', The Trilateral Commission, p. 4.

204 Submission 3, Ms Penelope Crossley, p. 8.

205 Australian Government Department of Resources, Energy and Tourism, 'National Energy Security Assessment 2011', p. v.

206 Submission 8, Australian Energy Market Commission, p. 2.

207 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 7.

5.10 The NEM functions to transport electricity across state borders to meet demand in every state. Mr Mark Duffy, Deputy Director-General, Department of Trade and Investment, Regional Infrastructure and Services, explained that ensuring energy security is one of the main purposes of the NEM:

> Tying ourselves into the national market is one of the best ways of guaranteeing our security because we have interconnections of significance between Victoria and Queensland so that we are sharing the spare, if you like. We do not all have to carry three spare tyres in the boot; we are sharing the spares across the network. Really that was one of the drivers of it.[208]

5.11 As part of the NEM, NSW's energy needs will be met by energy from Queensland or Victoria if necessary. Although it is the largest electricity-producing state in the NEM, NSW is a net importer of electricity, currently importing about 10 per cent of its electricity needs from other states each year. Mr Duffy explained that, if necessary, interconnectors between states can be expanded to facilitate increased imports:

> The first part of the answer as to how we provide security is that we have already designed ourselves into a system where we are between two other large States. We have ample capacity to move electricity between those three States, and we have capacity to expand the transition system between the States if that is required and it can be demonstrated that that is an economic investment to make.[209]

Ageing of assets in NSW

5.12 As discussed in Chapter Two, the Australian Energy Market Operator predicts that demand for electricity will increase over the next decade. However, with its existing generation capacity, NSW will not reach Low Reserve Condition (that is, the point where demand exceeds supply) until at least 2021-2022. This estimate is based on a forecast scenario of 'medium' economic growth.[210] Significant new capacity is therefore unlikely to be needed in the next decade.

208 Mr Mark Duffy, Deputy Director General, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 2.

209 Mr Mark Duffy, Deputy Director General, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 3.

210 AEMO, '2012 Electricity Statement of Opportunities', p. 3-8.

Figure 19: NSW summer supply-demand outlook

Source: AEMO '2012 Electricity statement of opportunities'

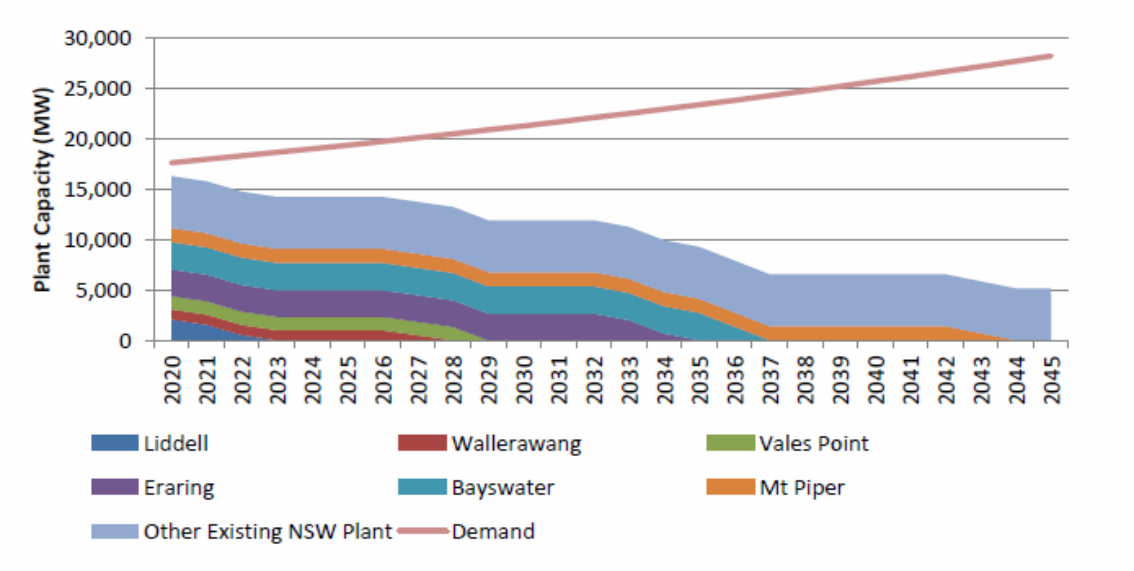
5.13 At the same time that demand is likely to increase, existing generation assets in NSW are ageing. As discussed in Chapter Two, electricity supply in NSW is heavily reliant on coal-fired power stations, most of which were built in the 1970s and 1980s. For example, the Munmorah power station, which was built in 1967-68, was closed in 2012 after 45 years of operation. In its submission, Delta Electricity explained that the standard 'life' of a coal-fired power station is about fifty years:

> Post this decade the oldest of the base-load power stations will reach fifty years in age, a traditional retirement age for such plant as increasing maintenance, refurbishment and life-extension costs typically make them uneconomic to operate.[211]

5.14 The other major power stations in NSW are due to reach the end of their operational life progressively, beginning from Liddell power station in about 2022. The figure below shows the expected life of the major existing power stations in NSW.

[211] Submission 10, Delta Electricity, p. 11.

Figure 20: Retirement of baseload power stations in NSW



Source: Delta Electricity, Submission 10, p. 10.

5.15 The expected increase in demand for electricity, combined with a progressive decline in generation capacity as existing plants retire, means that NSW may face energy security problems from the early 2020s if no further generation capacity is built.

5.16 The Australian Coal Association and NSW Minerals Council, in their submission, emphasised that investment needs to be made soon in order to avert supply shortages in the future:

> It takes 4-6 years to proceed from concept to power generation operation. That could be even longer depending on the fuel involved and the impact of new planning/environmental regulations. **This suggests investments need to be committed very soon so that finance and approvals to proceed can be finalised.**[212]

5.17 Similarly, Mr Keith Orchison, of Coolibah Pty Ltd, also drew the Committee's attention to the consequences of ageing baseload plant in NSW:

> A very important issue for consideration by the Committee is the outlook for reliability of existing coal-fired plant in NSW if we do not see investment in baseload capacity this decade … By, say, 2025, the Liddell plant will be 54 years old, Wallerawang 50 years and each of Bayswater and Eraring 43 years old. The availability of funds for major maintenance and upgrading activity, when carbon pricing is impacting on generators' income, needs careful exploration.[213]

5.18 The key issue in regard to energy security is whether the market will generate the investment needed to replace existing assets as these plants retire. In its submission, the National Generators Forum expressed the view that the NEM has generated adequate investment to date:

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212 Submission 28, Australian Coal Association and NSW Minerals Council, p. 7 (emphasis in original).

213 Submission 29, Coolibah Pty. Ltd., p. 2.

> The National Electricity Market has performed extremely well over the past 15 years, delivering significant benefits to residential and business customers in New South Wales and other NEM States. The evidence for this is highly competitive wholesale prices, outstanding levels of reliability within the bulk supply system, ongoing generation sector investment in response to changing demand patterns, and efficient investment in inter-regional transmission assets.[214]

5.19 Since its inception in 1998, the National Electricity Market has been successful in delivering investment to meet growing demand – particularly growing peak demand. However, this has not included investment in larger baseload generation plant because baseload plant has not been required to date.

5.20 As discussed in Chapter Two, NSW's existing baseload power stations were built by government. In its submission, Delta Electricity noted the 'market's lack of appetite for the relatively high risk that base-load generation entails'.[215] It is not clear how the market is likely to respond to significant shortfalls in supply caused by the retirement of existing baseload plant. However, it is clear that future investment decisions are likely to be influenced by a range of factors, the most obvious being the introduction of a carbon pricing scheme.

The impact of carbon pricing

5.21 Public debate about the possibility of a carbon pricing scheme went on for several years before the scheme was introduced in 2012. As Ms Lana Stockman, Manager, Wholesale Regulation, TRUenergy explained, the possibility of a carbon tax has already influenced investors:

> Historically we have had a surplus of baseload plant in the country and that has enabled the carbon debate to take its time. If we were running short of baseload plant and we were taking a long time to discuss carbon we probably could have a significant issue with energy security because who would want to invest in that uncertain environment? But there has not been a real big need to make those large investments. If that had occurred in that case the State governments would have had to help.[216]

5.22 On a similar note, Mr Paul Graham, Theme Leader, Carbon Futures, CSIRO Energy Transformed Flagship, observed that uncertainty about the possibility of a carbon price will influence investment decisions about not just coal-fired generation but any large energy proposals:

> One of the interesting things about the market in general is that uncertainty about whether there is or is not a carbon price is just as important as whether there is one or not. For example, before we had the carbon price legislation it would still be difficult to go to a bank and say, "I want to build a coal-fired power plant", because even if there is the risk of some future carbon price, that is too much risk to build a $3 billion plant of any nature and that means it is not viable.[217]

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214 Submission 30, National Generators Forum, p. 1.

215 Submission 10, Delta Electricity, p. 2.

216 Ms Lana Stockman, Manager, Wholesale Regulation, TRUenergy, Evidence, 26 March 2012, p. 35.

217 Mr Paul Graham, Theme Leader, Carbon Futures, CSIRO Energy Transformed Flagship, Evidence, 11 May 2012, p. 5.

5.23 The carbon pricing scheme was introduced in July 2012. Under the scheme, businesses that emit more than 25,000 tonnes of greenhouse gases per year must surrender a carbon permit for each tonne of carbon they release into the atmosphere. The commencing price of carbon has been set at $23 a tonne.

5.24 The carbon price is designed to encourage structural change in industry, towards less carbon-intensive technologies. As high emitters of carbon, coal-fired power stations are one of the principal targets of the scheme. The Independent Pricing and Regulatory Tribunal (IPART) explained the effect of the carbon tax on the electricity sector:

> The carbon pricing mechanism will increase the cost of generating electricity, which will increase wholesale prices, and thus the retail price of electricity. This is intended to send price signals to high emission-intensive generators, and facilitate the transition to a low emission-intensity energy sector. In addition, a price on carbon will send price signals to electricity consumers about the environmental impact of their consumption, and thereby reduce overall consumption and the associated carbon pollution.[218]

5.25 In its 2012 price determination, IPART allowed retail electricity prices to increase by an average of 16.4 per cent across NSW. As noted in the previous chapter, about half of this increase was attributed to increasing network costs. The other half – an increase of 8 per cent – was attributed to the impact of the carbon price.[219]

5.26 The carbon tax is paid by electricity generators and the cost is passed on to consumers through the wholesale price of electricity. However, Mr Greg Everett, Director of the National Generators Forum and Chief Executive of Delta Electricity, explained that not all of the cost could be recovered by generators, leading to a reduction in the value of generation assets:

> From the perspective of pricing, the simplest mathematical calculation is to look at $23 to start with, multiplied by the full emission rate of 0.9, and that is roughly the average across New South Wales generators. It gives you a figure of about $20 and that is the increase generators would be including in their bid prices. That will not be fully recovered through the pricing and that is because there are times when other generators with lower emission rates or renewables would be setting the price and, therefore, there would be no carbon uplift. From a pricing perspective there will be an increase in price … As a result of the failure to be able to pass on the cost of the carbon tax, all three generators have processed impairments to their asset values. Delta Electricity has impaired its Central Coast assets by $320 million ... part of that was for carbon and you cannot pull apart how much was due to carbon.[220]

5.27 Further, while the Commonwealth Government provided compensation to generators who use brown coal (mainly in Victoria), this compensation was not provided to NSW black coal generators.

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218 Independent Pricing and Regulatory Tribunal, 'Changes in regulated electricity prices from 1 July 2012', April 2012, p. 99.

219 Independent Pricing and Regulatory Tribunal, 'Changes in regulated electricity prices from 1 July 2012', April 2012, p. 2.

220 Mr Greg Everett, Director, National Generators Forum, Chief Executive, Delta Electricity, Evidence, 11 May 2012, p. 18.

5.28 Inquiry participants generally agreed that the carbon pricing scheme will discourage investment in any new coal-fired power stations. As electricity becomes more expensive, other forms of generation will become more competitive in relation to coal-fired generation. In its answers to questions on notice, the Department of Trade and Investment, Regional Infrastructure and Services indicated that new investment in coal-fired generation currently appears unlikely:

> The Carbon Tax is designed to change the generation mix, making coal based generation less viable. As a consequence, it is considered unlikely that any new coal based generation will be constructed in the near to medium future in NSW.[221]

5.29 Instead, it appears that new baseload generation is likely to be sourced from gas. For example, in its submission Delta Electricity expressed the view that 'Any new base load plant built within 10-15 years is likely to be gas fuelled due to the Commonwealth's carbon pricing scheme'.[222] Similarly, Mr Paul Ashby, General Manager, Commercial Development, AGL Energy, commented that:

> At least in the next decade most of the research is pointing to gas to take most of the growth. Once the mandatory Renewable Energy Target is done in 2020 the expectation is that gas will then take off as the marginal supplier.[223]

FUEL PRICES

5.30 In the absence of any further significant intervention in the energy market that favours one particular energy source over another, investment decisions relating to future sources of generation – and therefore energy security – will also be influenced by the cost of fuel. With coal likely to continue as the primary source of energy generation both nationally and in NSW for some years, and gas to grow in importance as a fuel source for electricity generation, future trends in coal and gas prices are particularly important.

Coal

5.31 While NSW has abundant resources of coal, there is some evidence that the market price of coal is increasing. As the Bureau of Resources and Energy Economics (BREE) notes, the export price of coal has risen strongly in recent years, in response to growing demand from developing countries.[224] Similarly, a review of fuel costs conducted by Intelligent Energy Systems (IES) for AEMO expressed the view that:

> Sustained high economic growth in China and to a lesser extent India have put upward pressure on export coal prices since mid 2007. Although there is always substantial uncertainty relating to future export coal price projections, IES is of the

221 Department of Trade and Investment, Regional Infrastructure and Services, Answers to questions on notice taken in evidence, 26 March 2012, p. 3.

222 Submission 10, Delta Electricity, p. 11.

223 Mr Paul Ashby, General Manager, Commercial Development, AGL Energy Pty Ltd, Evidence, 11 May 2012, pp. 62-63.

224 Bureau of Resource and Energy Economics 'Energy in Australia 2012', pp. 63-64.

> opinion that the sustained increases that have occurred over the last three and a half years will be maintained going forward.[225]

5.32 However, as the IES report points out, the relationship of domestic and export prices for coal is complex. Historically, electricity generators in NSW have not paid export prices for coal. Instead, they entered into long-term contracts with local suppliers which were also owned by the state government. The mines supplying NSW generators were sold to private operators in 2002.[226] As Delta Electricity noted in its submission, the sale of coal mines resulted in a change of priorities for coal suppliers, who were increasingly attracted to export markets.[227]

5.33 NSW generators are therefore likely to face higher prices when existing contracts expire. Mr Peter Morris, Director, Economic Policy, Australian Coal Association, explained the likely effects when existing coal supply contracts expire:

> Clearly, as long-term contracts are renegotiated there will be a move in the marketplace towards their being based on the international price of coal. Contracts in the past have been based typically on quantities with price restrictions and also with restrictions on the ability to pass on certain taxes, such as the Carbon Tax that will begin on 1 July. Therefore, with new contracts we can expect that there will be some pass through of the higher international prices, although they have been softening of late. The domestically delivered product price is not necessarily the price on the international market, because that price is the delivered price, which includes transport—and that is a very significant component of coal prices. Of course, if the coal is close to a power station it may be much cheaper. [228]

5.34 Concerns about rising coal prices influenced the NSW Government's decision in 2010 to establish a new coal mine at Cobbora. This project began as a joint venture between the three state-owned generation companies, Delta Electricity, Eraring Energy and Macquarie Generation, as an 'effort to secure domestic supply in the face of changing coal mine dynamics.'[229]

5.35 The coal from Cobbora is to be sold at cost price to NSW generators. The mine is expected to cost $1.5 billion to establish and produce up to 12 million tonnes of coal per annum.[230] As Delta Electricity indicates, the three major generation companies will become heavily reliant on coal from Cobbora, which is due to commence production in 2015. Indeed, in its submission Delta Electricity suggested that any delay in the development of the Cobbora mine constitutes a threat to energy security in NSW in itself.[231]

5.36 The New England Citizens' Policy Jury rejected subsidisation of coal for NSW generators, even though this makes electricity more affordable for consumers. The group expressed its concern that coal-fired power stations 'are currently able

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225 Intelligent Energy Systems (2011) 'Review of fuel costs: a report to AEMO', p. 27.

226 Submission 10, Delta Electricity, p. 11.

227 Submission 10, Delta Electricity, p. 11.

228 Mr Peter Morris, Director, Economic Policy, Australian Coal Association, Evidence, 26 March 2012, p. 21.

229 Submission 10, Delta Electricity, p. 12.

230 Tamberlin, B. (2011) 'Final Report of the Special Commission of Inquiry into the Electricity Transactions', p. 119.

231 Submission 10, Delta Electricity, p. 12.

to purchase coal at rates that are significantly below market price, and are therefore able to supply energy below the real cost,' and felt that this distorted the electricity market.[232]

5.37 The Tamberlin Inquiry recommended that the NSW Government sell the Cobbora mine.[233] Sale or lease of the mine is currently under consideration by the NSW Government.

Gas prices

5.38 Security of gas supply featured strongly in the NSW Government's response to the federal Draft Energy White Paper. There the NSW Government argued that 'gas supply security across the entire supply chain (production and energy infrastructure) should be the number one issue for consideration in the Final Energy White Paper'.[234]

5.39 As previously canvassed, the effect of the carbon pricing scheme on coal-fired generation is considered likely to increase the importance of gas as a fuel source. Although a fossil fuel, gas is lower in emissions (and therefore, under a carbon pricing scheme, lower in price) than coal. Mr Mark Duffy, Deputy Director-General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, described the likely effect of the carbon pricing scheme and the Renewable Energy Target on the demand for gas:

> So in order to rely on that capacity—and remember that the renewable energy target requires 20 per cent renewable resources in the mix by 2020—of wind we have to have available peaking power for when the wind drops, otherwise our system becomes unstable. That means we need a lot more gas. The carbon tax, if it is effective, will discourage investment in coal and encourage investment in gas. We need gas for that. We need gas for our existing peaking plants.[235]

5.40 Mr Duffy explained that the increasing demand for gas exports poses a particular challenge to the maintenance of supply in the domestic market:

> I am sure this Committee has heard the numbers before, but we supply about 6 per cent of gas that is consumed in New South Wales from New South Wales. So we are relying on the other States for supply. You have probably also been informed that there is a significant demand for export gas, which means possibly they have signed more contracts than they have had in the pipeline or there is a real challenge to the domestic supply as a result of this export demand.[236]

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232 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 5.

233 Tamberlin, B. (2011) 'Final Report of the Special Commission of Inquiry into the Electricity Transactions', p. xxi.

234 NSW Government, 'Draft Energy White Paper: NSW Government Submission', April 2012, p. 4.

235 Mr Mark Duffy, Deputy Director-General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 2.

236 Mr Mark Duffy, Deputy Director-General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 2.

5.41 In a similar vein, Mr Peter Morris, Director, Economic Policy, Australian Coal Association, also observed that the demand for export gas is likely to lead to higher domestic prices:

> Gas is an unknown quantity. However, clearly gas on the eastern seaboard is now priced at a lower rate than the international parity price. That is clear if we compare the gas price in the eastern part of Australia to the price paid in Western Australia. With the likely development of an international export gas industry, particularly from Queensland, and the nature of the national electricity market, which is interconnected and highly competitive, those gas prices will feed through.[237]

5.42 New South Wales does not have significant reserves of conventional gas and is heavily reliant on supplies from other states, which may in itself pose a threat to energy security. For example, Mr Paul Ashby, General Manager, Commercial Development, AGL Energy, observed that gas fields in other states that have supplied gas to NSW for many years are now in decline:

> In the olden days we could rely very comfortably on Santos's joint venture supplies out of Central Australia and Esso-BHP supply out of Victoria. New South Wales lived on that for some decades. We have noticed those fields are in decline in Central Australia.[238]

5.43 Mr Ashby also pointed to the possibility of interruptions to supply caused by problems with equipment or infrastructure:

> Even the facilities are starting to get old. We have had a number of major disruptions—the Longford explosion in 1988, a number of issues in Moomba through the 2000s. When those facilities go down—and there is only one pipeline bringing each of those things into Sydney—we have a problem in New South Wales and there have been major issues over the past decade. Almost certainly that will happen again, there is no doubt about it. Yes, there is a security of supply issue.[239]

5.44 While existing gas supplies are ageing, significant new gas supply projects are in development, particularly in Queensland. These new gas supplies, though, are intended for export. In its submission to the federal Energy White Paper, the NSW Government expressed its concerns about the development of LNG terminals in Queensland, which are designed to serve the export market. These terminals have the capacity to absorb existing eastern Australian gas supplies. The NSW Government indicated that this may affect supplies available to NSW:

> Potential consequences include that NSW and the ACT may have difficulty sourcing gas supplies or that gas pricing will increase towards or reach export parity. A steep jump in gas prices would substantially impact business and domestic gas use and the development of lower emissions gas fired electricity generation.[240]

5.45 In its Energy White Paper, the Commonwealth Government argues that supplies of gas will be adequate to meet both domestic and export demand until at least

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237 Mr Peter Morris, Director, Economic Policy, Australian Coal Association, Evidence, 26 March 2012, p. 21.

238 Mr Paul Ashby, General Manager, Commercial Development, AGL Energy, Evidence, 11 May 2012, p. 62.

239 Mr Paul Ashby, General Manager, Commercial Development, AGL Energy, Evidence, 11 May 2012, p. 62.

240 NSW Government, 'Draft Energy White Paper: NSW Government Submission', April 2012, p. 6.

2030.[241] AEMO's 'Gas Statement of Opportunities' also anticipates that future supplies will be adequate, despite projected increases in demand.[242]

5.46 The price of gas, or the likely future price of gas, is important for the maintenance of affordable energy supplies in the longer term, particularly as the relative importance of gas as a fuel source is predicted to grow. In a speech in October 2012, the NSW Minister for Resources and Energy, Chris Hartcher, noted that the NSW Government has set a target of doubling household gas connections by 2020.[243] This does not include gas used for electricity generation.

5.47 Historically, the price of gas in NSW has been modest, but prices are likely to rise as demand for gas increases. However, the 2011 National Energy Security Assessment observed that the gas market is complex and difficult to predict:

> Gas prices in Australia are projected to increase due to higher gas production costs and the impact of the liquefied natural gas (LNG) export market on the domestic market. This change may be more evident in the eastern market due to the rapid growth of the coal seam gas industry in Queensland that has occurred sooner than was expected in the 2009 NESA [National Energy Security Assessment]. Although the expected trend for gas prices is still upwards, the significant levels of global gas supplies that have emerged since the 2009 NESA will introduce greater competition in the LNG industry and constrain price increases. As witnessed in the United States, market dynamics can be difficult to predict.[244]

5.48 Significantly higher gas prices, if they do emerge, may affect the future shape of electricity generation in NSW. While gas is expected to play a larger part in electricity supply as the carbon pricing scheme makes coal-fired generation more expensive, this is dependent on gas remaining competitive with other forms of generation. Mr Duffy explained that the Renewable Energy Target, which mandates that 20 per cent of generation must come from renewable energy by 2020, will also interact with the relative prices of coal and gas:

> The issue of price relativity will come into this. We obviously have abundant coal, and we just talked about price pressure potentially on gas from the export boom. You could see a world where the price of gas will go up significantly and even with a carbon tax we may still find ourselves using a lot of coal. The relativity will definitely change; if the renewable energy target is held into place until 2020 the relativities will change.[245]

5.49 In a similar vein, Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, explained that the relative prices of coal and gas will

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241 Department of Energy, Resources and Tourism, 'Draft Energy White Paper: Strengthening the foundations for Australia's energy future', December 2011, p. 152.

242 Core Energy Group, 'Eastern and Southern Australia: Projected Gas Reserves', AEMO, '2012 Gas Statement of Opportunities', p. 28.

243 The Hon Chris Hartcher, Minister for Resources and Energy, speech to Australian Petroleum Production and Exploration Association conference, 9 October 2012, p. 5.

244 Australian Government Department of Resources, Energy and Tourism, 'National Energy Security Assessment 2011', p. 34.

245 Mr Mark Duffy, Deputy Director General, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 6.

interact with the carbon pricing scheme to determine which is the most cost-efficient form of generation:

> As I said, the trade-off between coal and gas will come down to the changes between coal, gas and carbon prices. For example, if you had a gas price of $8 or $9 a gigajoule, you would need a carbon price well in excess of $70 before you would make coal uncompetitive. We live in a world with gas prices of $3 to $4 a gigajoule. That enables gas and coal to compete vigorously, particularly with low carbon prices. As the price of gas increases—and we may see coal prices increase as the coal contracts unwind in New South Wales this decade—much of it will depend on the interaction between the three. [246]

5.50 The future price of gas will also be influenced by the development of the coal seam gas industry. Coal seam gas is discussed in more detail in Chapter Seven.

THE ROLE OF GOVERNMENT

5.51 Ensuring that the state has adequate supplies of energy available to meet its future needs is a key responsibility of government. In a speech in October 2012, the Hon Chris Hartcher, Minister for Resources and Energy, emphasised that, 'it is the role of a responsible Government to take the necessary action to maintain and increase our State's energy security'.[247]

5.52 For many years the NSW Government ensured energy security through its ownership of coal mines and power stations. However, with the establishment of the National Electricity Market and the sale of generation, the government is now reliant on the private sector to supply energy. Mr Tom Leuner, General Manager, Wholesale Markets, Australian Energy Regulator, explained that the market will invest in electricity generation when it is profitable to do so:

> I think the concept is that the private sector will build the necessary generation as and when it is needed based on price signals. Those price signals come through the spot market and the futures markets in the national electricity market. That is the concept, so in a way it is a matter of being prepared to rely on the private sector to fulfil those needs and the State Government not necessarily having to build anything itself.[248]

5.53 This view was echoed by the Sydney Citizens' Policy Jury, which expressed the view that 'market forces will drive where money and capital are needed to make profit'.[249]

5.54 Several stakeholders emphasised that the role of government is to facilitate development and investment and thus allow the market to provide supply as it is

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246 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence, 26 March 2012, p. 45.

247 The Hon Chris Hartcher, Minister for Resources and Energy, speech to Australian Petroleum Production and Exploration Association conference, 9 October 2012, p. 2.

248 Mr Tom Leuner, General Manager, Wholesale Markets, Australian Energy Regulator, Evidence, 11 May 2012, p. 45.

249 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 6.

required.[250] For example, the National Generators Forum expressed its belief that the NEM will deliver supply:

> the current NEM rules and governance arrangements should provide efficient signals for new private-sector investment in projects when, where, and of the technology necessary to deliver competitive prices and a reliable electricity supply.[251]

5.55 While investment will be driven by the forces of supply and demand operating in the National Electricity Market, this market is, importantly, regulated by government. The governance and operation of the NEM was discussed in Chapter Four. Ms Savage pointed out that the NSW Government maintains a role in regulating the NEM:

> I think governments will always be concerned about energy security and they should be. Even when New South Wales decides to privatise its assets, New South Wales will remain a member of the Standing Council on Energy and Resources and that is the oversight body for the energy market.[252]

5.56 However, some stakeholders felt that government should avoid intervening in the market and instead allow it to operate as freely as possible. For example, the Energy Supply Association of Australia expressed the view that government should facilitate rather than direct the market:

> What is needed is a flexible approach, which allows the market to operate smoothly and invest in new facilities when required without governments mandating a specific approach. In this respect, esaa considers that the NSW Government needs to maintain an enabling policy framework which allows the market to determine which fuels and technologies are best suited to contribute towards NSW's long term energy security.[253]

5.57 Several participants in the Inquiry expressed the view that the NSW Government should not seek to implement policies which may influence the National Electricity Market at a state level. For example, AGL Energy argued against state-based measures:

> It is important that the Inquiry note that New South Wales energy production and consumption needs to be considered within this national framework … AGL would caution against specific State-based policies that may distort the benefits achieved to date.[254]

5.58 Some stakeholders suggested that government should remove existing barriers to development of energy projects. For example, in its submission, Delta Electricity maintained that, 'the role for government in securing the NSW energy

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250 Submission 15, Energy Supply Association of Australia, p. 4, Submission 30, National Generators Forum, p. 2.

251 Submission 30, National Generators Forum, p. 2.

252 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, p. 42.

253 Submission 15, Energy Supply Association of Australia, p. 4.

254 Submission 14, AGL Energy Ltd, p. 1.

supply over the long term is to ensure that the barriers to deploying new plant are minimised.'[255]

5.59 Specifically in relation to coal, Ms Sue-Ern Tan, Deputy Chief Executive Officer, NSW Minerals Council, expressed the view that planning regulations and the approval process for coal projects constitute a barrier to development:

> I think the real problem for us is the delays and the uncertainty about when you will finally get a project approved. It is very uncertain from an investment perspective. We have to remember that mining projects are very long-term projects; they are 40, 50 year plans. There is a lot of background planning from an investment perspective that goes into putting up a project. If you are sitting in a pipeline waiting for an assessment process for over two years in some cases, that is not a good indicator to give investors security and certainty for their investment. So I think the planning approvals delay is a problem.[256]

5.60 However, in its answers to questions on notice, the Department of Trade and Investment, Regional Infrastructure and Services considered that in view of the number of generation projects already approved and awaiting development, planning approval processes do not constitute a significant barrier:

> Based on the number and capacity of proposed generation facilities, either with development approval or undergoing assessment in the NSW planning regime, it is difficult to argue that barriers to development of new generation exist although some proponents regularly express concern over the time delays that the regulatory system around the NSW planning approvals process introduce.[257]

5.61 In relation to ensuring security of gas supplies, Mr Tom Leuner, General Manager, Wholesale Markets, Australian Energy Regulator, felt that there was no obvious action that the NSW Government could take without interfering with the operations of the market:

> Anything that a government did would be interfering with the market price, which obviously comes at some form of cost in terms of efficiency, changing the supply-demand balance or something like that. If the market price goes up when the gas exports start from Queensland, that is the market at work. It is difficult to see a solution that would ensure there is cheaper gas or more gas for New South Wales that I can think of.[258]

5.62 Some jurisdictions, notably Western Australia, are moving towards reserving gas supplies for domestic consumption.[259] This is intended to avoid the possibility of local generators being exposed to high export prices. However, Origin Energy cautioned against this approach, again on the grounds that it would interfere with the operations of the market:

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255 Submission 10, Delta Electricity, p. 11.

256 Ms Sue-Ern Tan, Deputy Chief Executive Officer, NSW Minerals Council, Evidence, 26 March 2012, p. 25.

257 Mr Mark Duffy, Deputy Director-General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, Answers to questions on notice taken in evidence, 26 March 2012, p. 2.

258 Mr Tom Leuner, General Manager, Wholesale Markets, Australian Energy Regulator, Evidence, 11 May 2012, p. 44.

259 Submission 10, Delta Electricity, p. 13.

> In some jurisdictions governments have considered or implemented policy that reserves gas for domestic consumption. In our view such policies are counterproductive as they will act to deter gas exploration and future investment and lessen energy security. Developers will generally invest where they can access a market price and not where there is a threat of government intervening to control resources and markets.[260]

5.63 A number of stakeholders expressed concerns about governments intervening in the market to provide assistance to one form of energy or technology; this was referred to as 'picking winners'.[261] Conversely, stakeholders also expressed concerns about government placing regulatory barriers on particular technologies which may hinder the development of projects.[262]

5.64 At the same time, a number of stakeholders felt that there is a role for government to assist in providing long-term energy security by investing in, or encouraging, research and development.[263] Delta Electricity and the Australian Coal Association, for example, recommended that the NSW Government should invest in research into carbon capture and storage, while advocates of renewable energy recommended research into alternative forms of energy generation.[264] Carbon capture and storage is discussed in more detail in Chapter Six, while alternative forms of energy generation are discussed in Chapters Eight and Nine.

CITIZENS' POLICY JURY VIEWS

5.65 The Citizens' Policy Juries convened by the NewDemocracy Foundation expressed a range of different views about the role of government in ensuring energy security. The New England group expressed its view that the NSW Government should align its energy strategy to policies implemented at the federal level:

> Given the adoption of the carbon tax at a federal level, that the regulatory framework developed by the NSW Government be strategically aligned with the framework now emerging through mechanisms such as COAG, the ACCC, and various intergovernmental arrangements.[265]

5.66 The New England group also felt that energy policy and regulation requires a 'multi-partisan political approach'[266] and recommended establishment of a long-term, multi-party advisory committee to oversee policy development and implementation.[267]

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260 Submission 17, Origin Energy, p. 3.

261 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence, 26 March 2012, p. 40.

262 Submission 23, Infigen Energy, p. 9., Submission 19, Sustainable Energy Association of Australia, Submission 26, TRUenergy, p. 2, Submission 14, AGL Energy, p. 3.

263 Submission 23, Infigen Energy, p. 9.

264 Submission 10a, Delta Electricity, p. 9., Australian Coal Association and NSW Minerals Council, p. 2., Submission 17, Origin Energy, p. 3., Submission 25, Clean Energy Council, p. 3., Submission 23, Infigen Energy, p. 8.

265 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 4.

266 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 3.

267 As above, p. 10.

5.67 Both groups felt that environmental considerations should be given higher priority in developing energy policy. For example, the Sydney group observed that 'the importance of the environment is lost in most discussion about energy, in particular the national energy objectives.'[268] The group recommended that the NSW Government should initiate discussion to include pricing and environment in national energy objectives,[269] while the New England group felt that 'community expectations are increasing with respect to the prospect of a cleaner outcome for energy generation' and expressed the view that 'a transition is required to energy sources that have a significantly lower environmental impact.'[270]

5.68 Both groups made recommendations to increase the level of renewable energy as a proportion of energy generation, with the Sydney group recommending that 'there needs to be an increased utilisation of renewable energy beyond current Federal targets',[271] while the New England group recommended 'targeted stages to achieve a goal of 100% sustainable, renewable' energy by 2050.[272]

5.69 The New England group expressed the need for a transition to energy sources with a lower environmental impact as one of its core principles.[273] In this context, the group made a number of recommendations about actions that the NSW Government should take, including:

- Ensuring that NSW is part of a National Energy Strategy;
- Legislating to ensure that renewable energy generators have access to the market at set minimum prices;
- Legislating to protect health and the environment;
- Retaining public ownership of assets unless it can be clearly demonstrated that privatisation provides enduring advantages for consumers;
- Investing in the grid to facilitate access for renewable energy generators;
- Ensuring strategies to aid disadvantaged consumers.[274]

5.70 The Sydney group recommended that the NSW Government should develop resource zones to promote renewable energy and economic development in regional areas, facilitate demand management and encourage decentralised

268 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 7.

269 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 3.

270 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 4.

271 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 2.

272 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 10.

273 As above, p. 4.

274 As above, pp. 10-11.

generation. In relation to funding, pricing and regulation, the group recommended that the NSW Government should:

- Legislate to support and enable decentralised energy production;
- Provide long term legislative certainty for investment in renewable energy;
- Legislate to ensure transparency in billing;
- Legislate to allow 'time of day' and other flexible tariff options; and
- Legislate to ensure equitable access to the grid for renewable energy providers.[275]

5.71 Both groups expressed the view that existing coal-fired power stations should not be replaced when they reach the end of their productive life.[276]

5.72 These summaries are not exhaustive, as the groups made other comments and recommendations which are included in this report where relevant. Full copies of the Citizens' Jury reports are also included at Appendix Two and Appendix Three.

Committee comment

5.73 Through its carbon pricing scheme and the Renewable Energy Target, the federal Government has effectively placed an environmental cost on electricity generation in Australia. The Committee urges the NSW Government to avoid duplication of Commonwealth initiatives and allow the electricity market to operate freely within this existing framework.

5.74 The Committee believes that the NSW Government should not intervene directly in the electricity market by investing further in electricity generation assets. While State investment has been crucial in developing generation capacity and network infrastructure in NSW, the Committee is confident that the market will provide necessary investment to maintain adequate generation capacity.

5.75 The NSW Government must provide clarity and consistency in energy policy, and promote an enabling environment for research and investment. The Committee therefore believes that the NSW Government should avoid intervening in the market by implementing policies or programs which favour one source of energy or technology.

5.76 While the Committee does not support direct intervention in the electricity market, there is a role for government to encourage and facilitate innovation in the development of alternative sources of energy and technologies to reduce carbon emissions. The Committee therefore supports NSW Government investment in research and industry development where there are reasonable prospects that projects will become commercially viable.

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275 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, pp. 2-3.

276 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 7., New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 11.

5.77 It is apparent to the Committee that NSW has a competitive advantage in the market in relation to the production of black coal, and coal-fired electricity generation. However, subsidisation of black coal by the NSW Government through the development of the Cobbora mine is not consistent with a free market approach. The Committee therefore believes that the NSW Government should sell or lease the mine.

5.78 The Committee notes with concern the potential threat posed by increasing export demand to gas supplies in NSW. Given the increasing importance of gas in electricity generation, the Committee believes that there is a role for government to explore strategies to maintain affordable supplies of gas, and recommends that the NSW Government convene an expert panel to advise government in this regard.

5.79 The Committee acknowledges the work of the Citizens' Policy Juries convened by the NewDemocracy Foundation. The reports provided by the two Citizens' Policy Juries were very helpful in that they provided community input directly to the Committee. The recommendations and other comments made in the reports were considered by the Committee in its deliberations.

5.80 The Committee believes that there is considerable scope for Government to undertake similar consultative and deliberative processes with randomly selected members of the public on other controversial issues in the future.

RECOMMENDATION 5

That the NSW Government expedite the sale of remaining electricity generation assets.

RECOMMENDATION 6

That the NSW Government sell or lease the Cobbora Coal mine.

RECOMMENDATION 7

That the NSW Government convene an expert panel, including scientific input, to explore strategies to maintain affordable supplies of gas in New South Wales.

RECOMMENDATION 8

That the NSW Government consider undertaking deliberative democracy processes to consult with the NSW public on policy issues where appropriate.

Chapter Six – Carbon capture and storage

Introduction

6.1 As the electricity industry in NSW is heavily reliant on coal, carbon capture and storage (CCS) is of particular importance to NSW. In a context where carbon pricing will increase the cost of coal-fired power generation, the development of CCS technology is crucial for the future of the coal industry and for energy security in NSW. This chapter therefore examines CCS in some detail, including:

- how CCS works,
- potential of CCS technology,
- current and proposed projects, both in Australia and overseas,
- capture, transport and storage,
- location of potential storage sites in NSW,
- the economics of CCS, in terms of the likely costs, and
- the expected commercial deployment, including current levels of investment in CCS and the need for further investment.

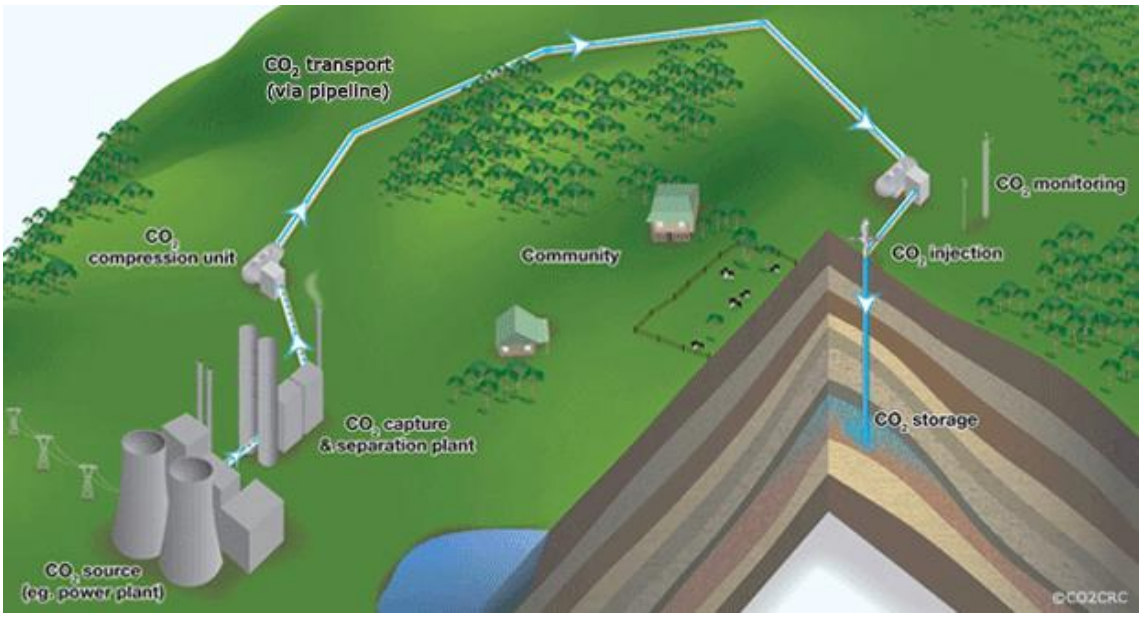
How CCS works

6.2 Carbon capture and storage is a technology designed to prevent large quantities of carbon dioxide (CO_2) from being released into the atmosphere from the use of fossil fuel in power generation and other industries. The technology comprises three component processes:

- capturing the CO_2 produced at large industrial plants using fossil fuels;
- transporting the CO_2 to a suitable storage site; and,
- storing the CO_2 by pumping it deep underground to be securely and permanently stored away from the atmosphere in rock.[277]

[277] www.globalccsinstitute.com/ccs/what-is-ccs, accessed 25 September 2012

Figure 21: How CCS works [278]



6.3 In its submission, Delta Electricity explained the CCS process, noting that CO_2 and natural gas have similarly been stored underground for millions of years from natural processes:

> CO_2 captured by the CCS process is compressed to a liquid and transported to a geological storage site. At the storage site, CO_2 will be injected underground and stored permanently in natural containment areas created by unique rock formations. This is the same process that has held CO_2 and natural gas in the ground for millions of years. [279]

Potential of CCS technology

6.4 According to Delta Electricity, carbon capture and storage has the potential to 'significantly reduce greenhouse emissions from new and existing coal and gas fired power stations, industrial processes and other stationary sources of carbon dioxide.'[280] It may provide for the continuation of coal and gas powered electricity generation in the future without intensive CO_2 emissions. In a carbon-constrained economy, the development of CCS could play an important role in determining the future viability of coal and gas generation.

6.5 The importance of developing CCS technologies was emphasised by Mr Greg Sullivan, Deputy Chief Executive Officer, Australian Coal Association, when he told the Committee about federal government modelling which suggests that coal will continue to be the largest source of electricity in New South Wales until 2034-35:

> Coal-fired power is the principal source of baseload electricity in New South Wales and, indeed, in the national electricity market. While Federal Government modelling

278 www.globalccsinstitute.com/ccs/how-ccs-works, accessed 25 September 2012

279 Supplementary Submission 10a, Delta Electricity, p. 4.

280 Supplementary Submission 10a, Delta Electricity, p. 3.

> points to a decline in the share of coal-fired generation in the power supply mix, coal will still be the largest single source of New South Wales power in 2034-35.[281]

6.6 In its submission, the Australian Coal Association also noted modelling which suggested that coal and gas could continue to account for around 30% of Australia's electricity mix by 2050.[282] While coal and gas continue to make up a significant proportion of Australia's electricity production, CCS can offer the potential to help meet emission reduction targets.

6.7 Without CCS, climate mitigation may prove to be far more expensive and emissions reductions may be difficult, if not impossible, to achieve. Professor Diane Wiley, Program Manager, Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC), explained:

> International Energy Agency modelling suggests that climate mitigation solutions without carbon capture and storage could cost countries 30 to 50 per cent more, and in many cases the emission reduction targets would be difficult or impossible to meet. Comparative cost analyses show that carbon capture and storage is a competitive technology when compared to other low-emission technologies, particularly when baseload electricity is required. [283]

6.8 In its submission Delta Electricity outlined the economic arguments for CCS, explaining that the 'availability of CCS will also reduce the carbon tax liability and increase the market competiveness for NSW generators which will, in turn, lead to lower electricity costs for NSW consumers.'[284]

6.9 Meanwhile, Mr Barry Jones, General Manager, Policy and Membership, Global CCS Institute, stressed that CCS was only one of a number of technologies that will be required to combat climate change effectively. Mr Jones suggested that it is not a matter of choosing between CCS and other alternatives, but that all available technologies will need to be deployed in order to meet carbon reduction targets:

> The IEA has consistently demonstrated over a number of years now in its work that if the world is to achieve the kind of greenhouse gas mitigation targets that they have stated, then it will require basically every available technology to be deployed. We need energy efficiency improvements at a large-scale, we need a large deployment of renewable technologies, we need CCS and we need other alternatives as well. The IEA estimates that in order to meet those mitigation targets you need every available technology to be deployed. That is why we say CCS is not an alternative to other technologies; it is a necessary part of an overall energy technology mix that one needs to meet greenhouse gas mitigation targets. [285]

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281 Mr Greg Sullivan, Deputy Chief Executive Officer, Australian Coal Association, Evidence, 26 March 2012, p. 19.

282 Submission 28, Australian Coal Association and NSW Minerals Council, p. 9.

283 Professor Diane Wiley, Program Manager, CO2CRC, UNSW, Evidence, 11 May 2012, p. 47.

284 Supplementary Submission 10a, Delta Electricity, p. 3.

285 Mr Barry Jones, General Manager, Policy and Membership, Global CCS Institute, Evidence, 11 May 2012, p. 48.

Current and proposed CCS projects in Australia and around the world

6.10 There are a number of CCS projects that have taken place, or are proposed, in New South Wales, as well as other locations in Australia and around the world.

6.11 One such project was the Delta Post Combustion Capture (PCC) project which ran until August 2010 at the Munmorah Power Station near Lake Macquarie. The project was the result of a collaboration between Delta Electricity and the CSIRO. In its submission Delta Electricity described the project, along with some of the challenges faced by post combustion capture projects:

> Delta Electricity has collaborated with the CSIRO on a successful research scale project to test the capture and release of up to 3000 tonnes of CO_2 per year at its Munmorah power station. The project investigated the potential to adapt the post carbon capture (PCC) aqueous ammonia absorption technology in Australian power plant conditions. The $7 million research scale pilot facility was used for a series of experimental campaigns in which the technical and operational characteristics of the process were established. A CO_2 removal efficiency rate in excess of 85% was achieved, a high purity of CO_2 (between 99-100%) was obtained and ammonia was also shown to be an effective solvent for SO_2 removal, providing evidence of multispecies removal capability. The experimental program was completed in August 2010.
>
> The operational experience with the aqueous ammonia pilot plant has confirmed the potential for PCC as a low emission technology, but also revealed further challenges of low absorption rates, ammonia losses from the system under some operating conditions and a large process cooling requirement.[286]

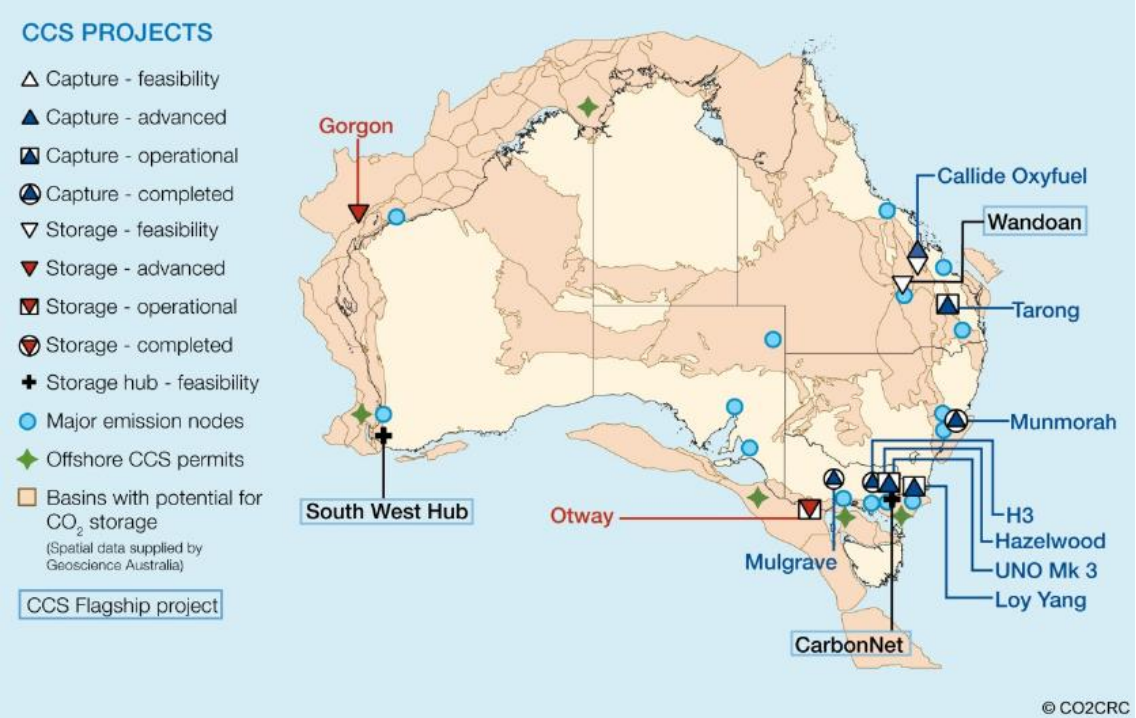
6.12 Following the completion of the initial pilot project at Munmorah Power Station, Delta has proposed another pilot project, which aims to demonstrate both the capture and storage components of CCS. The Australian Coal Association noted that the proposed project, which is expected to be located at Vales Point Power Station, will build on the knowledge gained from the Munmorah PCC project. The project is currently in the pre-feasibility stage, as the project team attempts to identify a suitable geological storage site for the CO_2.[287]

6.13 Elsewhere in Australia there are a number of other current or proposed CCS projects, as shown in the figure below:

[286] Supplementary Submission 10a, Delta Electricity, p. 6.

[287] Australian Coal Association and NSW Minerals Council, Answers to questions taken on notice taken in evidence, 26 March 2012, pp. 8-9.

Figure 22: Current and proposed CCS projects in Australia [288]



6.14 In evidence, Professor Dianne Wiley of the CO2CRC described the Otway storage project:

> Probably our best-known project is the Otway storage project in Victoria where 60,000 tonnes of CO_2 was injected into a depleted gas reservoir between 2008 and 2010. Although the injection has ceased, we continue to monitor the reservoir. In the last year, with additional funding from Australian National Low Emission Coal Research and Development, we conducted tests to successfully evaluate the residual trapping of CO_2 in a saline reservoir at the site. [289]

6.15 Another major CCS project in Australia is the proposed Gorgon project in Western Australia, which, when completed, 'will be the largest project storing carbon dioxide in a saline aquifer in the world.'[290]

6.16 Some evidence suggested that while each of the component processes of CCS is a proven technology, we are yet to see any commercial scale projects in Australia that combine all three processes to store CO_2 from electricity generators. For example, Delta Electricity's submission noted:

> Each of the technologies required to proceed with a CCS project (capture, transportation and storage) are in operation individually worldwide, but they have not been proven as an integrated process for capturing the CO_2 from a coal powered electricity generation plant at a commercial scale.

288 Submission 27, Australian Nuclear Science and Technology Organisation, p. 17.

289 Professor Diane Wiley, Program Manager, CO2CRC, UNSW, Evidence, 11 May 2012, p. 47.

290 Mr Barry Jones, General Manager, Policy and Membership, Global CCS Institute, Evidence, 11 May 2012, p. 48.

> The capture technology has been successfully used for CO_2 removal from sour gas in the oil and gas industry for decades. Natural gas and LNG projects such as Sleipner (Norway) and In Salah (Algeria) have been injecting more than 1 million tonnes of CO_2 each year into saline aquifers. There is also extensive operational experience with CO_2 transport, injection and storage in the US enhanced oil recovery industry where nearly 10 million tonnes of CO_2 is injected underground each year to increase subsurface reservoir pressures to improve oil extraction rates. The Gorgon LNG Project in Western Australia will soon be one of the largest storage projects in the world, storing over 3 million tonnes of CO_2 per year.
>
> While the capture and storage technical knowledge exists, the application of CCS on a power station at the scale required remains largely untested and therefore commercial and technical risks remain as obstacles to large scale deployment. Successful demonstration of a large scale integrated process under Australian conditions is critical to assess the commercial viability of the technology.[291]

6.17 However, Mr Barry Jones, General Manager, Policy and Membership, Global CCS Institute, advised the Committee that there are eight large-scale integrated projects (that is, projects which combine all three components – capture, transport and storage – of CCS) currently operating around the world. In addition, there are two projects under construction in the power sector, which, when completed will be the first integrated CCS projects for electricity generators in the world:

> We currently estimate that there are eight operating large-scale integrated projects around the world. Two of those are in Norway, one is in Algeria and the remainder are in North America. All of those projects are in non-power sector applications at the moment. Six are from natural gas processing where the carbon dioxide is separated from the natural gas stream as part of the production process and then transported and stored, there is a fertiliser project and a synthetic fuels project as well at a large-scale operating. In addition there are seven of these large-scale projects under construction around the world at the moment. …
>
> Importantly, of those seven projects under construction, two are in the power sector. There is a project in Canada that is under construction called the Boundary Dam project, and a project in the United States called the Kemper County project. They are both power sector projects and they will be the first large-scale integrated power sector CCS projects when they are completed in the next few years. [292]

6.18 The following sections consider each of the three component processes of CCS – capture, transport and storage – in further detail.

Capture

6.19 Capture is the first stage of the carbon capture and storage process. It involves capturing carbon dioxide (and potentially other greenhouse gases) that would otherwise be emitted into the atmosphere.

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291 Supplementary Submission 10a, Delta Electricity, p. 4.

292 Mr Barry Jones, General Manager, Policy and Membership, Global CCS Institute, Evidence, 11 May 2012, p. 48.

6.20 There are a number of different technologies to capture CO_2 which are currently being researched. However, as Professor Wiley explained, the preferred technology has yet to be determined:

> there are still questions about what the technology of the future will be. We have just said, if you want to buy something you could buy it off the shelf. That is available but it is going to be expensive. The jury is still out on where it will go in the future.[293]

6.21 Professor Wiley discussed a number of the competing capture technologies that are being explored, noting the different scope for disruptive or breakthrough innovations for each:

> There are three main technologies that we see on the horizon at the moment. Solvent technology is the technology that is being investigated, and it is commercial. At the moment you could buy it off the shelf, so to speak, but that is costly because of the energy that is consumed by the capture plant itself. There are most likely going to be incremental changes, perhaps in conjunction with looking at how the capture plant integrates to the power plant. There are some opportunities there.
>
> With membrane technology, it may well be a disruptive change. If you look back to membrane technology in the water industry, the disruptive change was when people worked out how to use submerged membrane systems. There was also a big change in the water industry because membrane technology went through a lot of materials development. We are likely to see that also in the gas area because so far there has not been much effort worldwide on actually developing membrane materials for power plant capture. So there is likely to be quite significant improvements there with the membrane technology.
>
> With adsorbents, again there has been very little work in that area. It is quite successful for oxygen separation from air, so we are hoping that we will find some materials that might actually solve that problem. [294]

6.22 The capture component of CCS is likely to be the most expensive part of the process for current projects. Professor Wiley informed the Committee that estimates of the cost of the process are between $60 and $100 per tonne of CO_2 captured:

> The estimates we have been doing, based on our ETIS projects, the capture costs can range anything between $60 to $100 a tonne or even more if you do not have a particularly good capture technology, but we would not be suggesting you implement those.[295]

Transport

6.23 Once the carbon dioxide is captured, the next stage of the CCS process is to transport it from the power station to the storage location. Because of the vast quantities of CO_2 involved, this transport occurs via gas pipelines. Mr Jones told the Committee that this component of the CCS process is already a mature technology and there is significant experience relating to the transport of CO_2, particularly in the United States:

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293 Professor Diane Wiley, Program Manager, CO2CRC, UNSW, Evidence, 11 May 2012, p. 56.

294 Professor Diane Wiley, Program Manager, CO2CRC, UNSW, Evidence, 11 May 2012, p. 52.

295 Professor Diane Wiley, Program Manager, CO2CRC, UNSW, Evidence, 11 May 2012, p. 53.

> …the transport of CO_2 in large quantities is already being done. There are thousands of kilometres of CO_2 pipelines operating today in the United States. They have been operating for decades. They already transport tens of millions of tonnes of CO_2 a year around the United States. So the transport technology for CO_2 is very well understood and pipeline transport is happening now on a large scale. [296]

6.24 CO2CRC provided details of a high-level scoping study estimating the cost of transporting CO_2 from New South Wales emission sources to several potential storage basins in eastern Australia. Their research found that the estimated transport costs 'range from about $10 per tonne of CO_2 transported to the nearest basin, to $32 per tonne transported to the furthest basin.' [297]

6.25 The CO2CRC further noted that transport costs 'are mainly driven by the distance between the emission sources and the storage basin location.'[298]

Storage

6.26 The final stage of the CCS process is the permanent storage of CO_2 underground. As noted earlier, the liquefied CO_2 is injected underground into natural containment areas created by unique rock formations.

6.27 There are a number of types of geological structure in which the CO_2 is stored. Professor Wiley suggested that there 'are two main areas where we anticipate that CO2 would be stored underground. Those are in depleted oil and gas fields or in saline aquifers.' [299]

6.28 It was put to the Committee that the geosequestration of CO_2 is a well understood process that involves few environmental risks or consequences. Mr Jones of the Global CCS Institute argued that the risks are well understood:

> I think geologists would argue that the consequences, if I can put it that way, of putting CO_2 that distance underground are fairly well understood. The type of reservoirs we are talking about are those that are deep and that have a very well-defined cap rock, so there is a trapping mechanism to make sure that CO_2 does not come up again. There are well understood analogues from the storage of things like natural gas underground where we know that it is possible to contain gas underground for many millions of years.
>
> The studies that have been done, both desktop studies but also by looking at some of the operating projects around the world, are giving the geological profession a very good understanding of what happens to CO_2 when you inject it underground, where it goes, and how it behaves. In a general sense, the risks are well understood, and the risks are generally quite low of putting CO_2 at that depth underground. The evidence is it stays there, it migrates in a well understood pattern through the rock, it is contained by the impermeable layers of rock above it and, because it is well

296 Mr Barry Jones, General Manager, Policy and Membership, Global CCS Institute, Evidence, 11 May 2012, p. 54.

297 CO2CRC, Answers to questions taken on notice in evidence, 11 May 2012, p. 1.

298 CO2CRC, Answers to questions taken on notice in evidence, 11 May 2012, p. 1.

299 Professor Diane Wiley, Program Manager, CO2CRC, UNSW, Evidence, 11 May 2012, p. 49.

> below any potable aquifers or water or other usage used by humans, there are really very few environmental consequences of putting it down there.[300]

6.29 The Global CCS Institute also provided the Committee with the results of a number of different studies examining the costs of storage. The table below presents the 2011 cost estimates for on-shore storage in saline aquifers, from agencies including the International Energy Agency, the Global CCS Institute and the United States Department of Energy's National Energy Technology Laboratory. Note that the costs estimates are in US dollars per tonne of CO_2 stored:

Table 4: Summary of recently completed CCS storage cost studies [301]

	Global CCS Institute	National Energy Technology Laboratory	International Energy Agency
US$ /t CO_2	6	3.2 - 5.6	<10

Location of storage sites in New South Wales

6.30 While the capture and transport technologies of CCS can be relatively easily adapted from one location to another, the identification and assessment of CO_2 storage locations is site specific and may require additional research and investment.[302]

6.31 Evidence provided to the Committee suggested that there is a dearth of information about the location of viable storage sites within New South Wales. For example, Dr Alex Wonhas, Director, CSIRO Energy Transformed Flagship, contrasted the potential displayed by Queensland and Victoria with that of New South Wales, noting that more work would be required to demonstrate viable sites in New South Wales:

> The general consensus is that there are reasonably promising sites and geological structures in Queensland and Victoria, but less so in New South Wales, so there would probably be more work required to establish viable storage reservoirs in this State. [303]

6.32 In its submission, Delta Electricity explained that the lack of data about geological structures in New South Wales stems from the fact that the state has not had the same history of exploration by the gas and oil industry which has occurred in other states:

> Despite the economic importance of the Sydney-Gunnedah Basin to the State, there is still a lack of data and a relatively poor understanding of the detailed geology of the Basin over wide areas and in all areas at depths greater than 600m. Compared to most other Australian states the deep sedimentary basins of NSW are virtually unexplored due to a historical lack of investment by traditional petroleum

300 Mr Barry Jones, General Manager, Policy and Membership, Global CCS Institute, Evidence, 11 May 2012, p. 48.

301 Global CCS Institute, Answers to questions taken on notice in evidence, 11 May 2012, p. 2.

302 Mr Greg Sullivan, Deputy Chief Executive Officer, Australian Coal Association, Evidence, 26 March 2012, p. 27.

303 Dr Alex Wonhas, Director, CSIRO Energy Transformed Flagship, Evidence, 11 May 2012, p. 5.

> exploration companies. This is due to the focus on shallow depth exploration for coal mining in NSW. [304]

6.33 Delta considered that the potential lack of suitable storage sites was the most significant barrier to the establishment of CCS in New South Wales. They further noted that the location of new coal-fired power stations in the NEM is likely to be influenced by the proximity of a suitable CO_2 reservoir, and suggested that 'if NSW has not identified geosequestration sites, any new power station may be constructed outside NSW which may result in reduced system security.'[305]

6.34 In light of similar concerns, Mr Greg Sullivan, Deputy Chief Executive Officer, Australian Coal Association noted that 'locating suitable storage sites for CO_2 sequestration is fundamental to the deployment of carbon capture and storage technology' and recommended that this 'should be a focus of the Coal Innovation NSW work program.'[306]

6.35 As part of the Coal Innovation NSW work program, the Department of Trade and Investment, Regional Infrastructure and Services has in fact already commenced the NSW Storage Capacity Project to assess the potential of storage opportunities within the state. The project will explore the sedimentary basins in NSW and assess their suitability for the geological storage of carbon dioxide. The Australian Coal Association explained that the objective of the project is twofold: to identify a suitable site for a CCS demonstration project, and to identify prospective sites for CCS storage across NSW. They explained progress to date:

> The project has completed drilling four wells, two near the coast between Newcastle and Sydney in the vicinity of Munmorah and Vales Point Power Stations respectively, and two in the Upper Hunter Valley near Merriwa. The analysis of these wells is complete. All four wells were drilled to provide base data from which to consider further drilling for more detailed site characterisation. However, none showed adequate porosity and permeability over sufficient depths to indicate potential for storage of even modest storage volumes. It was concluded that the available budget would be better spent in other areas. The project is planning to drill a further four wells in the Darling basin, which is located in the far west of the State. The planning and procurement for this drilling is currently under way.[307]

6.36 On 4 June 2012, the Hon Chris Hartcher, Minister for Resources and Energy, announced the NSW CO_2 Storage Assessment Program funding agreements between NSW, Geoscience Australia, and the Australian Coal Association Low Emissions Technology Ltd (ALCALET). Each body will contribute $18.1 million to the program. Drilling of the test wells in the Darling Basin is expected to begin in the first quarter of 2013. The total budget for the Darling Basin stage of the project is $21.6 million.[308]

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304 Supplementary Submission 10a, Delta Electricity, p. 8.

305 Supplementary Submission 10a, Delta Electricity, p. 3.

306 Mr Greg Sullivan, Deputy Chief Executive Officer, Australian Coal Association, Evidence, 26 March 2012, p. 20.

307 Australian Coal Association and NSW Minerals Council, Answers to questions taken on notice taken in evidence, pp. 3-4.

308 Mr Rick Fowler, Program Director, Coal Innovation NSW, Correspondence to Chair, 8 October 2012, pp. 2-4.

The economics of CCS

6.37 The implementation of carbon capture and storage involves significant up front capital costs as well as much higher ongoing costs than those that would ordinarily be incurred by a coal or gas power station.

6.38 The Committee received evidence about the additional capital costs associated with CCS from Inquiry participants such as the National Generators Forum. In its submission the National Generators Forum stated that incorporating CCS technology could treble the capital cost of a coal-fired power station:

> Investment in a thermal power station involves substantial financial outlays. For instance, the capital cost of a (four unit) 2,000MW black coal-fired station can cost upward of $5 billion to more than three times that for stations that incorporate carbon capture and storage (CCS) technologies.[309]

6.39 The CO2CRC provided the Committee with estimates of the total costs of CCS projects per tonne of CO_2. It observed that costs for the majority of current CCS projects are not available, and therefore the estimates provided are the results of engineering studies rather than real operating data:

> … There have been a number of recent generic engineering studies that have estimated total project costs for capturing, transporting and storing CO_2. From these studies, the indicative cost for fully integrated CCS projects range from A$80 to A$200 per tonne of CO_2 avoided. The levelised cost of electricity (LCOE) for CCS added to coal fired power plants falls in the range of A$100 to A$220 per MWh, which is similar to the range of costs for other low emission energy sources. These estimates are yet to be verified with real operating data.[310]

6.40 Cost was highlighted by Inquiry participants as one of the major barriers to commercial implementation of CCS on a large scale. For example, Mr Tim Reardon, Executive Director, National Generators Forum, suggested that 'CCS's limitation is more on a price competitiveness basis,' before noting that current projects on the storage potential in New South Wales will be valuable if and when CCS becomes commercially viable in the future.[311]

6.41 When asked by the Committee whether the $23/tonne carbon price would be sufficient to drive investment in CCS by the coal and power industries, Mr Peter Morris, Director, Economic Policy, Australian Coal Association, replied that for CCS development to be driven by the market, the carbon price would need to be $70 or greater:

> The quick answer is no, it will not. Some work by the Australian Strategic Policy Institute… suggests that the price on carbon would need to be $70 or more for carbon capture and storage to be driven by the market. [312]

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309 Submission 30, National Generators Forum, p. 7.

310 CO2CRC, Answers to questions taken on notice taken in evidence, 11 May 2012, p. 2.

311 Mr Tim Reardon, Executive Director, National Generators Forum, and Greg Everett, Director, National Generators Forum and Chief Executive, Delta Electricity, Evidence, 11 May 2012, p. 23.

312 Mr Peter Morris, Director, Economic Policy, Australian Coal Association, Evidence, 26 March 2012, p. 22.

6.42 In its 2012 'Australian Energy Technology Assessment', the Bureau of Resources and Energy Economics (BREE) provided estimates of the levelised cost of electricity (LCOE) for a number of types of power plants with CCS technology (LCOE methodologies are discussed further in Chapter Eight). As CCS is not currently considered to be commercially deployable, there were no estimates of the LCOE of power plants with CCS for 2012. Instead, the report projected that in the year 2030 - when the technology is expected to be deployable - the LCOE for a coal supercritical plant with CCS would be $192 per MWh. The report also projected that the 2030 LCOE for a combined cycle gas plant with CCS would be $158 per MWh.[313]

6.43 The federal government's Carbon Storage Taskforce found that carbon capture and storage is technically viable and that the first capture hub in Australia could be operational by 2020-25. The Taskforce noted that estimates of the cost of transporting and storing CO2 varied widely, but that the Latrobe Valley would be likely to have a competitive advantage due to its proximity to possible storage sites in the Gippsland Basin. The Taskforce did not produce estimates of the cost of capturing carbon.[314]

6.44 Estimates of the levelised cost of electricity for various alternative sources of energy generation are discussed in more detail in Chapter Eight.

Expected commercial deployment

6.45 A number of submissions suggested that development and deployment of CCS will not occur in the timeframe that is required, if at all.[315] For example, in its submission the Australian Nuclear Science and Technology Organisation declared that:

> Affordable clean coal being available in a short time frame is not supported by the science, or the technological maturity of the technologies, or the required regulatory assurance. A balanced consideration of worldwide evidence is that clean coal will not be economical in the required timeframe. The assumptions that underpin policy optimism in this regard therefore cannot be sustained.[316]

6.46 Mr John Doherty was similarly critical of the potential for CCS:

> It has been proposed that CO_2 emissions will be assisted by carbon capture and storage (CCS). Very large sums have been spent on CCS research and nothing has been produced which suggests it can be a physical possibility, let alone economic, for fossil fuel power generation in NSW in the next 20 years, or ever… One should stop wasting money on these dreams.[317]

313 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', pp. 63-67.

314 Carbon Storage Taskforce, 'National Carbon Mapping and Infrastructure Plan – Australia; Concise Report', September 2009, p. 1.

315 Submission 27, Australian Nuclear Science and Technology Organisation; Submission 31, Mr Barrie Hills; Submission 32, Mr John Doherty.

316 Submission 27, Australian Nuclear Science and Technology Organisation, p. 4.

317 Submission 32, Mr John Doherty, pp. 2-3.

6.47 Other Inquiry participants, such as Mr Sullivan, were more supportive of the technology, but conceded that the earliest expected commercial deployment of CCS would not be until 2035:

> There is still a good deal of work to be done to prove up carbon capture and storage technologies at a commercial scale… The projections for the commercial deployment of carbon capture and storage are still around 2030 to 2035 at this stage with initial deployment of commercial-scale demonstrations in the early 2020s. That is the earliest they would be available. It does not seem at this stage that the 2035 scenario has moved forward based on the work that has been done. [318]

Need for investment in CCS

6.48 In order to develop CCS technology, further research and investment will be required to move CCS beyond the current trial and demonstration phase to reach commercial viability and deployment. Mr Sullivan suggested that government investment would be needed to bring about the commercial deployment of CCS, arguing that:

> first-of-a-kind technology… has very often required substantial public sector investment for many years to bridge the commercial gap that exists at the outset of the development and deployment of the technologies. … There will be an ongoing need for public sector investment in CCS and that is true in every country.[319]

6.49 Dr Wonhas similarly suggested that CCS technology was at an early stage of development and noted the potential for future innovations to reduce costs. In the following exchange Dr Wonhas stressed that the deployment of CCS is required to drive industry investment and technological innovations:

> I think for carbon capture and storage, as with probably most of the technologies we have discussed, we are very much at the beginning of the learning curve and when we look at, for instance, what is in the research pipeline in terms of new capture technologies that reduce parasitic power losses, et cetera, there is still a lot more innovation that can reduce the cost in the long term—I am very confident of that. The key challenge though, I think it is important to say, is people will only make the investment in those innovations when they see deployment of those technologies, so if those technologies do not get deployed and big industry does not get interested in it, it would be very hard to justify the research programs and development programs to bring those costs down.
>
> Dr GEOFF LEE: So it is a market-driven or price-driven form of investment to drive costs down.[320]
>
> Dr WONHAS: Yes, without deployment of those technologies I would argue that, unless we have some phenomenal breakthrough, it is probably unlikely that we will see the costs coming down. That is exactly what we have seen across all of the

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318 Mr Greg Sullivan, Deputy Chief Executive Officer, Australian Coal Association, Evidence, 26 March 2012, p. 22.

319 Mr Greg Sullivan, Deputy Chief Executive Officer, Australian Coal Association, Evidence, 26 March 2012, p. 22.

320 Dr Geoff Lee MP, Evidence, 11 May 2012, p. 6.

> existing technologies—be it wind, be it solar—where over the last couple of decades we have seen some significant cost reductions. It is all driven by deployment.[321]

Current investment in CCS

6.50 The Committee received evidence suggesting that both government and industry have already committed significant investment towards the development of CCS technologies. For example, Mr Peter Morris, Director, Economic Policy, Australian Coal Association advised the Committee that members of the Association were raising $1 billion dollars over ten years to invest in CCS development.[322]

6.51 In its submission the Australian Coal Association provided further details about this $1 billion fund, including some of the projects it is supporting in collaboration with the NSW Government:

> This important initiative complements the Australian black coal industry's $1 Billion COAL21 Fund – the world's first voluntary industry fund to support CCS demonstration and deployment.
>
> The industry is committed to supporting the development and deployment of CCS in NSW. Under the COAL21 Fund the coal industry is currently partnering with the NSW Government in two major CCS projects:
>
> 1. the NSW Storage Program ($18.1 million) and
>
> 2. the Delta Post-Combustion Capture Project ($50 million).
>
> The industry is also investing in national projects of direct benefit to NSW, including $75 million over seven years for CCS research and development through Australian National Low Emissions Coal Research Ltd.[323]

6.52 Mr Barry Jones, General Manager, Global CCS Institute, advised that the federal government has also committed significant funds to the development of carbon capture and storage in the form of its CCS flagships program 'which provides several billion dollars worth of potential support for CCS projects and technologies.'[324]

Committee comment

6.53 The Committee recognises the particular importance of carbon capture and storage technology in NSW, which has a competitive advantage in the production and use of black coal for electricity generation.

6.54 The Committee notes that both Commonwealth and State Governments have provided significant support for research into carbon capture and storage technologies to date, and looks forward to the outcomes of demonstration projects currently under way in NSW and in other states. The Committee also

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321 Dr Alex Wonhas, Director, CSIRO Energy Transformed Flagship, Evidence, 11 May 2012, pp. 5-6.

322 Mr Peter Morris, Director, Economic Policy, Australian Coal Association, Evidence, 26 March 2012, p. 23.

323 Submission 28, Australian Coal Association and NSW Minerals Council, p. 10.

324 Mr Barry Jones, General Manager, Policy and Membership, Global CCS Institute, Evidence, 11 May 2012, p. 48.

endorses the current focus of State Government funding on the identification of suitable storage sites for CO_2 sequestration in New South Wales.

Chapter Seven – Coal seam gas

Introduction

7.1 Without significant reserves of conventional gas, NSW is vulnerable to increasing gas prices. Coal seam gas is a potential new source of energy which has the capacity to transform the gas industry in New South Wales, and improve the State's energy security.

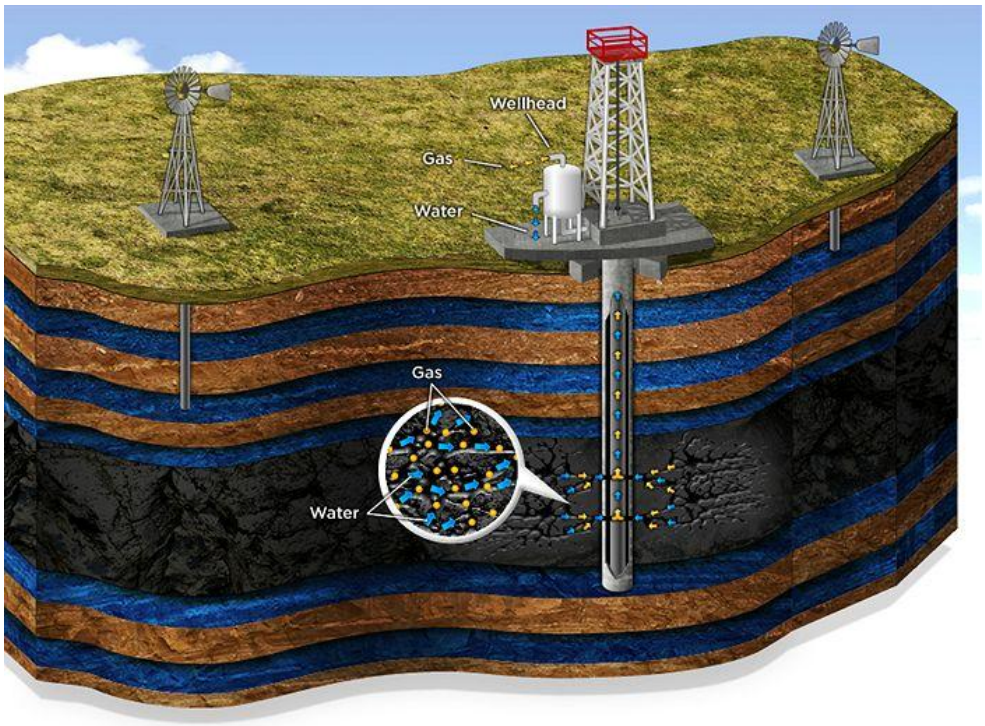
7.2 This chapter discusses the impact that coal seam gas may have on the economics of electricity generation within New South Wales, as well as opposition to coal seam gas development and recent developments in the regulatory environment which have sought to address community concerns about coal seam gas. The Committee considered that the NSW Government should conduct a public education campaign providing accurate information about coal seam gas production in New South Wales.

Coal seam gas reserves in New South Wales

7.3 Coal seam gas (CSG) is an unconventional form of natural gas, consisting primarily of methane, which occurs within the pores or fractures of coal seams. While CSG has been produced in the United States since the 1970s, it is a relatively new industry in Australia, with production commencing in the Bowen Basin in Queensland in 1996. The main CSG production project in NSW is the Camden Gas Project in the Sydney Basin, which began producing gas in 2001 and currently supplies around 6 per cent of the NSW gas market.[325]

[325] NSW Trade and Investment, Regional Infrastructure and Services – Coal seam gas website, www.resources.nsw.gov.au/community-information/coal-seam-gas/what-is-coal-seam-gas, accessed 2 October 2012; and General Purpose Standing Committee No. 5, 'Coal seam gas', NSW Legislative Council, p. 7.

Figure 23: Coal seam gas and its extraction [326]



7.4 New South Wales does not have significant reserves of conventional natural gas and is heavily reliant on supplies from other states.[327] In its submission, TRUenergy provided details of the conventional and coal seam gas reserves identified in Australia. As shown in the following table, New South Wales has a relatively small amount of conventional gas, but significant coal seam gas reserves.

326 www.abc.net.au/rural/content/2011/s3373965.htm, accessed 2 October 2012.

327 Mr Mark Duffy, Deputy Director-General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 3.

Table 5: Australian conventional and coal seam gas resources and reserve estimates as at 31 December 2010 (PJ) [328]

Basin	States	Remaining proved-plus-probable	Remaining proved-plus-probable plus possible	Prospective
Conventional gas reserves				
Adavale	Queensland	21	25	6
Bass	Victoria	266	337	182
Bowen-Surat	Queensland, New South Wales	205	351	210
Cooper-Eromanga	South Australia, Queensland	1,396	1,612	1,594
Gippsland	Victoria	5,455	7,163	3,184
Gunnedah	New South Wales	6	9	3
Otway	Victoria, South Australia	991	1,518	869
Total conventional gas reserves		8,340	11,015	6,047
Coal seam gas reserves				
Bowen-Surat	Queensland, New South Wales	33,719	52,335	43,817
Clarence-Moreton	Queensland, New South Wales	397	2,418	3,893
Galilee	Queensland	0	0	21,840
Gloucester	New South Wales	669	832	0
Gunnedah	New South Wales	1,520	2,797	50,000
Sydney	New South Wales	293	469	0
Total coal seam gas reserves		36,598	58,851	119,550

Notes: 'Remaining' gas reserves are defined as the total quantity of gas expected to be recovered from a reservoir over its remaining productive life.

Source: Australian Energy Market Operator, 2011, Gas Statement of Opportunities.

7.5 As was discussed in Chapter Five, gas-fired electricity generation is expected to increase in the coming years. A number of Inquiry participants noted the potential for growth in gas generation, driven by the fact that its carbon emissions are lower than those produced by coal-fired generation. TRUenergy, for example, expected a significant increase in gas-fired generation following the introduction of the carbon pricing scheme, noting that gas generation is a mature technology able to be deployed in a short time frame and close to major demand centres. TRUenergy also noted the capacity of gas generation to mitigate against the intermittency of renewable generation.[329]

7.6 While the demand for gas-fired generation is expected to increase in future years there are concerns about the capacity of existing sources of gas to meet growing

328 Submission 26, TRUenergy, pp. 35-36.

329 Submission 26, TRUenergy, p. 2.

future demand. Mr Andrew Lewis, Executive Director Energy, Department of Trade and Investment, Regional Infrastructure and Services, told the Committee that traditional sources of gas have been located in other states, but with these conventional supplies expected to soon reach their peak, there has been a recent focus on coal seam gas as a potential new source of supply:

> ... traditionally the sources of gas supply have been from Victoria, the Bass Strait and South Australia, the Cooper Basin, and they have been so for several decades now. As you would expect, those supplies are starting to peak, and looking forward to projections... those sources are expected to decline in their ability to meet the future demand for gas... from new gas-fired generation, increased household consumption as people are looking to gas as a fuel source, et cetera. So the focus is looking at where the new reserves of gas are. Queensland is probably where there is a fairly significant industry already developing in terms of coal seam methane and New South Wales has potential reserves that can supply our needs as well as other needs for a considerable amount of time. [330]

7.7 Companies such as AGL see coal seam gas as a viable source of gas for the domestic market, as it is likely to be less expensive than buying gas from a third party supplier in another state. Mr Paul Ashby, General Manager, Commercial Development, AGL, informed the Committee that AGL owns about half of the CSG resource within the state and their expectation is to produce about 50 per cent of their gas requirements from their own CSG resources.[331]

7.8 Mr Lewis indicated that the potential reserves of CSG in NSW are sufficient to supply the domestic market as well as demand for liquid natural gas exports:

> ...what I understand of both the Queensland and the New South Wales reserves, there is more than enough gas potentially available to supply new emerging markets, LNG export, increased gas-fired generation as well as the increasing demands of the traditional domestic manufacturing, industrial and household sectors. So there is enough gas there.[332]

7.9 Mr Lewis went on to say that 'the challenge is about ensuring the infrastructure is there to make sure that the various demands can be met'. The Department of Trade and Investment, Regional Infrastructure and Services considered that domestic reserves of CSG need to be developed in an appropriate and timely fashion, in order to reap benefits such as ensuring a reliable future gas supply.[333]

7.10 The Energy Supply Association of Australia suggested that it was important for the Government to accept new technologies such as coal seam gas (as well as emerging technologies like geothermal or CCS) without imposing onerous planning restrictions:

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330 Mr Andrew Lewis, Executive Director Energy, Department of Trade and Industry, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 4.

331 Mr Paul Ashby, General Manager, Commercial Development, AGL Energy, Evidence, 11 May 2012, pp. 58-59.

332 Mr Andrew Lewis, Executive Director Energy, Department of Trade and Industry, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 5.

333 Mr Andrew Lewis, Executive Director Energy, Department of Trade and Industry, Regional Infrastructure and Services, Evidence, 26 March 2012, pp. 4-5.

> The Government should also be prepared to accept technology developments such as coal seam and shale gas, wind, geothermal and carbon capture and sequestration (CCS) without resorting to overly restrictive planning regimes.[334]

Opposition to the development of CSG

7.11 As noted above, some Inquiry participants suggested that the Government should not impose excessive restrictions on the development of coal seam gas in New South Wales; however, other stakeholders expressed different views. For example, the Sustainable Energy Association of Australia considered that current NSW Government policies favour the development of CSG at the expense of renewable energy:

> Unfortunately, recent policy changes have shifted away from renewable energy to focus on the development of gas generation, primarily from CSG which acts as a discouragement to the planning of future investment in renewable energies that can potentially benefit the energy consumers of NSW. ...
>
> In SEA's view this is an extremely regressive step and is a clear case of 'picking winners' in terms of creating additional entry barriers for renewable energy projects in NSW while providing almost unfettered access for the development of CSG projects at the expense of stakeholder rights, in particular those of farmers and other landholders. [335]

7.12 Both of the Citizens' Policy Juries expressed concerns about coal seam gas. The Sydney Jury stated that public anxiety about coal seam gas exploration and production requires that there be 'strict regulatory controls to limit damage to prime agricultural land and aquifers, and more heavily populated areas, i.e. the Sydney basin region.'[336]

7.13 The New England Citizens' Jury, meanwhile, recommended that 'generation policy needs to set clear environmental and health bench marks that meet community expectations.' The Jury felt that 'coal seam gas, fraccing and uranium-based nuclear power are unacceptable given the current technologies and safety concerns' and recommended that there should be 'no new fossil fuel exploration for NSW power generation.'[337]

Previous coal seam gas Inquiry and consultation

7.14 The Committee notes that public concerns about coal seam gas have been raised and thoroughly investigated through the recent 'Inquiry into coal seam gas' conducted by the Legislative Council General Purpose Standing Committee No. 5.[338]

7.15 The General Purpose Standing Committee investigated numerous aspects of the coal seam gas industry including the following key issues:

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334 Submission 15, Energy Supply Association of Australia, p. 4.

335 Submission 19, Sustainable Energy Association of Australia, p. 12.

336 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 7.

337 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 10.

338 General Purpose Standing Committee No. 5, 'Coal seam gas', NSW Legislative Council.

- potential for CSG activities to contaminate water resources,
- fraccing,
- remediation in the event of deleterious environmental impacts,
- community engagement and consultation,
- land access and compensation,
- coexistence of agriculture and CSG industries,
- economic benefits of CSG,
- impact on energy security and prices,
- greenhouse gas emissions,
- alleged breaches of environmental regulations, and
- the regulatory regime governing CSG activities.[339]

7.16 The General Purpose Standing Committee made 35 recommendations about coal seam gas activities. These included recommendations to abolish the five year royalty holiday for CSG production and to implement a domestic gas reservation policy similar to that used in Western Australia, in addition to the report's final recommendation that the Government 'issue no further production licences until a comprehensive framework for the regulation of the coal seam gas industry is implemented.'[340]

7.17 Following the publication of the General Purpose Standing Committee's report on coal seam gas, the NSW Government released its Strategic Regional Land Use Policy, which itself involved 'an extensive period of consultation during which over 2,000 submissions were received and over 1,100 people attended public forums and information sessions.'[341]

7.18 The Strategic Regional Land Use Policy, along with the related Aquifer Interference Policy, have instituted stringent new controls to regulate the coal seam gas industry, with 27 new initiatives now in place to regulate coal seam gas exploration and production in NSW and to provide adequate protection to underground water resources. The Government's regulation of the industry has included a “Gateway” process for mining and CSG proposals on land identified as strategic agricultural land, along with the development of two Codes of Practice which require world’s best practice for fraccing and well design, as well as releasing a draft Code of Practice for Coal Seam Gas Explorers, 'to ensure strong

339 General Purpose Standing Committee No. 5, ‘Coal seam gas’, NSW Legislative Council, pp. xiv - xvii.

340 General Purpose Standing Committee No. 5, ‘Coal seam gas’, NSW Legislative Council, pp. xvi – xxi.

341 www.nsw.gov.au/sites/default/files/uploads/common/StrategicRegionalLandUsePolicy-MediaRelease_SD_v02.pdf, accessed 8 October 2012.

standards are set for industry during the exploration phase, including community consultation requirements.'[342]

7.19 The NSW Parliament has also recently passed the *Petroleum (Onshore) Amendment (Royalties and Penalties) Act 2012*, to abolish the five year royalty holiday for CSG production, and to increase penalties (up to $1.1 million for corporations) for certain breaches of exploration and mining laws.[343]

Committee comment

7.20 The Committee considers that there will be an increased demand for gas-fired generation in the future as the State transitions to lower carbon emissions. This increased demand, along with other factors such as dwindling supply of conventional gas and moves towards international price parity, are expected to put pressure on conventional gas prices and, as a result, the cost of electricity.

7.21 The development of New South Wales' significant coal seam gas resources has potential to ease some of these pressures. Coal seam gas has the potential to increase energy security and affordability in New South Wales, as well as providing other economic benefits to the State associated with the development of a new industry.

7.22 The Committee does not support a domestic gas reservation policy, as this would inappropriately interfere with the operations of the gas market. The Committee considers that the best way to encourage future gas production and supply is to allow the market to operate freely. However, if additional incentives are required in the future to encourage the domestic supply of gas, offering a reduction in royalties for domestic gas suppliers may be an option. The Committee notes that the recent removal of the five year royalty holiday for coal seam gas production would provide greater scope for this option to be explored, if it is required in the future.

7.23 The Committee notes that the views of the Citizens' Policy Juries reflect a strong apprehension about coal seam gas, particularly in parts of rural and regional New South Wales. The Committee acknowledges that there are public concerns about the coal seam gas industry and notes that these concerns have been raised and thoroughly investigated through the recent 'Inquiry into coal seam gas' conducted by the Legislative Council General Purpose Standing Committee No. 5, as well as through the NSW Government's consultation efforts in the development of its Strategic Regional Land Use Policy.

7.24 The Committee notes that in response to community concerns about the development of coal seam gas, the Parliament conducted an Upper House *Inquiry into coal seam gas*, and the NSW Government sought to address public concerns through the introduction of its Strategic Regional Land Use Policy and Aquifer Interference Policy, which will institute stringent new controls to regulate the

342 www.nsw.gov.au/sites/default/files/uploads/common/CSG-FAQ_SD_v01.pdf, accessed 27 September 2012; and www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/Aquifer-interference/Aquifer-interference , accessed 22 October 2012

343 The Hon Chris Hartcher MP, Petroleum (Onshore) Amendment (Royalties And Penalties) Bill 2012, 2nd reading speech, 23 October 2012.

coal seam gas industry, as well as through the introduction of the *Petroleum (Onshore) Amendment (Royalties and Penalties) Act 2012* which substantially increases penalties for mining and coal seam gas companies that breach exploration and mining laws. Notwithstanding these efforts, the Committee notes that there are still public concerns surrounding coal seam gas.

7.25 While the protective measures recently introduced by the NSW Government mean that New South Wales now has the strongest regulation of coal seam gas exploration and activity in Australia, the Committee believes that greater publicly available information and education about coal seam gas are required before CSG activity will be widely accepted in the community.

7.26 The Committee therefore finds that coal seam gas should not be ruled out as a source of energy in New South Wales, where development meets the stringent Government controls that have been recently implemented. The Committee recommends increased public education to provide accurate information about coal seam gas.

RECOMMENDATION 9

That the NSW Government conduct a public education campaign providing up-to-date and accurate information about the economic and environmental risks, relevant government regulations, and benefits of coal seam gas production in New South Wales.

Chapter Eight – Renewable Energy Generation

Introduction

8.1 This chapter addresses item (v) in the Terms of Reference: the potential for, and barriers to, renewable forms of energy generation. It focuses on those forms of renewable energy which are currently part of the energy mix in NSW, including hydroelectricity, which has provided electricity for NSW for many years, and the growing wind and solar industries.

8.2 The chapter considers the advantages and disadvantages of these forms of energy, as well as the potential for, and barriers to, further development of these industries. Best practice in other jurisdictions is also briefly canvassed, as are energy storage technologies, which are of particular importance to the wind and solar industries.

8.3 The Committee formed the view that the NSW Government should avoid trying to 'pick winners' and should not subsidise particular types of energy generation at a commercial scale. However, the Committee did consider that there is a role for government to further invest in research and development of energy storage technologies.

Context of renewable energy development

8.4 Increasing concerns about global warming and climate change have driven changes to energy policy, with both Commonwealth and State governments introducing measures to promote energy efficiency and develop alternative sources of energy. Concerns about the possible effects of increasing industrialisation on the earth's climate date back many years. The first United Nations Framework Convention on Climate Change was signed in 1992, with the Kyoto Protocol committing industrialised countries to stabilising greenhouse gas emissions initiated in 1997. Australia ratified the Kyoto Protocol in 2007.

8.5 In 2008, Professor Ross Garnaut was commissioned by the Commonwealth and State governments to examine the impacts of climate change on Australia and to recommend policy frameworks to improve the prospects of sustainable prosperity. In his report, Professor Garnaut concluded that 'the weight of scientific evidence tells us that Australians are facing risks of damaging climate change.'[344]

8.6 Use of fossil-fuel based energy is a key cause of greenhouse gas emissions that are the cause of climate change. The Commonwealth Climate Commission believes that it is therefore necessary to move away from reliance on fossil fuels:

> To lessen the risks to our economy, the environment and our way of life, we must significantly reduce the amount of greenhouse gases we produce. This will require a

[344] Garnaut, R., (2008) 'The Garnaut Climate Change Review: Final Report', Commonwealth of Australia, p. 1.

> progressive move away from relying on fossil fuels, like coal and oil, to cleaner forms of energy.[345]

8.7 As already discussed in previous chapters, both Commonwealth and State governments have introduced a range of measures aimed at reducing carbon emissions and encouraging energy efficiency or use of alternative forms of energy. Many of these measures pre-dated ratification of the Kyoto Protocol. The Commonwealth Renewable Energy Target, for example, was introduced in 2001. It mandates a target of 20 per cent renewable energy by 2020 and has been a key driver of investment in alternative energy generation over the last decade.

8.8 Renewable energy sources have significant advantages in addition to reducing carbon emissions. In most cases the effects of renewable energy generation upon the environment are significantly less than those of energy generated by fossil fuels. With the exception of concerns about the possible health impacts of wind farms, which are discussed in this chapter, renewable energy sources present no identified health or environmental impacts.

8.9 Further, renewable energy sources have no fuel costs, and are therefore not vulnerable to the fluctuations of fuel commodity markets. The deployment of renewable energies will thus diversify energy generation, reduce reliance on fuel markets, and increase Australia's energy security.

8.10 The Citizens' Policy Juries convened by the NewDemocracy Foundation expressed the view that targets for deployment of renewable energy should go beyond the current Renewable Energy Target. The New England group, for example, recommended that the NSW Government should:

> Build a strategic framework with targeted stages to achieve a goal of 100% sustainable, renewable/green energy mix, promoting flexible technologies choices for energy production. Targeted stages would provide increased assurance for investment in renewable/green energy technologies. An illustrative example is:
>
> - 30 per cent green energy/renewable by 2020;
> - 40 per cent green energy/renewable by 2025;
> - 50 per cent green energy/renewable by 2030;
> - 60 per cent green energy/renewable by 2035;
> - 70 per cent green energy/renewable by 2040;
> - 80 per cent green energy/renewable by 2045, and
> - 100 per cent green energy/renewable by 2050.[346]

345 Climate Commission, 'The Critical Decade: International action on climate change', August 2012, p. 7.

346 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 5.

Barriers to deployment of renewable energy

8.11 However, there are real barriers to the deployment of renewable energy generation. Some of these barriers, such as high capital costs, affect more than one source of energy generation. Without significant government investment, the cost of developing a new, expensive form of energy generation is prohibitively high for investors.

8.12 NSW has significant potential resources of wind and solar energy, but the intermittent nature of these energy sources constitutes a barrier to their widespread deployment, particularly for baseload generation. While demand for energy fluctuates, it rarely fluctuates in correlation with the production of wind and solar energy. In this sense, wind and solar energy are not secure.

8.13 NSW's legacy of coal-fired generation also presents a genuine barrier to the deployment of further renewable energy. As discussed in Chapter Two, NSW's existing electricity network was built around coal-fired generation, with the infrastructure of electricity transmission and distribution also focused on these same sources. The cost of connecting to the existing grid can be prohibitive for alternative energy generators. Added to this, much of the potential wind and solar energy resources are located in areas which are remote from existing electricity infrastructure.

8.14 For example, the Clean Energy Council acknowledged that connecting to the grid is a challenge and argued that the NSW Government should facilitate extensions to the grid to support renewable energy generators:

> Realising the full potential of NSW's renewable energy sources will require a shift in the locations where electricity is generated and the transmission capacity of such areas. The transmission system can present a challenge to connecting renewables to the grid, especially in areas of high penetration. The NSW Government can play a role in facilitating this through measures such as supporting extensions to the grid. Prioritising a review of current connection and approvals processes which act as a disincentive to the deployment of renewable energy projects such as bioenergy, cogeneration and trigeneration projects is imperative to realise the considerable opportunities provided by these technologies. [347]

8.15 The costs of connecting to the grid were identified by the Citizens' Policy Juries as a key barrier to the deployment of renewable energy generation. Both groups identified this as an issue. The Sydney group, for example, recommended that the grid be extended to connect renewable energy generators, and that this be funded by the Commonwealth Renewable Energy Fund.[348]

Levelised Cost of Energy (LCOE)

8.16 'Levelised Cost of Energy' (LCOE) is a commonly used tool for measuring and comparing the costs of different forms of electricity generation. The Bureau of Resource and Energy Economics (BREE) explained LCOE in the following terms:

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347 Submission 25, Clean Energy Council, p. 2.

348 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 2.

> LCOE is the most commonly used tool for measuring and comparing electric power generation costs. It reflects the minimum cost of energy at which a generator must sell the produced electricity in order to breakeven. It is equivalent to the long-run marginal cost of electricity at a given point in time because it measures the cost of producing one extra unit of electricity with a newly constructed electricity generation plant.[349]

8.17 LCOE estimates are used to compare costs for different types of existing electricity generation, as well as for estimating the future costs of different types of generation. They were used, for example, by the Bureau of Resource and Energy Economics in its 'Australian Energy Technology Assessment 2012', which estimated the current and future costs for 40 different types of electricity generation.

8.18 The calculation of levelised costs uses a complex formula involving a number of inputs and assumptions.[350] For technologies which have not yet been commercially deployed, cost estimates are more difficult to assess. The BREE report did not include LCOE calculations for such technologies until the date when they are likely to be commercially deployed.

8.19 The following figures include LCOE estimates from the BREE for generation technologies that are discussed in this report (major renewable technologies are discussed in this chapter, emerging renewable technologies and nuclear energy are discussed in Chapter Nine, while gas and coal have been discussed in previous chapters). Figure 21 includes LCOE estimates for the current year, while Figure 22 includes estimates of the costs that will apply in 2030.

8.20 As noted above, the BREE report did not include 2012 estimates for technologies that were not yet commercially available, thus there are a number of emerging technologies that only appear in Figure 22 (the 2030 LCOE estimates). Also note that each technology includes two LCOE estimates – one which includes the cost of the carbon price, and one which does not.

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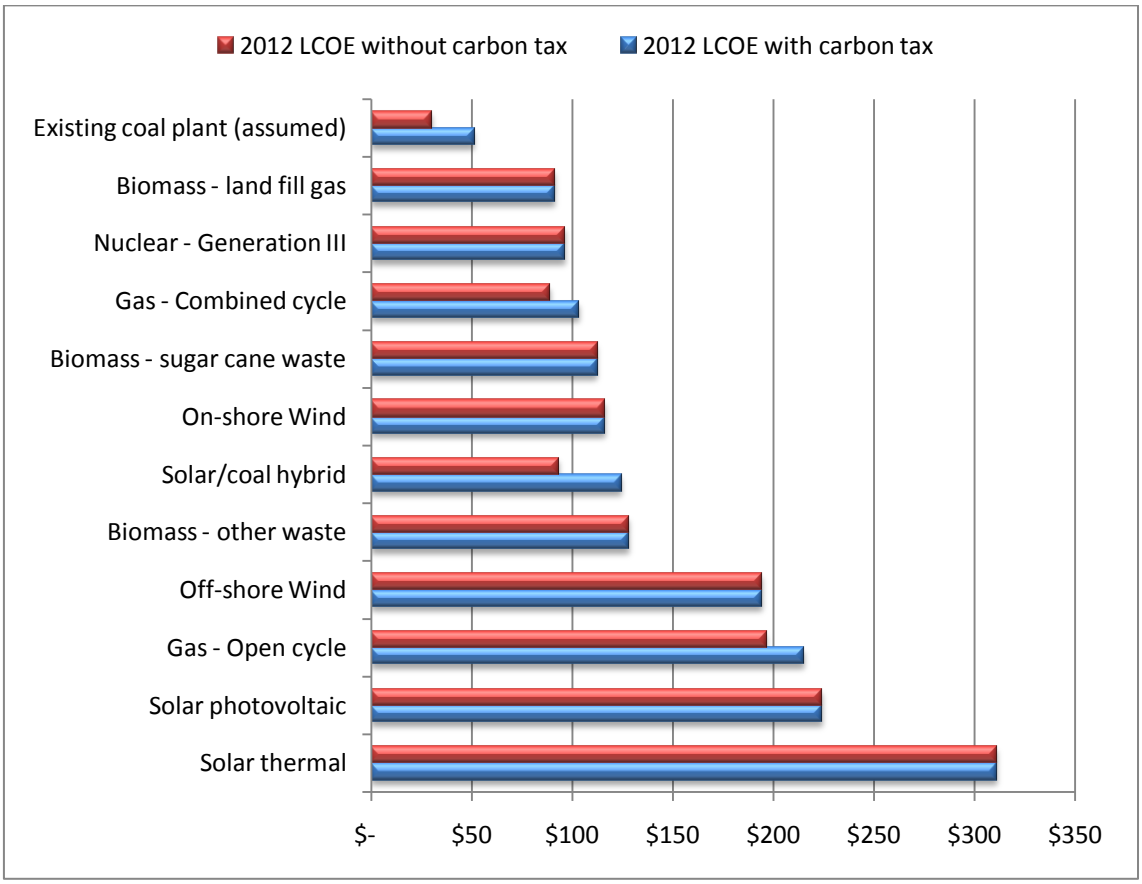
349 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 20.

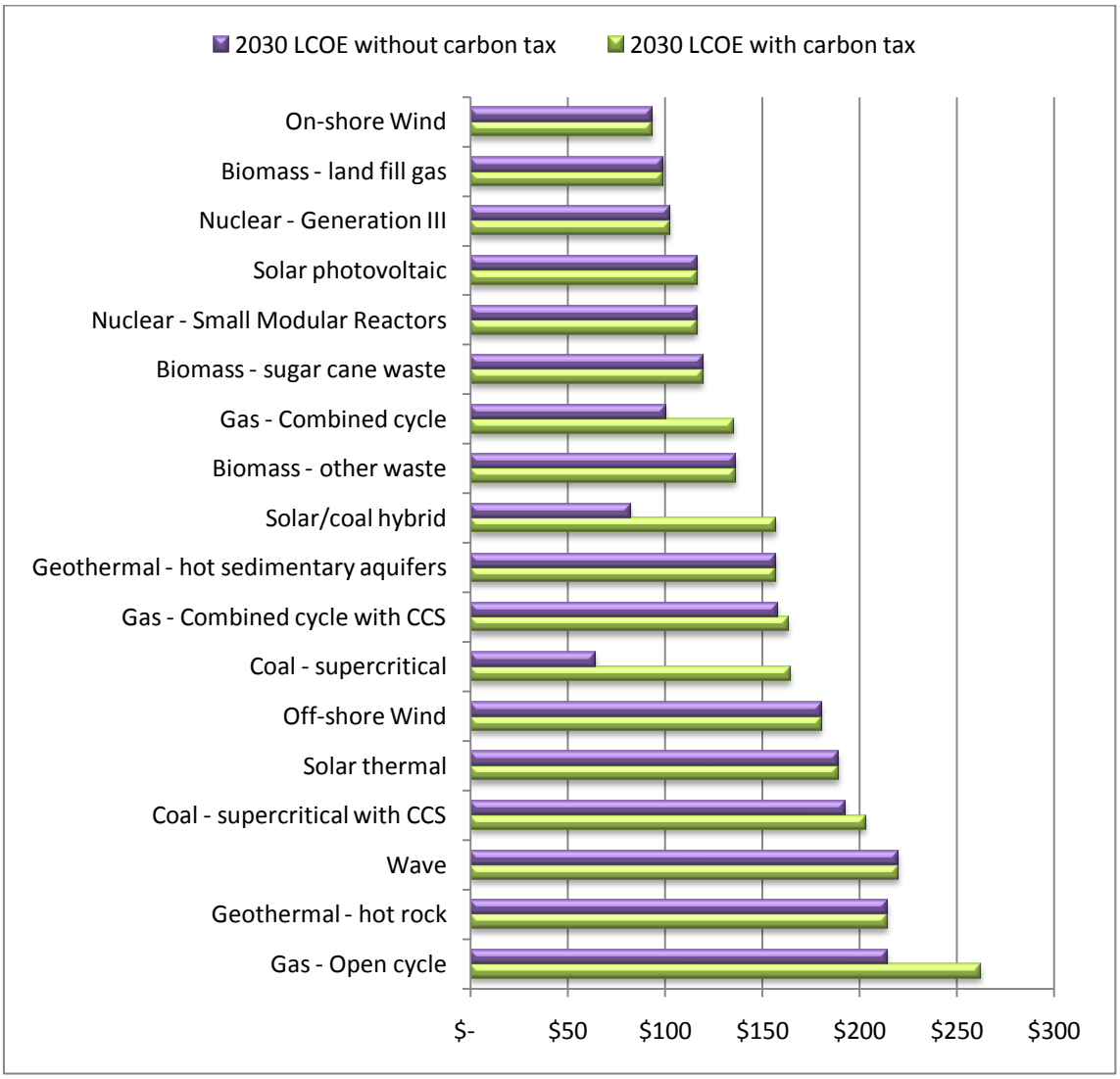
350 For details of the LCOE formula, see: Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', pp. 20-21.

Figure 24: Levelised Cost of Energy 2012 [351]



351 For further detail, see Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012'.

Figure 25: Levelised Cost of Energy 2030 [352]



HYDROELECTRICITY

8.21 Hydroelectricity is the generation of electricity by channelling falling or flowing water, from reservoirs, rivers or waterfalls, through water turbines. The method most commonly used involves dam water which is control released into turbines.[353]

8.22 The amount of energy created is dependent on the volume of water and the force of the water flow. The potential energy of the water is increased by the increased difference between the height of the water source (head) and the height of the turbine or outflow.[354]

352 For further detail see Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012'.

353 www.ga.gov.au/energy/other-renewable-energy-resources/hydro-energy.html, accessed 21 September 2012.

354 Geoscience Australia and the Australian Bureau of Agricultural and Resource Economics (2010) 'Australian Energy Resource Assessment', Canberra, p. 227.

8.23 Hydroelectricity is widely used in many countries and accounted for 16 per cent of the world's electricity generation in 2007.[355]

Advantages

8.24 Hydroelectricity has a significant advantage over other forms of electricity generation in that it is a mature technology which produces clean, renewable energy. Further, hydroelectricity also has 'low operating costs, and a high ramp rate (i.e. a quick response to electricity demand), enabling it to be used for either base or peak load electricity generation, or both.'[356] For example, the National Generators Forum observed that rapid-response hydroelectric power plants such as the various units in the Snowy River scheme, along with gas-fired power plants, are capable of modifying or 'ramping' their output up or down very quickly in order to respond to changing patterns of electricity demand.[357] This is a significant advantage over coal-fired stations, which require more time to adjust their output.[358]

8.25 The CSIRO has given an LCOE for hydroelectricity at $191.81 in 2015 and $179.95 in 2030.[359]

Current capacity

8.26 There are over 100 hydroelectric power stations in Australia, with the majority located in New South Wales, Victoria and Tasmania.

8.27 The overwhelming proportion of hydroelectric power in NSW is sourced from generators in the Snowy Hydro scheme. Other hydro stations – primarily operated by Sydney Water – represent a smaller proportion of generating capacity. For example a relatively small, 50MW station operates as part of the Warragamba Dam in New South Wales.

Other jurisdictions

8.28 In Tasmania, the predominant source of energy is hydroelectric due to the abundant rainfall and elevation changes that make hydroelectricity reliable and plentiful.[360] Similarly, hydroelectricity accounts for a large proportion of electricity generation in New Zealand. In contrast, New South Wales generally has limited areas of elevation, variable rainfall, and high rates of evaporation.[361]

Future capacity

8.29 The capacity for further development of hydroelectric resources in Australia is limited due to the scarcity of water.[362] Existing potential for hydroelectricity,

355 Geoscience Australia and the Australian Bureau of Agricultural and Resource Economics (2010) 'Australian Energy Resource Assessment', Canberra, p. 225.

356 Geoscience Australia, www.ga.gov.au/energy/other-renewable-energy-resources/hydro-energy.html, accessed 3 October 2012.

357 Submission No 30, National Generators Forum, p. 8.

358 Submission No 30, National Generators Forum, p. 9.

359 CSIRO, (2011) 'Unlocking Australia's Energy Potential', pp. 66-67.

360 Submission 10, Delta Electricity, p. 5.

361 Geoscience Australia and ABARE (2010) 'Australian Energy Resource Assessment', Canberra, p. 233, p. 236.

362 As above.

certainly in NSW, has already been developed. For example, the National Generators Forum observed that:

> most major available hydroelectric resources have already been developed, so that new opportunities are limited to upgrades of existing facilities or installations of small generating units.[363]

8.30 In relation to the opportunity for future hydro projects within the State, Mr Crockett, General Manager, Pacific Hydro, expressed the view that projects will be limited to irrigation or run-of-river facilities which will be of small capacity, with an estimated production per dam of 'between one and five megawatts'.[364] Asked about capacity for utilising the Murray and Murrumbidgee rivers, for example, Mr Crocket said, 'I would say yes, but again it tends to be quite low head. So it will be small capacity. You would get anything between one and five megawatts, say, per dam.'[365]

8.31 Mr Crockett noted that there are some hydro facilities operating on irrigation dams in Victoria. However, an issue with these facilities is that electricity production is dependent on when the irrigation systems are in operation. As irrigation flows are irregular, the value of such a facility will not be as high as other forms of hydroelectricity.[366]

WIND ENERGY

8.32 Wind power currently provides only a small percentage (just 0.8% in 2011[367]) of electricity generated in NSW. However, in some other states in the National Electricity Market wind plays a greater role. For example, in South Australia wind accounts for 24 per cent of the state's capacity.[368] The following table from AEMO outlines the existing wind generation installed in New South Wales.

Table 6: Existing wind generation in NSW at 31 July 2012 [369]

Power Station	Capacity (MW)
Gunning	46.5
Woodlawn	48.3
Blayney	9.9
Capital Wind Farm	140.7
Crookwell	4.8
Cullerin Range	30
Kooragang	0.6
Total	**280.8**

363 Submission 10, Delta Electricity, p. 49.

364 Mr Lane Crockett, General Manager, Pacific Hydro, Evidence, 11 May 2012, p. 15.

365 Mr Lane Crockett, General Manager, Pacific Hydro, Evidence, 11 May 2012, p. 15.

366 Mr Lane Crockett, General Manager, Pacific Hydro, Evidence, 11 May 2012, p. 15.

367 NSW Auditor-General's Report, 'Financial Audit Volume Four 2012: focusing on electricity', p. 15.

368 Australian Energy Regulator, 'State of the Energy Market 2011', p. 27.

369 www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information, accessed 14 October 2012.

8.33 Unlike solar energy, the majority of wind capacity installed in New South Wales takes the form of mid to large-scale projects. The largest currently installed wind farm is Capital Wind Farm, with a capacity of 140 MW, however wind farms of over 800 MW are under development in New South Wales.[370] The Committee visited Capital Wind Farm on 17 August 2012.

8.34 Wind generation is a mature, proven technology with relatively low capital investment costs for renewable energy. The National Generators Forum and Pacific Hydro both reported that wind energy is the most cost-effective renewable energy source in Australia, with the exception of hydroelectricity.[371] Epuron, in its submission, also noted that wind and solar energy are mature, commercially proven technologies that have been widely deployed:

> …in the present day solar and wind energy are already commercially proven, mature and widely available. These energy sources provide an invaluable low emission, low water use opportunity that will provide decades of clean energy to NSW.[372]

8.35 Mr Russell Marsh, Policy Director, Clean Energy Council, told the Committee that 'wind power is now the cheapest form of renewable energy we have across Australia and it is getting cheaper.'[373]

Growth of wind generation

8.36 In its submission, Infigen Energy commented on the extraordinary growth of wind energy around the world over the past 15 years:

> Wind energy installations worldwide have been rising very consistently and rapidly worldwide. The chart below shows that wind energy worldwide has grown by over 25%, year-on-year, every year, for the past 15 years… To put it another way, wind energy capacity worldwide has doubled every 3 years for the past 15 years. [374]

8.37 Infigen further noted that 'some of the leading countries for wind installations, such as Germany, have generally lower wind speeds than NSW.'[375]

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370 See Table 6: Existing wind generation in NSW at 31 July 2012 and Table 7: NSW wind projects under development at 31 July 2012.

371 Submission 30, National Generators Forum, p. 45; Submission 21, Pacific Hydro, p. 4.

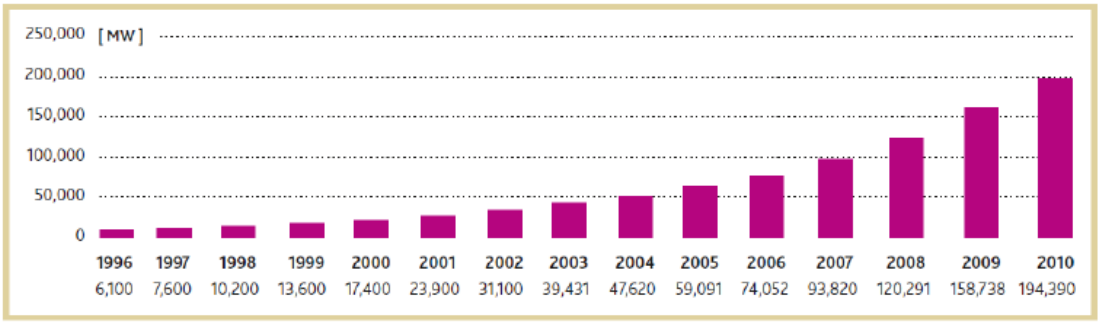
372 Submission 18, Epuron, p. 3.

373 Mr Russell Marsh, Policy Director, Clean Energy Council, Evidence, 26 March 2012, p. 48.

374 Submission 23, Infigen Energy, p. 4.

375 Submission 23, Infigen Energy, p. 4.

Figure 26:Global cumulative installed wind capacity 1996-2010.[376]



8.38 Australia, and to a lesser extent New South Wales, has also seen rapid growth in the installation of wind generation over recent years.[377] However, stakeholders such as Pacific Hydro and Epuron suggested that there is potential for substantial increases in the penetration of wind energy in New South Wales. In its submission, Pacific Hydro suggested that New South Wales has the potential for at least 3000MW of wind energy,[378] while Epuron claimed that between 20 and 30 per cent of the electricity generated in the National Electricity Market could be sourced from wind power.[379]

8.39 Mr David Swift, Executive General Manager, Australian Energy Market Operator, explained that in the past other states in the NEM have led the way with developing wind capacity, but New South Wales is now becoming the focus for new wind generation:

> To date, wind generation has focused in other states in the national market; however, based on industry information, investors are increasingly focusing on New South Wales when developing new wind generation projects. This is consistent with the latest Australian Energy Market Operator modelling, which shows that New South Wales could become the region with the most generation capacity in the next 10 to 20 years. This is due in part to the better statistical correlation of wind generation in New South Wales with demand. [380]

8.40 In its draft 'Renewable Energy Action Plan', the NSW Government indicated that New South Wales 'has around 2,000 MW of new wind generation proposals with development consent and an additional 6,700 MW under assessment through the planning system.'[381]

8.41 The following table from the Australian Energy Market Operator lists the wind generation projects that were under development in New South Wales as at 31 July 2012.

376 Submission 23, Infigen Energy, p. 4.
377 Clean Energy Council, 'Review of the Australian Wind Industry 2011', p. 3.
378 Submission 21, Pacific Hydro, p. 4.
379 Submission 18, Epuron, p. 3.
380 Mr David Swift, Executive General Manager, Corporate Development, AEMO, Evidence, 26 March 2012, p. 48.
381 NSW Government. 'Draft NSW Renewable Energy Action Plan', 2012, p. 10.

Table 7: NSW wind projects under development at 31 July 2012 [382]

Project	Capacity (MW)	Start Date
Bango Wind Farm	TBA	TBA
Ben Lomond	200	TBA
Birrema Wind Farm	240	TBA
Boco Rock	270	TBA
Bodangora Wind Farm	100	TBA
Box Hill	25	TBA
Capital 2 Wind Farm	112	Apr-14
Collector	120-235	TBA
Conroys Gap	30	TBA
Crookwell 2	92	TBA
Crookwell 3	102	TBA
Crudine Ridge Wind Farm	159-261	TBA
Eden Wind Farm	14	TBA
Flyers Creek Wind Farm	108-120	Apr-15
Glen Innes Wind Farm	50-75	TBA
Golspie Wind Farm	TBA	TBA
Gullen Range	TBA	TBA
Kyoto Energy Park	32	TBA
	13.75	TBA
Liverpool Range Wind Farm	810	TBA
Paling Yards	221	TBA
Rye Park	220-240	TBA
Sapphire Wind Farm	238-425	TBA
Silverton Wind Farm	897	TBA
Taralga	122	Sep-13
Uungula Wind Farm	TBA	TBA
White Rock Wind Farm	238	TBA
Yass Valley Wind Farm	222	TBA

Emerging technology

8.42 While onshore wind generation is a proven technology that has been widely deployed across the National Electricity Market, other types of wind energy technologies are still in their infancy. These include off-shore wind farms, of which, to date, there have been no developments in Australia, though there are a number of off-shore facilities operating internationally.[383]

382 www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information, accessed 14 October 2012.

383 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 73.

8.43 High altitude wind energy is another emerging wind technology that the Committee heard about during the Inquiry. While this technology is less developed than off-shore wind energy, the submission from Altitude Energy contended that high altitude wind energy is the best renewable energy resource in the world. Altitude Energy claimed that the LCOE of high altitude wind energy could be about $50/MWh less than that of conventional coal or ground based wind. Altitude Energy suggested that the cost advantage is primarily due to the high capacity factor (70%) that can be obtained with high altitude wind systems.[384]

Cost

8.44 As noted earlier, wind generation is one of the most cost competitive forms of renewable energy available. In its 2012 'Australian Energy Technology Assessment', the Bureau of Resources and Energy Economics provided levelised cost of electricity (LCOE) estimates for both on-shore and off-shore wind farms.

8.45 The BREE reported an LCOE for on-shore wind of $116/MWh in 2012, and $93/MWh in 2030.[385] For off-shore projects, the BREE reported an LCOE of $194/MWh in 2012, and $180/MWh in 2030. Higher costs for off-shore projects reflect higher upfront costs for underwater foundations and electrical distribution systems, as well as higher operating and maintenance costs.[386]

8.46 In its submission Origin Energy suggested that, at current technology costs, wind will account for most of the renewable generation capacity required to meet the Renewable Energy Target.[387]

8.47 Infigen Energy argued that wind energy is beneficial to consumers because it leads to reductions in the wholesale cost of electricity. Infigen Energy explained that wind energy has low marginal costs, which means that wind generators typically underbid coal and gas generators on the wholesale market. Thus, as wind generation increases, it drives down wholesale prices:

> While wind turbines are relatively expensive to build, they are amongst the cheapest electricity generating technologies to operate as their fuel, the wind is free and does not incur any resource extraction or transportation expense. This is important as electricity generators tend to bid into the wholesale market at prices near their marginal, or incremental, costs of generation. Therefore, wind farms almost always underbid coal and gas fired generators. This increase in low cost generation entering the National Electricity Market results in downward pressure on wholesale electricity prices.…
>
> A recent report by the Australian Energy Market Commission (AEMC) has forecast that the reduction in wholesale electricity prices caused by the LRET scheme will be $10-$15/MW-hr across the National Electricity Market in 2020. Therefore, the

384 Submission 12, Altitude Energy, p. 1.

385 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 73.

386 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 73.

387 Submission 17, Origin Energy, p. 2.

> market benefit of wind energy reducing wholesale electricity prices in SA today is forecast to continue, and expand, to 2020. [388]

8.48 In addition to putting downward pressure on wholesale prices when it is available, wind generation does not have any fuel costs, unlike coal or gas generation. For this reason, as Infigen Energy observed, wind energy can also provide security against volatile fuel prices in the future:

> It is also worth noting that renewable electricity generation plants, such as those powered by solar and wind, do not have any fuel price risk. The same cannot be said for gas and coal fired generators. Gas prices, in particular, are widely forecast to double later this decade once LNG export facilities cause the gas market to be exposed to export parity pricing. Likewise, as current low cost coal contracts expire, coal prices for coal fired generators are also likely to rise towards export price levels. Therefore, renewable electricity plants provide security against potentially volatile fuel prices and corresponding increases in future electricity prices. [389]

Barriers

8.49 Wind power faces a number of barriers which may limit or hinder future investment. The Australian Coal Association and NSW Minerals Council summarised the barriers faced by wind energy which will be further described in the following pages:

> Wind faces more stringent approval requirements, public acceptance issues and the cost of additional investment in back-up generation to address intermittency concerns. [390]

Intermittency

8.50 Wind generation is an intermittent source of energy, relying on the wind to blow in order to generate electricity. The Australian Nuclear Science and Technology Organisation (ANSTO) stated in its submission that the intermittency of wind means wind farms will not operate at their full capacity for much of the time. ANSTO further argued that this results in higher electricity costs for consumers in those countries which have a high proportion of wind power:

> However, as evidenced by the state's largest wind farm to date, wind power is intermittent. "Spinning reserve" gas plants or diversion of hydro baseload is required to provide a reliable service. The effect of this situation is well understood in the global setting. Countries with high wind penetration have higher costs than countries that depend on FFS [fit for service] low carbon sources such as hydro and nuclear. Wind investments will tend to increase consumer electricity costs relative to trading partners who opt for FFS options. [391]

8.51 Other stakeholders such as ERM Power[392] and the National Generators Forum claimed that wind generation output is often negatively correlated with demand, meaning that wind generation tends to be low when demand is high, and vice

388 Submission 23, Infigen Energy, p. 6.

389 Submission 23, Infigen Energy, p. 7.

390 Submission 28, Australian Coal Association and NSW Minerals Council, p. 9.

391 Submission 27, ANSTO, p. 18.

392 See Submission 16, ERM Power, p. 3.

versa. For example, the National Generators Forum argued that wind energy was unreliable in meeting demand for this reason:

> More generally, the experience in a number of Australian states (for instance, in South Australia) has been that while there may be significant wind capacity, this is of relatively little value in terms of meeting demand in a reliable manner. For instance, analysis undertaken of the contribution of wind to meeting peak demand during the 2009 heat wave in South Australia suggested that output from wind generation was negatively correlated with demand, so that generation tended to be at its lowest when demand peaked and vice versa.[393]

8.52 The National Generators Forum further argued that this negative correlation with demand and intermittency requires wind capacity to be almost entirely duplicated by other types of peaking plant. This means that development of wind energy provides few savings in the development of other generation plant:

> The intermittency characteristics of wind imply that relatively little generation capacity can be 'saved' by installing renewables, and that potentially significant volumes of complementary, quick response generation capacity must be maintained, as well as other network equipment installed, to be called on when renewable generation suddenly falls. [394]

8.53 Mr Mark Duffy, Deputy Director General, Resources and Energy, Department of Trade and Investment, similarly argued that additional investment in wind generators will require additional gas peaking power to be available:

> …in a general sense, the renewable policies will bring forward investment in wind, primarily wind, and wind is subject to weather.
>
> So in order to rely on that capacity—and remember that the renewable energy target requires 20 per cent renewable resources in the mix by 2020—of wind we have to have available peaking power for when the wind drops, otherwise our system becomes unstable. That means we need a lot more gas.[395]

Wind forecasting and existing peaking plant

8.54 While the variability and unpredictability of wind generation was cited as a disadvantage, the Committee heard evidence that the Australian Energy Market Operator has developed a wind forecasting system to address the unpredictable aspect of wind power.

8.55 Pacific Hydro explained that wind energy, while variable, is predictable and has been successfully integrated into the NEM with the use of AEMO's wind forecasting system, which has an accuracy of around 98 per cent:

> Wind is variable, but its existence is relatively predictable for the operation of semi-scheduled utility scale wind generation. Indeed, wind is sufficiently predictable that in the connected eastern sea-board grid, it can be integrated into system and market

393 Submission 30, National Generators Forum, p. 36.

394 Submission 30, National Generators Forum, p. 36.

395 Mr Mark Duffy, Deputy Director General, Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services, Evidence, 26 March 2012, p. 3.

operation by the Australian Energy Market Operator to around 98% accuracy, using their wind energy forecasting system (AWEFS). [396]

8.56 Mr David Swift, Executive General Manager, Corporate Development of the Australian Energy Market Operator, provided further detail about the operation of AEMO's Australian wind energy forecasting system (AWEFS):

> The Australian wind energy forecasting system is integrated into our market systems and feeds into those systems' forecasts of generation both in the very short term—for the next five minutes, one hour, day—out to longer periods of time. That information is used in the despatch of plant to make sure that the system remains stable and resilient by incorporating the best forecast of the wind generation. It is also incorporated in the data that flows back to all the generators that are in the net. They can see what the scope for supply is four hours out, 10 hours out and for tomorrow, that sort of thing, in their short-term planning time frame.
>
> In those planning time frames the AWEFS has achieved very good accuracy. I am certainly happy to provide that to the Committee, but it is probably of the order of 4 per cent or 5 per cent error. That is very important in our market because other market participants need to efficiently be able to bid and to know what they are bidding into. Are they likely to be required this afternoon? Are they likely to be required tomorrow? The large coal-fired power stations require notice to be able to generate. Even larger gas-fired generators need to book their gas shipments. We see the wind energy forecasting system as a very valuable adjunct to the market to make wind integrate into the market more seamlessly and to ensure that we maintain security of supply.[397]

8.57 It should be noted that while the wind forecasting system implemented by AEMO appears to have somewhat addressed the unpredictable quality of wind generation, it does not overcome the intermittency that is inherent to wind power.

8.58 However, Mr Russell Marsh, Policy Director, Clean Energy Council, contended that arguments about the need to build additional peaking generation in order to overcome the intermittency of wind generation are overstated in the context of a power system that already has significant peaking generation:

> To pick up the point about reliability—saying if you build a wind farm you have to build other generation to back it up—it is not the case that if you build a wind farm you have to have another power station built next to it with exactly the same capacity because when the wind does not blow you need that power. Across our network we have flexibility and fluctuations of demand and generation, and our network is designed to do that. As far as I am aware—and the market operator backs this up—we have never had to build a power station purely on the basis of having wind generation in the system. In some places—and South Australia is an example—we are putting more wind in and deploying less gas and coal than we were. In some places you can say that actually deploying wind means you can deploy less of other technologies, so yes, it is variable. That variability is easily managed, it can be forecast to a certain extent, and certainly at the moment our market operator is not

396 Submission 21, Pacific Hydro, p. 5.

397 Mr David Swift, Executive General Manager, Corporate Development, Australian Energy Market Operator, Evidence, 26 March 2012, p. 15.

> concerned about the need to have back-up sitting there just because a wind farm may go down. They have back-ups sitting there for a whole host of reasons.[398]

Effect on network

8.59 The National Generators Forum noted the intermittency and unpredictability of wind and suggested that this can affect the stability and reliability of the electricity network as a whole:

> …the large-scale introduction of renewable generation raises some specific issues, since an increase in the proportion of energy generated from renewable energy sources can weaken the stability and reliability of a power system. A key characteristic of generation from wind (and to a lesser degree from other forms of renewable energy) is that it is intermittent and therefore unpredictable. The output associated with individual wind generators, for instance, can change by as much as 50 per cent in a five-minute dispatch interval. One consequence of this variability is that interconnectors between regions must be operated at lower limits to avoid overloads, which in turn reduce the total generation capacity available to meet demand.[399]

8.60 However, in 2011 AEMO conducted an analysis of the issues arising from the large-scale integration of wind generation in the National Electricity Market. One of the key findings of its report was that the NEM 'is well-designed for integrating large amounts of wind generation. Favourable characteristics include short dispatch intervals, semi-dispatch of wind generation, wind forecasting that is integrated into the dispatch process, and flexible frequency control markets.'[400]

Planning restrictions

8.61 Some Inquiry participants felt that assessment processes for wind farm developments were onerous or unfair, and that policy uncertainty is damaging the industry.[401] For example, Epuron argued that:

> Despite significant progress around the world, in Australia a small minority of people is creating concern in some communities in relation to new wind energy developments. Australia has some of the most stringent assessment processes for the development of wind energy. Best practice means that the rules are clear to all and any changes are incremental and based on scientific evidence gathered over time. It is vital that this remains the case. Policy uncertainty is damaging to the industry, and prevents lower costs of capital from being applied to renewable energy projects.[402]

8.62 In December 2011 the NSW Government released Draft Planning Guidelines for wind farms.[403] Some Inquiry participants expressed concerns about these guidelines, arguing that they place onerous restrictions on the wind industry. For

398 Mr Russell Marsh, Policy Director, Clean Energy Council, Evidence, 26 March 2012, p. 48.

399 Submission 30, National Generators Forum, p. 36.

400 AEMO, '2011 National Transmission Network Development Plan', p. 4-1.

401 Submission 23, Infigen Energy, p. 9., Submission 25, Clean Energy Council, p. 2., Submission 24, Vestas Australia, p. 8.

402 Submission 18, Epuron, p. 3.

403 Department of Planning and Infrastructure, 'Draft NSW Planning Guidelines: Wind Farms', December 2011.

example, the Sustainable Energy Association of Australia argued that the introduction of planning restrictions for wind farms is a form of 'picking winners' because it creates additional barriers for this type of generation:

> In particular, the introduction of "the tightest wind farm regulations in the world" along with statements by the government that there is a decided preference against the introduction of wind as a future potential source of energy in NSW, a view personally endorsed by the Premier. In SEA's view this is an extremely regressive step and is a clear case of 'picking winners' in terms of creating additional entry barriers for renewable energy projects in NSW while providing almost unfettered access for the development of CSG projects at the expense of stakeholder rights, in particular those of farmers and other landholders. [404]

Effects on community

8.63 The possible health impacts of wind farms have received some media attention.[405] Community concerns about the health impacts of wind farms – particularly relating to noise they create – were documented in the NSW Legislative Council General Purpose Standing Committee No 5 report on 'Rural wind farms.' However, Mr Lane Crockett, General Manager, Pacific Hydro, argued that these concerns are not supported by scientific evidence:

> Maybe we will start with the health relating to wind... There have been 17 international health studies, mostly commissioned by governments, which concluded that there was no direct physical interaction between what is emitted from a wind turbine and human health. So there is no physical interrelation between noise or whatever is emitted from a wind turbine.[406]

8.64 Despite community concerns, Pacific Hydro claimed that there is significantly more community support for wind energy than for fossil fuels:

> Community polling continues to show that the overwhelming majority of Australians support wind energy development over continued investment in fossil fuels.
>
> Pacific Hydro's recent survey of 1000 people living in communities where wind farms operate or are proposed showed that 83% support wind farms, while 14% were opposed to their development. Results for New South Wales were 77% support wind farms, 21% opposed. For gas fired power plants: 53% support, 35% opposed and for new coal fired power plants: 30% support and 61% opposed.[407]

8.65 Inquiry participants also argued that wind farms provide benefits to local communities.[408] For example, Pacific Hydro explained that wind farms benefit the economy of those rural areas where they are located:

> From our experience, wind energy investment can provide significant economic benefit to communities in which they operate through landholder payments, community funds and/or direct and indirect support to local government.

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404 Submission 19, Sustainable Energy Association of Australia, p. 12.

405 See, for example, Lloyd, G., 'What you can't hear can hurt you,' *The Australian*, 25 January 2012.

406 Mr Lane Crockett, General Manager, Pacific Hydro, Evidence, 11 May 2012, p. 13.

407 Submission 21, Pacific Hydro, p. 2.

408 Mr Jonathan Upson, Senior Government Affairs and Development Manager, Infigen Energy, Evidence, 26 March 2012, p. 73.

> There are many examples of wind energy projects providing sufficient income streams to enable farmers to remain on the land. In most cases, wind turbines can co-exist with other farming activities such as grazing. In this way, wind energy offers multiple benefits in terms of building resilience into regional and rural jobs and communities in addition to reducing emissions.[409]

8.66 Similarly, Mr Marsh argued that wind farm development provides both short and long-term economic benefits to rural areas:

> When you have a wind farm being built, you get a lot of people travelling into the area, so things like local supermarkets, pubs and hotels benefit from the wind farm—not just in the short term but on a long-term basis. There is evidence in certain places where there are wind farms now that local pubs or hotels are really happy that the wind turbine is there because it can bring tourists into the area and people coming to visit the wind farm will stay and use the facilities in the local area.[410]

SOLAR ENERGY

8.67 As noted in Chapter Two, solar energy currently makes up a very small proportion (0.4%) of the electricity generated in New South Wales. The vast majority of solar capacity in New South Wales is in the form of rooftop solar photovoltaic (PV) systems installed on homes and businesses throughout the State. This type of generation, in which numerous small localised generators are spread throughout the network, is known as distributed generation or embedded generation and will be discussed further in Chapter Ten.

8.68 As shown in the following table from the NSW Department of Trade and Investment, there are at least 200,000 customers with over 434 MW of solar capacity installed (or planned) in New South Wales.

Table 8: Connection and application data as reported by network distribution businesses at 27 July 2012 [411]

	Connections	Outstanding Applications	Total
Solar Bonus Scheme	145,429 Customers	^	145,429 Customers
	338.008 MW	^	338.008 MW
Non Solar Bonus Scheme	40,329 Customers	18,222 Customers	58,551 Customers
	At least 62.278 MW*	At least 34.220 MW*	At least 96.498 MW*
TOTAL – small scale generators	185,758 Customers	18,222 Customers	203,980 Customers
	At least 400.286 MW*	At least 34.220 MW*	At least 434.506 MW*

*One network does not provide non Solar Bonus Scheme generating capacity data.
^As of 1 July 2012, all outstanding applications that were previously eligible for and counted under the Solar Bonus Scheme became ineligible for the Scheme. As such, these applications are not counted in this table.

8.69 Though it still accounts for only a small portion of the total electricity being generated in New South Wales, solar electricity has grown rapidly in recent years.

409 Submission 21, Pacific Hydro, p. 4.

410 Mr Russell Marsh, Policy Director, Clean Energy Council, Evidence, 26 March 2012, p. 48.

411 www.trade.nsw.gov.au/__data/assets/pdf_file/0007/444364/Fortnight-to-27-July-2012.pdf, accessed 14 October 2012.

Infigen Energy, in its submission, stated that the installation of solar PV systems had 'quadrupled in the past three years'.[412]

8.70 A number of factors combined to drive the rapid expansion of solar energy in New South Wales in recent years. In a 2012 report on 'Solar feed-in tariffs', the Independent Pricing and Regulatory Tribunal (IPART) outlined some of these factors, including the NSW Government's Solar Bonus Scheme and the Federal Government's Renewable Energy Target scheme, as well as a drastic reduction in the cost of solar panels. IPART explained that:

> In recent years, government schemes have provided generous subsidies to customers installing solar photovoltaic units (PV units). The Federal Government's Renewable Energy Target scheme provides an up-front subsidy on PV units, while the NSW Government's Solar Bonus Scheme provided subsidised feed-in tariffs for the electricity produced by PV units.
>
> At the same time as these subsidies were available, the cost of installing PV units fell significantly. As a result, over 160,000 customers have installed over 358 megawatts (MW) of PV generation capacity in NSW.[413]

8.71 In his 2011 report on the 'Solar Bonus Scheme', the NSW Auditor-General observed that the price of solar panels had dropped by more than half since mid-2009, which, in conjunction with the Commonwealth subsidy, was seen as a reason for the high uptake of the NSW Solar Bonus Scheme.[414] Two further factors which may have contributed to the growth in small scale solar generation are rising retail electricity prices and community concerns about carbon emissions, both of which may make solar electricity more attractive to consumers.

Solar Bonus Scheme

8.72 The NSW Government's Solar Bonus Scheme commenced on 1 January 2010, and was originally legislated to run for seven years until December 2016. The scheme offered customers a gross feed-in tariff[415] of 60 cents per kilowatt hour (c/KWh) for electricity generated by eligible roof-top solar PV systems and mini wind turbines connected to the electricity grid.[416]

8.73 The take-up of the scheme was much greater than expected by the Government and as a result, costs were also higher than initially anticipated.[417] In response to the growing costs of the scheme, on 27 October 2010 the Government reduced

412 Submission 23, Infigen Energy, p. 4.

413 IPART, 'Solar feed-in tariffs', March 2012, p. 1.

414 New South Wales Auditor-General's Report, 'Special Report: Solar Bonus Scheme', November 2011, p. 2.

415 A gross feed-in tariff pays system owners a set amount per KWh for all electricity generated by their system, regardless of whether they use the electricity themselves or export it back to the grid. A net tariff, on the other hand, only pays system owners for the electricity that they export back to the grid, in excess of what is consumed by their own property.

416 New South Wales Auditor-General's Report, 'Special Report: Solar Bonus Scheme', November 2011, p. 2.

417 IPART, 'Solar feed-in tariffs', March 2012, p. 1.

the feed-in tariff to 20 c/KWh, before finally closing the scheme to new applications on 28 April 2011.[418]

8.74 While the Solar Bonus Scheme, in conjunction with other factors, contributed to the increase in the installation of solar capacity in the State, it has been criticised for being overly generous and imposing unnecessary costs on consumers. Delta Electricity, for example, argued that the scheme was economically inefficient and added costs to consumers:

> …overly-generous regulatory schemes like the solar feed-in tariff drove the rapid deployment of 300MW of solar PV in NSW. These schemes are economically inefficient and result in an unnecessary cost burden being imposed on consumers. Government should engender investment in generating capacity in NSW on the basis of legitimate market signals rather than implement policies that distort the market.[419]

8.75 In his 2011 Special Report on the Solar Bonus Scheme, the Auditor-General found that the total tariffs to be paid under the scheme would be between $1.05 billion and $1.75 billion and that the majority of the funds in the New South Wales Climate Change Fund would be required to reimburse distribution network service providers for their tariff payments to retailers under the scheme. The Auditor-General was highly critical of the planning and management of the scheme, finding that:

- the Scheme had three broadly stated objectives, with no specific targets against which progress could be measured. These objectives do not include reducing emissions or obtaining value for money
- no cost-benefit analysis was undertaken before the Government's decision in 2008 to introduce a scheme. Likewise, no cost-benefit analysis was undertaken when changes were made to the Scheme in 2009, or when changes were made to funding arrangements early in 2011
- no market research was undertaken (including about non-tariff options) to investigate customer motivations in generating renewable energy
- little was done early enough to identify and reduce relevant risks. I found no contingency planning, analysis and assessment of options and exit strategies to address potential high risk situations
- no overall implementation program, including no clear definition of project roles and responsibilities of those involved in implementing and delivering the Scheme
- the Scheme lacked the most elementary operational controls. There was initially a poor monitoring system. There was a time limit of 2016, but initially there was no cap on total Scheme capacity and costs
- there were significant shortcomings in the provision of information to Government decision-makers

418 New South Wales Auditor-General's Report, 'Special Report: Solar Bonus Scheme', November 2011, p. 2.

419 Submission 10, Delta Electricity, p. 4.

- there were insufficient review points based on applications so that progress could be assessed and the Scheme amended or even stopped, if necessary. The one legislated review point was when capacity reached 50 MW. By the time that review was complete, capacity had doubled to 100 MW.

- at the outset, there was no audit process to provide program assurance. [420]

8.76 In its submission, AGL also drew attention to Solar Bonus Scheme and its interaction with Commonwealth subsidies which, it suggested, ultimately led to higher electricity prices:

> Energy policy within Australia often suffers due to a lack of coordination between the States and the Commonwealth. This is not unsurprising given our Federalist system of government. However, perverse outcomes occur when policies are implemented without mutual consideration or coordination. The growth in incentives for small scale solar PV generation in recent years is a crucial example of how uncoordinated policy can lead to perverse policy outcomes. In a recent paper, Nelson, Simshauser and Kelley highlighted the regressive nature of Feed-in Tariffs and IPART in its recent draft pricing determination highlighted the problems associated with multiple support mechanisms for solar PV leading to higher overall electricity prices.[421]

8.77 Following the closure of the Solar Bonus Scheme to new applicants, the NSW Government requested IPART to conduct a review to determine a fair price for small scale solar generation. IPART's review was to set a price which would not increase electricity prices for other consumers or require additional Government funding, but would pay a fair price to small scale generators for the electricity they fed back into the grid. For 2012/13, IPART determined a price range of between 7.7 and 12.9 c/KWh.[422]

8.78 Some stakeholders to the Inquiry claimed that such changes to Government policy can act as a barrier to the development of the renewable energy industry.[423] For example the Total Environment Centre and Nature Conservation Council of NSW suggested that a lack of government policy support or inconsistency in the provision of support is a key barrier to the utilisation of renewable energy sources in New South Wales, citing the fluctuating feed-in tariffs for solar PV in New South Wales. [424]

8.79 Greenpeace Australia similarly noted the cessation of NSW Government support for solar energy, which affects its potential contribution to the future energy mix of the State:

> Other power sources such as solar photovoltaics and wind have experienced modest growth in recent years. These technologies have the potential to make a major contribution to NSW's future energy mix but have had their policy support cut off, by

420 NSW Auditor-General's Report, 'Special Report: Solar Bonus Scheme', November 2011, pp. 3-4.

421 Submission 14, AGL Energy, p. 3.

422 NSW Government, 'Draft NSW Renewable Energy Action Plan', 2012, p. 16.

423 See Submission 2, Greenpeace Australia, Submission 11, Total Environment Centre and Nature Conservation Council of NSW.

424 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 10.

> either the axing of the solar feed-in tariff or the above-mentioned restrictions on the placement of wind farms.[425]

8.80 However, according to the NSW Government, in its recently released *Draft Renewable Energy Action Plan*, there is still significant demand for solar PV since the closure of the Solar Bonus Scheme:

> There continues to be significant demand for smallscale solar PV, with 42,632 customers applying to connect small generators since the closure of the Solar Bonus Scheme (as at 18 May 2012).[426]

Small-scale Renewable Energy Scheme

8.81 The Small-scale Renewable Energy Scheme (SRES) was established by the Federal Government on 1 January 2011 following the split of the Renewable Energy Target into two streams – the Large-scale Renewable Energy Target (LRET) for large-scale renewable generators; and the SRES for small-scale generators.[427]

8.82 The Climate Change Authority explained the reasons behind the separation of the scheme in a recent Issues Paper on the Renewable Energy Target Review:

> Higher than expected uptake of small-scale systems - provided with extra encouragement through the Solar Credits multiplier and state/territory feed-in tariffs - had created a large number of certificates, depressing prices and discouraging investment in large-scale projects. The division of the RET was designed to address this issue by creating separate incentives for large-scale renewable energy projects (such as wind farms) and small-scale technologies (such as solar PV and solar water heaters), which no longer directly competed with one another under the RET scheme. [428]

8.83 While the Federal Government attempted to address the oversupply of small-scale Renewable Energy Certificates by the separating of the Renewable Energy Target into the LRET and SRES schemes, the Committee heard that there is still an overhang of certificates in the market, which is delaying investment in large-scale infrastructure. Mr Lane Crockett, General Manager Australia, Pacific Hydro, explained:

> The Renewable Energy Target requires the electricity retailers in 2020 to provide 20 per cent of power to their consumers from renewables. So the certificate is set up to guarantee that that happens. Unfortunately, when it was lifted to the 20 per cent target there were a few, let us say, adjustments to it, which caused an oversupply through the rooftop solar in particular blowing the 5:1 ratio of RET. That got sorted at a Commonwealth level, but there is an overhang of renewable energy certificates in the market, which means that the market is very sluggish to call forward the

425 Submission 2, Greenpeace Australia, p. 3.

426 NSW Government, 'Draft NSW Renewable Energy Action Plan', 2012, p. 16.

427 Australian Government Climate Change Authority, 'Renewable Energy Target Review, Issues Paper', August 2012, p. 14, p. 32.

428 Australian Government Climate Change Authority, 'Renewable Energy Target Review, Issues Paper', August 2012, p. 14, 32.

> investment in new infrastructure to meet the 20 per cent by 2020, which is a fixed target.[429]

Potential for solar

8.84 Despite the concerns just discussed about over-generous and uncoordinated policies, there is still potential for growth in the capacity of solar generation in New South Wales. According to the NSW Government's draft 'Renewable Energy Action Plan', AEMO has forecast that by 2031 there will be over 4000MW of solar PV installed in NSW.[430]

8.85 The National Generators Forum commented on the abundant solar resources available, reporting that 'Australia has the highest average solar radiation per square metre of any continent in the world'. However, the NGF submission also noted that 'many solar energy resources are in remote locations.'[431]

8.86 In his submission, Dr Rob Stokes MP, Parliamentary Secretary for Renewable Energy, discussed the potential for solar PV and solar thermal energy in New South Wales, noting that reductions in the cost of solar energy, along with increasing retail electricity prices, will make the technology more attractive in the future:

> Technological improvements and dramatic reductions in production and component costs are also increasing opportunities for electricity generation from renewable sources. Good exposure to solar radiation provides huge opportunity for solar PV and solar thermal electricity generation. Cost reductions in solar PV in particular will make this technology more and more attractive to households and businesses in the context of rising costs of centralised electricity generation using fossil fuels. A big technological advantage of solar PV is that it empowers users to generate their own electricity to meet their own energy needs. This has the additional advantage of reducing demand, especially during the summer peak, on the existing electricity network.[432]

Large-scale solar projects

8.87 At present there are no large scale solar generation projects operating in New South Wales. However, there are a number of larger projects being planned or under construction, including the Capital Solar Farm near Bungendore, as well as proposed solar farms near Nyngan and Broken Hill.

8.88 On 17 August 2012, a delegation of the Committee visited the site of Infigen Energy's proposed Capital Solar Farm. The project has two stages. Capital East Solar Farm is a demonstration facility that is soon to begin construction. When completed it will be the first solar PV system registered as a market generator in the National Electricity Market (with a 200 kW capacity, it will also be the smallest market generator in the NEM). The larger Capital Solar Farm will be a 50 MW solar PV farm that occupies an area of approximately 100 hectares. Both

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429 Mr Lane Crockett, General Manager, Pacific Hydro, Evidence, 11 May 2012, p. 16.

430 NSW Government, 'Draft NSW Renewable Energy Action Plan', 2012, p. 9.

431 Submission 30, National Generators Forum, p. 46.

432 Submission 33, Dr Rob Stokes MP, p. 3.

projects are located close to Capital Wind Farm in order to share the available infrastructure.[433]

8.89 Another large scale solar project being developed is the solar farm being developed at Nyngan and Broken Hill as part of the Commonwealth's Solar Flagships program. Details of the project, which is expected to begin construction in 2014, were outlined in the draft *Renewable Energy Action Plan:*

> The NSW Government is working with the Commonwealth Government to facilitate construction of one of the largest solar photovoltaic projects in the world in NSW. The $441.36 million project, to be developed by AGL and First Solar, will produce 159MW – enough electricity to power around 30,000 homes. The project will be built over two NSW sites and will create around 185 direct jobs at Broken Hill and up to 300 at Nyngan.[434]

Emerging technology

8.90 While solar PV is the main technology currently deployed in New South Wales for the generation of electricity from solar power, there are a number of other solar technologies being developed and deployed around the world. These include various types of solar thermal projects and solar/coal hybrid projects.

8.91 Solar thermal technologies differ from solar PV in that they are based on the concept of concentrating solar radiation to produce steam, which drives electricity generating steam turbines. Solar PV, on the other hand, converts solar energy directly into electricity, without the intervening step of creating steam. There are a number of solar thermal technologies being researched and developed including parabolic trough, central receiver and compact linear fresnel reflectors.[435]

8.92 While solar thermal is still an emerging technology, its main advantage over solar PV is that it can more easily overcome intermittency issues by employing thermal storage, which is much more cost effective than battery storage.[436]

8.93 Solar thermal technology may also be deployed in conjunction with existing coal-fired power plants to improve efficiency of these plants. Dr Rob Stokes MP explained that such hybrid power plants would increase the efficiency of fossil fuel use and reduce carbon emissions:

> Existing solar thermal technology could also be deployed to pre-heat water used in traditional coal-fired power plants. Such hybrid technologies can vastly improve the efficiency of fossil fuel use in thermal power plants and substantially reduce greenhouse gas emissions from stationary energy production.[437]

Cost

8.94 The '2012 Australian Energy Technology Assessment' by the Bureau of Resources and Energy Economics (BREE) provided levelised cost of electricity (LCOE)

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433 Infigen Energy, 'Powering the future with renewable energy: Infigen Energy development pipeline', p. 4.

434 NSW Government, 'Draft NSW Renewable Energy Action Plan', 2012, p. 9.

435 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 35.

436 Dr Alex Wonhas**,** Director, CSIRO Energy Transformed Flagship, Evidence, 11 May 2012, p. 8.

437 Submission 33, Dr Rob Stokes MP, p. 2.

estimates for a variety of solar technologies. The BREE reported an LCOE for solar photovoltaic (non-tracking) plants of $224/MWh in 2012, and $116/MWh in 2030.[438] For solar thermal plants using central received technology and storage, the BREE reported an LCOE of $311/MWh in 2012, and $189/MWh in 2030.[439]

8.95 The major barrier to the development of solar energy projects in Australia appears to be their high upfront costs.[440] For example, Infigen Energy indicated that large-scale solar PV is not currently cost competitive with wind energy, and therefore it is not economically viable to build a large-scale solar PV plant without further financial support, such as the Commonwealth Government's Solar Flagships Program:

> …solar PV is currently not cost competitive with wind energy, and therefore it is not economically viable to build and operate a solar PV plant relying on the LRET scheme (and a carbon price of $23/tonne). Therefore, specific grants are required in order to build larger scale Solar PV plants such as the Commonwealth's Solar Flagships program. Additional funding from State Governments can improve the economic viability of solar PV projects even further… Infigen Energy considers that the NSW State Government should continue this support to enable NSW to obtain its fair share of regional investment in solar PV facilities. [441]

Grid parity

8.96 While the cost of solar energy remains significantly higher than that of some other technologies, Mr Russell Marsh of the Clean Energy Council informed the Committee that household solar panels are coming down in cost and approaching 'grid parity.'[442] Dr Alex Wonhas of the CSIRO explained that grid parity 'means that the retail cost of electricity is the same as the cost of power produced from your rooftop solar photovoltaic panel.' Dr Wonhas further suggested that these two will soon be equal.[443]

8.97 The Clean Energy Council reported that the current retail price of electricity in New South Wales, and thus the value for grid parity, is around $200 - $250 per megawatt hour. They further explained that rooftop solar essentially competes against the retail price of electricity, rather than the wholesale costs.[444]

Barriers

8.98 ERM Power suggested that solar PV has a number of issues which affect its efficiency as a form of energy generation:

> …issues can readily be identified with domestic PV - inefficient capital, additional network costs (to manage reverse flows), negative welfare impacts, minimal carbon abatement benefit - and with the Solar Flagships scheme. [445]

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438 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 71.

439 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 71.

440 Submission 30, National Generators Forum, p. 46.

441 Submission 23, Infigen Energy, p. 8.

442 Mr Russell Marsh, Policy Director, Clean Energy Council, Evidence, 26 March 2012, p. 51.

443 Dr Alex Wonhas**,** Director, CSIRO Energy Transformed Flagship, Evidence, 11 May 2012, p. 7.

444 Clean Energy Council, Answers to questions taken on notice taken in evidence, 26 March 2012, p. 2.

445 Submission 16, ERM Power, p. 3.

8.99 The Australian Nuclear Association argued that solar energy and other renewables are limited by their intermittent nature:

> While renewable sources of energy such as hydro, wind, solar, biomass and geothermal will make increasingly important contributions to electricity generation, many of these sources are limited by their dilute and/or intermittent nature. [446]

8.100 Delta Electricity also emphasised that solar and wind energy are intermittent, and claimed that they 'will require breakthroughs in commercial scale energy storage if they are to become a reliable source of energy.' [447]

Best practice in alternative energy generation in other jurisdictions

8.101 The Committee did not receive a substantial amount of evidence regarding best practice in alternative energy generation in other jurisdictions. Some Inquiry participants, such as Ms Lana Stockman of TRUenergy, suggested that electricity sources are primarily a factor of the natural resources available in a jurisdiction, and that energy policy should similarly be focused on the natural resources of the jurisdiction:

> Look at what has happened overseas. In Norway there is hydro, because it is the natural resource. The Texas market is all gas because that is what the natural resource is. In New Zealand there is a lot of hydro. If you had to estimate, you would have to look at what you have to begin with. It does not look like New South Wales has any tidal power, so I would not be betting on that. I think if you have to come up with policy you have to think about what are the basic elements you already have, that you know you have, and at least tilt your policies in favour of those, as opposed to saying that we are going to spend X billion dollars in investing in some technology and we do not know if it works or if it would work in this particular State. [448]

8.102 While there is a question over the utility of comparisons between jurisdictions with different resources available to them, a number of different jurisdictions were highlighted as leading the world in terms of installed capacity of different types of renewable energy generation. For example, the Total Environment Centre and Nature Conservation Council of NSW suggested that Germany is a world leader in solar, wind and biomass renewable energy:

> Germany provides an excellent example of how renewables can be incorporated into electricity systems. Germany has become one of the world's leaders in installed renewable energy capacity, without making significant use of hydro power. Germany produces 36.5 TWh per year of wind energy, 33.5 using biomass and 12 using solar. Despite its mild climate, Germany has the highest installed capacity of solar electricity in the world. By comparison, Australia as a whole only produces 684.4 GWh from solar each year. Germany has achieved these impressive uptake rates through a combination of longstanding and stable feed-in tariffs, which has increased solar production from 1 GWh in 1990 to the present rate, strong governmental support through R&D funding, and a culture that is more accepting of renewable energy technologies. [449]

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446 Submission 4, Australian Nuclear Association, p. 4.

447 Submission 10, Delta Electricity, p. 4.

448 Ms Lana Stockman, Manager, Wholesale Regulation, TRUenergy, Evidence, 26 March 2012, p. 34.

449 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 11.

8.103 Mr Jonathan Upson, Senior Development and Government Affairs Manager, Infigen Energy similarly noted that Germany has significantly higher amounts of solar energy capacity than Australia, despite having less sun:

> There is no significant amount of large-scale solar generation in Australia, so it is not worth talking about that. The amount of rooftop PV installations—over 1 gigawatt, one million watts, of electricity is installed today at great expense. By worldwide standards that is still better than some countries and worse than others. It certainly is a lot less than Germany, which has a lot worse sun than we do, but better than some other countries.[450]

8.104 Mr Upson also focused on the growth of the wind energy industry around the world, highlighting that Denmark and South Australia lead the world in the level of penetration of wind energy in the market:

> One thing that is easy to lose track of, pardon me for saying it, on the other side of the world from Europe and America is that wind energy has been an absolute phenomenal success story overseas. It has been growing over 25 per cent year on year every year for the past 15 years. I would challenge you to try to think of another industry that has had that sustained and rapid growth rise. That means that every three years the amount of wind energy worldwide is doubled and three years later it is doubled again and three years later it is doubled once again. New South Wales is by far well behind the rest of the country on installing renewable energy. Every country has a different penetration rate. Denmark leads at the moment with somewhat over 20 per cent market penetration. South Australia, if it was a separate country, would be second, which is a terrific accomplishment for it. For other countries, some are 12 per cent and 10 per cent, and other installed electricity generation is from renewable energy. [451]

8.105 Epuron, in its submission, also suggested that northern Europe continues to lead the world in onshore and offshore wind generation, although it also noted that China aims to install 'wind capacity greater than 6 times Australia's entire generation capacity in the next few years.'[452]

8.106 Ms Clare Savage of the Energy Supply Association discussed a number of other emerging technology projects around Australia:

> There are many exciting things happening in emerging technologies. Some Australian companies are developing wave technology. The CETO wave energy technology developed by Carnegie is very interesting. The company has a successful pilot project at Fremantle. Geothermal technology is also interesting, but there is much work to be done to prove it up. Wind energy will continue to have a strong role to play because it is an established renewable technology. Some of the large-scale solar facilities offer good opportunities, particularly if they can be well located in terms of the solar peak and demand peak. [453]

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450 Mr Jonathan Upson, Senior Development and Government Affairs Manager, Infigen Energy, Evidence, 26 March 2012, p. 67.

451 Mr Jonathan Upson, Senior Development and Government Affairs Manager, Infigen Energy, Evidence, 26 March 2012, p. 67.

452 Submission 18, Epuron Pty Ltd, p. 3.

453 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence 26 March 2012, p. 43.

8.107 The issue of access to transmission networks in remote areas was raised by Vestas, who suggested that Texas offers a successful model that could be adopted in NSW:

> With respect to the issue of planning and funding access to new transmission networks in remote areas, the most widely known and successful solution seems to be the concept of Competitive Renewable Energy Zones (CREZs) in Texas USA, administered by grid manager ERCOT.
>
> Under that model, the regulatory body mandates investment in new transmission assets in areas rich in renewable energy resources but poor in terms of transmission. This cost is initially passed on the end consumer of electricity, but as each new wind farm connects to the grid, the developer pays a connection fee and correspondingly reduces the amount paid by energy users.
>
> Vestas considers that this approach should be adopted in NSW for both distribution and transmission access, and on a national basis for transmission lines across state borders. [454]

8.108 In her submission to the Inquiry, Ms Penelope Crossly argued that a combination of long-term regulatory strategies are required to encourage renewable energy generation, and highlighted two key actions for governments:

> Studies have shown that a combination of regulatory strategies is most effective in encouraging the growth of renewable energy generation. Furthermore, in order for regulation within the renewable energy sector to be successful, it must provide a predictable long-term framework to encourage investment. This is particularly important in liberalised markets as investors make their decisions based on 'the long-term expectations of price developments and costs.'
>
> In order to support a market transition to a greater use of renewable technologies in the generation mix, encourage infrastructure development and create financial incentives, it is argued that two key things need to happen. First, governments need to improve the incentives to lend to or invest in renewable generation by creating a economically viable and stable regulatory environment. Secondly, governments should encourage the broader use of 'smart grid' technologies to enable a greater amount of variable generation to be utilised. This will assist the development of sufficient renewable energy generation capacity to ensure energy security.[455]

8.109 Epuron discussed the criteria for best practice in renewable energy policy, suggesting that 'best practice means that the rules are clear to all and any changes are incremental and based on scientific evidence gathered over time.'[456]

8.110 The National Generators Forum also highlighted a number of principles that they considered should underpin energy generation policies:

- policies should be 'market-based' in order to ensure that the costs of achieving a given target, including associated administrative and compliance burdens, can be minimised;

454 Submission 24, Vestas Australian Wind Technology, p. 10.

455 Submission 3, Ms Penelope Crossley, p. 11.

456 Submission 18, Epuron Pty Ltd, p. 3.

- governments should refrain from technology-specific regulations, from 'picking winners', and from applying multiple overlapping schemes, all of which are costly and undermine the environmental effectiveness of policies; and

- given the long planning horizon of investment in an ESI, policy certainty is of overriding importance to encourage market-driven investment on the basis of durable price signals.[457]

8.111 While they highlighted a number of general principles that could be applied across jurisdictions, the National Generators Forum indicated that it is difficult to make comparisons of energy policies between jurisdictions, given the variety of policy instruments available. They also suggested that overlapping or duplicated policies may lead to high administrative and compliance costs, as well as creating a complex regulatory environment:

> Given the wide range of policy instruments available, comparisons of alternative generation policies between jurisdictions and countries are very difficult. In addition, policies at the federal level are often duplicated by state-based or local policies that also seek to support alternative generation technologies of one form or another. …there are often multiple policies that often overlap in terms of the objectives they seek to achieve. In its assessment of Australian and international carbon price policies, for instance, the Productivity Commission (2011) identified approximately 230 emissions reductions policies in Australia and emphasised the correspondingly complex regulatory environment, potential for overlapping policies, as well as high administrative and compliance costs. [458]

ENERGY STORAGE

8.112 Rising peak demand and the increasing deployment of renewable energy sources have increased the incentive to improve technologies for storing energy. Ecoult Energy calls energy storage the 'missing piece of the puzzle in the renewable energy cycle', because of its capacity to overcome – or at least to reduce - the intermittency of wind and solar generation.[459] Mr David Jordan suggested that the 'storage of energy is the best solution to matching supply with demand and cutting waste.'[460] A US study explained the advantages of effective energy storage technologies:

> Increased deployment of renewable generation, the high capital cost of managing grid peak demands, and large investments in grid infrastructure for reliability and smart grid initiatives is creating new interest in electric energy storage systems. Just as transmission and distribution (T&D) systems move electricity over distances to end users, energy storage systems can move electricity through time, providing it when and where it is needed.[461]

457 Submission 30, National Generators Forum, p. vii.

458 Submission 30, National Generators Forum, p. 51.

459 Ecoult Energy Storage Solutions, 'Ecoult Megawatt Scale Energy Storage', p. 2.

460 Submission 9, Mr David Jordan, p. 4.

461 Electric Power Research Institute, 'Electricity Energy Storage Technology Options: A white paper primer on applications, costs and benefits', December 2010, p. ES-1.

8.113 Mr Jordan described a number of energy storage options that are available, including pumped hydro, batteries, methanol and solar hot water systems:

> The best example of this is pumping water back up the dam during off peak that is available during peak load. There are other options including battery storage and converting energy into a fuel like methanol or hydrogen that can be converted back into electricity during peak load. Instead of home solar panels pushing unwanted energy into the grid threatening infrastructure, why not charge batteries at the home and run the home off the battery during peak load.
>
> Another practical storage method is solar water, where the water is heated during the day and does not requiring peak load energy to heat water at night. [462]

8.114 Existing technologies for storing electricity (such as lead acid batteries) are not effective or economical for use on a large scale. Worldwide, the amount of electricity stored is just a fraction of that generated. The bulk of storage currently used is made up of pumped hydro, which effectively stores water for electricity generation. The Electric Power Research Institute explained the landscape of energy storage technologies currently in use:

> While many forms of energy storage have been installed, pumped hydro systems are by far the most widely used, with more than 127,000 megawatts (MW) worldwide. Compressed air energy storage (CAES) installations are the next largest, followed by sodium-sulfur batteries. All remaining energy storage resources worldwide total less than 85 MW combined, and consist mainly of a few one-off installations.[463]

8.115 While the Committee did not receive a substantial amount of evidence about energy storage, there are a number of different energy storage technologies which are either in use on a small scale or in various stages of development. With the exception of compressed air energy storage and flywheels, these mainly comprise various types of batteries. Some, such as lead-acid and lithium-ion batteries, are already widely used. However, there are a number of other battery technologies including advanced lead-acid batteries, vanadium redox, zinc-bromine (Zn/Br), sodium-sulphur, and sodium nickel chloride batteries.[464]

8.116 The CSIRO Energy Transformed Flagship provided evidence about its work on the Ultra-Battery, an advanced lead-acid battery it developed which is now in production and use overseas:

> storage is a vital enabler, especially if you are thinking about a future electricity grid with a high penetration of intermittent renewables. That is why for many years we have conducted research into the space. We are conducting it in two aspects of storage: one is the development of actual new battery technology that is particularly suited to that task, and CSIRO has developed and now commercialised a modified lead-acid battery called the UltraBattery, which is cheaper than comparable batteries with similar performance and particularly suited to the grid integration of renewables but also for hybrid electric vehicle applications. It is currently being

462 Submission 9, Mr David Jordan, p. 5.

463 Electric Power Research Institute, 'Electricity Energy Storage Technology Options: A white paper primer on applications, costs and benefits', December 2010, p. ES-2.

464 Electric Power Research Institute, 'Electricity Energy Storage Technology Options: A white paper primer on applications, costs and benefits', December 2010, pp. 4-4-20.

> produced by East Penn in the United States, which is the largest independent battery manufacturer, and Furukawa in Japan.[465]

8.117 Energy storage has a wide range of potential applications, from supporting generation to assisting transmission and distribution functions and customer uses. Dr Alex Wonhas explained a project that the CSIRO Energy Transformed Flagship is undertaking at Hampton Wind Park, using storage to regulate wind power generation:

> The second aspect of what we are doing is that we are then using these technologies to basically do a grid integration of renewables, and that is where this project that is happening in Hampton in New South Wales fits in, where we have a large one-megawatt battery bank and we basically take the output of the wind farm and provide a more smooth output into the electricity grid, which then can support the grid and which can also provide regulation services for the electricity grid.[466]

8.118 In answers to questions on notice, Dr Wonhas indicated that there is no comprehensive evaluation of the economics of storage options in the Australian context.[467] Dr Wonhas observed that the economics of energy storage will depend on a number of different factors:

> The current and future economic viability of storage solutions, such as the one developed at Hampton, depends on a large variety of factors. These factors include for example, the demand and supply characteristics at the specific location where the device is located in the electricity grid, the ability to access benefits such as avoided network expansion costs, the type of application (e.g. short term storage to deal with second or minute fluctuations or longer term, peak shifting, applications to deal with demand-supply imbalances on an hourly time-scale).[468]

Electric vehicles

8.119 Electric vehicles are another technology that has the potential to act as a form of energy storage in the future. While electric vehicles draw energy from the grid to recharge their batteries, there may also be potential for electric vehicles to feed electricity back into the grid, or to a household, when it is needed; this is known as 'vehicle to grid' or 'vehicle to house' technology. If the timing of recharging and feeding electricity back to the grid/house is managed appropriately, electric vehicles could assist in smoothing out demand by recharging at times of low demand and then acting as a source of electricity in times of peak demand, thus reducing pressure on the grid.

8.120 While the take-up of electric vehicles is still in its infancy, it is expected to accelerate in the coming decades. The Commonwealth Government's 'Energy White Paper 2012' suggested that growth in electric vehicles will increase after 2020:

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465 Dr Alex Wonhas, Director, CSIRO Energy Transformed Flagship, Evidence, 11 May 2012, p. 4.

466 Dr Alex Wonhas, Director, CSIRO Energy Transformed Flagship, Evidence, 11 May 2012, p. 4.

467 Dr Alex Wonhas, Director, CSIRO Energy Transformed Flagship, Answers to questions on notice taken in evidence, 11 May 2012, p. 1.

468 Dr Alex Wonhas, Director, CSIRO Energy Transformed Flagship, Answers to questions on notice taken in evidence, 11 May 2012, p. 1.

> There will be further development and take-up of hybrid and fully electric passenger vehicles. While this is expected to be slow to 2020, it is likely to accelerate over the following decade (Treasury 2011). Success will depend on the availability of cost-effective vehicles suitable to Australian conditions, improved battery technologies, timely and effective energy supply options, and the management of the effects on the energy distribution network.[469]

8.121 The New England Citizen's Jury noted that the use of electric vehicles, along with other forms of energy storage, can play a significant role in providing 'green dispatchable energy' and suggested that research and development in energy storage will become 'more and more important as we increase the proportion of renewable energy.'[470]

8.122 The ability of electric vehicles to help with peak demand was noted by Ms Clare Savage, Executive General Manager of the Energy Supply Association of Australia; however, Ms Savage also highlighted that managing the timing of charging vehicles will determine whether electric vehicles help or hinder the peak demand situation:

> Certainly as sellers of electricity we would love to see electric vehicle take-up. One of the most important things about electric vehicle take-up will be the charging style. If you do still have a situation where time of use is not reflected charging electric vehicle could actually help the peak demand situation if people charged overnight. You would actually do what we call flatten the load profiles so you do not have those big jumps in peak demand and the cost of peak demand. But if you do not put the right charging mechanisms in you could actually end up with all these mini peaks or, at worst, people are charging their car as soon as they get home from work which makes the peak even worse. The sorts of things we are concentrating on at the moment is making sure that the policy settings that will surround electric vehicle uptake will actually mean that they are an asset to the system rather than the opposite. [471]

8.123 These concerns were similarly noted in the Energy White Paper which discussed the additional network costs that could be imposed if electric vehicle charging is left unmanaged:

> Analysts suggest that even a relatively high level of electric vehicle adoption would result in only a moderate increase in demand for electricity. However, recent analysis by the Australian Energy Market Commission found that new metering and pricing structures are required to support efficient charging patterns and allocation of cost. If electric vehicle charging is left unmanaged, the commission estimates that each electric vehicle could add up to an additional $10 000 in electricity network and generation costs, of which $6500 to $7000 would be borne by consumers other than the vehicle owner.[472]

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469 Australian Government, 'Energy White Paper 2012: Australia's energy transformation', p. 36.

470 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 6.

471 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence, 26 March 2012, p. 43.

472 Australian Government, 'Energy White Paper 2012: Australia's energy transformation', p. 89.

Committee comment

8.124 The Committee considers that there is value in encouraging a diversity of energy supply sources as a means of managing energy security risk. Increased investment in a range of electricity generation types will continue to put downward pressure on electricity prices and increase the level of energy security in New South Wales.

8.125 The Committee is pleased to note the development of wind and solar energy in New South Wales to date, which will assist the State in reaching the current Renewable Energy Target. However, the Committee considers that there are considerable barriers to the deployment of renewable energy on a wide scale. In particular, the intermittent nature of wind and solar generation means that major advances in energy storage technology are required before these forms of energy can be deployed for baseload generation.

8.126 Efficient energy storage has the potential to ameliorate the intermittency associated with wind and solar energy, as well as to improve the efficiency of existing coal-fired generation. The Committee believes that there is a role for government in investing in and encouraging research and innovation, particularly in the development of energy storage technologies.

8.127 The number of electric vehicles in Australia is currently very small, but is expected to grow in coming decades. The Committee considers that the Government should closely monitor the take up of electric vehicles and future developments in storage technologies associated with electric vehicles.

8.128 Other barriers to renewable energy include community concerns about wind farms, and the cost of connecting renewable energy resources to the grid, especially if they are located a long distance from the existing grid. The Sydney Citizens' Policy Jury recommended that the grid should be extended to renewable energy resources throughout regional New South Wales and that this grid extension should be funded by the Federal Government's Clean Energy Finance Corporation. Therefore the Committee proposes that the NSW Minister for Resources and Energy forward the Citizens' Policy Jury recommendation to the relevant Commonwealth Government minister for consideration.

8.129 While solar energy may prove to have a competitive advantage in New South Wales over the longer term, the cost blow outs of schemes such as the Solar Bonus Scheme demonstrate the difficulties that can arise from the interplay of overly generous and uncoordinated policies by multiple levels of government.

8.130 As mentioned elsewhere in this report, the Committee considers that the market is the most efficient mechanism to determine resource allocation. The Committee believes that the Government should allow the market to operate effectively so that the most efficient forms of electricity generation can supply the demand requirements of the State.

8.131 The Committee acknowledges that there is obviously an environmental cost associated with greenhouse gas emissions, but considers that this cost has been addressed at a Federal level through the Renewable Energy Target and carbon tax. Therefore the Committee does not support further State Government

subsidies of particular types of electricity generation which may distort the market.

8.132 The Committee considers that previous Governments have unduly distorted market forces and imposed unnecessary costs on consumers through the operation of overly generous subsidy schemes such as the NSW Solar Bonus Scheme.

8.133 While opposing 'picking winners', the Committee believes that it is important to keep options open in regard to emerging technologies which may prove commercially viable in the future. In this sense the committee considers that there may be scope for Government investment in research and development of emerging technologies which are in their early stages of development, such as energy storage, as well as Government promotion of innovation. However, such assistance should not extend to the development of commercial scale applications which distort the market.

RECOMMENDATION 10

That the NSW Government not subsidise particular types of generation on a commercial scale.

RECOMMENDATION 11

That the NSW Government consider and encourage research and development of energy storage technologies.

RECOMMENDATION 12

That the Minister for Resources and Energy write to the relevant Commonwealth Government ministers to convey the Sydney Citizens' Policy Jury recommendation that electricity network extensions to renewable energy resources should be funded by the Commonwealth Government's Clean Energy Finance Corporation.

Chapter Nine – Alternative Forms of Energy Generation

Introduction

9.1 This chapter further addresses item (v) in the Inquiry's Terms of Reference, exploring the potential for, and barriers to, alternative forms of energy generation.

9.2 To date, the development of renewable forms of energy generation in Australia has focused on hydroelectricity, solar and wind energy. However, there are a number of alternative forms of energy generation which have the potential to provide significant amounts of energy, including nuclear power and various renewable sources: bio-mass, geothermal, tidal and wave. This chapter focuses on these alternative forms of energy generation, including the potential for and barriers to their development, and the likely costs.

9.3 The Committee believes that no form of energy generation should be ruled out arbitrarily. However, there are significant barriers to the development of the alternative forms of energy generation discussed in this chapter.

9.4 Currently, the use of renewable sources of energy, such as wind, solar, biofuel, waste, and geothermal, accounts for 2 per cent of electricity generation in New South Wales, a smaller proportion than the rest of Australia (2.7 per cent) and worldwide (3.3 per cent).[473]

NUCLEAR ENERGY

9.5 While nuclear energy is not renewable, it is considered an alternative energy source. With low carbon emissions, nuclear energy offers a viable option to reduce carbon emissions. However, public concerns about the safety of nuclear energy have prevented the deployment of nuclear energy in Australia.

9.6 There are currently no nuclear power generators operating in Australia. The existing nuclear facilities, such as the OPAL reactor at Lucas Heights,[474] are used for research, industrial and medical purposes.

Deployment of nuclear power around the world

9.7 While there are no nuclear generators in Australia, the Australian Nuclear Association (ANA) observed that nuclear power is a mature, proven technology, which is widely used around the globe, producing 14 per cent of the world's electricity.

> Nuclear power is widely used for baseload electricity generation around the world, although not yet in Australia. Nuclear reactors for generating electricity are a mature technology. The industry has over 14,700 reactor-years of experience in operating

473 Submission 4, Australian Nuclear Association, p. 2.

474 www.ansto.gov.au/discovering_ansto/anstos_research_reactor, accessed 11 October 2012.

> civilian nuclear reactors since the world's first commercial nuclear power station was opened in England in 1956. International experience demonstrates that large nuclear power reactors are reliable generators of baseload electricity with high availability.
>
> There are 434 nuclear power plants operating in 30 countries, producing 14% of global electricity (Jan 2012). Countries with a significant reliance on nuclear electricity include France with 74% of electricity produced from nuclear power in 2010, Ukraine with 48%, South Korea with 21% and USA with 20%; the European Union has 35%. In addition, 61 nuclear power reactors are under construction and 156 nuclear power reactors are on order or planned with approvals, funding or major commitment in place.[475]

9.8 The Australian Nuclear Science and Technology Organisation (ANSTO) indicated that most developed economies and a number of developing economies include nuclear power in their long-term energy security strategies. They further noted that 'of the 34 OECD countries, 18 operate nuclear power reactors' and only four of the remaining 16 OECD countries do not import electricity from jurisdictions that generate nuclear power – Australia, Iceland, Israel and New Zealand.[476]

9.9 In his submission, Mr John Doherty made observations of the established nuclear industry around the world, and noted that a number of other nations such as Vietnam, Thailand, Indonesia and Singapore are currently considering nuclear power.[477] However, the National Generators Forum, in its submission to the Inquiry, suggested that the limited availability of alternative domestic fuel resources was often a factor in countries opting to use nuclear power.[478]

Advantages of nuclear power

9.10 The Committee heard evidence from a number of stakeholders about the advantages of nuclear power over other existing or emerging technologies[479]. As will be explained further below, the advantages of nuclear power include its status as a mature, proven technology, its low carbon emissions and its capacity to increase energy security.

9.11 ANSTO argued that nuclear power is a mature technology with a number of advantages such as price stability, low carbon emissions and a secure fuel supply:

> Nuclear power generation is a mature, proven technology that has provided base load power in a number of countries for 50 years. It has a number of advantages such as fuel price stability, low operating costs, low emissions and waste and, a secure fuel supply. As demonstrated elsewhere in the world, nuclear power has much to offer in the way of achieving a diverse energy mix and contributing to medium to long term energy security. [480]

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475 Submission 4, Australian Nuclear Association, p. 1.

476 Submission 27, Australian Nuclear Science and Technology Organisation, p. 4, p. 21.

477 Submission 32, Mr John Doherty, p. 4.

478 Submission 30, National Generators Forum, pp. 28, 30.

479 Submission 4, Australian Nuclear Association, Submission 27, Australian Nuclear Science and Technology Organisation, Submission 32, Mr John Doherty, Submission 31, Mr Barrie Hill.

480 Submission 27, Australian Nuclear Science and Technology Organisation, p. 4.

9.12 ANSTO argued that nuclear power plants can provide low-carbon electricity generation in a reliable and affordable manner. They suggested that adding nuclear generation to the New South Wales energy mix would accelerate the Government's objective of CO_2 emission reductions, as well as mitigating 'future trade risk in a "carbon penalising" trade regime globally'. ANSTO further claimed that this could be achieved 'without major impact on economic prosperity.'[481]

9.13 Nuclear power produces significantly less greenhouse gas emissions than existing fossil fuel technologies. The Australian Nuclear Association (ANA) explained that nuclear generation, including the entire fuel cycle of mining, transport and reaction, produces far fewer emissions than coal or gas:

> Nuclear power is a low emitter of greenhouse gases and air pollution. Nuclear power plants emit virtually no greenhouse gases, but some greenhouse gases are emitted in mining, ore processing, construction of power stations and transport of materials and equipment – as they are in other mining and energy industries. The greenhouse gas emission from the whole nuclear fuel cycle is 10 to 100 times less than the emission from natural gas and coal.[482]

9.14 In evidence, Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, suggested that governments may wish to consider nuclear energy in the future if we are unable to develop renewable, zero-emissions, baseload technologies:

> There are obviously other technologies such as carbon capture and storage, which Australia will rely upon if we cannot find zero-emissions baseload technologies and we continue to have carbon constraints going forward. Governments may wish to consider nuclear energy in years to come. It is certainly not on the political agenda now, but if governments can satisfy themselves that it is safe and reliable it could be part of the mix.[483]

9.15 Energy security is another factor that may add to the appeal of nuclear generation. Both the ANA and ANSTO argued that nuclear power would add to New South Wales energy security. They suggested that adding nuclear energy to the New South Wales energy mix would diversify the technologies relied on to produce power. They also noted that fuel costs are a relatively small proportion of overall costs, thus making nuclear power less sensitive to fuel price fluctuations.[484]

9.16 The ANA and ANSTO also commented on Australia's significant uranium reserves, with ANSTO noting that Australia is a major producer of uranium and thus could maintain a secure local supply of nuclear fuel:

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481 Submission 27, Australian Nuclear Science and Technology Organisation, pp. 3-4.

482 Submission 4, Australian Nuclear Association, p. 4.

483 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence, 26 March 2012, p. 45.

484 Submission 4, Australian Nuclear Association, p. 3; Submission 27, Australian Nuclear Science and Technology Organisation, p.3, p. 19.

> Australia is the world's third largest producer of uranium, and therefore an Australian nuclear power industry could maintain a secure and reliable local source of nuclear fuel should the industry become further developed. [485]

9.17 However, ANSTO also indicated that there were significant challenges associated with implementing enrichment processing facilities in Australia; meaning that even if uranium was mined here, it may need to be processed overseas before being used in a nuclear reactor in Australia. [486]

Costs of nuclear energy

9.18 Nuclear energy is considered a competitive form of baseload generation in many other countries. However, as the Australian Nuclear Association observed in its submission, in New South Wales coal-fired generation is expected to remain a cheaper source of electricity, unless there is a sufficient carbon price imposed:

> In many countries, nuclear electricity is already cheaper than other forms of baseload electricity generation. Although the costs of nuclear electricity in Australia can really only be known when there is a fully commercial proposal to build several nuclear power plants, the large reserves of low-cost coal means that electricity from coal in NSW would be cheaper than electricity from nuclear unless or until coal is penalised for its emission of carbon dioxide.
>
> In its 2006 report to the Prime Minister, the UMPNER [Uranium Mining, Processing and Nuclear Energy Report] Taskforce estimated that nuclear electricity would be 20-50 percent more expensive in Australia than coal fired power if pollution including carbon dioxide emissions is not priced.[487]

9.19 The Australian Nuclear Science and Technology Organisation advised that while nuclear power involves very high capital costs, the ongoing operational and maintenance costs in established nuclear markets are very low. ANSTO suggested that if 'appropriate accounting for greenhouse gas and other emissions' is in place, then nuclear power becomes a competitive option in relation to existing coal and natural gas plants.[488]

9.20 In their submissions, both the ANA and ANSTO referred to studies which suggest that nuclear energy may be a competitive option for low emission, baseload generation. The ANA referred to a 2011 study comparing five low-emission, baseload technologies (including coal with CCS, gas with CCS, nuclear and solar thermal), which found that nuclear was the cheapest option and best able to meet the Intergovernmental Panel on Climate Change timetable for greenhouse gas abatement.[489]

9.21 ANSTO also cited a 2006 Federal Government report which suggested a carbon price of between $15 - $40 per tonne of CO_2 would be required to make nuclear energy competitive with coal. ANSTO also noted that the current carbon price fell within this price bracket:

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485 Submission 27, Australian Nuclear Science and Technology Organisation, p. 19.

486 Submission 27, Australian Nuclear Science and Technology Organisation, p. 19.

487 Submission 4, Australian Nuclear Association, p. 2.

488 Submission 27, Australian Nuclear Science and Technology Organisation, p. 5, p. 19.

489 Submission 4, Australian Nuclear Association, p. 2.

> According to the Prime Minister's *Uranium Mining, Processing and Nuclear Energy Report* (UMPNER) from 2006, nuclear power would become economically competitive with conventional coal-based electricity at low to moderate prices for carbon dioxide emissions – at approximately A$15-40/t CO_2-e.67 This is dependent on investors' perception of risk, and the specific technology employed. The federal "carbon price" to be introduced 1 July 2012 will be fixed at A$23/t CO_2-e for the first three years of operation. This falls within the range which UMPNER described as producing an economic environment in which nuclear can compete with fossil fuels.[490]

9.22 While the ANA presented evidence about the competitiveness of nuclear energy in a variety of international jurisdictions, it also reported that 'the precise competitiveness of different baseload technologies depended very much on local circumstances and the costs of financing and fuels'.[491]

LCOE

9.23 In its 2012 'Australian Energy Technology Assessment', the Bureau of Resources and Energy Economics provided levelised cost of electricity (LCOE) estimates for two types of nuclear reactors: Large scale (i.e. greater than 1 gigawatt) Generation III advanced light water reactors; and Small Modular Reactors (SMR).

9.24 For Generation III reactors the LCOE in 2012 was $96/MWh and the 2030 estimated LCOE was $102/MWh.[492]

9.25 The assessment did not include an LCOE estimate for Small Modular Reactors for 2012, as the technology was not considered commercially deployable. The 2030 estimated LCOE for Small Modular Reactors was $116/MWh.[493]

9.26 While these costs are at the lower end of the scale compared with some other forms of generation, the Committee heard that some stakeholders had reservations about the accuracy of such LCOE estimates. For example, Mr Jonathan Upson, Senior Development and Government Affairs Manager at Infigen Energy, suggested that the 2030 LCOE for nuclear energy was highly optimistic.[494]

Emerging nuclear technologies

9.27 Although nuclear power plants have been in operation for over 50 years, nuclear technology is continually developing, and the Committee heard evidence about a number of emerging technologies. Some of the potential technological developments brought to the Committee's attention included Generation IV reactors, Small Modular Reactors (SMRs), thorium and nuclear fusion.

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490 Submission 27, Australian Nuclear Science and Technology Organisation, p. 19.

491 Submission 4, Australian Nuclear Association, p. 2.

492 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 77.

493 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 77.

494 Mr Jonathan Upson, Senior Development and Government Affairs Manager, Infigen Energy, Evidence, 26 March 2012, p. 72.

Generation IV reactors

9.28 Generation IV nuclear reactors are the next generation of large scale nuclear fission reactors that are currently being researched. ANSTO explained that Generation IV plants are expected to be safer and more efficient than the existing Generation II and III plants that operate today.[495]

9.29 In its submission, ANSTO indicated that Generation IV reactors are unlikely to be deployed until 2030, but once developed they may offer a number of potential advantages over current nuclear reactors:

> Although it is unlikely to be a reality until at least 2030, the development of Generation IV reactors has the potential to greatly extend the lifetime of fuel deposits, increase energy output and offer greater proliferation and physical protection capability.[496]

9.30 Mr Tony Irwin of the Australian Nuclear Association explained that one of the advantages of Generation IV reactors will be their ability to use waste from current generators as a fuel source, thus reducing existing radioactive waste:

> …the next generation of reactors that is being researched, particularly by a program led in the US, will actually be able to burn some of the waste from the existing light water reactors—the existing fleet of reactors. That is going to be a really exciting development because that will get rid of one of the big problems: the spent fuel radioactive waste.[497]

9.31 Mr John Doherty similarly noted that the volume of waste from nuclear reactors – which is already significantly less than the waste produced by fossil fuel generators – is expected to reduce even further with the advent of the next generation of nuclear reactors:

> The volume of waste generated in comparison with fossil based fuels is miniscule and can be safely stored on site, initially underwater and then when it has cooled, on the surface. It can be reprocessed and has future value. With the advent of generation IV reactors, the small amount of existing waste will be substantially reduced in volume and potency.[498]

Small Modular Reactors

9.32 Small Modular Reactors (SMRs) are a type of nuclear reactor currently being developed which are designed to be smaller than typical nuclear power plants. The size of SMRs ranges between 10MW and 300MW. In his submission Mr Doherty provided some details of the history and characteristics of SMRs:

> …over 50 SMR reactor designs have been under development to provide power sources to isolated networks and for applications such as barge-mounted power stations for back-up power at remote locations. SMR technology had its genesis in naval applications and has proved to be exceptionally reliable, with over 50 years of

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495 Submission 27, Australian Nuclear Science and Technology Organisation, p. 18.

496 Submission 27, Australian Nuclear Science and Technology Organisation, p. 22.

497 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 35.

498 Submission 32, Mr John Doherty, p. 3.

> naval operational experience by a number of the world's major navies. It has been proven to have an excellent safety record.
>
> SMR's are reactors sized in the range 10 MWe to 300 MWe and cover a wide range of technologies from the earlier Generation II naval Pressure Water Reactors (PWR) to Generation IV Advanced High Temperature Liquid Metal (HTLMR) reactors. A number of these reactors are scheduled to be licensed by the Nuclear Regulatory Commission (NRC) by 2013-2014 when they will be available for manufacture.
>
> SMR's are factory manufactured with the reactor and steam generator integrally housed in a containment vessel. The steam turbine power generation plant is external to the reactor steam generation vessel and of traditional engineering design. [499]

9.33 In his submission, Mr Barrie Hill noted the recent development of small modular nuclear reactors, suggesting that they would be ideally suited for installation in regional New South Wales:

> Over the past few years there has been considerable development of small modular reactors for power generation. These units range in size from 45 to 300 MWe and would be ideally suited to installation in country New South Wales near the ends of the existing grid. [500]

9.34 Mr Hill further suggested that small modular reactors 'mitigate many of the perceived safety concerns associated with larger nuclear power plants.'[501]

9.35 In evidence, Mr Tony Irwin of the Australian Nuclear Association explained that an advantage of SMRs is that 'you can add modules as required so you get a lower initial construction cost and they are very good for remote locations.' However, Mr Irwin admitted that the deployment of SMRs is still a few years away, saying that, 'the small modular reactors, there is not a full-sized demonstration in work at the moment. There will be by around 2018, 2020.' [502]

Thorium

9.36 Thorium is an alternative fuel to uranium for nuclear energy. While thorium itself is not a fissile material, it may be converted into uranium in a nuclear reactor, which can then be used as a fuel. Mr Irwin explained the advantages of thorium, including its abundance and the type of radioactive waste it generates, but also pointed out the extra costs involved in the thorium fuel cycle compared with uranium:

> Thorium is a very interesting material. It is not a fissile material like uranium. You cannot fill a reactor with thorium and it will work. It is what is called a fertile material so you can breed uranium from thorium. So, you put thorium in a uranium reactor and it breeds more uranium, which you can then use in another reactor. So, it is not a direct thorium cycle, it is a breeder cycle. It has some advantages because the uranium you produce is now 233 instead of 235. You get a different sort of radioactive waste mix, and there are some advantages in that. Thorium is abundant,

499 Submission 32, Mr John Doherty, p. 4.

500 Submission 31, Mr Barrie Hill, p. 9.

501 Submission 31, Mr Barrie Hill, p. 9.

502 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 33, p. 35.

> there are huge quantities worldwide. It is more abundant than uranium and I think long term it will be a good alternative, but the extra cost of what you have to do to thorium at the moment means it is not really worthwhile with current uranium costs and uranium reactors. It has been used in the United States; it has been trialled in Germany as well. Several countries have done several trials on thorium. When you look at the next generation of reactors, it is an alternative fuel. I would not say the sort of fuel you would be interested in in this context in this sort of timescale.[503]

Nuclear fusion

9.37 Nuclear fusion is a different type of nuclear reaction to that which takes place in current nuclear power stations. It is sometimes considered to be a potential future source of energy, although thus far this remains a distant possibility. As noted by the Bureau of Resources and Energy Economics in their 2012 *Australian Energy Technology Assessment*, fusion reactions have been demonstrated in research conditions, but commercial deployment is not considered possible for many years:

> While fusion conditions can currently be created for research purposes, the ability to economically do so with a net positive energy has so far eluded researchers. It is possible that commercial fusion technology could become a reality by 2050. The nuclear fusion reaction accessible with current technology requires atoms of two heavy hydrogen isotopes – deuterium and tritium – to fuse. It is envisaged that tritium will be bred within the reactor from a lithium blanket and so it is not required to be transported to or from the reactor site. [504]

9.38 While the possibility of generating electricity from fusion is considered a long distant aspiration by many in the field, there are some researchers and organisations which hope to make fusion a reality in a much shorter timeframe. For example, the Australian company Star Scientific Limited is attempting to develop an economic muon catalysed fusion process.[505] [506]

Barriers

9.39 There are a number of barriers to the development of a nuclear energy industry in New South Wales. These include real and perceived safety concerns, as well as concerns about nuclear waste and nuclear weapons, in addition to which are the legal and political barriers that must be overcome before nuclear power could become a reality in the state.

Safety concerns

9.40 The public's concerns about the safety of nuclear reactors are widely recognised, especially in light of the 2011 Fukushima incident in Japan. As this Inquiry is not specifically about nuclear energy, the Committee did not receive a lot of evidence about specific safety concerns in regard to nuclear energy, but they are perhaps best inferred from the following question posed by the Chair during the public hearing on 11 May 2012:

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503 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 35.

504 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 57.

505 www.starscientific.com.au/muon-catalysed-fusion/, accessed 11 October 2012.

506 Muon catalysed fusion is a process where a subatomic particle known as a muon captures two hydrogen atoms and forces them to fuse, resulting in energetic particle release and helium.

> Whenever nuclear energy is raised in a community forum invariably someone will ask… "Would you have it in your electorate?" or "Would you want it in your suburb?" Would you be comfortable having your residence within a kilometre of a nuclear power plant? [507]

9.41 In response to this question, Mr Tony Irwin of the Australian Nuclear Association replied that he would prefer a nuclear power plant over many other types of power stations or industries:

> Personally I would prefer to have a nuclear power plant than a chemical plant or coal fire power station or other sorts of industries. The best place is to put it within a reasonable distance of where you need the load but where you have an isolated area. There is an emergency planning zone [EPZ] around most nuclear power plants. That is to minimise the immediate effects around that plant. That is a fairly small zone. You have a fair amount of freedom in where you locate it. [508]

9.42 ANSTO, in its submission, identified a number of key events which it believes have influenced the negative public opinion regarding the safety of nuclear energy in Australia:

> Several key events can be identified as having contributed to the development of Australian society's attitude to nuclear power. These events include the nuclear weapons testing at Maralinga/Emu Field in the 1950s; the Ranger Uranium enquiry in the 1970s; the decision made in the early 1980s to restrict uranium mining; continued nuclear weapons testing in the South Pacific in the 1980s and 1990s; and the Three Mile Island and Chernobyl accidents, in 1979 and 1986 respectively. We can now add to this list the ongoing situation in Fukushima. Discussions of the nuclear industry in Australia are invariably framed within the context of these events, whether accurate or specific details are known or not, and irrespective of technological progress since they occurred. [509]

9.43 The Australian Nuclear Association considered that fears about nuclear power are misplaced, arguing that nuclear power is among the safest forms of electricity generation:

> The ANA recognises that there is public concern in NSW around the development of nuclear power in the State. Although fears are understandable, they are misplaced. Nuclear power would be amongst the safest and least environmentally damaging ways to generate our electricity. [510]

9.44 The ANA stated that previous accidents, such as Chernobyl, were the result of ineffective safety regulations and containment structures and asserted that 'no-one will ever again build a nuclear power station of the Chernobyl type.'[511] In a similar vein, Mr Tony Irwin noted that modern reactors have safety systems, which would avert the types of accidents that have previously occurred:

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507 Mr Jonathan O'Dea MP, Chair, Public Accounts Committee, 11 May 2012, p. 35.

508 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 35.

509 Submission 27, Australian Nuclear Science and Technology Organisation, p. 22.

510 Submission 4, Australian Nuclear Association, p. 3.

511 Submission 4, Australian Nuclear Association, p. 3.

> …reactors like the Westinghouse reactor have what they call passive safety systems. One of the problems in Japan is that they lost their electricity supply and water supplies. They were reliant on outside supplies. Modern reactors have passive safety systems. So within the reactor building they have water tanks gravity fed to provide water to the core. In addition, they have tanks that are pressurised with gas, which again inject into the core, and then they use natural circulation as well. They can survive for quite a long time without any external supplies.[512]

9.45 Mr Irwin further claimed that nuclear power is statistically the safest form of generation:

> …on the basis of deaths per kilowatt hour of generation, nuclear is by far the safest of all the generation. There have been no deaths from radiation at a nuclear power plant except Chernobyl. Even at Fukushima the 20,000 deaths were from the tsunami and none was from radiation, even in this very extreme accident.[513]

Nuclear waste

9.46 Nuclear waste, which remains radioactive for hundreds of years, is another issue which must be addressed before implementing nuclear power in New South Wales. In his submission to the Inquiry, Mr Graeme Jessup argued that the economic assessment of any form of electricity generation must take into account all of the financial implications of the entire generation process (including construction, fuel and remediation costs). In relation to nuclear energy Mr Jessup noted, *inter alia*, that 'the cost of long term management of the spent nuclear fuel for current and future generations' would be of particular significance for an economic assessment of nuclear energy.[514]

9.47 Mr Irwin discussed nuclear waste, explaining that there are different types of nuclear waste and describing the appropriate treatment for each.[515]Mr Irwin suggested that nuclear waste is currently effectively managed around the world.[516]

Nuclear weapons

9.48 While apprehension about nuclear proliferation may be held by the general public, the Australian Nuclear Association dismissed concerns about the potential to produce nuclear weapons from materials used in a hypothetical nuclear generator in New South Wales:

> The commercial operations of a nuclear industry in NSW would not involve any risk of the diversion of materials into the production of nuclear weapons. Materials suitable for weapons would not be handled at any stage and all operations would be fully under Australian regulatory supervision. [517]

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512 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 36.

513 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 33.

514 Submission 6, Mr Graeme Jessup, p. 4.

515 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 37.

516 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 33.

517 Submission 4, Australian Nuclear Association, p. 4.

Addressing public concerns about nuclear energy

9.49 In its submission, ANSTO acknowledged that there are a number of public concerns about nuclear energy, but considered that active public debate and education could address these concerns:

> Despite its maturity, it is clearly recognised that there a number of important public concerns raised about nuclear, including waste, proliferation and safety. These issues have been extensively examined in many countries through comprehensive studies.
>
> Active public engagement and debate, transparent, clear and factual information in other countries have been shown to significantly allay public concerns. Independent, strong regulators are also seen to be key to public confidence. [518]

9.50 ANSTO also pointed to research conducted by the Nuclear Energy Agency which indicated that acceptance of nuclear power increases proportionally with knowledge and experience of the industry. ANSTO believed that engaging with the community and addressing the lack of knowledge about nuclear power would allay public concerns.[519]

Legal and policy barriers

9.51 The Australian Coal Association considered that nuclear energy was not a realistic option for political reasons and would take a minimum of ten years to implement:

> …while nuclear power supplies baseload energy it is not a realistic option for NSW politically and would take a minimum of ten years to develop even if it were given the green light.[520]

9.52 Vestas, in its submission, referred to a 2012 report by the Grattan Institute which found that nuclear power stations are unlikely to be built in Australia unless the government takes on most of the material risks of the project, which would be expensive and unpopular with consumers:

> As noted by independent think tank the Grattan Institute, other alternatives such as nuclear power and so-called Carbon Capture and Storage technology for coal-fired generators are unlikely to be built in Australia unless government takes on most of the material risks of the project. That is likely to be expensive and highly unpopular with taxpayers, particularly while lower-cost alternatives such as wind energy are ready to be built right now.[521]

9.53 The *Australian Radiation Protection and Nuclear Safety Agency Act 1998* prohibits licensing of nuclear facilities in Australia. Mr Irwin explained the changes to legal requirements that must be undertaken in order to build nuclear power plants:

> At the moment the nuclear regulator, the Australian Radiation Protection and Nuclear Safety Agency, is not allowed to license a nuclear power plant. So there have

518 Submission 27, Australian Nuclear Science and Technology Organisation, p. 5.

519 Submission 27, Australian Nuclear Science and Technology Organisation, p. 22, p. 24.

520 Submission 28, Australian Coal Association and NSW Minerals Council, p. 7.

521 Submission 24, Vestas Australian Wind Technology, p. 5.

> to be changes to the *Australian Radiation Protection and Nuclear Safety Agency Act* to allow them to issue a licence. Then, for New South Wales, there is a prohibition law against the building of a nuclear power generation facility. There will have to be changes there. As far as the regulating and licensing concerns, licensing proceeds in steps, so there is a site licence, a construction licence and an operating licence. [522]

9.54 When asked how long it would take to have a nuclear power plant operating in New South Wales, given the legislative and construction hurdles that need to be navigated, Mr Irwin estimated that it 'would be about 10 years.'[523]

9.55 In its submission the Australian Nuclear Association indicated a number of the legislative and policy barriers must be changed to progress development of nuclear power in New South Wales:

> The ANA recommends that legislative and policy issues be resolved, including repeal of the NSW *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986* No. 194, so that commercial nuclear power plants can be proposed, built and operated, consistent with meeting environmental, safety and planning criteria. [524]

9.56 The *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986* (NSW) expressly prohibits uranium mining, exploration and the generation of electricity from uranium in NSW. Section 8 of the Act states that, 'A person shall not construct or operate a nuclear facility'. The same section defines a nuclear facility to include 'a nuclear reactor, whether or not designed for the purpose of generating electricity'. Section 9 of the Act expressly prohibits State authorities from operating nuclear reactors to generate electricity. The *Mining Legislation Amendment (Uranium Exploration) Act,* passed in April 2012, removes the ban on uranium mining and exploration.

Citizens' Policy Jury views

9.57 The New England Citizens' Policy Jury found that nuclear energy was not supported by the broader community and thus it was considered unacceptable as a source of electricity generation in New South Wales:

> That the broader Community does not currently have confidence in either uranium-based nuclear energy generation or coal seam gas extraction technologies, and that until such time as the community's confidence level improves significantly in respect to both these technologies, they are not recommended for inclusion in any energy generation mix for NSW.[525]

9.58 The Sydney Citizens' Policy Jury, by contrast, recommended that the NSW Government should 'initiate informed public discussion regarding emerging nuclear technologies, such as thorium, as an energy source.'[526]

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522 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 35.

523 Mr Anthony Irwin, Member, Australian Nuclear Association, Evidence, 11 May 2012, p. 35.

524 Submission 4, Australian Nuclear Association, p. 5.

525 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 2.

526 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 3.

9.59 The Sydney group argued that Australia's political stability and geological resources provided an opportunity to utilise the country's substantial thorium resources for the development of future power stations. They further noted that thorium power stations:

> would be more cost effective, have a lower carbon footprint, and safer processes that produce minimal waste with significant reduction in the risk of development of weapons. [527]

9.60 The Jury considered that the option of developing nuclear energy should not be dismissed and that, pending the outcomes of informed public discussions, nuclear power stations might be developed over the medium to long term.[528]

Biomass

9.61 Biomass as an energy source is an umbrella term for two distinct forms of energy production. The first is the production of energy through direct combustion of discarded organic material (including forest residues, wood chips, and municipal waste). The second form involves the chemical or thermal conversion of organic material into a usable form of fuel, either as fibres or as a chemical.

9.62 Biomass has a significant advantage as a renewable power source because it has the potential to provide continuous base-load power generation, unlike solar and wind which are intermittent and according to Delta Electricity, 'require breakthroughs in commercial scale storage to become a reliable source of energy.'[529]

Direct combustion - vegetation

9.63 The largest source of direct combustion biomass energy production in Australia is bagasse (a by-product of sugar production). Bagasse is a primary carbon-neutral fuel source that has been used for over 50 years and currently accounts for one per cent of energy production in Australia.[530]

9.64 The Bureau of Resources and Energy Economics has predicted the costs of a sugar cane waste power currently at $112/MWh and in 2030 at $119/MHh.[531]

9.65 A variety of other crops can be used as biofuel, such as corn, hemp, and certain oil-rich woods. However, direct combustion of vegetative matter grown specifically as biofuel has been criticised as being environmentally and economically inefficient, because it supplants more high-value forms of agriculture such as food production.[532]

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527 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 6.

528 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 6.

529 Submission 10, Delta Electricity, p. 14.

530 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

531 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 76.

532 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

9.66 The Bureau of Resources and Energy Economics has predicted the costs of a land fill waste power plant currently at $91/MWh and in 2030 at $99/MHh.[533]

Direct combustion - waste

9.67 Biogas involves the harvesting of methane produced in the breakdown of sewage, municipal rubbish and food waste.

9.68 Production is highly cost-effective as it typically occurs at sewerage treatment plants. For example, the Woodlawn Bioreactor near Canberra, which uses Sydney's waste as fuel, is commercially profitable.[534]

9.69 Biogas energy production capacity has grown at approximately 78% a year since 1995. However, it is argued that to make the industry competitive would require improved waste collection and incentives.[535]

9.70 Delta Electricity argued that there is a conflict between State and Federal legislation in regard to which alternative fuel sources are deemed eligible for power generation. Delta Electricity noted that fuels permitted by the Office of the Renewable Energy Regulator for the generation of Renewable Energy Certificates are not approved by the NSW Office of Environment and Heritage. As a result, fuels permitted in some states and territories are prohibited in New South Wales. This constitutes a potential barrier to development in NSW.[536]

9.71 Biomass, together with wind power, is expected to account for most of Australia's increase in renewable resource energy production to 2030.[537] The Australian Business Council for Sustainable Energy (BCSE) has argued that electricity produced from biomass could increase to 10-17 per cent of Australia's total electricity consumption by 2020.[538]

9.72 The Bureau of Resources and Energy Economics (BREE) has stated that biogas and biomass are highly competitive forms of electricity generation and are projected to remain cost competitive out to 2050.[539] BREE has predicted the costs of a waste power plant currently at $128/MWh and in 2030 at $136/MHh.[540] However these costs are estimates which also include the use of wood and other waste products. Sewage-based biomass energy production has essentially no resource fuel costs, only capital costs.[541]

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533 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 76.

534 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

535 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

536 Submission 10, Delta Electricity, p. 14.

537 Australian Bureau of Agricultural and Resource Economics, 'Energy in Australia 2008', Department of Resources, Energy and Tourism, Australian Government.

538 Australian Bureau of Agricultural and Resource Economics, 'Energy in Australia 2008', Department of Resources, Energy and Tourism, Australian Government.

539 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 16.

540 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 74.

541 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 76.

9.73 The NSW Government has provided Cargill Australia Limited with funding to develop a biogas project at Cargill's Wagga Wagga beef processing facility that will generate energy from animal waste methane. The project involves the construction of a 75 million litre covered anaerobic pond and the installation of 1400kW of co-generation set to generate 1200kW of electricity and 500kW equivalent of steam.[542]

Geothermal energy

9.74 There are two forms of geothermal energy available in Australia: one utilises geothermal aquifers and the other utilises the pumping of water into hot fractured rock with temperatures over 250°C, which is also referred to as Enhanced Geothermal Systems (EGS).

9.75 Geothermal energy is considered a sustainable resource as extraction can occur for a significant period without depleting the source.[543] Geothermal is an approved energy source under the Renewable Energy Target scheme.

Geothermal aquifers

9.76 Geothermal energy production by geothermal aquifers is both cheap and clean. Production is more common in volcanically active areas, such as in New Zealand where it produces 7 per cent of the country's electricity.[544]

9.77 The Great Artesian Basin, part of which is located in north-west New South Wales, is considered one of Australia's best potential sources of geothermal aquifer energy. However, as the amount of electricity likely to be produced is limited and is in an isolated geographical location, it is considered a viable energy source only for small communities located in close proximity.[545]

9.78 The Bureau of Resource and Energy Economics has predicted the costs of electricity generated from hot sedimentary aquifers in 2030 at $157/MHh.[546]

Enhanced Geothermal Systems

9.79 Enhanced Geothermal Systems (EGS) involves the propulsion of turbines by high-pressure steam resulting from the injection of water into deep boreholes in hot fractured rock. The International Energy Agency believes that this form of geothermal energy has the potential to supply five per cent of the world's electricity by 2020.[547]

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542 http://www.environment.nsw.gov.au/grants/ccfred.htm, accessed 4 October 2012.

543 Ladislaus Rybach (2007) 'Geothermal Sustainability', GEOWATT AG, Dohlenweg 28, CH-8050 Zurich, Switzerland.

544 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

545 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

546 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 74.

547 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

9.80 In Australia, geothermal energy has the potential to provide some 20,000 years of energy consumption at 2005 consumption levels.[548] Such production will depend on significant advances in technology, which AEMO does not expect to be available until sometime between 2020 and 2030.[549]

9.81 The CSIRO also argued that geothermal energy has the potential to be a low-cost, baseload, low emissions technology but warned that the technology has significant technical and commercial risks attached to it that must be addressed prior to implementation.[550]

9.82 Cost is a major impediment to producing electricity from geothermal energy. The process is reliant on access to subsurface rock with temperatures over 250°C. At present, technological limitations allow for drilling only up to 5km, which is generally above the depth at which rock of the necessary temperature occurs. This renders the process viable only in areas of rock above the average temperature of that found in New South Wales.[551] Further, the current cost of establishing whether an area is suitable to produce geothermal energy is estimated at between $15 and $20 million[552], for which no commercial return is guaranteed.

9.83 According to the CSIRO, economic analysis suggests that 'flow' (predicting and ensuring high flow rates of a working fluid such as water through the subsurface structures) will be essential in delivering competitively priced geothermal electricity. The CSIRO argued that further funding of research would allow for advancements in this area.[553]

9.84 According to AEMO, the development of this resource in the next decade will require focus on increasing the amount of energy produced per well and reducing the costs of drilling. Understanding Australia's geothermal resources will ensure that the resources with the right characteristics to be developed economically are targeted.[554]

9.85 The Bureau of Resource and Energy Economics has predicted the costs of a geothermal – hot rock power station in 2030 at $214/MHh.[555]

9.86 Mr Rob Stokes MP, Parliamentary Secretary for Renewable Energy, in his submission, argued that geothermal energy has great potential:

548 Somerville, M., et al. (1994) 'Hot Dry Rocks Feasibility Study', Australian Energy Research and Development Corporation Report 94/243.

549 CSIRO Energy Transformed Flagship, 'AEMO 100% Renewable Energy Study', 3 September 2012, p. 8.

550 CSIRO Energy Transformed Flagship, Answers to questions on notice taken in evidence, 11 May 2012, question 4.

551 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

552 Mr Lane Crockett, General Manager Australia, Pacific Hydro, Evidence, 11 May 2012, p. 12.

553 CSIRO Energy Transformed Flagship, Answers to questions on notice taken in evidence 11 May 2012, question 4.

554 CSIRO Energy Transformed Flagship, 'AEMO 100% Renewable Energy Study', 3 September 2012, pp. 8-9.

555 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 75.

> based on current technology, geothermal energy has the greatest capacity to provide dispatchable electricity, with New South Wales having good potential geothermal energy resources in areas [with] proximity to existing coal-fired generators, and the associated transmission infrastructure.[556]

9.87 Mr Stokes' view echoed that of the CSIRO Energy Transformed Flagship, which observed that New South Wales has attractive geothermal resources located in the Hunter Valley, which are close to existing electricity infrastructure. The proximity of these resources to coal fired power stations provides the opportunity for hybrid application to pre-heat steam.[557]

9.88 Geodynamics Limited was developing the first geothermal energy project in NSW, the Hunter Valley Geothermal Project. Using EGS at depths of 4000 to 5000 metres, wells would supply a 10 MW binary cycle power station. The project aimed to demonstrate the potential of the Hunter Valley hot rock resources and pave the way for expansion to a 50 MW plant and, potentially, a 200 MW plant. The project received over $10 million in NSW Government funding.[558] However, the company has since reported that no field activities are planned for the immediate future at either of their Hunter Valley locations.[559]

9.89 Geodynamics Limited is also constructing a 525 MW geothermal plant at Innamincka in South Australia, which is scheduled to become part of the grid in 2018.[560]

Tidal Power

9.90 Tidal power involves the conversion of the energy of tides into electricity, using the pressure of tides flowing through turbines. Such power stations currently operate in China, Canada and several European countries.

9.91 Tidal power is considered a potential energy source for north-west Australia as this area has some of the largest tides in the world, of up to 10 metres. However, the relatively high capital costs and lengthy construction times for large tidal schemes, as well as the geographical isolation of the potential locations, are considered major obstacles to the growth of this energy sector in Australia.[561]

9.92 Tidal power is not a viable energy source for New South Wales, as the state does not have a tidal range of five metres or more, which is required for large-scale installations.[562]

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556 Submission 33, Dr Rob Stokes MP, p. 1.

557 CSIRO Energy Transformed Flagship, Answers to questions on notice taken in evidence, 11 May 2012, question 4.

558 http://www.environment.nsw.gov.au/grants/ccfred.htm, accessed 16 October 2012.

559 http://geodynamics.com.au/IRM/content/projects_huntervalley.html, accessed 16 October 2012.

560 Australian Energy Regulator, 'State of the Energy Market 2011', p. 45.

561 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

562 Parliament of Australia, 'The potential for renewable energy to provide baseload power in Australia', Research Paper no. 9, 2008–09.

Waves

9.93 Wave power is the generation of electricity using the energy generated by ocean surface areas. Wave power systems use the swell of the ocean rather than the waves themselves. Various projects using different systems are currently being trialled in South Australia, Tasmania, Victoria and Western Australia.

9.94 In July 2012, the federal Government provided a grant to Oceanlinx (a wave energy development company) to construct a 20m by 20m 1MW Commercial Wave Energy Demonstrator near Port MacDonnell in South Australia. This project will use shallow water variant technology on a commercial scale and be connected to the grid in 2013.[563]

9.95 According to the Bureau of Resources and Energy Economics, 'the global wave power industry is still immature and commercial production of wave energy is very limited.'[564]

9.96 The Bureau of Resources and Energy Economics has predicted the cost of a wave power plant in 2030 at $220/MHh.[565]

Committee comment

9.97 The Committee heard that several alternative renewable energy sources have the potential to produce significant amounts of electricity for New South Wales and, as previously stated, the Committee believes that no potential option should be ruled out.

9.98 In this vein, the Committee heard evidence that nuclear energy has significant benefits as a form of low-emissions baseload power generation. These benefits were recognised by the Sydney Citizens' Policy Jury. The Committee recognises that there are also genuine community concerns about nuclear energy. The Committee therefore urges the NSW Government to initiate public discussion about nuclear power generation as an option for the state.

9.99 There are substantial legislative barriers to development of nuclear energy, at both Commonwealth and State level. NSW cannot progress development of nuclear energy without the co-operation of the Commonwealth Government. The Committee therefore urges the Minister for Energy and Resources to raise the issue of nuclear power generation at the Standing Council on Energy and Resources, with a view to reviewing the *Australian Radiation and Nuclear Safety Agency Act 1998.*

9.100 However, the Committee notes that development of some alternative forms of energy generation is dependent on advancements in science - advancements that are not guaranteed. The Committee therefore recognises the continued importance of government support for research and development of alternative sources of energy generation.

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563 http://www.oceanlinx.com/news-and-media/world-s-1st-1mw-wave-energy-converter/, accessed 9 October 2012.

564 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 48.

565 Bureau of Resources and Energy Economics, 'Australian Energy Technology Assessment 2012', p. 76.

9.101 The Committee notes that geothermal energy and biomass are expected to play a significant role in future electricity generation, as these appear to show the most potential and will provide continuous, as opposed to intermittent, energy generation. However, neither technology is expected to be viable prior to 2030 and geothermal energy, in particular, will require significant investment.

9.102 The Committee notes that the use of biomass for electricity production will be largely concentrated on waste and sewage, due to concerns about agricultural production of vegetation matter solely for energy purposes. However, the Committee was concerned by suggestions of inconsistency between State and Federal legislation regarding the eligibility of alternative fuel sources for renewable electricity generation. The Committee therefore encourages the NSW Government work with the Commonwealth and other State and Territory Governments to ensure there is consistent legislation across jurisdictions.

9.103 The Committee looks forward to results of the Hunter Valley Geothermal Project the geothermal plant in Innamincka, South Australia, and Cargill's Wagga Wagga beef processing facility.

RECOMMENDATION 13

That the Minister for Resources and Energy raise the issue of nuclear power generation at the Standing Council on Energy and Resources, with a view to reviewing the *Australian Radiation and Nuclear Safety Agency Act 1998.*

RECOMMENDATION 14

That the Minister for Resources and Energy work with the Commonwealth and other State and Territory ministers for energy to pursue consistency between State and Federal legislation regarding eligible fuel sources for renewable energy generation.

Chapter Ten – Demand management

Introduction

10.1 This chapter considers a number of measures that are designed to manage or reduce energy consumption. Although not explicit in the Terms of Reference, these measures are relevant to the Inquiry because improved use of energy can reduce the need for costly additions to electricity generation capacity and network infrastructure.

10.2 In particular, this chapter focuses on demand management, including:

- existing demand management measures,
- the potential for, and barriers to, improved demand management,
- the recent 'Power of choice' review conducted by the Australian Energy Market Commission (AEMC),
- smart meters and time of use pricing, and concerns about their impact on vulnerable customers, and
- consumer education and information, including energy education for school students.

10.3 This chapter also canvasses distributed generation, which de-centralises electricity generation through the grid, primarily through small-scale renewable generation such as solar panels but also co-generation and tri-generation, which utilise heat produced in buildings for electricity generation. Energy efficiency measures, which are designed to reduce the amount of electricity used in buildings, are also discussed herein.

10.4 The Committee found that improved demand management, energy efficiency and, potentially, distributed generation, offer significant potential to reduce peak demand, with its corresponding costs. Importantly, demand management also offers consumers the opportunity to participate in the market by more actively managing their use of energy. The Committee therefore made a number of recommendations in relation to these strategies, which are detailed at the end of the chapter.

DEMAND MANAGEMENT

10.5 Demand management may be referred to by a variety of names, such as demand response or demand side participation. Demand management better distributes demand for electricity, for example, by reducing consumption at peak times.[566]

10.6

[566] Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 3.

10.7 Demand management has the potential to reduce energy generation and network costs by reducing demand, particularly peak demand, which is a major driver of network expansion. In their submission, the Total Environment Centre and Nature Conservation Council of NSW explained that peak demand, which occurs for only a few hours a year, contributes to a significant portion of electricity costs, and noted that demand management options can reduce this peak demand:

> Demand side participation can be particularly effective if used specifically to reduce peak demand. It is estimated that 25% of retail electricity costs are a result of periods of extremely high demand that occur for less than 40 hours per year, i.e. 0.45% of the time. Demand side participation options could prevent these peaks in demand occurring and reduce the need for costly generation and infrastructure. [567]

10.8 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia similarly noted the extent to which peak demand acts as a driver for network investment:

> Peak demand is the single biggest cause of network investment in this State. The fact that you have rising peak demand, and falling average demand, means that you actually need to build the networks bigger and bigger to charge them over a smaller number of hours because you actually charge over average use not over maximum demand. The analogy that I find useful is it would be like building the Sydney Harbour Bridge big enough that no car ever had to pause in peak hour. That is essentially what we have to do with the network. [568]

10.9 Ms Savage told the Committee that the Australian Energy Market Commission (AEMC) had recently shown that '$11 billion worth of electricity infrastructure is currently used for only 100 hours a year.' Ms Savage claimed that demand management could be a legitimate and cost-effective alternative to investment in new generation. [569]

10.10 The CSIRO Energy Transformed Flagship also asserted the value of demand management, reporting findings from its 2009 analysis of the economic benefits of demand management, distributed generation and energy efficiency:

> CSIRO analysis has shown that demand side measures are the most cost effective measures to contain the rise of electricity prices while at the same time reducing the carbon emissions intensity of our electricity system. In 2009, CSIRO has completed an analysis of the economic benefits to Australia of energy efficiency, distributed generation and demand side management. In this study, we found that the benefit of a scenario where energy efficiency, distributed generation and demand side response is enabled compared to a scenario where these options are not available has a net present value (at 7% discount rate) of $130 billion… [570]

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567 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 3.

568 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence 26 March 2012, p. 43.

569 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence 26 March 2012, p. 37.

570 CSIRO Energy Transformed Flagship, Answers to questions taken on notice taken in evidence, 11 May 2012, p. 2.

10.11 In its submission, ERM Power explained how reducing peak demand and flattening the load curve could reduce the need for capital investment in electricity generation, reduce emissions and, over time, reduce network costs:

> …the optimal generation plant mix is primarily determined by the shape of the load duration curve.
>
> A flatter load curve (that is, less peaky end-demand) would require less capital to be invested in generation capacity to supply a given amount of energy and, in the long-run, reduce the average generation sector emissions intensity (more baseload and less peaking plant).
>
> Moreover, in time a flatter load curve would substantially reduce the largest and fastest growing component of retail electricity bills, network costs. [571]

10.12 ERM Power concluded that there was 'enormous scope' for reductions in retail bills through demand management innovations.[572]

Existing demand management measures

10.13 There are some existing demand management measures in place in the National Electricity Market, including direct load control (for hot water and pool pumps), curtailable load arrangements, pricing strategies, thermal energy storage, energy conservation and efficiency, residential fuel substitution, power factor correction programs and distributed generation.[573]

10.14 Most existing demand management measures, such as load shedding and interruptible supply, are implemented by network providers and relate to large industrial users of energy. However, off peak hot water is an example of demand management in the residential setting which has been widely adopted.

10.15 Mr Greg Everett, Director of the National Generators Forum and Chief Executive, Delta Electricity, noted that there is already some evidence of consumers and retailers effectively managing demand in New South Wales:

> We are already seeing consumers managing their demand quite effectively. We have seen considerable decay in demand in New South Wales, in fact in all jurisdictions in Australia apart from Tasmania—which is fairly flat. What we are seeing amongst consumers is implementation of energy efficiency and even at peaks we are aware that retailers are managing some of those peaks with their customers to avoid some of the higher demand periods and reduce the peak demand.[574]

10.16 In answers to questions on notice, the NSW Department of Trade and Investment, Regional Infrastructure and Services provided a history of some of the demand management solutions that have been implemented in New South Wales:

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571 Submission 16, ERM Power, p. 3.

572 Submission 16, ERM Power, p. 3.

573 Australian Energy Market Commission, 'Power of choice - giving consumers options in the way they use electricity, Directions Paper', 2012, p. 32.

574 Mr Greg Everett, Director, National Generators Forum and Chief Executive, Delta Electricity, Evidence, 11 May 2012, p. 19.

> Managing the growth in peak demand has been a long term issue for NSW. Schedule 2 Section (6) (5) of the Electricity Supply Act 1995 required the Minister to impose licence conditions on NSW electricity distributors to seek non network demand management solutions prior to investing capital in expanding the network.
>
> The initial Demand Management Code of Practice (the DM Code) recognised by the Minister on 28 October 1999, allowed a choice between two frameworks for investigating and implementing demand management strategies. This reflected the views at the time and was subsequently modified in the second edition of the DM Code in May 2001 to a single framework designed to promote market based approaches to investigating non-network alternatives.
>
> More recently, in 2008 the Ministerial Council on Energy (now the Standing Council on Energy and Resources) undertook policy work to establish a national framework for electricity distribution network planning and expansion. This framework included obligations for network operators to undertake demand management activities for all proposed network expansions greater than $2 million in value.
>
> The Australian Energy Market Commission (AEMC) is currently preparing to undertake the statutory process to change the National Electricity Rules to give effect to the new framework. It is expected that these new rules will come into effect and replace the NSW DM Code, in late 2012.[575]

10.17 Transmission and distribution network service providers in the NEM are currently obliged to consider alternatives to network expansion, such as demand management measures, when planning major transmission or distribution projects. Mr Peter McIntyre, Managing Director, TransGrid, stated that TransGrid has successfully used demand management initiatives to defer major projects:

> …TransGrid has been able to defer major projects that are required to cater for increasing peak demand growth, using demand side response. Regulatory incentives and other administrative arrangements encourage and support these activities.
>
> Transmission networks must have sufficient capacity to meet the maximum demand placed on their network. Peak demand is a strong driver of the need to reinforce transmission networks. TransGrid actively considers network support from non-network options in better generation and load side curtailment to meet these peaks. TransGrid acquires its network support through competitive tenders, expressions of interest and requests for proposals. An assessment is then made against other options, such as network upgrades, to determine which option has the most merit in proceeding. It should be noted that the regulatory test for transmission explicitly requires transmission companies like TransGrid to demonstrate how they have considered on an even footing alternatives to network augmentation before network augmentation can be undertaken. [576]

10.18 Mr McIntyre claimed that TransGrid is a leader in the NEM in the acquisition of network support, providing details of a successful project which saved over $14 million:

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575 NSW Department of Trade and Investment, Regional Infrastructure and Services, Answers to questions taken on notice taken in evidence, 26 March 2012, p. 4.

576 Mr Peter McIntyre, Managing Director, TransGrid, Evidence, 26 March 2012, p. 56.

> For a one year deferral of its Western 500 kV project approximately three years ago, TransGrid acquired 250 megawatts of support from a gas generator project in the Wollongong area, 50 megawatts of support from a load reduction of a major industrial load in Western Sydney and 50 megawatts of aggregated support of load reduction in the Newcastle, Sydney and Wollongong areas. To date these contracts remain the largest successful implementation of network support in the National Electricity Market. They provide an Australian benchmark for the tendering and contracting of network support in deferring major capital projects and, in this case, saved customers more than $14 million that was returned to customers.[577]

10.19 The Total Environment Centre and Nature Conservation Council of NSW described another mechanism – the D-Factor mechanism – which encourages network providers to undertake demand side projects:

> NSW operates the successful D-factor mechanism, which has encouraged some increase in demand side participation to date. This mechanism could be expanded and improved in order to further encourage the investigation of cost-effective demand side participation options by Distribution Network Service Providers (DNSPs). This scheme allows NSW DNSPs to recover costs and foregone revenues associated with demand side participation projects, i.e. the regulated revenue that they spend on reducing demand rather than increasing supply.
>
> The D-factor mechanism has resulted in a reduction of the average annual growth in summer peak demand of about 7% and 3% in 2004/5 and 2005/6 respectively. The total cost of this reduction was $5.1million, compared to the avoided network costs of $19.3 million.[578]

10.20 The CSIRO Energy Transformed Flagship advised the Committee that government already supports a number of effective demand management measures, such as building regulations and Minimum Equipment Performance Standards.[579] They also informed the Committee of a number of programs run by the CSIRO, which provide consumers with information about managing energy use:

> CSIRO through its Energymark (with support from the NSW government)… and EnergySavers program… have provided Australians with targeted information to help them manage their energy demand and reduce their energy bills, which is particularly important for low income and financially constrained households. Programs of this type can have meaningful results, typically in the 10-20% energy reduction range and, depending on design, may be delivered at low costs, often with a net societal benefit. [580]

Potential for greater demand management

10.21 While the evidence presented above indicates that there are some strategies in place to encourage demand management in the NEM, a number of stakeholders

577 Mr Peter McIntyre, Managing Director, TransGrid, Evidence, 26 March 2012, p. 56.

578 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 5.

579 CSIRO Energy Transformed Flagship, Answers to questions taken on notice taken in evidence, 11 May 2012, p. 2.

580 CSIRO Energy Transformed Flagship, Answers to questions taken on notice taken in evidence, 11 May 2012, p. 2.

suggested that there is potential to expand the scope of demand side participation.[581]

10.22 In their submission the Total Environment Centre and Nature Conservation Council of NSW outlined the following demand side options, which they indicated could be implemented or expanded in New South Wales:

- Peak load management
  - Load curtailment arrangements, which includes 25 NSW smelters that agree to interrupt their electricity use at times of peak demand;
  - Hot water shifting – already 1.04 million customers in NSW;
  - Dynamic Peak Pricing/Critical Peak Pricing;
- Whole-load management
  - Energy efficiency and conservation;
  - Fuel substitution;
  - Power factor correction;
- Distributed generation
  - Standby generators (current installed level equivalent to 400-500MVA in NSW);
  - Small-scale renewables.[582]

10.23 EnerNOC's submission asserted that while a number of demand response applications are already provided by generators in the NEM, efficient outcomes could also be achieved through the use of aggregated Demand Response (DR):

> …with the technology now available to control short term reductions in electricity user demand there is a more efficient outcome through an aggregated DR. The aggregated DR is formed from existing (already built) capacity for electricity users to forego some electricity demand for short periods without harm to their business. Our experience is that most commercial and industrial users are willing to make these small adjustments to their demand under agreements which provide payment for their action.[583]

10.24 Ms Lana Stockman, Manager, Wholesale Regulation at TRUenergy, spoke of some programs that the New Zealand Government had implemented to assist retailers with demand management measures:

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581 See Submission 7, EnerNOC Australia; Submission 11, Total Environment Centre and Nature Conservation Council of NSW; Submission 16, ERM Power; Submission 34, Institute of Sustainable Futures; CSIRO, Answers to questions taken on notice taken in evidence, 11 May 2012; TRUenergy, Evidence, 26 March 2012.

582 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, pp. 4-5.

583 Submission 7, EnerNOC, p. 2.

> There are a whole range of options. Some of the stuff I have been involved with is that the New Zealand Government has a Conservation Authority that works with manufacturers and brokers relationships. They may negotiate on behalf of a large number of manufacturers with certain industry participants to install things; for example, machine rewinding. Machines use a lot of power and if they are not optimally tuned they can chew up a lot of energy and increase the cost of distribution networks quite considerably. One of the programs I was partially involved with in New Zealand looked at targeting those participants but the Government got involved and brokered those relationships to make sure it was all fair and above board, but also to kind of legitimise it—it was not that retailers were out to hurt manufacturers—and to facilitate a two-way conversation I guess.[584]

10.25 In answers to questions on notice, TRUenergy reported that one of the 'key factors for success for these programs has been the emphasis on measuring delivered benefits, and subsequent value for all energy consumers.'[585]

10.26 The Committee also received evidence about a number of trial programs that have attempted to implement additional demand management options. These included the Ausgrid's Smart Grid Smart City project which is being undertaken in a number of locations such as Newcastle, Scone, Sydney CBD and Ku-ring-gai. The project is designed to demonstrate the technical and commercial viability of a number of smart technologies including electric vehicles, energy storage and smart metering services. [586]

10.27 Perth's Solar City program was another such program that sought to address peak demand. The Energy Supply Association of Australia reported the following promising findings of the program:

- a trial of direct load control for air-conditioners reduced participants' energy consumption at peak time by 20% during the first year;
- customers who were provided with an electronic in-home display which shows their electricity consumption in real-time had an average 6.82% reduction in electricity use; and,
- a trial of time-of-use pricing showed a 10.9% reduction in use during the 'super peak' period. [587]

Barriers to demand management

10.28 There may be a number of barriers to implementing particular demand management measures in the National Electricity Market, including regulatory structures, split incentives or a lack of sophisticated metering technology. Stakeholders such as ERM Power, the CSIRO and AEMO provided the Committee with information about barriers to improved demand management.

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584 Ms Lana Stockman, Manager, Wholesale Regulation, TRUenergy, Evidence, 26 March 2012, p. 36.

585 TRUenergy, Answers to questions taken on notice, 26 March 2012, p. 3.

586 NSW Government, 'NSW Government submission: draft energy white paper', April 2012, p. 10.

587 Energy Supply Association of Australia, Answers to questions taken on notice taken in evidence, 26 March 2012, p. 2.

10.29 ERM Power noted that there are multiple impediments to demand management which prevent further reform. These include both regulatory impediments and vested interests:

> These include the indifference of the large vertically-integrated energy companies with franchise customers to high regulated tariffs, a regulatory structure for monopoly distribution and transmission networks that rewards higher capital expenditure, and a lack of regulatory flexibility to allow customers (and smaller retailers) to share in the benefits of demand response.[588]

10.30 In answers to questions on notice the CSIRO highlighted split incentives as another barrier to the development of demand management measures. Split incentives occur in situations where a decision maker is not exposed to the full costs or benefits of their action, and thus does not necessarily have the incentive to maximise benefits or minimise costs efficiently.[589] The CSIRO provided the example of installing an air-conditioner to describe how the price paid by a consumer may not reflect the overall costs imposed on the electricity system. The CSIRO argued that individuals have only limited incentives to invest in alternatives (such as insulation) which may have a lower overall cost. The CSIRO suggested that providing market mechanisms to pass on avoided network costs could be an effective form of demand management:

> Other market failures are often around split incentives. For example the Draft Energy White Paper 2011 by the Federal Government states: "while it may cost around $1500 to purchase and install a 2 kilowatt (electrical input) reverse-cycle air conditioner, such a unit could impose costs on the energy system as a whole of $7000 when adding to peak demand. These capital costs are recovered over time through energy bills, but because of the way energy is priced only some of the costs are paid by the purchaser of the air conditioner while the broader system costs are spread across all customers." … There is hence only limited incentive by the buyer of a conventional air-conditioning unit to invest into passive (e.g. insulation) or active (e.g. solar thermal air-conditioning systems...) alternative solutions that could significantly reduce the total system costs (without even taking into account subsidies such as RECs). Therefore providing a market based mechanism to pass avoided network costs onto those who make investments to avoid peak demand could be one of the single most effective measures to manage demand effectively.[590]

10.31 In evidence, Mr David Swift, Executive General Manager, Australian Energy Market Operator, told the Committee that a number of inquiries have been undertaken to identify ways for customers to participate in the market. Mr Swift also outlined another example of split incentives – in leased buildings, where the building owner does not use or pay for the building's electricity. Mr Swift suggested that these kinds of situations can create barriers to implementing demand management:

> There have been a number of inquiries looking at how we can better have consumers participate in the market to become more active buyers, if you like, to discriminate in terms of the way in which they use energy. A lot of those studies

588 Submission 16, ERM Power, p. 3.

589 CSIRO, 'Intelligent grid: a value proposition for distributed energy in Australia', 2009, p. 12.

590 CSIRO Energy Transformed Flagship, Answers to questions taken on notice taken in evidence, 11 May 2012, p. 2.

> indicate that there are some barriers in some cases, for example, cases where in commercial buildings the building owner could be quite different than the person who actually uses the energy, those sorts of matters. [591]

10.32 Mr Swift further suggested that a lack of sophisticated metering technology can impede demand management at a domestic/household level, but noted that implementing such meters can be quite expensive.[592]

10.33 The Total Environment Centre and Nature Conservation Council of NSW suggested that the National Electricity Rules and National Electricity Objective are biased against demand side participation. They recommended that changes be made to the 'National Electricity Rules and the National Electricity Objective to favour demand side participation, lower cost energy solutions and improved environmental performance.'[593]

AEMC 'Power of choice' review

10.34 Providing greater opportunities for demand side participation and allowing consumers to better manage their energy consumption have also been the focus of an ongoing review by the AEMC. In September 2012, the AEMC released a draft report for their 'Power of choice – giving consumers options in the way they use electricity' review. [594] This review is the third stage of the AEMC's inquiries into demand side participation, with two earlier reports being released in May 2008 and December 2009.[595]

10.35 The draft report proposes a number of changes to provide consumers with information and enable them to access demand side options, as well as enabling the market to support consumer choice through better incentives to capture the value of demand side options. Some of the proposals put forward in the draft report include:

- allowing large consumers, or third parties acting on behalf of consumers, to participate in the wholesale electricity market and to receive the spot price for changing their demand;
- introducing different electricity tariffs at different times of day and in different locations to reward consumers for changing their behaviour, while providing safeguards for vulnerable customers who may be affected by time varying prices;
- improved access to consumption data to inform consumer choices;

591 Mr David Swift, Executive General Manager, Corporate Development, Australian Energy Market Operator, Evidence, 26 March 2012, pp. 16-17.

592 Mr David Swift, Executive General Manager, Corporate Development, Australian Energy Market Operator, Evidence, 26 March 2012, pp. 16-17.

593 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 12

594 Australian Energy Market Commission, 'Power of choice - giving consumers options in the way they use electricity, Draft Report', September 2012.

595 www.aemc.gov.au/Market-Reviews/Completed/review-of-demand-side-participation-in-the-national-electricity-market.html, accessed 5 October 2012.

- the introduction of time varying tariffs to be supported by consumer education to increase understanding of the potential benefits;
- encouraging investment in metering technology;
- improved incentives for network service providers to consider demand side participation options rather than additional network investment in poles and wires, where efficient to do so; and
- enabling consumers to sell their distributed generation (e.g. solar, embedded generation, battery storage) to parties other than their retail electricity supplier.[596]

Smart meters and time of use pricing

10.36 Smart meters are a type of meter that can provide electricity suppliers and consumers with real time information about electricity usage – as opposed to traditional 'accumulation' meters that record consumption over a three month period. Smart meters measure how much electricity is used every 30 minutes, meaning that customers can better monitor their power use. Different rates can be charged based on when electricity is used.[597]

10.37 Time of use pricing implies that consumers are charged different rates (tariffs) for their electricity use, according to the time of day at which they use it. Electricity consumed in peak periods (for example, between 2pm and 8pm) is charged at a higher tariff than electricity consumed at other times of the day.

10.38 In practice, the time of use pricing tariffs charged for retail residential consumers are much less variable than wholesale electricity prices. In its 'Power of choice' review, the AEMC explained that time of use retail tariffs attempt to balance efficient price signals against practical considerations:

> In practice there are limitations on achieving complete cost reflectivity for consumers, even with interval metering technology in place. This is due to the difficulty of designing associated tariffs, the transactions costs involved and need to develop prices that consumers understand and accept. These reasons are greater for the residential sector than for commercial and industrial consumers. For example, full half hourly pass through of the wholesale price is unlikely to be viable or desirable for most residential consumers; and designing network tariffs for every consumer that reflect the true locational variation of network costs would be far too complex. Network and retail prices will inevitably reflect a balance between the need for efficient signalling of costs and more practical considerations.
>
> For this reason when we refer to cost reflective prices in the context of this review we do not mean prices that are perfectly cost reflective from a theoretical stand point, but rather are likely to provide a more efficient price signal to consumers

596 Australian Energy Market Commission, 'Power of choice - giving consumers options in the way they use electricity, Draft report - Information sheet',www.aemc.gov.au/Media/docs/Draft-report---Information-sheet-9dd641ac-6f1e-4f95-8824-823c1fa31025-0.pdf ,accessed 5 October 2012.

597 www.savepower.nsw.gov.au/households/downloads-and-resources/save-power-fact-sheets/electricity-bills-and-meters.aspx, accessed 18 October 2012.

> compared with those that currently exist. This may involve prices varying by both time and location. [598]

10.39 The AEMC described a number of retail tariff options that are available or have been trialled in Australia:

> There is a wide range of tariff options, either currently available or in their trial stages, that provide varying degrees of cost reflectivity above existing flat tariffs. These include time of use (TOU) and variations of TOU such as seasonal TOU, full wholesale price pass through (real time pricing or RTP); critical peak pricing (CPP); variable peak pricing (VPP), peak time rebates/incentives and new forms of network charges that attempt to capture the cost of peak demand (such as capacity based charging).
>
> These rates can also be mixed and matched in various ways. For example a basic TOU structure could be matched with a CPP of some form. Some options can be applied to residential and small business consumers, while others may be more appropriately applied to large industrial facilities given their business operations. At the core of all these options is a price that varies over time to capture the impact of consumption on the costs of electricity supply at different times. [599]

10.40 For most residential customers, time of use pricing refers to retail tariffs which fall into one of three price bands - peak, shoulder or off peak – with the peak tariff being highest and off-peak being the lowest.

10.41 Smart meters provide customers with more information about their electricity usage. When combined with time of use pricing, smart meters may encourage consumers to reduce their usage in peak times. As peak demand is a significant driver of network costs, reducing peak demand has the potential to reduce future network costs. The Energy Supply Association of Australia (ESAA) noted the potential for time of use pricing and smart meters to impact on demand:

> Other ways to provide an incentive to efficiently reduce electricity consumption would be to remove retail price regulation and allow for the introduction of more dynamic customer tariffs. These changes would provide a price signal to consumers that better reflects the cost of using electricity at different times of day. Tools such as smart meters and in-home displays will be needed to enable a transition to flexible time-of-use pricing. [600]

10.42 Mr Tim Nelson, Head of Economic Policy and Sustainability, AGL Energy, similarly suggested that smart meters and associated pricing innovations can be cost-effective tools for managing energy demand:

> Other policy measures that governments could start to look at are incentivising the technology that would facilitate greater consumer control of their energy consumption—things like smart meters, which enable retailers to offer time-of-use pricing and those types of innovative pricing products. One of the things that we are

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598 Australian Energy Market Commission 'Power of choice - giving consumers options in the way they use electricity, Draft report', September 2012, p. 84.

599 Australian Energy Market Commission 'Power of choice - giving consumers options in the way they use electricity, Draft report', September 2012, p. 84.

600 Energy Supply Association of Australia, Answers to questions taken on notice taken in evidence, 26 March 2012, p. 1.

> very keen on is trying to incentivise our customers to use less at various times of the day because it is a more cost-effective way for us to serve them than just to continually build power stations and for the network businesses to continually build network capacity.
>
> I think a combination of deregulation of prices and the introduction of smart metering technology would work.[601]

10.43 According to analysis undertaken by the Australian Energy Market Commission as part of its 'Power of choice' review, switching to time of use pricing has the potential to save average consumers between $100 and $200 a year.[602]

10.44 Other stakeholders to the Inquiry who supported the introduction of time of use pricing included Mr Russell Marsh, Policy Director, Clean Energy Council, who suggested that the introduction of time of use pricing would also act as an incentive for households to install solar photovoltaic (PV) systems:

> The more we move towards time of use pricing will help. To pick up the point about time of use pricing and particularly things like solar and some of the household technologies, if people are going to get strong signals as to when to use power and when not to use power, it could really make a difference to their usage. For example, going back to the point about household solar photovoltaics being close to grid parity, there were some examples in places in New South Wales where some people on time of use tariffs—there were times of the day when they were paying 45¢ a unit for their electricity and with the photovoltaics system on their roof they are able to offset that 45¢ a unit, so that is a very good benefit to having photovoltaics on the roof.
>
> Our view is that moving to time of use pricing, with the right information and signals in place for the householder to respond to that, and saying, "There will be times when it is going to be expensive for you to use electricity but also there are going to be times when it is very good for you to use your own generation because you can offset an extremely high cost for power" is the way to go. Whether that can be done without fully deregulating the retail sector is another question. Certainly the move towards more efficient and time of use pricing for energy is something we certainly support. [603]

10.45 Both of the Citizens' Policy Jury reports suggested changes to the way retail electricity prices are charged, in order to more effectively encourage demand management. The Sydney Citizens' Jury report recommended legislating 'to allow "time of day" and other flexible tariff options.'[604]

10.46 In their report, the New England Citizens' Jury suggested that the current methods of charging for electricity are inefficient. They felt that at present consumers 'are not encouraged by pricing to be efficient' and suggested that 'lowering availability charges and balancing the loss of income by increasing usage charges would provide greater incentive for people to lower their demand.'

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601 Mr Tim Nelson, Head of Economic Policy and Sustainability, AGL Energy, Evidence, 11 May 2012, p. 60.

602 Australian Energy Market Commission, 'Power of choice - giving consumers options in the way they use electricity, draft report', September 2012, p. v.

603 Russell Marsh, Policy Director, Clean Energy Council, Evidence, 26 March 2012, p. 53.

604 Sydney Citizens' Jury, 'Recommendations on energy economics and security in NSW', August 2012, p. 3.

Among the recommendations of the New England Citizens jury was the proposal that 'policy should recognise and reward efficiency in generation and consumption'.[605]

10.47 In its submission to the Commonwealth Government's 'Draft Energy White Paper', the NSW Government noted that smart meters have already been deployed in some regions of New South Wales as part of a large scale trial program being undertaken by Ausgrid. However, the Government noted that a cost-benefit analysis is to be completed before any further roll out of smart meters is undertaken:

> NSW notes that Ausgrid is undertaking a large scale pilot trial program that will see the first integrated smart city in Australia. The Smart Grid Smart City Project is designed to demonstrate the technical and commercial viability of a number of smart technologies including electric vehicles, energy storage and smart metering services. The Smart Grid Smart City Project is expected to run until 2013 and customer participation in the project is voluntary. Ausgrid was awarded $100 million from the Commonwealth Government to undertake the project. It will occur across NSW including customers in Newcastle, Scone, the Sydney CBD and Ku-ring-gai.
>
> The NSW Government is commencing a cost-benefit analysis prior to any further roll out of smart meters in NSW. With the network business consolidation, the Government is ensuring a co-ordinated review so that there is a common position. The review will be informed by the experience of the Victorian Government in this regard and will consider both benefits and costs for consumers, businesses and electricity networks. The review will focus on empowering customers with choices as well as considering the costs and benefits to consumers of time-of-use tariffs compared with flat, all day tariffs.[606]

10.48 While some of the above evidence suggests that the introduction of smart meters and time of use pricing has the potential to reduce electricity demand as well as reducing customers' electricity bills, there are also costs involved in the installation of smart meters. According to the Australian Energy Regulator's 2011 'State of the Energy Market' report, the introduction of smart meters in Victoria added $70 to network charges for the average small retail customer in 2010 and a further $8 in 2011. Over the period from 2012 to 2015 smart meters are expected to increase costs by $9-21 per year.[607]

10.49 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, informed the Committee about the consumer backlash that was experienced in Victoria following the mandatory introduction of smart meters throughout the State. Ms Savage highlighted the importance of educating consumers about the benefits of smart meters before rolling them out across the state, and suggested that permitting time of use tariffs was crucial to making the most of smart meter technology:

> I would say to you that the industry could have, and us in particular, could have been better at talking to customers about the benefits of smart meters before the roll out.

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605 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 7, 10.

606 NSW Government, 'NSW Government submission: draft energy white paper', 2012, p. 10.

607 Australian Energy Regulator, 'State of the Energy Market 2011', p. 75.

> I think one of the challenges in Victoria has been we have had a mandatory roll out but a lot of people do not understand why it is happening and so ensuring that customers understand the benefits, are able to access those benefits, so not having a moratorium on time-of-use tariffs when you roll out smart meters is fairly important as well. In New South Wales it has been more of a voluntary approach to it but Energy Australia, which is now Ausgrid, has done quite a significant scale roll out of both Smart meters and time-of-use tariffs. My understanding is it has had a very positive reception.
>
> One of the questions we did ask in that focus group research last year was about smart meters and smart technologies. Certainly in Victoria there was fairly negative feedback about it but in all other jurisdictions when it was explained to people that it would help them to manage energy use throughout the day the reception was very positive.
>
> … It is certainly something that we believe, having time-of-use tariffs is an important way to unlock the benefits of a smarter grid and of a smart meter in particular. [608]

10.50 In its submission to the Commonwealth Government's 'Draft Energy White Paper', the NSW Government also expressed some caution about the prompt roll out of smart meters across the country, suggesting that the practical experiences of Victoria and New South Wales should inform the process:

> NSW experience to date suggests that households and businesses have different electricity use patterns and therefore respond differently to higher peak pricing. Additionally, some households have very limited choice as to when they can use electricity, for example households with young children or pensioners. Even if these households are able to change their demand patterns, the impact of this change may be minimal.
>
> The Draft Energy White Paper asserts that "pricing reform in itself should not, on average, increase overall costs; over time it should reduce costs through greater efficiency and demand side response to price signals". NSW asserts that rather than generalising about average impacts, the validity of this assertion for different classes of customers should be further tested to ensure appropriate public policy on pricing reform is adopted. It is particularly important that the most vulnerable households (including families and pensioners) are not left paying for expensive expansions in peak capacity, as they have no option but to consume electricity at peak periods, whilst other households move to low peak pricing. [609]

Vulnerable consumers

10.51 The Public Interest Advocacy Centre (PIAC) raised a concern about time of use tariffs in regard to their impact on vulnerable consumers, especially those who have little discretion over their electricity usage. Mr Edward Santow, Chief Executive Officer of PIAC, explained his concerns about the effect that introducing time of use pricing may have on certain groups of consumers, such as people with a disability:

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608 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence, 26 March 2012, pp. 43-44.

609 NSW Government, 'NSW Government submission: draft energy white paper', April 2012, p. 10.

> The concern that we have is that moves towards time of use tariffs tend to discuss consumers as if they were one homogenous group. In other words, they tend to aggregate all consumers and treat them all alike, perhaps not paying enough attention sometimes to the fact that there are people with low levels of discretionary use of electricity or energy more generally, and they simply are unable to shift their load to off-peak or shoulder pricing periods. For those people, any mandatory adoption of time of use pricing would really have the potential to pose quite significant challenges. We, at the Public Interest Advocacy Centre, have done some research recently on the question here and our research has really focused on the use of electricity by people with physical disability. When asked in this research whether this target group of people with disability have a condition that requires their living spaces to be heated or cooled, 75 per cent of people answered 'yes'. In addition, 39 per cent of people relied on some kind of in-home service or product that runs on fixed schedules that cannot be easily moved to accommodate the peak electricity price periods.
>
> …the risk is that you have someone who is totally reliant on a motorised wheelchair. We are getting very strong information from groups that represent people in that category who say, "We need to charge the wheelchair every day, which sucks up quite a significant amount of electricity", and they are already starting to say, "We are curtailing our activities, going out less frequently and engaging less with the community." That, as a human rights-social justice question, is really terrible, and it is not a result we are looking for.[610]

10.52 PIAC provided further information about the groups of consumers who may be unable to adjust their electricity usage away from peak periods, and therefore may be unfairly disadvantaged by the introduction of time of use pricing:

> … there are groups of consumers who may be older, have physical disabilities or medical conditions who are not able to shift their use away from peak periods. These consumers can be divided into two categories: Those who require in-home care services; and those who require the in-home use of life support equipment or air conditioners for medical reasons. PIAC believes that, without adequate protection, there is a very real risk that these consumers would be disadvantaged by the introduction of TOU [Time Of Use] pricing.[611]

10.53 PIAC noted that the NSW Government currently has a number of protections in place for vulnerable consumers, such as the Life Support Energy Rebate and Medical Energy Rebate, but questioned the extent to which the Medical Energy Rebate could sufficiently cover additional costs incurred by a person with a disability, as well as the strict eligibility rules for the scheme.[612]

Consumer education and information

10.54 Providing consumers with information and education about how to reduce their electricity consumption can be an effective method of managing demand. Ms Savage reported that consumer focus groups consistently ask for greater information about how they can manage their electricity consumption more effectively. Ms Savage also informed the Committee about a successful education

610 Mr Edward Santow, Chief Executive Officer, Public Interest Advocacy Centre, Evidence, 11 May 2012, pp. 26-27.

611 Public Interest Advocacy Centre, Answers to questions taken on notice in evidence, 11 May 2012, p. 2.

612 Public Interest Advocacy Centre, Answers to questions taken on notice in evidence, 11 May 2012, p. 3.

program run by the Western Australian Government which focused on managing peak demand:

> One of the things that they consistently said in the focus groups was … that they did want even more information about why prices have been rising and how they can use energy more efficiently. I think there is a big case for the industry and governments, both State and Federal, to work together in terms of educating customers around how they use energy, whether it is turning your air conditioner to 24^{o} instead of 21^{o} or something like that. There are lots of practical things people can be educated about which would make a big difference.
>
> … In terms of the biggest difference around cost to the system is peak demand. It is about educating people to use less between 3.00 p.m. and 8.00 p.m. is fairly important. The Western Australian Government through its utilities ran what they called the Beat the Peak campaign over about four years. It was purely and simply designed to educate customers about switching off through that period. You raised a question before about conservation in water and it was sort of a similar philosophy about getting people to appreciate that they can still run their air conditioner—we are not saying not to have the things that you need—but that is not the time also to put on a load of washing or pop on your dryer: do that at night time if you can. Getting people to switch is the most important thing. [613]

10.55 In answers to questions on notice, the ESAA reported on the outcomes of the Western Australian 'Beat the Peak' education campaign, noting that a third of respondents changed their behaviour as a result of the campaign:

> In 2007, market research on the campaign found that 83 per cent of the surveyed population recalled the messages in the campaign, and 29 per cent said that seeing the campaign changed the way they used energy in their home between 3 and 6pm.
>
> In 2009, the 'Beat the Peak' advertising campaign encouraged the Perth community to 'set air conditioners to 24°C' in order to reduce peak energy consumption. According to Western Power's 2009 Annual Report, survey results indicated 99 per cent of residents recalled this message and one third of residents who saw the advertising believed they have changed their behaviour. [614]

10.56 The ESAA considered that providing consumers with information about ways to reduce consumption was one of the best ways to manage demand. The ESAA argued that empowering consumers with information and strategies to save energy can be highly effective:

> There are a range of techniques that can be used to help households reduce electricity consumption. One of the best ways to achieve this is to improve the level and quality of information to consumers about ways to reduce consumption. By giving consumers the information they need about their own electricity consumption, energy saving products and energy saving tactics, they are empowered to make their own decisions about how to best manage their electricity

613 Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, Evidence, 26 March 2012, p. 43.

614 Energy Supply Association of Australia, Answers to questions taken on notice taken in evidence, 26 March 2012, p. 2.

> use. In-home displays, energy efficiency ratings for appliances and building energy efficiency ratings are examples of such informational tools. [615]

10.57 In evidence, Mr Santow stressed the value of improving energy literacy in the community and assisting consumers to become more effective participants in the energy market. However, Mr Santow also suggested that previous efforts by various levels of government to provide education about energy have not always been effectively coordinated or consistent:

> The last point I would make relates to a number of the things that this Committee has been looking at but perhaps most closely relates to the question of preparing the market for perhaps eventual price deregulation. That is improving energy literacy. In our experience we believe that consumers need to be more skilled in the intricacies of retail offers in order to become more effective participants in the energy market. It is sometimes hard at least outside of government to see which jurisdiction has responsibility for increasing consumer energy literacy and I guess our observation—I do not make this critically at all but I think it is a fact nonetheless—is that the efforts that are made do not always seem to be coordinated as well as they might be and sometimes they are very time limited by periodic funding. [616]

10.58 Ms Lana Stockman, Manager, Wholesale Regulation, TRUenergy, considered that there was significant value in government working together with the electricity industry to educate consumers about electricity use. However, Ms Stockman emphasised that it is important to target education messages appropriately, to avoid unintended outcomes:

> I think there is a huge role for that in educating consumers, and I think it needs to be a joint effort between government and industry. It is a very tricky issue and there are a lot of social issues that need to be taken into account. In New Zealand I have been through a couple of public conservation campaigns where we wanted people to restrict usage, and you would have some terrible cases where elderly people at home would be forgoing heating and stuff because the campaign had scared them so much. Those are really unfortunate outcomes. That is not what we would want to see.[617]

Energy education for school students

10.59 Educating students about the electricity system and methods to manage electricity usage may also play a role in helping to reduce electricity demand both now and in the future.

10.60 Part of the NSW Government's Climate Change Fund has already been allocated to the establishment of the Schools Energy Efficiency program, which aimed to help reduce greenhouse gas emissions from NSW public high schools. The $20 million program is operated by the Department of Education and Communities and the Office of Environment and Heritage and is open to approximately 225 NSW high schools. Key elements of the program include:

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615 Energy Supply Association of Australia, Answers to questions taken on notice taken in evidence, 26 March 2012, p. 1.

616 Mr Edward Santow, Chief Executive Officer, Public Interest Advocacy Centre, Evidence, 11 May 2012, pp. 26-27.

617 Ms Lana Stockman, Manager, Wholesale Regulation, TRUenergy, Evidence, 26 March 2012, p. 36.

- facilitating lighting retrofits for participating schools;
- a Student Savings Fund of up to $18,000 per high school for students to select and fund their own energy efficiency projects;
- providing internet access to school electricity meters - to educate students and allow tracking of performance;
- supplying monitoring equipment for students to monitor the energy use at their school and in their homes;
- providing access to a program officer to provide technical support to teachers and students;
- supplying curriculum material for teachers; and
- requiring participating schools to develop a School Environmental Management Plan, with online support through a Sustainable Schools Program.[618]

10.61 While the above program may increase a school's energy efficiency and contribute to the education of students in participating schools, the Committee considers that there may be further opportunities for students to engage with and learn about electricity and energy efficiency. For example, establishing a school education centre on energy, which students from any school could visit, may be another avenue for enhancing students' understanding of electricity. Existing centres in other jurisdictions, such as Singapore Power's Energy Efficiency Centre, may provide a model for the establishment of a similar centre in New South Wales.

DISTRIBUTED GENERATION

10.62 Distributed generation, also known as embedded or decentralised generation, can be defined as small-scale energy generation located within the distribution network.[619] Distributed generation is contrasted with more traditional centralised generation, which is often located some distance from the load and makes use of the electricity transmission network. Distributed generation includes household solar PV systems, as well as other technologies such as mini hydro systems, wind turbines and cogeneration or tri-generation plants.

10.63 One of the main advantages of distributed generation is its potential to reduce the need for costly expansion of the transmission network. Mr Russell Marsh, Policy Director, Clean Energy Council, explained that locating generation close to demand saves on transmission costs:

> **…**if you are locating generation close to where it is needed, so your generation is close to where the demand is, there are some savings to be made because you do not have to transport the electricity that far. The further you have to transport the electricity, the more you lose in costs. So putting generation closer to the form of demand makes a number of savings.[620]

618 www.environment.nsw.gov.au/grants/ssep.htm, accessed 9 November 2012

619 Submission 20, Essential Energy, p. 3.

620 Mr Russell Marsh, Policy Director, Clean Energy Council, Evidence 26 March 2012, p. 53.

10.64 Solar PV systems make up the bulk of distributed generation capacity installed in New South Wales and, as was noted in Chapter Eight, subsidy schemes such as the NSW Solar Bonus Scheme have been a major driver of the deployment of solar PV across the State. Following the excessive costs of the Solar Bonus Scheme the NSW Government closed the Scheme to new applicants in April 2011, and subsequently requested the Independent Pricing and Regulatory Tribunal (IPART) to determine a fair price for the output of small scale solar generation which fed back into the network.

10.65 IPART's determination was to operate in such a way as to support a competitive electricity market in NSW, while also ensuring that there should be no resulting increase in retail electricity prices or additional Government funding required. In setting a benchmark price range, IPART was also restricted from 'including a value for potential reductions in network costs' and from 'including a value for other potential benefits, including reductions in electricity losses and changes to the pool price and load shape.'[621]

10.66 Both of the reports from the Citizens' Policy Juries discussed the benefits of decentralised generation. The Sydney Citizens' Jury report noted the King Island Renewable Energy Integration Project, which combines a variety of forms of distributed generation, including wind, solar and biodiesel, along with an energy storage system, and suggested that the project is 'a good example of a decentralised power supply for small communities and has the potential to be explored in NSW.'[622]

10.67 The Sydney Citizens' Jury recommended 'legislative change to support and enable decentralised energy production. This is an "on the grid" or "off the grid" option, as appropriate.'[623]

10.68 The New England Citizens' Jury recommended that 'The electricity grid needs to be transformed into a decentralised network'.[624] The Jury's report indicated that some effort would be required to upgrade the existing network to allow for the inclusion of more distributed generation, and suggested that the Government should provide this support:

> …one technical area that needs state support is in the development of the grid management systems that will be required to allow for the inclusion of power generation technologies that are decentralised and may or may not generate continuously (e.g. solar and wind).[625]

621 www.ipart.nsw.gov.au/Home/Industries/Electricity/Reviews/Retail_Pricing/Solar_feed-in_tariffs_-_2012-2013, accessed 22 October 2012.

622 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, pp. 2-5.

623 Sydney Citizens' Policy Jury, 'Recommendations on energy economics and security in NSW', August 2012, pp. 2-5.

624 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 11.

625 New England Citizens' Jury, 'Clearing the air: Recommendations of the New England Citizens' Jury on Energy Economics and Security in NSW', August 2012, p. 5.

10.69 While the transformation of the electricity network to increase the capacity of distributed generation was supported by stakeholders such as Greenpeace,[626] the Total Environment Centre and the Nature Conservation Council of New South Wales,[627] as well as the reports of both Citizens Juries, some stakeholders, such as Essential Energy and Ausgrid, raised concerns about the added costs and complications that distributed generation can create for the network.

10.70 In its submission, Ausgrid noted that distributed generation complicates the management of the distribution network as electricity, which historically flowed in one direction only – from generators to consumers – may now flow in either direction, depending on the amount of energy being generated and used by a particular household system:

> Historically, a distribution network has been uni-directional; (i.e., it transported energy from the generation sources to the customers). This uni-directional flow has been the basis of traditional planning, design, and investment for decades.
>
> The emergence of increasing numbers of EGs [Embedded Generators] connections that can alternate between requiring load from the distribution network and exporting load into the distribution network (i.e. EGs can operate as both positive and negative 'loads') at diverse points within the network, complicates both load-flows and capacity planning. Moreover, where the output of embedded generation is large enough to significantly influence the normal load-flows (in some cases even reverse them) there are additional technical issues that need to be addressed, particularly with respect to protection and voltage regulation.[628]

10.71 Ausgrid questioned the ability of distributed generation to mitigate or defer distribution network costs because the distribution network is required to supply customers in situations when their distributed generator is not working.[629] This means that the same level of investment in transmission and distribution would still be required, whether the distributed generation is installed or not. Essential Energy similarly argued that distributed generation and, in particular, intermittent generation such as solar PV, does not offset investment in centralised generation, transmission and distribution networks because solar PV systems generate little energy at times of peak demand:

> As most embedded generators are solar PV systems, weather conditions determine the extent to which embedded generators can contribute energy to the network. On a typical sunny day, maximum generation from a solar PV generator occurs between midday and 3pm, when energy needs across the distribution network are usually moderate. At times of peak energy demand, typically between 5pm and 10pm, embedded generation makes practically no contribution, and therefore, at present, does not offset the investment required in large-scale generation, transmission and distribution to provide adequate capacity for times of peak demand.[630]

10.72 Essential Energy also noted that the 'clustering' of large numbers of distributed generation systems within a small area of the network can put strain on the

626 Submission 2, Greenpeace, p. 4.

627 Submission 11, Total Environment Centre and the Nature Conservation Council of NSW, p. 3.

628 Submission 13, Ausgrid, p. 3.

629 Submission 13, Ausgrid, p. 3.

630 Submission 20, Essential Energy, p. 3.

network and increase network management costs to maintain power quality. Essential Energy suggested that, given these circumstances, distributed generation provides 'no substantial gain to the wider network' and benefits 'only the customer who has installed the system'.[631]

10.73 However, despite their concerns about the difficulties that distributed generation has presented for managing the distribution network, Essential Energy believed that there was potential for distributed generation to 'make a significant contribution to energy generation at times of peak demand,' and suggested that in the future it may also reduce the need for network investment. For this to occur Essential Energy suggested that the following three 'fundamentals' need to be in place:

- Development and use of energy storage technology;
- Deployment of "smart grid" technology to manage the energy network; and
- The ability to site embedded generators at areas of the network where they are of most economic benefit.[632]

Cogeneration and tri-generation

10.74 Cogeneration is the simultaneous generation, in one process, of thermal energy and electrical energy. Cogeneration is also referred to as combined heat and power and makes productive use of the heat that is normally discarded as waste in conventional generators.[633]

10.75 Tri-generation is the simultaneous production of electrical energy, heat and cooling from a single fuel source. It can also be referred to as combined heat, cooling and power. Cogeneration and tri-generation plants are typically installed in large commercial buildings.

10.76 During the Committee's public hearing on 26 March 2012, Mr Russell Marsh of the Clean Energy Council highlighted the landlord/tenant spit incentive problem as a factor in the reduced deployment of cogeneration in recent years:

> Certainly I think it is true that co-generation is not as attractive now as it was. It is something we are looking at. There is a range of reasons why co-generation is not being rolled out as much as it has been in the past. Some of it is largely to do with this whole thing about whether it is best suited to some of the office blocks you are thinking about in Sydney. It is kind of, who pays the electricity bill and who is responsible for the energy generation? If you are paying the electricity bill, if you are tenanting that building you may not get any benefit from having a co-generation plant installed but someone has to pay for that co-generation plant to be installed. It is less to do with the relative price of the fuel and more to do with this landlord-tenant split where the person responsible for supplying energy to that building has no incentive to install a more efficient energy source, which co-generation would be, because the tenants are paying the bill.

631 Submission 20, Essential Energy, p. 3.

632 Submission 20, Essential Energy, p. 3.

633 www.environment.nsw.gov.au/air/cogentrigen.htm, accessed 19 October 2012.

10.77 However, Mr Marsh suggested that if such barriers could be negotiated and gas prices rise in the future, there may be rejuvenated growth in cogeneration projects:

> If you can get around some of those issues then co-generation does work if you can get through some of those barriers. But if we are going to see, as a lot of people are predicting, gas prices going up, then you may see co-generation and tri-generation becoming more popular as it is a more efficient way of using the electricity and heat from that technology. So as gas prices go up, you might see co-generation becoming more popular again. [634]

Environmental Upgrade Agreements

10.78 Environmental Upgrade Agreements were introduced in New South Wales in 2011, and provide a new method for financing distributed generation or other environmental improvements to existing buildings. They allow local councils to enter into environmental upgrade agreements with owners of certain buildings and finance providers as a way of funding works to improve the energy, water or environmental efficiency or sustainability of those buildings.[635]

10.79 Environmental Upgrade Agreements make it easier to access finance for environmental improvements to existing commercial, industrial, strata scheme and large multi-unit residential buildings in NSW. Under the agreements, a finance provider lends funds to a building owner for environmental upgrades, and this low-risk loan is repaid through a local council charge on the land. Tenants of commercial buildings can be asked to contribute to the costs. However, the additional costs must be offset by their reduced energy and water bills.[636]

10.80 At present the City of Sydney Council and Parramatta City Council are the only local councils that offer Environmental Upgrade Agreements, although the following councils are planning to introduce them:

- Lake Macquarie City Council
- The City of Newcastle
- North Sydney Council
- Penrith City Council
- Wollongong City Council.[637]

ENERGY EFFICIENCY

10.81 Energy efficiency measures reduce the amount of energy consumed in meeting the needs of electricity consumers.[638] Energy efficiency measures include

634 Mr Russell Marsh, Policy Director, Clean Energy Council, Evidence, 26 March 2012, p. 52.

635 www.environment.nsw.gov.au/grants/, accessed 21 September 2012.

636 www.environment.nsw.gov.au/sustainbus/eua.htm, accessed 21 September 2012.

637 www.environment.nsw.gov.au/sustainbus/eua.htm, accessed 21 September 2012.

638 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 3.

activities such as changing types of lighting, improvements to insulation, minimum energy performance standards and labelling, and other activities that reduce energy consumption.

10.82 As discussed in Chapter Four, the NSW Government introduced the Energy Savings Scheme in 2009 to create a financial incentive to reduce electricity consumption by encouraging energy efficiency activities. The scheme provides opportunities for energy saving equipment and technologies to be delivered to businesses and households. According to the IPART, the Energy Savings Scheme administrator, participants in the scheme have benefited from lower electricity bills through implementing energy efficiency activities and have gained income from selling energy savings certificates through its market based mechanism.[639]

10.83 The Total Environment Centre and Nature Conservation Council of NSW commented on the Energy Saving Scheme, suggesting that a cost benefit analysis of the scheme demonstrated that it was cost effective:

> NSW also has the Energy Savings Scheme (ESS), which places an obligation on liable parties to procure and surrender energy savings certificates, representing energy savings.
>
> A recent Cost Effectiveness Analysis Report for the ESS shows how efficient demand side participation can be. The report found a net benefit of almost $25 is provided by each energy savings certificate created under the scheme. Energy savings are predicted to be 7.5TWh over the life of the scheme, mitigating 7.6Mt CO2e.20 As such, the report concludes that, "the scheme makes both financial and environmental sense with an overall net resource benefit across all types of activity".[640]

10.84 In evidence, Mr Russell Marsh, Policy Director, Clean Energy Council suggested that the state-based Energy Savings Scheme should be expanded to a national scheme:

> Our view is that—as we are doing—having some form of energy efficiency scheme, as you have in New South Wales, that has incentive for the energy efficiency industry to go out and install energy-efficient equipment in houses and industry across the State is the right way to go. We are supporting that being expanded on a national level because our view is that it is economy of scale. If you have a larger market then the cost of this stuff will come down. If you move towards a more national market for energy efficiency the chances are we can deliver energy efficiency more efficiently than if it was done on an individual State-by-State basis.[641]

10.85 The NSW Government has indicated that it has undertaken some steps towards harmonising the Energy Savings Scheme with that Victoria's energy efficiency scheme. In its submission to the Federal Government's Energy White Paper, the NSW Government suggested that harmonisation of the New South Wales and Victorian schemes would:

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639 www.ess.nsw.gov.au/files/51028fae-34be-4714-859c-9f5d012a87c3/ESS_Fact_Sheet_2012.pdf, accessed 18 October 2012.

640 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 6.

641 Russell Marsh, Policy Director, Clean Energy Council, Evidence, 26 March 2012, p. 51.

- make it easier for firms creating energy efficiency certificates to operate in both States;
- reduce compliance costs for electricity retailers that operate in both jurisdictions;
- potentially broaden the range of activities that can occur in both jurisdictions; and
- reduce duplication of government resources.[642]

10.86 The Total Environment Centre and Nature Conservation Council of NSW suggested that the harmonisation of the New South Wales and Victorian energy efficiency schemes, along with the ongoing consultation on a National Energy Savings Initiative, presented 'a good opportunity to evaluate the ESS, strengthen its provisions and ensure that NSW is a leader in energy efficiency.'[643]

10.87 However, by contrast, the National Generators Forum recommended that consideration be given to:

> …reviewing the rationale and effectiveness of the Energy Savings Scheme, given indications that high retail prices are already having a significant dampening effect on energy demand and the interventionist and costly nature of the scheme.[644]

10.88 The Committee also notes that the Auditor-General has commenced a performance audit on 'Building energy use in public hospitals' and looks forward to the outcomes of the audit, which may provide some useful guidance regarding building energy efficiency for NSW Health and other Government agencies.[645]

Committee comment on demand management

10.89 The Committee considers that demand management measures have the potential to be the most effective and efficient method of avoiding the increasing costs of the electricity system, particularly those costs associated with meeting peak demand. Greater implementation of demand management measures, therefore, has considerable potential to reduce the electricity bills of consumers in New South Wales.

10.90 However, the Committee found that the existing structure and rules of the National Electricity Market provide only limited opportunities for the implementation of demand management measures. There are effective advocates representing the supply side of the electricity equation, but the Committee believes that there is potential for demand side measures to make a more substantial impact on rising electricity costs. The Committee therefore supports the recommendations of the AEMC's draft 'Power of choice' report and encourages the NSW Minister for Resources and Energy, through his position on the Standing Council on Energy and Resources, to support those

642 NSW Government, 'NSW Government submission: draft energy white paper,' April 2012, p. 12.

643 Submission 11, Total Environment Centre and Nature Conservation Council of NSW, p. 6.

644 Submission 30, National Generators Forum, p. iv.

645 Mr Sean Crumlin, Director Performance Audit, Audit Office of New South Wales, Correspondence to Chair, 7 September 2012, p. 1.

recommendations of the report for which there is a demonstrated economic benefit that will be reflected in reduced electricity bills for consumers.

10.91 The Committee found that the implementation of smart meters and time of use pricing provide substantial opportunities for greater demand side participation. The Committee supports the roll out of smart meters across the State, and notes that the introduction of time of use pricing is required in order for many of the benefits of smart meters to be realised.

10.92 The Committee considers some protection for vulnerable consumers may be required to ensure that they are not unduly disadvantaged by the implementation of time of use pricing and recommends that existing safeguards for vulnerable consumers be reviewed to ensure that they address any increased costs imposed by time of use pricing.

10.93 The Committee found that educating consumers and providing them with information about their electricity consumption are vital for managing electricity demand. Increasing educational opportunities for students may also play a role in managing electricity consumption and the Committee considers that establishing a school education centre about energy may build consumers' capacity to participate in the energy market in the longer term.

RECOMMENDATION 15

That the Minister for Resources and Energy, through his position on the Standing Council on Energy and Resources, support the adoption of the recommendations of the Australian Energy Market Commission's 'Power of choice' review regarding:

- **Facilitating consumer access to electricity consumption information;**
- **Accelerating the deployment of smart meter technology;**
- **Phasing in time varying pricing;**
- **Establishing a new demand response mechanism that allows consumers or third parties to participate in the wholesale electricity market and receive payment for reducing demand;**
- **Improving incentives for network service providers to consider demand side options; and**
- **Enabling consumers to sell distributed generation to parties other than their retail supplier;**

provided that there is a demonstrated economic benefit for consumers.

RECOMMENDATION 16

That the NSW Government develop a strategy for the implementation of smart meters and time of use pricing in New South Wales.

RECOMMENDATION 17

That NSW distribution service providers be required to provide customers with full disclosure of pricing tariff changes, prior to installing smart meters.

RECOMMENDATION 18

That the NSW Government review existing programs to support vulnerable consumers, including the Life Support Energy Rebate and Medical Energy Rebate, to ensure that these programs provide sufficient protection from additional costs related to the implementation of smart meters.

RECOMMENDATION 19

That the NSW Government conduct an education campaign about energy use, smart meters and time of use pricing, as well as a campaign targeting vulnerable consumers about managing energy consumption and energy saving strategies.

Committee comment on distributed generation

10.94 The Committee considers that distributed generation has potential to reduce investment in transmission and centralised generation infrastructure. However, the location or type of generation may affect the ability of distributed generation to reduce network costs. In some cases, such as the installation of solar PV in certain areas, it may even increase network management costs.

10.95 The Committee therefore encourages greater deployment of distributed generation, but considers that it should be focused in areas of the network that will benefit most from distributed generation.

10.96 The Committee recommends that when making its next determination for a fair price for solar PV, IPART be permitted to set different values for different regions of the network, taking into account whether such generation will provide an economic benefit or cost for particular regions within the network; and that IPART provide similar determinations for other forms of distributed generation.

10.97 The Committee considers that Environment Upgrade Agreements are a means of addressing the landlord/tenant split incentive problem that currently acts as a barrier to environmental upgrades to commercial buildings. The Committee considers that the Office of Environment and Heritage should further encourage relevant government authorities to adopt this innovative method of funding environmental improvements to commercial buildings.

RECOMMENDATION 20

That the Independent Pricing and Regulatory Tribunal be permitted to set different values for different regions of the State when making its next determination for a fair solar photovoltaic feed-in tariff, taking into account whether such generation will provide an economic benefit or cost for particular regions within the network.

RECOMMENDATION 21

That in addition to setting a fair solar feed-in tariff, the Independent Pricing and Regulatory Tribunal also provide determinations for a fair feed-in tariff for other types of distributed generation, based on the actual market value of each type of distributed generation.

RECOMMENDATION 22

That NSW distribution service providers work with electricity retailers to determine a fair value for distributed generation feed-in tariffs, based on the location within the network and the actual market value of the distributed generation.

RECOMMENDATION 23

That the Office of Environment and Heritage promote Environmental Upgrade Agreements to encourage relevant government authorities to adopt this innovative method of funding environmental improvements to commercial buildings.

Committee comment on energy efficiency

10.98 The Committee supports the harmonisation of the New South Wales and Victorian energy efficiency schemes, as this has the potential to reduce compliance costs and offers an economy of scale for energy efficiency activities.

10.99 The Committee also looks forward to the outcome of the National Energy Savings Initiative and the implementation of a national energy efficiency scheme in the place of multiple state-based schemes.

RECOMMENDATION 24

That the Minister for Resources and Energy, through his position on the Standing Council on Energy and Resources, promote a consistent national approach to energy efficiency schemes.

Appendix One – NewDemocracy Project

newDEMOCRACY

NSW Parliament Legislative Assembly
Public Accounts Committee

Process Design Overview:
Identifying the View of an Informed Public: Energy Economics and Security in NSW

Overview

The Public Accounts Committee (PAC) has commenced an inquiry into the comparable economics of electricity generation.

The contentious nature of the subject matter can be expected to have an impact on the public acceptance of the Committee's findings. Item 5 in the Terms of Reference is likely to be the source of the greatest contention and is proposed as the topic for this deliberative process.

The newDemocracy Foundation (NDF) will provide a design for public deliberation with the objective of providing a method which is viewed as a reflection of community views rather than as a partisan exercise.

Traditional models of decision making and community engagement tend to reward those with a specific interest: i.e. the loudest voices dominate. This process will use random selection of NSW citizens to deliver the most representative sample possible of the community - a miniature population – in order to determine what everyday citizens would recommend given sufficient time and information.

Objective

The objective of this process is to return an agreed community view on item 5 from the Terms of Reference, being:

the potential for, and barriers to, development of alternative forms of energy generation (eg: tidal, geothermal) in NSW.

This question is posed slightly differently below (pg 3) so as to have broader appeal when soliciting the sample thus encouraging broader participation.

It is noted that in this context 'energy' refers to electricity generation.

Methodology

It is proposed that a two Citizens' Policy Juries of 45 participants will be convened for a 2½ month process: one in metropolitan Sydney and one in Tamworth.

Invitations will be extended to a catchment area spanning an agreed number of electorates appropriate to each of the Sydney and Tamworth located processes. Reimbursement of transport costs is being explored so as to avoid excluding participants who may find this a hardship.

Random selection will be used to identify participants as a means of securing a descriptively representative sample of the community. Stratification will be used to ensure a mix of metro/regional participants and age groups are represented.

Selection of Participants

Invitations for each Citizens' Policy Jury would be issued to a sample of 4,000 citizens randomly drawn from the electoral roll. Invitations will explain the process and ask the citizen to decide to opt in to be eligible for selection in the Policy Jury. *(10% response rate required, 20% expected)*

From positive responses, samples are drawn electronically based on pre-agreed stratification goals: recommended as being age and residential location. The objective is to achieve a group descriptively representative of the community even if one subset of the community responds disproportionately to the initial invitation.

This sample (and 5 reserves) will be sent a comprehensive schedule and explanatory kit of pre-reading, with the output being for them to provide a final acceptance allowing NDF to finalise the jury.

While it is recommended a modest per diem payment be announced after this final confirmation and provided at the conclusion of the process it is understood that the PAC budget does not allow for this. For a regional event to be viable reimbursement of travel costs is highly desirable and NDF is evaluating this.

The group is convened solely for this process: any future Policy Jury should recommence a fresh selection process.

Preparation and Information Process

Information and judgment are required to reach decisions. We operate these panels because the judgment of random samples (or mini-publics) has been shown to achieve very high levels of

public trust. It is thus imperative that the method of provision of information to the groups does not erode that trust.

Prior to the Policy Jury's first meeting, a background document will be circulated to the panellists: this should be the entirety of the executive summaries from the submissions made to the Committee (with full submissions available to read upon request). This is the baseline content for deliberation. NDF also proposes that a call for summary submissions (one page) will be made through mainstream print media – giving companies, interest groups, expert groups and citizens the chance to contribute. However, throughout the meeting process the Jury is able to request a submission or an appearance from experts of their choosing (as well as hearing more from a submission contributor). It is understood that the Jury would be requesting attendance in its own capacity, not under the authority of the PAC, which has statutory powers related to its role as a parliamentary body.

The CSIRO have confirmed their interest in ensuring ready access to expertise as required.

It is recommended that an online discussion forum (for the use of the Jury, but visible to the public) be operated as part of the process.

What is the status of the Citizens' Policy Jury?

The Citizens' Policy Jury is not a parliamentary proceeding and would not attract parliamentary privilege. However, the Committee highly values public input and considers that the process will be an integral component of the inquiry.

What Does the Citizens' Policy Jury Decide?

It is important that the limit of the group's decision-making authority is pre-agreed and clearly conveyed.

It is proposed that the remit of the jury is to reach agreement on:

The order of preference, barriers to adoption (including financial aspects and public perception issues) and recommended course of action with regard to alternative forms of energy generation (eg: tidal, geothermal) in NSW.

In terms of authority, it is proposed that:

The Public Accounts Committee undertakes that the Jury's recommendations will be provided to the NSW Government as part of the Committee's final report.

Early agreement by the Public Accounts Committee on these two points is the most critical element to the success of the process.

Participants will be advised that the report will be debated in parliament.

What Constitutes a Decision?

In order to shift the public mindset from adversarial, two party, either/or contests and convey a message of broad based support for the recommendations, the Foundation suggests a 75% supermajority be required for a final decision from the group. In practice, citizens' panels tend to reach consensus (or group consent) positions with minority voices included in any report; they rarely need to go to a vote.

Operations

A skilled facilitator has been identified for the Sydney process who is accredited by the International Association of Public Participation who will provide services pro bono. NDF will meet costs associated with the Tamworth event.

Assistance in creating the documentation and facilitating expert appearances will be provided by a Foundation volunteer in conjunction with the CSIRO.

Meetings would take place within either Parliament facilities during business hours or the University of Sydney as venues available at negligible cost. Advice is being sought with regard to an appropriate venue in Tamworth.

Costing Outline

Key cost areas involved for the PAC are the use of Parliament's facilities and printing costs. It is understood the PAC is unable to fund catering, postage, per diems, transport or consultant costs but can advise on costs and distribute electronic mail.

Process design, selection, and provision of facilitators will be at the Foundation's cost.

Key Issues to be managed:

- Interface with subject matter experts to ensure accessibility and availability for participation.
- Interest group buy-in (explicit invitation for inclusion in the preparation of background information is suggested).
- Preparation and assembly of background information (assuming that to some extent the submissions received will inform this process).

- Communication task (this will end up being an education campaign for the broader community as well as a communications task).

DRAFT TIMELINE FOR 2012 DELIBERATIVE PROCESS:

ENERGY ECONOMICS AND SECURITY IN NSW
AN INQUIRY BY THE PUBLIC ACCOUNTS COMMITTEE OF NSW PARLIAMENT

Topic: ***The order of preference, barriers to adoption (including financial aspects and public perception issues) and recommended course of action with regard to alternative forms of energy generation (eg: tidal, geothermal) in NSW.***

Start –3 months	Research Committee preparatory planning session. Key topics: ➢ Agree Academic Oversight Representatives. ➢ Identify required background materials for inclusion. ➢ Revise/ amend/ review this program. ➢ Final budget approval by each party. ➢ Agree ideal timings for PAC representatives to attend metro and regional jury assemblies.
Start –80 days	Invitation sent to a random sample of 4,000 citizens drawn from the electoral roll for <u>each</u> Policy Jury. Estimated 20% positive response rate. Briefing of independent, skilled lead facilitator(s). Selection of online platform services (including moderators)
Start -60 days	First round selection to secure representatives. ➢ Seeking 45 panellists per Policy Jury (45 + 5 reserves is ideal). ➢ Explanation of commitment required: attendance at all elements of process, including potential online discussion presence. ➢ Stratified random sample to deliver descriptive match to community (NDF to provide technology/ expertise).
Start -30 days	Finalisation of participants. Provision of welcome kit of materials. Potential to open up online discussion environment for participants.
Start -14 days	Media briefing to explain process.

Day 1 (all dates TBC – June proposed) *(Full day required, Saturday suggested)*	**Opening day: The First Assembly – The Learning Phase**. ➢ Introduction of the topic upon which they will deliberate: understanding remit and authority. Explanation of influence and context: what will be done with the results the groups produce. ➢ Introduction of the process, and its precedents; understanding the inevitability of bias & importance of constructive, critical thinking/doing. ➢ Agreement on group guidelines for participation. ➢ Jury sessions with 2-3 expert speakers driven by each group's online discussions prior to meeting. Includes open Q&A. ➢ Group to identify speakers sought for future assemblies. ➢ Ensure familiarity with and acceptability of online tools
Day 14 (4 hours approx.)	**The Second Assembly – Understanding** Deliberative focus is on the public submissions and on the juries' own online idea formulation and exploration of challenge at hand. It is envisaged that 4-6 expert speakers will appear in-person or via Skype. Ongoing online discourse among the panellists is encouraged during the "away" period.
Day 16	*Convenors' Review: do the participants need more time or assistance to come to a full understanding of their choices? Potential to extend meeting schedule at this point.*
Day 28 (Full day reqd)	**The Third Assembly – Reflect. Discuss. Deliberate.** There is no fixed output from the session: the goal is to provide a face to face forum for the representatives to reconvene to discuss their views in small groups. The facilitator should encourage groups to move toward commencing the prioritisation task.
Day 42	**The Final Assembly – Reaching Consensus.** Delivery of a prioritised list of energy preferences, the barriers that exist, and the recommended course of actions of the Policy Jury for each (with a record kept of minority views). Recommendation(s) must be Specific, Measurable, Actionable, Realistic and with a Time horizon. Presentation of recommendations to Public Accounts Committee.
Day 44	Post event debrief and agreement on Action Items.

Appendix Two – New England Citizens' Policy Jury Report

Clearing the Air

Recommendations of the New England Citizens' Jury on Energy Economics and Security in New South Wales.

For:

The New South Wales Parliament Legislative Assembly Public Accounts Committee

Deliberations concluded August 2012

Clarification of Remit

The Public Accounts Committee provided the Citizens' Jury with the following remit:

> *Agree on an order of preference, barriers to adoption (including financial aspects and public perception issues) and recommended course of action with regard to alternative forms of energy generation in NSW*

After consideration of this remit, inclusive of presentations by several experts representing particular interests and knowledge bases relevant to the subject of the concerns of the Public Accounts Committee, the New England Citizens' Policy Jury decided to critically revisit the above remit.

Specifically, the Citizens' Policy Jury reached the conclusion that the requirement to 'agree on an order of preference … with regard to alternative forms of energy generation in NSW' presupposed that the optimal mechanism of choosing a so-called 'order of preference' generation resides in a process of political decision-making. On the contrary, after a review of the available evidence, we determined that the take-up of alternative energy forms is best determined by what we will denote as a 'guided market approach'.

Nevertheless, the Citizens' Policy Jury did determine three fundamental parameters of this approach with respect to the so-called 'order of preference', namely:

1. That pre-existing interference of pricing signals, particularly with respect to non-renewable energy sources (specifically, coal) ought to be addressed as soon as possible;
2. That adoption of alternative forms of energy generation be guided by triple bottom-line sustainability (economic; social; environmental) as determined by the largely pre-existing regulatory framework;
3. That the broader Community does not currently have confidence in either uranium-based nuclear energy generation or coal seam gas extraction technologies, and that until such time as the community's confidence level improves significantly in respect to both these technologies, they are not recommended for inclusion in any energy generation mix for NSW.

Executive Summary

It was the determination of the New England Citizens' Policy Jury that considerable diversity of alternative energy generation sources has already been invested in NSW and indeed more generally. Further, this suite of technologies provides solid grounds for optimism with respect to moving toward a future based upon a higher reliance on renewable energy. Nevertheless, the New England Citizens' Policy Jury did identify several barriers to the adoption of these technologies, namely:

1. The aforementioned market distortion created by the State Government's subsidisation of coal-fired electricity generation in NSW. In the opinion of the New England Citizens' Policy Jury, the NSW Government is in a unique position to decouple the negative political economies generated by this subsidisation – over time – and as such assist in moving the State toward a more sustainable energy future.
2. The New England Citizens' Policy Jury recognises that components of energy infrastructure – particularly the distribution network – exhibit characteristics of a so-called 'natural monopoly' (i.e.: where one firm – the state – can meet most of market demand and still achieve the lowest average cost per unit). As such, the Jury recommends that the Government exercise due diligence with respect to this natural monopoly, by retaining state ownership of it (the so-called 'poles and wires' of the network) while at the same time facilitating emerging alternative forms of energy generation to participate in this network. Expansion of the network is a technology neutral form of renewable energy subsidy.
3. That, notwithstanding the recommendation that the market be relied upon to generate both innovation and efficiencies in the energy sector generally, a strategic framework, or 'time-line' for the implementation of reliance upon renewable energy sources be provided at the level of the State Government, as a means to provide greater certainty for investors in these renewable energy forms.
4. Given the adoption of the carbon tax at a federal level, that the regulatory framework developed by the NSW Government be strategically aligned with the framework now emerging through mechanisms such as COAG, the ACCC, and various intergovernmental arrangements.

Statement of Principles and Assumptions

1. NSW consumers expect a reliable and continuous uninterrupted energy supply.
2. A transition is required to energy sources that are healthier for workers and the general community both now and in the future. Community expectations are increasing with respect to the prospect of a cleaner outcome for energy generation.
3. A transition is required to energy sources that have a significantly lower environmental impact.
4. Energy generation, retailing and pricing structures must have energy efficiency incentives as a core principle for both consumers and generators.
5. Government should adopt a holistic approach to energy generation by looking at the relationship between generation, transmission, delivery, efficiency, demand and the NSW energy market and the renewable energy target.
6. Despite its taking the lead, Government ought to recognise that energy solutions need a multi-partisan political approach.
7. Viable economic alternatives need to compete fairly with existing generation techniques. Barriers to entry to the NSW energy market must be reviewed to facilitate easier market access for the alternative technologies.
8. Infrastructure needing to be replaced or built must be more flexible to allow for decentralised generation.
9. It ought to be acknowledged that the NSW energy network is a part of a national system and the implications this has for power generation in the State.
10. The New England Policy Jury chose to not focus on specific technologies (existing or emerging) as such recognising that these are continuing to change and develop.
11. That the safety net for low-income and other disadvantaged consumers continues.

Analysis of Current Environment

Technical

1. The state of NSW no longer runs its power generation facilities. Consequently, it is no longer a state responsibility to dictate the technology to be used. Rather, it is a state responsibility to ensure that whichever technology is used it does not create an unhealthy working environment for the employees or the citizens of the state; now or in the future.

2. A mix of alternative energies and technologies is poised on the edge of the market; nevertheless, we recognise that this mix will continue to change and develop.

3. Those companies developing the various alternative technologies are the ones who will be able to determine when they have reached the viable stage. They are also the ones who will incur the costs and enjoy the profits.

4. Nevertheless, one technical area that needs state support is in the development of the grid management systems that will be required to allow for the inclusion of power generation technologies that are decentralised and may or may not generate continuously (e.g. solar and wind).

Economic

For new technology companies to enter the marketplace, they must be able to foresee a profit whilst providing power at a competitive rate to their rivals, both current and developing.

Barriers to the entry:

1. The companies running the state's coal-fired power stations are currently able to purchase coal at rates that are significantly below market price, and are therefore able to supply energy below the real cost. Alternative technology companies who are trying to enter into the power generation market are starting with a significant economic disadvantage because of this.
2. Control of the retail market is by groups with a vested interest in the current generation methods. As a consequence, new entrants, whilst able to offer power at rates competitive with the current wholesale rate, do not have appropriate access to the market.
3. Some forms of generation, whilst highly competitive when operational, do not continuously generate power and so may need supplementation from other sources on occasion e.g. Solar, Wind, Tidal, and Wave. This implies the need for an environment involving co-operative generation strategies rather than the competitive ones that exist in the current marketplace. Such technologies could include solar thermal, geothermal and solar-pumped hydro as methods of providing green dispatchable energy load.
4. Research and development of energy storage becomes more and more important as we increase the proportion of renewable energy. Solar thermal, geothermal, bio-gas,

pumped-hydro, use of electric cars can play a significant role in providing green dispatchable energy.

5. If the cost of extending the network has to be absorbed by a business developing an alternative technology, e.g. to a Solar power station located in the country, then this will significantly limit the ability of a business to be competitive even if the technology can significantly lower generation costs.

Network

1. The existing network has evolved to satisfy the needs of a centralised, coal-fired generation system.

2. Further, grid management technologies and systems for NSW assume a limited number of power stations providing electricity relatively close to the majority of demand. Whilst some alternative technologies may be able to be similarly located, there may be sound technical reasons for choosing a site significantly further away e.g. locating a solar power plant because of climatic advantages.

3. The use of alternative technologies for power generation will require more flexibility in the location of the network and in the management of the network. The cost of extending the network and the cost of developing the appropriate management technologies and systems are a network cost and need to be included in the network budget appropriately. They must not be borne by the new entrants. The infrastructure to support the alternative technologies should be provided in the same way that it was provided to existing coal fired power stations and to the mining industry; for example when a new mine site is established that is not close to existing infrastructure.

Political

Currently the energy strategy development focus is clouded by vested interests and disparate government policy. There is no national focus to long-term energy solutions.

1. Decisions have historically been made affecting energy generation in NSW that have not been related to long-term sustainable delivery solutions.
2. Traditional energy generation providers have an unfair advantage.
3. Government at the national level has responded to environmental concerns by recently introducing a price on carbon. The NSW Government ought to reinforce this commitment to clean sustainable energy as a mechanism to promote economic growth.

Social

1. There has historically been no focus for energy consumers around sustainable energy usage.
2. There is a significant sector of low income earners who cannot afford their traditional usage levels under the current tariff structure.
3. Manufacturing businesses are becoming less competitive due to escalating tariffs, thereby negatively affecting employment. Increasing energy costs are a factor in this.

4. Current carbon-based fuel sourced generation creates significant health issues for both workers and the wider community.
5. Decisions around power generation, delivery and policy are not tested against traditional social indicators.
6. Consumers are not encouraged by pricing to be efficient. Lowering availability charges and balancing the loss of income by increasing usage charges would provide greater incentive for people to lower their demand.

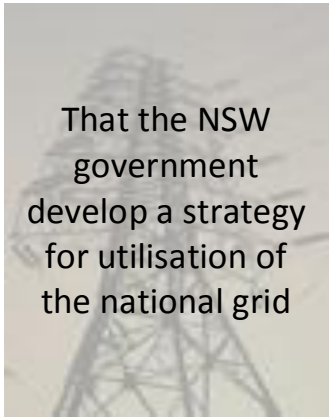
Environmental

1. The environmental impacts of the choices that are made need to take into consideration more than just the emissions. Soil, water, flora, fauna and air are all impacted, from pollutants to degradation, extinctions to genetic isolation through to genetic biodiversity. All these environmental impacts directly impact on our current, and future, health and well-being. It is important to take into consideration all environmental factors, not just a few.

Salient Facts

1. Fossil fuel reserves are finite and their continued use for energy generation creates significant health issues both for the workers and the wider community.
2. Economically viable alternative energy technologies are available to implement now, but alternative energy generators have difficulty accessing a market entry point under the current structure.
3. Economically viable alternative energy technologies are continuing to be developed and improved.
4. The renewable energy technology industry is looking for more certainty from government with respect to the environment in which they are operating to be able to make the long-term investment decisions required to enter the market place.
5. Existing coal fired power stations are reaching decommission dates and are in receipt of subsidies that provide them with a significant commercial advantage over non-fossil fuel generators (e.g.: coal price below the market value and excise tax exemptions for mines).
6. The current grid design is based on centralised power generation because of the availability of the fuel source (e.g.: coal). Alternative methods of power generation may be best suited to locations other than these.
7. Energy prices for consumers are rising, despite their efforts to reduce consumption. Indeed, the NSW energy demand has decreased in recent times.
8. Generally, the power generating companies have strong ties with the retail sale companies, and therefore they have the ability to disadvantage companies who can generate power from alternative sources.

- **Recommendations**



Parliament should adopt a multi-partisan approach to energy policy and regulation.

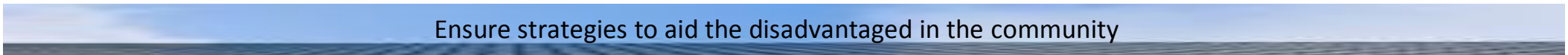
Policy should recognise and reward efficiency in generation and consumption

Generation Policy needs to set clear environmental and health bench marks that meet community expectations.

Ensure infrastructure provision focuses on efficient and cost effective energy outcomes

The electricity grid needs to be transformed into a decentralised network.

Separate electricity-generation from retail sectors.



Recommendations

1. Build a strategic framework with targeted stages to achieve a goal of 100% sustainable, renewable/green energy mix, promoting flexible technologies choices for energy production. Targeted stages would provide increased assurance for investment in renewable/green energy technologies. An illustrative example is:
    - 30 per cent green energy/renewable by 2020;
    - 40 per cent green energy/renewable by 2025;
    - 50 per cent green energy/renewable by 2030;
    - 60 per cent green energy/renewable by 2035;
    - 70 per cent green energy/renewable by 2040;
    - 80 per cent green energy/renewable by 2045, and
    - 100 per cent green energy/renewable by 2050.
2. That the NSW government develop a strategy for efficient integration with the national grid.
    - Ensure that NSW plans to be part of a National Energy Strategy, as renewable energy sources are not evenly distributed nationally and some areas have a comparative advantage in types of renewables.
    - NSW takes best advantage of the national grid to maximise economic, environmental and social benefits from the national electricity distribution system.
3. Governance of the NSW energy market needs to be revised to facilitate improved market access for renewable energy.
    - Legislation should guarantee decentralised small, medium and large scale generation has access to the NSW energy market at a set minimum price.
    - Subsidies for coal-fired power, such as 'below market price coal' should be phased out as contracts are renewed.
4. Parliament should adopt a multi-partisan approach to energy policy and regulation.

    To create long-term business confidence to invest in renewable energy, parliament should set up an on-going multi-party advisory committee that extends beyond a single term. This committee is to oversee the long-term policy development and implementation.
5. Policy should recognise and reward efficiency in generation and consumption.
    - All consumers, individuals, businesses and communities should be rewarded for efficiencies through incentives – for example:
        - A review of the tariff structures and an educational program to help consumers become more efficient.
        - Promotion of smart card system so consumers can participate in rewards as shareholders in renewable energy production.
        - Service availability fees should be kept low with increases, when necessary, only in usage fees to encourage efficiency.
6. Generation Policy needs to set clear environmental and health bench marks that meet community expectations.

- Environmental and health considerations come before financial costs. Legislation should protect environment and health.
- Coal seam gas, fraccing and uranium-based nuclear power are unacceptable given the current technologies and safety concerns.
- Review plans to build new coal fired power stations.
- No new fossil fuel exploration for NSW power generation.

7. Ensure infrastructure provision focuses on efficient and cost effective energy outcomes.
   - Provide a legislative framework on generation ownership and mandating continuity of supply.
   - Conduct a review of public/private ownership for generation, network and retail functions to ensure operators are accountable and consumer needs are met.
   - Existing public ownership should be retained unless it is clearly demonstrated that asset sales will provide enduring advantages for electricity consumers
8. The electricity grid needs to be transformed into a decentralised network.
   - Investment in the grid should be directed toward optimal renewable energy locations, e.g.: wind along the dividing range and solar west of the range. A decentralised network has the added advantage of regional jobs, skills and investment as well as increasing the percentage of renewable energy in NSW.
   - Increased investment in a "smart grid" will help to lower peak demand.
9. Separate electricity generation from retail sectors to remove the monopoly that at present restricts access at the wholesale levels of alternative energy. The areas of energy generation, the wholesale energy market and the retail energy market need to be totally independent from each other.

   Our reasoning for this is that the separation will:
   - Increase competition
   - Prevent monopolies dominating price determination
   - Open the market to new alternative supplies
   - Lead to more decentralised power generation
   - Bring more realistic price outcomes as a result of the competition for market share.
10. Ensure strategies to aid the disadvantaged in the community

    As energy prices are likely to increase above CPI, the disadvantaged should receive energy subsidies on a regular 4-6- month basis
    That the ACCC monitor for price gouging and anti-competitive pricing from all sectors of energy supply industries.

Appendix Three – Sydney Citizens Policy Jury Report

RECOMMENDATIONS ON ENERGY ECONOMICS AND SECURITY IN NSW

SYDNEY CITIZENS' POLICY JURY

August 2012

Submission to the New South Wales Parliament Legislative Assembly Public Accounts Committee

Opening Statement

The Sydney Citizens' Policy Jury members wish to express their thanks to the NSW Parliament Legislative Assembly Public Accounts Committee for the opportunity to present our recommendations for your consideration and evaluation.

Remit

The Public Accounts Committee tasked the Sydney Citizens' Policy Jury with the following remit:

Agree on an order of preference, barriers to adoption (including financial aspects and public perception issues) and recommended course of action with regard to alternative forms of energy generation in NSW.

Executive Summary

As part of the extensive research and evaluation process undertaken, which included presenters from various fields of expertise and industry, careful consideration of the Remit was undertaken by the Sydney Citizens' Policy Jury.

The Sydney Citizens' Policy Jury unanimously concluded that the challenge is not to agree an order of preference, but instead to create certainty so that all renewable technologies have a chance to compete on merit. The biggest barrier is location and the connection to the grid. We offer five recommendations which we hope the NSW Government will adopt to address this, and are confident that this would secure the future energy requirements for the State.

Priority Recommendations

Underpinning our recommendation is one key fact and the Jury's unanimous belief.

Approximately 90% of the energy generation in New South Wales relies on the burning of fossil fuels which is the primary cause of increased greenhouse gases.

There needs to be an increased utilisation of renewable energy beyond current Federal targets.

Develop Resource Zones

- The grid is currently not structured to incorporate the rich renewable resources throughout regional NSW. (Reference: The CSIRO submission maps NSW's energy opportunity).
- Many of these sources of renewable energy are a long distance from the existing grid, making them currently uneconomic to develop.
- The Jury **recommends** that the current grid be extended to these sources of renewable energy when required and should be funded by the Federal Government's Renewable Energy Fund.
- The NSW Government would foster economic development in regional areas to promote growth and investment, by pursuing this recommendation.

Facilitate Demand Management

- Demand Management will allow efficient handling of peak loads by prioritised load shedding.
- This is an achievable short term objective that will be facilitated by a Smart Grid.
- The Jury **recommends** that the NSW Government urgently prioritise development of a Smart Grid.

Encourage Decentralised Generation

- The Jury **recommends** legislative change to support and enable decentralised energy production. This is an 'on the grid' or 'off the grid' option, as appropriate.

Funding, Pricing and Regulation

The Jury **recommends** that the NSW Government:

- Provide long term legislative certainty for investment in renewables.
- Legislate to ensure transparency in billing, i.e., the specifics of what do we pay for.
- Legislate to allow 'time of day' and other flexible tariff options.
- Legislate equitable access to the grid for all renewable energy providers.
- Initiate discussion to include pricing and environment in the national energy objectives.

Nuclear debate

- The Jury recommends that the NSW Government initiate informed public discussion regarding emerging nuclear technologies, e.g., Thorium, as an energy source.

Salient facts and Assumptions to Support Recommendations

The recommendations are supported by the following Salient Facts and Assumptions.

Key Facts

- Approximately 90% of power produced in NSW today comes from fossil fuel sources. This was noted by a broad range of expert witnesses.
- Federal Government regulations require that 20% of our energy must be supplied by renewable, with the additional requirement of reducing greenhouse gas emissions by 5% on 2000 levels.
- Transmission and additional generation infrastructure is responsible for around half of a residential household power bill, as noted by CSIRO and AGL speakers.

Resource Zones

- From mapping of available renewable resources, it is possible to identify renewable resource zones.[1] [2] [3]
- Establishment of resource zones will help to minimise the cost of extending the grid to remote areas, to minimise the cost to the renewable energy investor.

The Grid

- ***Demand Management (Peak Loads)***
  - Peak loads are caused by increased utilisation of equipment such as air conditioners and heaters.
  - The Jury was positively disposed to the submission from the Total Environment Centre, which stated demand side participation can be particularly effective. [Reference: Submission 11 – page 3, note 4]
  - Technology exists to control load, by turning on and off thermostatically controlled household, industrial and commercial equipment.
  - The King Island submission and presentation was favourably received by the Jury.
  - Time of day charging and load shedding are enabled by the installation of smart meters and a smart grid (Reference: Submission 14 by AGL - page 4 and 113).

[1] CSIRO 'Unlocking Australia's energy potential'

[2] Grenatec- PAEI-Aust East Timor Report

[3] University of Melbourne 'Zero Carbon Australia Stationary Energy Plan'

- The Smart Grid is necessary to enable individual households, industrial and commercial users to be able to generate power from a variety of renewable sources and that power can be sold back to the grid.
- Further incentives should be established to encourage the installation of renewable energy generators once the Smart Grid is operational.
- Encourage the use of storage facilities to store excess renewable energy generated in individual households and commercial and industrial facilities (e.g. Electric Car & Lithium Ion batteries).
- The peak load demand is driven by high utilisation of certain appliances during approximately only 10 days per annum.
- The implementation of all these initiatives requires a process of dialogue, education and communication with consumers.

- ***Decentralised Generation***

- Tasmania Hydro has implemented the King Island Renewable Energy Integration Project (KIREIP)[4], a decentralised generation program to support the energy requirements of the island's approximately 2000 inhabitants.

- The KIREIP project balances a mix of existing renewable energy resources with the inclusion of Bio Diesel, Vanadium Redox Battery (VRB), Wind farm expansion, Uninterruptible Power Supply Class Diesel Engine (D-UPS) and an Energy Storage System.

- As outlined in the project overview, 'the project…is aiming to develop a world leading power system on King Island. KIREIP will result in the use of renewable energy for over 65% of the island's energy needs, and will reduce CO^2 emission by more than 95%'.

- The King Island Model is a good example of a decentralised power supply for small communities and has the potential to be explored in NSW. In addition to the clever use of new technology, a feature of this model was the strong community consultation used as part of the process.

[4] www.kingislandrenewableenergy.com.au

Funding, Pricing and Regulation

- Market forces will drive where money and capital are needed to make profit.
- Government can encourage and facilitate direction for the market.
- The rooftop solar PV program resulted in a glut of renewable energy certificates which may take two years to clear, which has an impact on large scale renewable investment, as noted by Pacific Hydro speaker.
- There is no conclusive proof that the corporate sector run power generators better than the government, as noted by the speaker from AGL.
- Retailers are prohibited from offering innovative or flexible tariff options which encourage reduced consumption.
- State Governments earn royalty on income from fossil fuels.
- Energy zones can reduce transmission investment costs.
- Peak prices can justify investment in energy storage.

Nuclear

- The unanimous view of the Jury was that the proposed issue of nuclear power generation should not be dismissed. A minority view (10%) supported starting deployment in the immediate future. While this view was not shared, the Jury was in agreement that the topic should be discussed in greater detail with the Australian public.

- The Jury recommends that the NSW Government initiate informed public discussion into the viability of emerging nuclear technologies, e.g., Thorium, as an energy source for future power stations.

- This would be on a medium to long term timeframe and would be in conjunction with the development of education programs, dependent on the outcomes of the public discussions.

Why did the Jury reach this decision?

- Australia is uniquely situated from a geological and political stability perspective, to utilise its substantial existing resources of thorium deposits for the development of future power stations. These power stations, in comparison to the more established nuclear technologies, would be more cost effective, have a lower carbon footprint, and safer processes that produce minimal waste with significant reduction in the risk of development of weapons.

- Smaller modular plants have the potential for ease of installation and site flexibility, with lower capital construction costs.

Environmental / General

- The importance of the environment is lost in most discussion about energy, in particular with national energy objectives.
- By 2020, 20% of our energy must be supplied by renewable, with the additional requirement of reducing Greenhouse Gas emissions by 5% on 2000 levels.
- Environmental and emission concerns will continue to drive the requirement for a greater share of renewable energy increases but they have not resulted in increased productivity (IPART).
- Reducing emissions while continuing to burn coal will necessarily encourage newer technologies and further research into carbon capture and storage.
- Public anxiety about coal seam gas exploration and production requires strict regulatory controls to limit damage to prime agricultural land and aquifers, and more heavily populated areas, i.e. Sydney basin region.
- As NSW is part of the National Energy Market (NEM), it is understood that any future changes to NSW's energy supply and distribution will affect the NEM.
- Coal and Gas will continue to provide base load and intermediate power for the short term future, but aging coal plants should not be replaced.
- Decoupling providers and networks will help eliminate the incentive for networks to increase profit by increasing usage.
- Short and longer term energy targets will need to be established to provide market certainty.
- Government regulation is the best way of rapidly introducing new energy technologies.
- Reference: CSIRO 'Unlocking Australia's Resource Potential' fully lists capital, OEM and Recurrent costs for each energy type.

Conclusion

The Jury concluded that the challenge is not to agree an order of preference, but instead to create certainty so that all renewable technologies have a chance to compete on merit. The biggest barrier is location and the connection to the grid, regulation which inhibits innovative technologies connecting to the grid and inflexible pricing models which stop incentive based plans being offered.

We offered five key recommendations which will:

- ✓ create investment certainty across all renewables through an expansion of the grid to a CSIRO identified 'Resource Zone'
- ✓ allow for the innovative practice of Demand Management to be applied
- ✓ regulate to allow decentralised generation
- ✓ reform pricing to allow for time of day and flexible tariff options
- ✓ start a discussion about advanced nuclear technology

We thank the Committee for the opportunity to explore this topic in depth and with access to a wide range of expertise. We appreciate the chance to be heard and look forward to your response.

Thank you

Sydney Citizens' Policy Jury

Appendix Four – List of Submissions

1	Docklands Science Park Pty Ltd
1a	Confidential
2	Greenpeace Australia Pacific Ltd
3	Ms Penelope Crossley
4	Australian Nuclear Association
5	Australian Energy Market Operator - AEMO
6	Mr Graeme Jessup
7	EnerNOC Australia Pty Ltd
8	Australian Energy Market Commission
9	Mr David Jordan
10	Delta Electricity
10a	Confidential
10b	Delta Electricity
11	Total Environment Centre, Nature Conservation Council of NSW
12	Altitude Energy Pty Ltd
13	Ausgrid
14	AGL Energy Ltd
14a	Confidential
15	Energy Supply Association of Australia
16	ERM Power
17	Origin Energy Limited
18	Epuron Pty Ltd
19	Sustainable Energy Association of Australia
20	Essential Energy
21	Pacific Hydro Australia
22	TransGrid
23	Infigen Energy Limited
23a	Confidential
24	Vestas Australian Wind Technology Pty Ltd
25	Clean Energy Council

26	TRUenergy Pty Ltd
27	Australian Nuclear Science and Technology Organisation
28	Australian Coal Association and NSW Minerals Council Ltd
29	Coolibah Pty Ltd
30	National Generators Forum
31	Mr Barrie Hill
32	Mr John Doherty
33	Dr Rob Stokes MP
34	University of Technology Sydney

Appendix Five – List of Witnesses

Monday 26 March 2012, Macquarie Room, Parliament House

Witness

Department of Trade and Investment, Regional Infrastructure and Services, Resources and Energy

Mr Mark Duffy
Deputy Director General

Mr Andrew Lewis
Executive Director, Energy

Australian Energy Market Operator (AEMO)

Mr David Swift
Executive General Manager

TRUenergy

Ms Lana Stockman
Manager Wholesale Regulation

Mr Ross Edwards
General Manager Business Development

Australian Coal Association

Mr Peter Morris
Director, Economic Policy

Mr Greg Sullivan
Deputy Chief Executive Officer

NSW Minerals Council

Ms Sue-Ern Tan
Deputy CEO

Energy Supply Association of Australia

Ms Clare Savage
Executive General Manager

Clean Energy Council

Mr Russell Marsh
Policy Director

TransGrid

Mr Peter McIntyre
Managing Director

Infigen Energy Limited

Mr Jonathan Upson
Senior Development and Government Affairs Manager

Friday 11 May 2012, Macquarie Room, Parliament House

Witness

CSIRO Energy Transformed Flagship

Dr Alex Wonhas
Director

Mr Paul Graham
Energy Economist

Pacific Hydro Australia

Mr Lane Crockett
General Manager

National Generators Forum

Mr Tim Reardon
Executive Director

Mr Greg Everett
Director

PIAC

Mr Edward Santow
Chief Executive Officer

Australian Nuclear Association

Mr Anthony Irwin

Australian Energy Regulator

Mr Tom Leuner
General Manager, Markets Branch

Mr Chris Pattas
General Manager, Network Regulation South

Mr Mark Wilson
Director, AER Wholesale Markets

CO2CRC

Professor Dianne Wiley
Program Manager

Global CCS Institute

Mr Barry Jones
General Manager - Policy and Membership

AGL Energy Limited

Ms Sarah McNamara
Head of Government and Community Engagement

Mr Tim Nelson
Director, Economic Policy and Sustainability

Mr Paul Ashby
General Manager, Commercial Development

Appendix Six – Extracts from Minutes

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 11)

9.45 am, Wednesday, 23 November 2011
Room 814-815, Parliament House

Members Present

Mr O'Dea, Dr Lee, Mr Torbay, and Mr Williams.

Apologies

Apologies were received from Mr Bassett and Mr Daley.

1. Confirmation of Minutes and matters arising

Resolved on the motion of Mr Torbay, seconded by Mr Williams: That the minutes of the meeting of 9 November 2011 be confirmed.

*****

3. Referral letter from the Minister for Resources and Energy re: Inquiry into the comparable economics of energy generation in NSW, dated 10 November 2011.

Resolved on the motion of Mr Williams, seconded by Dr Lee: That the Committee adopt Terms of Reference for the Inquiry into the economics of energy generation, advertise the inquiry and call for submissions by Friday 10 February 2012.

Resolved, on the motion of Dr Lee, seconded by Mr Torbay: That the Committee invite Mr Iain Walker, Executive Director, The New Democracy Foundation, to address the Committee at its next meeting on 1 December 2011.

*****

10. Next meeting

The meeting adjourned at 11.05 am until 10.00 am on Thursday 1 December 2011

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 12)

10.00 am, Thursday, 1 December 2011
Waratah Room, Parliament House

Members present

Mr O'Dea, Dr Lee, Mr Torbay, Mr Bassett and Mr Daley

Apologies

Apologies were received from Mr Williams

1. Confirmation of Minutes

Resolved on the motion of Dr Lee, seconded by Mr Torbay: That the minutes of the meeting of 23 November 2011 be confirmed subject to correction of typographical errors.

*****

3. Briefing to the Committee

Mr Iain Walker, Executive Director, New Democracy Foundation, was in attendance and briefed the Committee about the work of the New Democracy Foundation.

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the Committee request the New Democracy Foundation to provide a project proposal to include deliberative democracy processes as part of the Committee's consultations with stakeholders for the Inquiry into the Economics of Electricity Generation.

*****

5. Next meeting

The Committee adjourned at 12.45pm until 9.30am on Thursday 16 February 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 13)

3:02pm, Wednesday, 25 January 2012
Room 1043, Parliament House

Members present in Room 1043

Mr O'Dea

Members present via teleconference

Dr Lee, Mr Bassett and Mr Daley

Apologies

Apologies were received from Mr Torbay, and Mr Williams.

1. Confirmation of Minutes and matters arising

Resolved on the motion of Mr Daley, seconded by Dr Lee: That the revised minutes of the meeting of 1 December 2011 be confirmed.

*****

2. Inquiry into the Economics of Energy Generation – Proposed site visit

Resolved on the motion of Mr Bassett, seconded by Mr Daley: That the Committee visit Delta Electricity's power stations located on the Central Coast on 17 February 2012 at 7:30am, and that the Committee seek the Speaker's approval for the site visit.

The Chair also advised that he is planning to arrange a briefing for the Committee about electricity pricing.

*****

5. Next meeting

The meeting adjourned at 3.12 pm until 9.30 am on Thursday 16 February 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 14)

9.30 am, Thursday, 16 February 2012
Room 1043, Parliament House

Members Present

Mr O'Dea, Mr Torbay, Mr Bassett, Mr Williams and Mr Daley

Apologies:

Apologies were received from Dr Lee

1. Confirmation of Minutes

Resolved on the motion of Mr Bassett: That the minutes of the meeting of 25 January 2012 be confirmed.

*****

4. Inquiry into the comparative economics of energy generation

- Letter from the Australian Energy Regulator re: Inquiry into the comparative economics of energy generation, dated 16 December 2011.
- Letter from The Treasury re: Inquiry into the Economics of Energy Generation dated 9 February 2012.
- Submissions received from:
    1. Docklands Science Park
    2. Greenpeace Australia Pacific Ltd.
    3. Ms Penelope Crossley (Individual)
    4. Australian Nuclear Association
    5. Australian Energy Market Operation (AEMO)
    6. Graeme Jessup (Individual)
    7. EnerNOC Australia
    8. Australian Energy Market Commission
    9. Mr David Jordan (Individual)
    10. Delta Electricity
    11. Joint submission from Total Environment Centre and Nature Conservation Council of NSW
    12. Altitude Energy Pty. Ltd.
    13. Ausgrid
    14. AGL Energy Pty. Ltd.
    15. Energy Supply Association of Australia
    16. ERM Power for generations
    17. Origin Energy Limited
    18. Epuron Pty. Ltd.
    19. Sustainable Energy Association of Australia
    20. Essential Energy
    21. Pacific Hydro Australia
    22. TransGrid

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the Committee note the correspondence received and authorise the publication of submissions 1-22 on its website, unless any requests for confidentiality are received from submission authors.

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the Committee continue to accept submissions to the inquiry until 30 March 2012.

5. (i) Site visit: Delta Electricity, Vales Point and Colongra Power Stations

Resolved, on the motion of Mr Torbay, seconded by Mr Williams: That the Committee note the arrangements for the site visit on Friday 17 February 2012.

(ii) Inquiry into the economics of electricity generation

Resolved, on the motion of Mr Torbay, seconded by Mr Williams: That the Committee note the media release proposed timetable for the Inquiry and the media release regarding the Committee's visit to Central Coast power stations.

6. Letter from Mr Iain Walker, Executive Director, NewDemocracy Foundation re: Process Design Overview: Identifying the view of an informed public

Resolved, on the motion of Mr Bassett, seconded by Mr Torbay: That the Committee note the correspondence from Mr Iain Walker, Executive Director, NewDemocracy Foundation and endorse the proposal subject to further negotiations regarding the Committee's involvement in a regional forum.

*****

11. Next meeting

The Committee adjourned at 10.29 until 7.30 am on Friday, 17 February 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 15)

10:04 am, Thursday 23 February 2012
Room 1043, Parliament House

Members Present

Mr O'Dea (Chair), Mr Bassett, Mr Daley, Dr Lee and Mr Williams.

Apologies

An apology was received from Mr Torbay.

1. Confirmation of Minutes

Resolved, on the motion of Mr Bassett, seconded by Mr Williams: That the minutes of the meeting held on 16 February 2012 be confirmed.

2. Inquiry into the economics of energy generation – Briefing on electricity pricing

Mr Andrew Lewis, Executive Director Energy, Division of Resources and Energy, Department of Trade and Investment, Regional Infrastructure and Services briefed the Committee on the electricity market and electricity pricing in New South Wales.

The briefing was interrupted at 10.33 am due to a division in the Legislative Assembly and resumed at 10.45 am.

3. Inquiry into the economics of energy generation

i. Submissions received

The following submissions were received:

Submission 23 – Infigen Energy Limited
Submission 24 – Vestas
Submission 25 – Clean Energy Council
Submission 26 – TRUenergy
Submission 27 - Australian Nuclear Science and Technology Organisation

Resolved, on the motion of Dr Lee, seconded by Mr Williams: That the Committee authorise publication of submissions 23 - 27 on its website, unless any requests for confidentiality are received from submission authors.

ii. Appendix to Submission 22 - Transgrid

Resolved, on the motion of Dr Lee, seconded Mr Bassett: That the Committee publish the Transgrid NSW Annual Planning Report 2011 as an appendix to Submission 22.

iii. Proposed hearing date

Resolved, on the motion of Dr Lee, seconded Mr Daley: That the Committee hold a public hearing on 26 March 2012 from 9.00 am - 4.30 pm.

Members are asked to forward suggestions for witnesses to committee staff.

iv. Corrections to Submission 17

Resolved, on the motion of Dr Lee, seconded Mr Williams: That the Committee amend the minor typographical errors in Submission 17 as requested by the submission author and publish the updated submission on the Committee's website.

4. General Business

*****

i. New Democracy Foundation proposal

The Committee noted that the New Democracy Foundation is seeking to confirm dates for the Committee to meet with citizens' forums in Sydney and Tamworth. Committee staff will consult with members regarding their availability to attend forums in Sydney and Tamworth on two different Saturdays in June or July.

5. Next Meeting

The Committee adjourned at 11.35 am until 9.30 am on Thursday 8 March 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 16)

10:00 am, Thursday 8 March 2012
Room 1043, Parliament House

Members Present

Mr O'Dea (Chair), Mr Bassett, Mr Daley, Dr Lee, Mr Torbay and Mr Williams.

1. Confirmation of Minutes

Resolved, on the motion of Mr Bassett, seconded by Dr Lee: That the minutes of the meeting held on 23 February 2012 be confirmed.

*****

3. Inquiry into the economics of energy generation

i. Further submissions received

Submission 28 – Australian Coal Association and NSW Minerals Council
Submission 29 – Coolibah Pty Ltd
Submission 30 – National Generators Forum
Supplementary Submission 10a – Delta Energy
Supplementary Submission 10b – Delta Electricity

Resolved, on the motion of Mr Bassett, seconded by Mr Torbay: That the Committee authorise publication of submissions 28 - 30 and supplementary submission 10a on its website, unless any requests for confidentiality are received from submission authors, and that supplementary submission 10b be treated as confidential.

ii. Witnesses for 26 March public hearing

The Committee agreed to invite witnesses to give evidence before the Committee at its public hearing on 26 March, as outlined in the notice of hearing circulated with the meeting papers. The Committee also requested that proposed questions include a question regarding the likely impact of the carbon tax. The Chair also asked the staff to distribute the newsletter produced by Mr Keith Orchison (Coolibah Pty Ltd.) to all members.

iii. Second public hearing date

The Committee agreed to hold a second public hearing as part of the Inquiry into the Economics of Energy Generation on Friday 11 May 2012.

*****

7. Next Meeting

The Committee adjourned at 10.03 am until 9.30 am on Thursday 15 March 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 17)

9.37 am, Thursday, 15 March 2012
Room 1043, Parliament House

Members present

Mr O'Dea, Mr Torbay, Mr Bassett and Mr Williams

Apologies

Apologies were received from Dr Lee and Mr Daley

1. Confirmation of Minutes

Resolved on the motion of Mr Bassett, seconded by Mr Williams: That the minutes of the meeting of 8 March 2012 be confirmed.

2. Correspondence

*****

ii. Letter from Mr Colin Barry, NSW Electoral Commissioner, re: Request from NewDemocracy Foundation, dated 13 March 2012 (tabled by the Chair).

Resolved on the motion of Mr Williams, seconded by Mr Torbay: That the Committee note the correspondence and staff liaise with Mr Barry to clarify issues arising from his letter.

*****

5. Inquiry into the economics of energy generation

i. Public hearing, 26 March 2012

Resolved, on the motion of Mr Williams, seconded by Mr Torbay: That the Committee note the Notice of Hearing. Mr Williams requested that questions for witnesses include issues relating to the future of energy security in NSW.

ii. Energy State of the Nation 2012, 23 March 2012

Resolved, on the motion of Mr Bassett, seconded by Mr Torbay: That the Chair and one staff member attend the Energy State of the Nation conference on 23 March 2012.

iii. Central Coast visit of inspection report

Resolved, on the motion of Mr Bassett, seconded by Mr Williams: That the Committee note the report of the visit of inspection to Vales Point and Colongra power stations on 17 February 2012 and that photos used in the report also be used in the PAC newsletter.

*****

7. Next meeting

The Committee adjourned at 10.20 until 9.00 am on Monday 26 March 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 18)

Monday, 26 March 2012
9:00am
Macquarie Room, Parliament House

Members present

Mr O'Dea, Dr Lee, Mr Bassett, Mr Daley and Mr Williams

Apologies

Apologies were received from Mr Torbay

1. Public hearing - Inquiry into the economics of energy generation

The public were admitted at 10.00 am.

The following witnesses were sworn and examined:

- Mr Mark Duffy, Deputy Director-General, Department of Trade and Investment, Regional Infrastructure and Services, Resources and Energy
- Mr Andrew Lewis, Executive Director Energy, Department of Trade and Investment, Regional Infrastructure and Services, Resources and Energy.

Mr Duffy and Mr Lewis agreed to take questions on notice and provide answers by Friday 13 April 2012.

Evidence completed, Mr Duffy and Mr Lewis withdrew.

The following witnesses were sworn and examined:

- Mr Greg Sullivan, Deputy Chief Executive Officer, Australian Coal Association
- Mr Peter Morris, Director, Economic Policy, Australian Coal Association
- Ms Sue-Ern Tan, Deputy CEO, NSW Mineral Council.

Mr Sullivan, Mr Morris and Ms Tan agreed to take questions on notice and provide answers by Friday 13 April 2012.

Evidence completed, Mr Sullivan, Mr Morris and Ms Tan withdrew.

The following witnesses were sworn and examined:

- Ms Lana Stockman, Manager, Wholesale Regulation, TRUEnergy
- Mr Ross Edwards, General Manager Business Development, TRU Energy.

Ms Stockman and Mr Edwards agreed to take questions on notice and provide answers by Friday 13 April 2012.
Evidence completed, Ms Stockman, Mr Edwards and the public withdrew.

The Committee adjourned at 12.56pm.

The Committee resumed at 1.15pm

2. Publication of transcript of hearing 26 March

Resolved, on the motion of Mr Bassett, seconded by Mr Daley: That the Committee publish the transcript of the hearing on its website once members and witnesses have had an opportunity to make corrections.

3. Answers to questions on notice

Resolved, on the motion of Dr Lee, seconded by Mr Williams: That the Committee request answers to questions taken on notice at the hearing by Friday 13 April 2012.

*****

5. Correspondence

Resolved, on the motion of Mr Bassett, seconded by Dr Lee: That the Committee note the following correspondence:

i. Letter from Mr Colin Barry, NSW Electoral Commissioner, re: Request from NewDemocracy Foundation, dated 16 March 2012

*****

7. Other business

*****

Public hearing

The public hearing resumed at 1.25pm. Witnesses and the public were admitted.

Ms Clare Savage, Executive General Manager, Energy Supply Association of Australia, sworn and examined.

Ms Savage agreed to take questions on notice and provide answers by Friday 13 April 2012.

Evidence completed, Ms Savage withdrew.

Mr Russell Marsh, Policy Director, Clean Energy Council, sworn and examined.

Mr Marsh agreed to take questions on notice and provide answers by Friday 13 April 2012.

Evidence completed, Mr Marsh withdrew.

Mr Peter McIntyre, Managing Director, Transgrid, sworn and examined.

Mr McIntyre agreed to take questions on notice and provide answers by Friday 13 April 2012.

Evidence completed, Mr McIntyre withdrew.

Mr Jonathan Upson, Senior Development and Government Affairs Manager, Infigen Energy Limited, sworn and examined.

Mr Upson tabled two documents:

- 'Wind energy can be the leading electricity source'
- 'Reliable, baseload power?'

Mr Upson agreed to take questions on notice and provide answers by Friday 13 April 2012.

Evidence completed, Mr Upson withdrew. The public also withdrew.

Resolved, on the motion of Dr Lee, seconded by Mr Williams: That the Committee accept the documents tabled by Mr Upson and publish them on its website.

8. Next Meeting

The Committee adjourned at 4.45pm until 9.30 am on Thursday, 29 March 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 19)

Thursday, 29 March 2012
9:32am
Room 1043, Parliament House

Members present

Mr O'Dea, Mr Bassett, Mr Torbay and Mr Williams.

Apologies

Apologies were received from Mr Daley and Dr Lee.

1. Confirmation of minutes of meeting of 26 March 2012

Resolved, on the motion of Mr Bassett, seconded by Mr Williams: That the minutes of the meeting of 26 March 2012 be confirmed.

2. Inquiry into the economics of energy generation

i. Submission from Mr Barrie Hill (No. 31)

Resolved, on the motion of Mr Williams, seconded by Mr Bassett: That the submission be published subject to removal of the author's personal details.

ii. Draft media release

The Committee discussed the draft media release and agreed to some improvements.

Resolved, on the motion of Mr Williams, seconded by Mr Bassett: That the Committee note the media release regarding the inquiry into the economics of energy generation which will be distributed subject to minor changes by the Chair.

iii. Transcript of public hearing

Resolved, on the motion of Mr Bassett, seconded by Mr Williams: That the Committee note the uncorrected transcript of the public hearing on 26 March 2012 and provide corrections to staff by Wednesday 4 April 2012.

iv. Public hearing 11 May

Resolved, on the motion of Mr Williams, seconded by Mr Torbay: That the Committee note the draft schedule for the public hearing on Friday 11 May and propose to invite a witness from an appropriate consumer organisation.

*****

7. Next meeting

The Committee adjourned at 10.00am until 9.45am on Wednesday 4 April 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 20)

Wednesday 4 April 2012
9:45am
Jubilee Room, Parliament House

Members present

Mr O'Dea, Mr Bassett, Mr Daley, Dr Lee, Mr Torbay and Mr Williams.

1. Confirmation of minutes of meeting of 29 March 2012

Resolved, on the motion of Mr Torbay, seconded by Dr Lee: That the minutes of the meeting of 29 March 2012 be confirmed.

2. Inquiry into the economics of energy generation

Resolved, on the motion of Mr Williams, seconded by Mr Bassett: That submissions no. 32 and 33 be published, and that any further submissions received before the Committee's meeting on Thursday 3 May also be published provided that no requests for confidentiality are received from submission authors.

*****

6. Other business

ii) New Democracy Foundation

The Committee noted that the New Democracy Foundation is beginning to distribute invitations to its deliberative democracy process, and requested that staff seek a copy of information provided to participants before it is distributed.

7. Next Meeting

The Committee adjourned at 10.30am until 9.45am on Thursday 3 May 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 21)

Wednesday 2 May 2012
10.05am
Room 1254, Parliament House

Members present

Mr O'Dea, Mr Bassett, Mr Daley, Mr Torbay and Mr Williams.

Apology

An apology was received from Dr Lee.

1. Confirmation of minutes of meeting of 4 April 2012

Resolved, on the motion of Mr Williams, seconded by Mr Torbay: That the minutes of the meeting of 4 April 2012 be confirmed.

*****

5. Inquiry into the Economics of Energy Generation

i. Answers to Questions on Notice received from Mr Mark Duffy, Deputy Director-General, NSW Trade & Investment Resources & Energy, dated 13 April 2012
ii. Letter from Chair to submission authors
iii. Proposed briefing from AGL

Resolved, on the motion of Mr Daley, seconded by Mr Williams:

i. That the Committee publish answers to questions on notice from Mr Mark Duffy, NSW Trade & Investment Resources & Energy, on its website,
ii. Note the correspondence from the Chair to submission authors regarding the Citizens' Policy Jury process, and,
iii. Authorise the NewDemocracy Foundation to publish submissions to the Inquiry into the Economics of Energy Generation on its website for use by participants in the Foundation's Citizens' Policy Jury process.

The Committee also noted that representatives from AGL will give evidence at the public hearing for the Inquiry into the Economics of Energy Generation on 11 May 2012.

*****

8. Other business

The Committee discussed arrangements for the proposed visit to Tamworth to attend NewDemocracy Foundation consultations on 21 July 2012. The Chair indicated that he plans to travel to Tamworth on 20 July and hold a press conference at the Tamworth Powerstation Museum. Mr Daley and Mr Torbay indicated that they will drive to Tamworth on 20 July.

9. Next Meeting

The Committee adjourned at 10.35am until 9.45am on Thursday 10 May 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 22)

Thursday 10 May 2012
9.45am
Room 1053, Parliament House

Members present

Mr O'Dea, Dr Lee, Mr Bassett, Mr Torbay and Mr Daley.

Apology

An apology was received from Mr Williams.

1. Confirmation of minutes of meeting of 2 May 2012

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the minutes of the meeting of 2 May 2012 be confirmed.

2. Inquiry into the Economics of Energy Generation

i. Answers to Questions on Notice received from Ms Lana Stockman, Manager, Wholesale Regulation, TRUEnergy, dated 27 April 2012

ii. Answers to Questions on Notice received from Mr David Chapman, Acting Executive General Manager, AEMO, dated 8 May 2012

iii. Answers to Questions on Notice received from Mr Peter Morris, Director, Economic Policy, Australian Coal Association, dated 23 April 2012

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the Committee accept answers to questions on notice received from Ms Stockman, Mr Chapman and Mr Morris and publish them on its website.

*****

7. Briefing from NewDemocracy Foundation

Mr Iain Walker, Ms Deb Cameron and Mr Rod Matthews joined the meeting and briefed the Committee on the NewDemocracy Citizens' Policy Jury process and the methodology to be used in selecting participants and conducting the process. The Committee is to attend the Citizens' Policy Jury deliberations in Sydney on 16 June and in Tamworth on 21 July 2012. Mr Walker will send the Committee an updated version of the previously circulated paper about the project.

8. Next meeting

The Committee adjourned at 10.45am until 9.30am on Friday 11 May 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 23)

Friday 11 May 2012
9.30am
Macquarie Room, Parliament House

Members present

Mr O'Dea, Dr Lee, Mr Bassett, Mr Torbay and Mr Williams.

Apology:

An apology was received from Mr Daley.

1. Public hearing – Inquiry into the Economics of Energy Generation

Witnesses and the public were admitted.

Dr Alex Wonhas, Director, Energy Transformed Flagship, sworn and examined. Mr Paul Graham, Energy Economist, affirmed and examined.

Dr Wonhas and Mr Graham agreed to take questions on notice and forward answers to the Committee.

Evidence completed, Dr Wonhas and Mr Graham withdrew.

Mr Lane Crockett, General Manager, Pacific Hydro Australia, affirmed and examined.

Mr Crockett agreed to take questions on notice and forward answers to the Committee.

Evidence completed, Mr Crockett withdrew.

The Committee adjourned at 11.05 am.

The Committee resumed at 11.20 am.

Mr Tim Reardon, Executive Director, National Generators Forum, and Mr Greg Everett, Board member, sworn and examined.

Mr Reardon and Mr Everett agreed to take questions on notice and forward answers to the Committee.

Evidence completed, Mr Reardon and Mr Everett withdrew.

Mr Edward Santow, Chief Executive Officer, Public Interest Advocacy Officer, sworn and examined. Mr Oliver Derum sat with Mr Santow as an observer.

Mr Santow agreed to take questions on notice and forward answers to the Committee.

Evidence completed, Mr Santow and Mr Derum withdrew.

The Committee adjourned at 12.55pm.

The Committee resumed at 1.50pm.

Mr Tony Irwin from the Australian Nuclear Association, affirmed and examined.

Mr Irwin agreed to take questions on notice and forward answers to the Committee.

Evidence completed, Mr Irwin withdrew.

Mr Tom Leuner, General Manager, Markets Branch, Australian Energy Regulator, Mr Chris Pattas, General Manager, Network Regulation South, Australian Energy Regulator, and Mr Mark Wilson, Director, Wholesale Markets, Australian Energy Regulator, attended by teleconference. Mr Leuner affirmed and examined, Mr Pattas sworn and examined, Mr Wilson, affirmed and examined.

Mr Leuner, Mr Pattas and Mr Wilson agreed to take questions on notice and forward answers to the Committee.

Evidence completed, Mr Leuner, Mr Pattas and Mr Wilson withdrew and the teleconference was closed.

The Committee adjourned at 3.15pm.

The Committee resumed at 3.30pm.

Professor Dianne Wiley, Program Manager, CO2CRC, sworn and examined. Mr Barry Jones, General Manager, Policy and Membership, Global Carbon Capture and Storage Institute, affirmed and examined.

Professor Wiley and Mr Jones agreed to take questions on notice and forward answers to the Committee.

Evidence completed, Professor Wiley and Mr Jones withdrew.

Ms Sarah McNamara, Head of Government Affairs, AGL, and Mr Tim Nelson, Head of Economic Policy and Sustainability, AGL, sworn and examined. Mr Paul Ashby, General Manager, Commercial Development, Upstream Gas, AGL, affirmed and examined.

Ms McNamara, Mr Nelson, and Mr Ashby agreed to take questions on notice and forward answers to the Committee.

Evidence completed, Ms McNamara, Mr Nelson, and Mr Ashby withdrew.

The public withdrew.

Resolved, on the motion of Dr Lee, seconded by Mr Torbay: That the Committee publish the transcript of the public hearing on the Inquiry into the Economics of Energy Generation on its website once members and witnesses have had an opportunity to correct any errors, and that

the Committee request answers to questions on notice taken at the hearing be provided by 18 June 2012.

2. Next meeting

The Committee adjourned at 5.10 pm until 9.45am on Thursday 24 May 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 24)

Thursday 24 May 2012
9.45 am
Room 1043, Parliament House

Members present

Mr O'Dea (Chair), Dr Lee (Deputy Chair), Mr Bassett, Mr Torbay and Mr Williams.

1. Confirmation of minutes of meetings on 10 and 11 May 2012

Resolved, on the motion of Mr Bassett, seconded by Mr Williams: That the minutes of the meetings held on 10 May 2012 and 11 May 2012 be confirmed.

2. Correspondence

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the Committee note the following items of correspondence received:

*****

ii. Letter from The Hon Greg Smith SC MP, Attorney-General, re: NewDemocracy Foundation application to NSW Sheriff's Office, dated 18 April 2012

*****

4. Inquiry into the economics of energy generation

i. Answers to questions taken on notice from 26 March public hearing

Resolved, on the motion of Mr Bassett, seconded Mr Williams: That the Committee accept the answers to questions taken on notice received from the Energy Supply Association of Australia and the Clean Energy Council and publish them on its website.

ii. Invitation from Mr Jonathan Upson from Infigen Energy to visit a wind farm

The Committee agreed that members would consider a proposal to visit a wind farm at the next meeting.

*****

7. Other business

*****

ii. newDemocracy process - research interviews

The Chair noted that Committee members will be contacted about taking part in research interviews relating to the newDemocracy process. The interviews will be conducted by Dr Carolyn Hendriks of the Australian National University.

*****

The committee adjourned at 10.05 am until 9.45 am on Thursday, 31 May 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 25)

Thursday 31 May 2012
9.45am
Room 1043, Parliament House

Members present

Mr O'Dea, Dr Lee, Mr Bassett, Mr Daley, Mr Torbay and Mr Williams.

1. Confirmation of previous minutes

Resolved on the motion of Mr Bassett, seconded by Mr Torbay: That the minutes of the meeting of 24 May 2012 be confirmed, subject to amendment of item 7.1 to include 'and agreed that they had no issues'.

*****

2. Inquiry into the economics of energy generation

Members discussed the proposal to visit a wind farm and asked staff to circulate an email with possible dates for the visit.

*****

8. Next meeting

The Committee adjourned at 10.45 am until 9.45am on Thursday 14 June 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 26)

Thursday 14 June 2012
9.45am
Room 1043, Parliament House

Members present

Mr O'Dea, Dr Lee, Mr Bassett, Mr Daley, Mr Torbay and Mr Williams.

1. Confirmation of previous minutes

Resolved, on the motion of Mr Bassett, seconded by Dr Lee: That the minutes of the meeting of 31 May 2012 be confirmed.

*****

3. Inquiry into the economics of energy generation

i. Answers to questions on notice taken at public hearing on 26 March 2012, received from Mr Jonathan Upson, Senior Development and Government Affairs Manager, Infigen Energy, dated 5 June 2012

Resolved, on the motion of Dr Lee, seconded by Mr Torbay: That the Committee note the answers to questions on notice received from Mr Jonathan Upson, Infigen Energy.

ii. Submission 23a, received from Infigen Energy

Resolved, on the motion of Dr Lee, seconded by Mr Torbay: That Submission 23a from Infigen Energy remain confidential as requested by the author.

iii. Letter received from Mr Martin Poole, Executive Director, Epuron Energy, dated 6 June 2012

Resolved, on the motion of Dr Lee, seconded by Mr Torbay:: That the Committee forward the correspondence from Mr Poole to Mr Iain Walker, Executive Director, NewDemocracy Foundation.

iv. Article in Australian Financial Review

Resolved, on the motion of Dr Lee, seconded by Mr Bassett: That the Committee note the article about the Committee's work with the NewDemocracy Foundation that appeared in the Australian Financial Review on 21 May 2012.

v. Proposed visit to wind farm

Resolved, on the motion of Mr Daley, seconded by Mr Torbay: That the Committee accept Mr Jonathan Upson's invitation to visit the Capital Wind Farm on 17 August 2012.

*****

6. Other business

*****

Mr Bassett offered his apologies for the NewDemocracy event on Saturday 16 June.

7. Next meeting

The Committee adjourned at 10.10am until 9.45am on Thursday 21 June 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 27)

Monday 18 June 2012
9.30am
Jubilee Room, Parliament House

Members present

Mr O'Dea, Dr Lee, Mr Bassett, Mr Daley, and Mr Williams.

Apologies

An apology was received from Mr Torbay

*****

4. Other business

The Chair provided a verbal report on the NewDemocracy Foundation event which he and Dr Lee attended on 16 June 2012. A second event is to be held in Tamworth on 21 July 2012 and the Chair suggested that the Committee conduct a meeting in Tamworth on Friday 20 July.

*****

5. Next meeting

The Committee adjourned at 12.50pm until 9.45am on Thursday 21 June 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 28)

Thursday 21 June 2012
9.45am
Room 1043, Parliament House

Members present

Mr O'Dea, Mr Bassett, Mr Torbay and Mr Williams.

1. Confirmation of minutes of previous meetings

Resolved, on the motion of Mr Bassett, seconded by Mr Torbay: That the minutes of the meeting of 14 June 2012 be confirmed.

Resolved, on the motion of Mr Williams, seconded by Mr Torbay: That the minutes of the meeting of 18 June 2012 be confirmed.

*****

3. Inquiry into the economics of energy generation

i. Answers to questions on notice taken at public hearing on 11 May 2012

Resolved, on the motion of Mr Bassett, seconded by Mr Torbay: That the Committee note the following answers to questions on notice received from witnesses who appeared at the public hearing on 11 May 2012, publish the answers on its website and forward them to the NewDemocracy Foundation, subject to confidentiality requests from submission authors:

- Mr Edward Santow, Public Interest Advocacy Centre, dated 14 June 2012
- Mr Barry Jones, General Manager, Policy and Membership, Global Carbon Capture and Storage Institute, dated 18 June 2012
- Professor Dianne Wiley, Program Manager, CO2CRC, dated 18 June 2012
- Dr Alex Wonhas, Director, Energy Transformed National Research Flagship, dated 18 June 2012
- Mr Lane Crockett, General Manager, Pacific Hydro Australia, dated 19 June 2012 (tabled at meeting).

ii. Visit to Capital Wind Farm, 17 August 2012

Resolved, on the motion of Mr Torbay, seconded by Mr Williams: That the Committee travel to Capital Wind Farm on 17 August 2012, subject to confirmation of arrangements.

Mr Bassett indicated that he will drive to Capital Wind Farm. Mr Williams offered his apologies for the visit.

*****

6. Other business

i. NewDemocracy event in Tamworth on 21 July 2012.

The Chair requested staff to seek permission to invite representatives of the NewDemocracy Foundation to dine with the Committee on 20 July in Tamworth.

*****

7. Next meeting

The Committee adjourned at 10.15am until 9.45am on Thursday 16 August 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 29)

Friday 20 July 2012
6.15 pm
Comfort Inn, Tamworth

Members present

Mr O'Dea, Mr Bassett, Mr Daley and Mr Torbay.

Apologies

Apologies were received from Dr Lee and Mr Williams

1. Confirmation of minutes of previous meetings

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the minutes of the meeting of 21 June 2012 be confirmed.

*****

3. Inquiry into the economics of energy generation

i. Report plan

Members noted the report plan. Mr O'Dea asked members to provide any comments on the plan to staff by the end of July 2012.

ii. Visit to Capital Wind Farm

The Committee noted arrangements for the visit to Capital Wind Farm on Friday 17 August 2012. Mr Torbay has advised that he is not available that day.

iii. NewDemocracy event 21 July 2012

Members noted the arrangements for the NewDemocracy event on 21 July. Mr O'Dea briefed members about media coverage of the event and the Committee's visit to Tamworth. Mr O'Dea asked staff to circulate copies of any media articles as well as the recent article which appeared in the *Australian Financial Review*.

*****

5. Briefing regarding Citizens' Policy Jury

Mr Iain Walker, Executive Director, NewDemocracy Foundation, Ms Deborah Cameron, and Dr Carolyn Hendriks joined the meeting and provided a briefing about the Citizens' Policy Jury process and the NewDemocracy event on 21 July.

6. Next meeting

The Committee adjourned at 7.20pm until 9.45am on Thursday 16 August 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 30)

Thursday 9.45am
Room 1043, Parliament House

Members present

Mr O'Dea, Dr Lee, Mr Bassett, Mr Daley, Mr Torbay and Mr Williams.

Apologies

Mr O'Dea advised that he may arrive late.

The meeting opened at 9.45am. As Mr O'Dea was not present, Dr Lee took the Chair.

1. Confirmation of minutes of meeting of 20 July 2012

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the minutes of the meeting of 20 July 2012 be confirmed.

*****

3. Inquiry into the economics of energy generation

i. Answers to questions on notice taken at public hearing on 11 May 2012

Resolved, on the motion of Mr Bassett, seconded by Mr Williams: That the Committee note the answers to questions on notice received from Mr Tom Leuner, Australian Energy Regulator, dated 14 June 2012, and keep this information confidential with the exception of the *State of the Energy Market* report which should be published on the Committee's website.

ii. Correspondence received

Resolved, on the motion of Mr Torbay, seconded by Mr Williams: That the Committee note the correspondence received from Mr David May, dated 11 August 2012.

iii. NewDemocracy event in Tamworth, 21 July 2012

Resolved, on the motion of Mr Williams, seconded by Mr Torbay: That the Committee note the news articles referring to the Committee's visit to Tamworth on 20-21 July 2012.

iv. Visit to Capital Wind Farm – 17 August 2012

Resolved, on the motion of Mr Bassett, seconded by Mr Torbay: That the Committee invite Mr Rob Stokes MP, Parliamentary Secretary for Energy, to attend the visit to Capital Wind Farm on 17 August 2012 as an observer.

Mr O'Dea joined the meeting at 9.55am and took the Chair.

*****

5. Other business

Mr O'Dea advised that he has met with the following stakeholders regarding the Inquiry into the Economics of Energy Generation:

- Centre for Energy Technology, Adelaide University
- Mr Jonathan Jutsen, Energetics
- Mr Mike Zimmerman, Building IQ.

*****

7. Next meeting

The Committee adjourned at 10.55am until 9.45am on Thursday 23 August 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 31)

Thursday 9.50am
Room 1043, Parliament House

Members present

Mr O'Dea, Mr Bassett, Mr Daley, and Mr Torbay.

1. Confirmation of minutes of meeting of 16 August 2012

Resolved, on the motion of Mr Bassett, seconded by Mr Torbay: That the minutes of the meeting of 16 August 2012 be confirmed.

2. Inquiry into the economics of energy generation

i. Submission received

Resolved, on the motion of Mr Daley, seconded by Mr Torbay: That Submission 34, Dr Chris Dunstan, Institute for Sustainable Futures, be published on the Committee's website.

ii. Correspondence received

Resolved, on the motion of Mr Torbay, seconded by Mr Williams: That the Committee note the correspondence from Mr Jonathan Jutsen, received on 19 August 2012.

iii. Visit to Capital Wind Farm – 17 August 2012

Members discussed the visit to Capital Wind Farm on 17 August 2012 which was very successful.

*****

4. Other business

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the Chair write to:

- Infigen Energy, to thank them for organising the Committee's visit to Capital Wind Farm;
- Participants in the Citizens' Policy Jury process conducted by the NewDemocracy Foundation, to thank them for their participation; and,
- A letter of support for the Centre for Energy Technology, Adelaide University, for their application for funding for research into the health effects of wind farms.

5. Next meeting

The Committee adjourned at 10.15am until 9.45am on Thursday 6 September 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 32)

Thursday 9.45am
Room 1043, Parliament House

Members present

Mr O'Dea, Mr Bassett, Mr Daley, Dr Lee and Mr Torbay.

1. Confirmation of minutes of meeting of 23 August 2012

Resolved, on the motion of Mr Torbay, seconded by Mr Bassett: That the minutes of the meeting of 23 August 2012 be confirmed.

2. Inquiry into the economics of energy generation

i. Correspondence from Mr Iain Walker, Executive Director, NewDemocracy Foundation, dated 3 September 2012

Resolved, on the motion of Mr Bassett, seconded by Dr Lee: That the Committee publish the reports provided by the New Democracy Foundation on its website and consider them in detail at its next meeting; further, that the Committee publish the draft media release announcing receipt of the reports.

ii. Report from the visit to Capital Wind Farm

Resolved, on the motion of Mr Daley, seconded by Mr Torbay: That the Committee note the report from the visit to Capital Wind Farm on 17 August 2012.

*****

5. Other business

The Committee agreed to discuss the report for the Inquiry into the Economics of Energy Generation at its next meeting.

6. Next meeting

The Committee adjourned at 10.08 am until 9.45am on Thursday 13 September 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 33)

Thursday 9.45am
Room 1043, Parliament House

Members present

Mr O'Dea, Mr Bassett, Mr Daley, Dr Lee, Mr Torbay and Mr Williams.

1. Confirmation of minutes of meeting of 6 September 2012

Resolved, on the motion of Mr Bassett, seconded by Dr Lee: That the minutes of the meeting of 6 September 2012 be confirmed.

2. Inquiry into the economics of energy generation

i. Report from Citizens' Policy Juries (previously circulated)

The Committee discussed the reports from the Citizens' Policy Juries in Tamworth and Sydney.

*****

5. Next meeting

The Committee adjourned at 10.45 am until 9.45am on Thursday 20 September 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 34)

Thursday 9.45am
Room 1043, Parliament House

Members present

Mr O'Dea, Mr Bassett, Mr Daley, Mr Torbay and Mr Williams

Apology

An apology was received from Dr Lee

1. Confirmation of minutes of meeting of 13 September 2012

Resolved, on the motion of Mr Torbay, seconded by Mr Williams: That the minutes of the meeting of 13 September 2012 be confirmed.

*****

5. Inquiry into the economics of energy generation

i. Letter to Coal Innovation NSW

The Chair advised the Committee that he had met with Mr Greg Sullivan, Deputy Chief Executive Officer of the Australian Coal Association.

Resolved, on the motion by Mr Torbay, seconded by Mr Williams: That the Committee write to Coal Innovation NSW requesting an update on the NSW Storage Capacity Project and also to Mr Sullivan to seek further information regarding carbon capture and storage.

*****

8. Next meeting

The Committee adjourned at 10.07 am until 9.45am on 16 October 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 35)

Thursday 9.45am
Macquarie Room, Parliament House

Members present

Mr O'Dea, Mr Bassett, Dr Lee, Mr Torbay and Mr Williams

1. Confirmation of minutes of meeting of 20 September 2012

Resolved, on the motion of Dr Lee, seconded by Mr Torbay: That the minutes of the meeting of 20 September 2012 be confirmed.

2. Correspondence

Resolved, on the motion of Dr Lee, seconded by Mr Bassett:

Received:

*****

ii. Letter from Mr Sean Crumlin, Director Performance Audit, Audit Office of NSW requesting details of Committee deliberations with Mr Zimmerman (Building IQ) and Mr Jutsen (Energetics) for Inquiry into the Economics of Energy Generation, dated 26 September 2012.

*****

viii. Letter from Mr Jai McDermott, A/g Deputy CEO, Australian Coal Association, re: Carbon Capture and Storage, dated 4 October 2012.

ix. Letter from Mr Rick Fowler, Program Director, Coal Innovation Program, re: NSW CO_2 Storage Assessment Program, dated 8 October 2012.

*****

5. Inquiry into the economics of energy generation

i. Supplementary submission 1a, Mr John Martin, Docklands Science Park, received 12 October 2012 (attached)

Resolved, on the motion of Dr Lee, seconded by Mr Bassett: That the Committee acknowledge the supplementary submission from Docklands Science Park and publish it on its website.

ii. Lunch with NewDemocracy participants, 25 October 2012

Resolved, on the motion of Dr Lee, seconded by Mr Bassett: That the Committee invite participants in the Citizens' Policy Juries conducted by the NewDemocracy Foundation to lunch at Parliament House on Thursday 25 October 2012 at 12.30pm.

iii. Chair's presentation to Energy Policy Institute, 3 December 2012

Resolved, on the motion of Dr Lee, seconded by Mr Bassett: That the Committee note the Chair will make a presentation to the Energy Policy Institute on 3 December 2012.

*****

9. Other business

*****

The Committee noted the draft Notice of Hearing for Friday 26 October. The Committee will discuss the draft report on the Inquiry into the Economics of Energy Generation after the hearing, from 11.40am to 1.00pm.

10. Next meeting

The Committee adjourned at 10.00 am until 9.45am on 25 October 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 36)

Thursday 25 October 2012
9.45am
Room 1043, Parliament House

Members present

Mr O'Dea, Mr Bassett, Dr Lee, Mr Daley, Mr Torbay and Mr Williams

1. Confirmation of minutes of meeting of 18 October 2012

Resolved, on the motion of Dr Lee, seconded by Mr Bassett: That the minutes of the meeting of 18 October 2012 be confirmed.

*****

4. Inquiry into the economics of energy generation

The Chair tabled the draft report.

Resolved, on the motion by Mr Torbay, seconded by Dr Lee: That the Committee will:

- meet on 26 October to have preliminary discussions on the report's findings and recommendations
- detailed secondary consideration of the report at the deliberative meeting on 15 November
- move the start time of the deliberative meeting on 15 November to 09:00
- consider the adoption of the report at the deliberative meeting on 22 November.

*****

8. Next meeting

The Committee adjourned at 10.03 am until 9.15am on 26 October 2012.

MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 37)

Friday 26 October 2012
9.15am
Macquarie Room, Parliament House

MEMBERS PRESENT

Mr O'Dea, Mr Bassett, Mr Daley, Mr Torbay

Apologies

Dr Lee and Mr Williams

*****

2. Inquiry into the economics of energy generation

Preliminary discussions on the report's findings and recommendations.

3. Next meeting

The Committee adjourned at 11.40am until 9.00am on 15 November 2012.

DRAFT MINUTES OF PROCEEDINGS OF THE PUBLIC ACCOUNTS COMMITTEE (NO. 37)

Friday 15 November 2012
9.00am
Room 1043, Parliament House

MEMBERS PRESENT

Mr O'Dea, Dr Lee, Mr Bassett, Mr Daley, Mr Torbay and Mr Williams

4. Confirmation of minutes of meetings of 25 October and 26 October

Resolved, on the motion of Dr Lee, seconded by Mr Williams: That the minutes of the meeting of Thursday 25 October 2012 be confirmed.

Resolved, on the motion of Mr Torbay, seconded by Mr O'Dea: That the minutes of the meeting of Friday 26 October 2012 be confirmed.

5. Correspondence

Resolved, on the motion of Mr Williams, seconded by Dr Lee: That the Committee note the following items of correspondence:

Received

- Mr Andrew Lewis, Executive Director Energy, Department of Trade and Investment, Regional Infrastructure and Services, re: questions regarding Inquiry into the Economics of Energy Generation, dated 6 November 2012.

*****

6. Inquiry into the economics of energy generation

i. Draft inquiry report (previously circulated)

The Chair tabled his draft report entitled 'The Economics of Energy Generation' which, having been previously circulated, was taken as read.

Mr Williams left the meeting.

Members considered the report in detail.

Resolved, on the motion of Dr Lee: That the Committee agreed that Recommendation 1 be omitted and re-inserted on page 87 to become the new Recommendation 8, with other Recommendations re-ordered accordingly.

Mr Daley moved: That paragraph 2.85 be deleted.

Question put.

The Committee divided.

Ayes: Mr Daley, Mr Torbay

Noes: Mr O'Dea, Mr Bassett, Dr Lee.

Question resolved in the negative.

Mr Daley moved: That Recommendation 6 be deleted.

Question put.

The Committee divided.

Ayes: Mr Daley, Mr Torbay

Noes: Mr O'Dea, Mr Bassett, Dr Lee.

Question resolved in the negative.

Mr Daley moved: That Recommendation 9 be deleted.

Question put.

The Committee divided.

Ayes: Mr Daley, Mr Torbay

Noes: Mr O'Dea, Mr Bassett, Dr Lee.

Question resolved in the negative.

Mr Daley moved: That Recommendation 13 be deleted.

Question put.

The Committee divided.

Ayes: Mr Daley, Mr Torbay

Noes: Mr O'Dea, Mr Bassett, Dr Lee.

Question resolved in the negative.

Mr Daley moved: That Recommendation 15 be deleted.

Question put.

The Committee divided.

Ayes: Mr Daley, Mr Torbay

Noes: Mr O'Dea, Mr Bassett, Dr Lee.

Question resolved in the negative.

Dr Lee requested that an introductory summary of each chapter be included.

Resolved, on the motion of Dr Lee, seconded by Mr Torbay: That the report as amended be the report of the Committee and that it be signed by the Chair and tabled in the House.

That the Chair and Committee staff be permitted to correct any stylistic, typographical and grammatical errors.

That, once tabled, the report be published on the Committee's website.

7. Other business

The Chair tabled a draft media release regarding release of the report on the Inquiry into the Economics of Energy Generation, which was noted by members.

8. Next meeting

The Committee adjourned at 10.25am until 9.45am on 22 November 2012.

*****