ELECTRICITY IN TASMANIA

A HYDRO TASMANIA PERSPECTIVE

Hydro Tasmania
the renewable energy business

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CONTENTS

ABBREVIATIONS

ABS	Australian Bureau of Statistics
AC	Alternating current
ACA	Australian Coal Association
ACE CRC	Antarctic Climate and Ecosystems Cooperative Research Centre
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AETV	Aurora Energy (Tamar Valley)
AURORA ENERGY	Aurora Energy Pty Ltd
BSI	Bass Strait islands
CCGT	Combined cycle gas turbine
CCS	Carbon capture and storage
CLP	China Light and Power Group
COAG	Council of Australian Governments
CPRS	Carbon Pollution Reduction Scheme
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DC	Direct current
DIER	Department of Infrastructure, Energy and Resources
DPIWE	Department of Primary Industries, Water and Environment*
DSM	Demand Side Management
EEO	Energy Efficiency Opportunities
EGS	Engineered (or Enhanced) Geothermal Systems
EPA	Environment Protection Authority
FCAS	Frequency Control Ancillary Services
FCSPS	Frequency Control System Protection Scheme
FRC	Full retail competition
GL	Gigalitre
GWEC	Global Wind Energy Council
GWh	Gigawatt hours
HEC	Hydro-Electric Commission
IEA	International Energy Agency
IGCC	Integrated gasification combined cycle
kW	Kilowatt
LPG	Liquefied petroleum gas
LRC	Low reserve capacity
LRMC	Long run marginal cost
MCE	Ministerial Council on Energy
MMA	McLennan Magasanik Associates Pty Ltd
MW	Megawatt
NEM	National Electricity Market
NSP	Network Service Provider
NEMMCO	National Electricity Market Management Company
NIEIR	National Institute of Economic and Industry Research
NREG	Network Extensions for Remote Generation
NWC	National Water Commission
NWI	National Water Initiative
OCGT	Open cycle gas turbine
OTTER	Office of the Tasmanian Economic Regulator
PASA	Projected Assessment of System Adequacy
PB	Parsons Brinckerhoff Australia Pty Ltd
PV	Photovoltaic
REC	Renewable Energy Certificate
RET	Renewable Energy Target
SOO	Statement of Opportunities
TIDB	Tasmanian Irrigation Development Board
TNSP	Transmission Network Service Provider
Transend	Transend Networks Pty Ltd
WMA	Water Management Act

* DPIWE has formerly been known as both DPIW and DPIWE. It is presently known as DPIPWE.

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FOREWORD

Hydro Tasmania is Australia's leading renewable energy business and the largest manager of water in the country.

For almost a century, 'the Hydro' has been an integral part of the growth and development of Tasmania, powering the economy and helping to build the modern State. In recent years, it has taken that leadership into the national and international arenas as a renewable energy leader while continuing to generate the energy required by a 21st Century economy.

Of late, there has been growing recognition of the capacity of the State's existing and potential renewable energy sources to play a key role in Australia's transformation to a low carbon economy.

As Hydro Tasmania looks forward, we can see not only many great opportunities, but also some significant risks for the electricity industry in Tasmania. How it responds to these, and the choices it makes in doing so, will be critical to ensuring a secure energy supply while making a meaningful contribution to limiting and reducing greenhouse gas emissions.

Hydro Tasmania as a market participant believes it is timely to advance informed public discussion on the industry's future. To facilitate this, we have drawn together information and ideas and included up-to-date data to form a reference document that looks at the important issues facing the Tasmanian electricity industry – in particular, how Tasmanian electricity demand can be met in a sustainable, efficient and cost-effective manner.

We believe this document can assist discussion on how the sector can best respond to key issues such as achieving the Government's aspirations for renewable energy, ensuring security of supply and deregulation of the local market.

The issues compiled are wide-ranging. The future possibilities raised are both exciting and challenging and not without the potential for disagreement and argument, something we believe is entirely appropriate if we are to achieve our true potential as a State.

To that end, I encourage readers to reflect on the contents of the report against my own observations of some elements necessary for a competitive, sustainable and reliable electricity sector in Tasmania - one characterised by:

- strong governance through a nationally consistent competitive market for electricity generators and retail customers, where prices are set by the market in a transparent manner
- a market framework and price signals to deliver the transmission infrastructure necessary for the development of new renewable energy projects, ensuring strong locational signals for new investment while preserving market access and avoiding perverse outcomes
- a stable policy environment that provides investment certainty and facilitates an effective approvals process grounded in sustainable land use planning
- realising the role that Tasmania can play as a major renewable energy source for the National Electricity Market, with potentially a largely export-focused electricity generation mix, facilitated by increased transmission capacity
- the realisation of the full value and potential of hydro-electricity in Tasmania through a return to production of 10,000 GWh per year, and active contribution to the integrity of the National Electricity Market. This includes maximising the role of hydropower in meeting peak electricity demand, supporting other new and variable renewable energy technologies
- the widespread deployment of wind energy generation and other current and emerging renewable energy technologies, thereby making a material contribution to the State's energy mix, including solar PV, solar hot water, geothermal energy, biomass and ocean energy
- a highly efficient end-use sector where major savings in electricity consumption have been achieved in the residential, commercial and industrial sectors by adopting cost-effective energy efficiency measures and maximising the opportunities for demand side response from electricity customers
- a customer evolution on the demand side where electricity is no longer a commodity provided through a non-negotiable per kWh price, but rather is part of a new equation for other energy services where grid and off-grid options, including distributed generation, are considered on all scales (residential/commercial/industrial) and customers respond to cost-reflective price signals, facilitated by an intelligent electricity network.

The transition these observations propose is ambitious, but one I believe is achievable, premised on growth of renewable energy and inspired by sustainability.

I am confident this document will create the foundation for considered debate.
If you would like to provide any feedback on its contents, please do so via:

- E-mail - ceo@hydro.com.au
- writing to me at
  GPO Box 355, Hobart 7001

Vince Hawksworth
CEO
Hydro Tasmania
October 2009

KEY MESSAGES

Future electricity demand

Tasmania's electricity consumption, which is heavily influenced by industrial activity, is forecast to grow at an average annual rate of 0.69% in the next decade.

Hydro Tasmania believes that future electricity consumption could, however, be significantly influenced, both upwards and downwards, by factors such as the mass uptake of energy efficiency and changes to major industrial load due to companies entering or exiting Tasmania.

Generation options to meet increasing demand

There are a range of electricity supply and demand side options that will be part of Tasmania's electricity future.

In the near term, additional generation capacity could be provided by biomass, hydro, gas and wind generation. In the longer term, technologies that are at an early stage in the technology innovation/development process are likely to play an important role; these include solar energy, geothermal energy and marine energy, as well as a range of distributed generation technologies, including storage.

Renewable energy

New renewable energy development in Tasmania will play a key role in achieving the Tasmanian Government's target to reduce greenhouse gas emissions by 60% below 1990 levels by 2050, and the State's policy objective to facilitate significant renewable development, thereby becoming a net exporter of renewable and low-carbon electricity to the fossil fuel-dominated National Electricity Market (NEM). However, until technology costs are lowered through efficiencies of scale, local manufacturing and the 'learning' process, renewable energy technologies will not be commercially viable in the absence of policy support.

The Commonwealth expanded Renewable Energy Target (RET), as well as the proposed Carbon Pollution Reduction Scheme and other clean energy funding initiatives, are vital pre-requisites to achieving a higher level of renewable energy generation in both Tasmania and the mainland.

Hydro Tasmania considers that hydro generation has the capacity to play an important role in contributing to the stability of the NEM as the proportion of variable renewable energy generation (wind and solar PV) increases in the future. Subject to economic viability, this could translate into new commercial opportunities for Tasmania's hydro generation capacity to assist in the wider deployment of other renewable energy technologies.

Energy efficiency

The reduction of electricity consumption through energy efficiency has the capacity to make a very significant contribution to offsetting growth in electricity consumption, but realising the benefits is not without challenge. While numerous studies have highlighted the potential to cost effectively improve energy efficiency in the residential, commercial and industrial sectors, action to date has been limited due to a number of barriers, including information failures, misalignment of incentives, capital constraints and behavioural barriers, amongst others. Hydro Tasmania believes that new policy approaches above and beyond a national emissions trading scheme will be required to overcome these barriers.

Electricity market arrangements

The NEM provides a comprehensive market and institutional framework to ensure that supply reliability is maintained in Tasmania at the lowest possible cost. Under this framework, responsibility for ensuring that there is sufficient generation capacity to meet future demand is effectively vested in the market, and not in any particular energy sector company – a fundamental change from the pre-electricity reform era, where until recently, Hydro Tasmania shouldered this responsibility.

The current electricity market arrangements represent a significant departure from the past integrated industry, and present opportunities as well as risks to energy companies. Energy companies may need to pursue new avenues to compete and thrive in this new environment. Hydro Tasmania considers that this could include investing in generation, growing market share in the mainland and entering into new strategic partnerships that open up opportunities to develop and market new services to customers.

Security of supply

Current industry modelling indicates that the combination of current and proposed on-island generation plus Basslink imports provides a significant buffer against hydrological variability or other contingencies in the Tasmanian generation mix.

Future supply-demand scenarios could range for example from (a) an under-supply situation; (b) a supply-demand equilibrium; or (c) an over-supply situation. New generation investment decisions should therefore be tested against multiple scenario outcomes rather than being predicated on a single supply-demand scenario.

Basslink, through its ability to import or export, provides a valuable balancing capability against an under-supply or over-supply situation.

Transmission access

While natural increases in peak demand (particularly for heating and cooling) are a primary driver of transmission investment, the anticipated increase in renewable energy generation as a result of the legislated 20% RET and forthcoming climate change driven policies – in particular, the Federal Government's proposed Carbon Pollution Reduction Scheme - also presents new transmission-related challenges in regard to (a) optimising transmission investment to support new renewable energy generators, and (b) addressing congestion on the shared transmission network which could lead to existing generation being 'constrained off'.

Optimising transmission investment to support new renewable energy generation may be best addressed by the Australian Energy Market Commission's conceptual Network Extensions for Remote Generation (NERGs) proposal, which enables the construction of optimised connection assets to accommodate proposed renewable energy generation developments while ensuring risks to network service providers are managed.

Resolving congestion on the shared transmission network is likely to require the introduction of a national congestion management regime to achieve orderly dispatch in the presence of network congestion.

Intelligent networks

Hydro Tasmania considers that significant increases in small-scale distributed generation, the potential for large numbers of electric vehicles requiring recharging, the emergence of next generation appliances that can be managed remotely or locally by households, and real-time pricing signals that provide incentives for consumers to alter their consumption patterns, will require smarter and more responsive electricity networks, as well as changes to network regulatory arrangements that incentivise them to actively pursue these options.

Bass Strait islands

Due to geographic location and the electricity generation technologies deployed, the cost of supplying electricity on the Bass Strait islands is significantly higher than on mainland Tasmania. Even though the cost of electricity supply to customers is subsidised by the Tasmanian Government, price remains higher than regulated electricity tariffs in mainland Tasmania.

Given the current reliance on diesel fuel and the anticipated increases in oil prices, it may be beneficial to replace existing high-cost diesel generation with cost-effective renewable energy alternatives. In doing so, the Bass Strait islands have the potential to showcase the benefits of significant renewable energy generation, and create new opportunities for commercialising renewable energy technologies in Tasmania and other markets.

1. BACKGROUND AND CONTEXT

Electricity is a cornerstone of our modern lifestyles and economy. It provides heating, cooling, lighting, industrial energy, and powers much of the technology we use. Access to a clean, reliable and competitive electricity supply is a critical element of Tasmania's future – and underpins the achievement of three of the twelve Tasmania *Together* 2020 Goals:[1]

- Goal 1: A reasonable lifestyle and standard of living for all Tasmanians
- Goal 10: Thriving and innovative industries driven by a high level of business confidence
- Goal 12: Sustainable management of our natural resources.

The power industry has a long and proud history in Tasmania, and has changed considerably over the years. In contrast to the past centrally controlled industry with a single company performing all functions, the industry today comprises competing electricity generators, separate transmission and distribution network operators, integration with the National Electricity Market, interconnection with the mainland through Basslink and competing electricity retailers. However, the industry faces a number of challenges in the future. How it responds to those challenges will to a large measure affect how it progresses into the 21st Century.

In Australia, the imperative for environmental sustainability and climate change is ushering in a new era characterised by water scarcity, recognition of the interdependencies between energy and water, the drive to reduce greenhouse gas emissions and the move to a low carbon economy. While there are many diverse technology options for new electricity supply in Tasmania to provide ongoing security of supply, there are a number of factors that could affect the future supply-demand balance. Consequently, the commercial deployment of these options will require considered long term policy decisions taking into consideration the new market driven industry framework and possible scenarios for the future.

Nationally, the introduction of retail competition opens up a new chapter in the evolution of the industry. It will allow customers to choose between competing suppliers offering electricity from renewable and non renewable energy sources as well as a range of 'smart' energy services, including real time demand management and distributed generation. However, the new environment presents opportunities as well as risks. Energy companies will need to pursue new avenues to compete and thrive in this new environment.

The purpose of this document is to create the basis for informed discussion on issues and challenges to meet Tasmanian electricity demand in a sustainable, efficient and cost effective manner, and to contribute towards ensuring the Tasmanian electricity sector is able to respond commercially and competitively to changes in the electricity market.

The layout of the document is as follows.

- Sections 2 and 3 explore demand projection and generation supply options respectively
- Section 4 canvasses electricity market arrangements and implications for Tasmanian energy companies
- Section 5 examines security of supply issues
- Section 6 addresses challenges associated with incorporating new generation in Tasmania
- Section 7 provides an overview of electricity in the Bass Strait islands.

1 Tasmania*Together*2020.

2. ELECTRICITY DEMAND PROJECTIONS

Key messages

- *Tasmania's electricity consumption, which is heavily influenced by industrial activity, is forecast to grow at an average annual rate of 0.69% in the next decade.*
- *Hydro Tasmania believes that future electricity consumption could, however, be significantly influenced, both upwards and downwards, by factors such as the mass uptake of energy efficiency and changes to major industrial load due to companies entering or exiting Tasmania.*

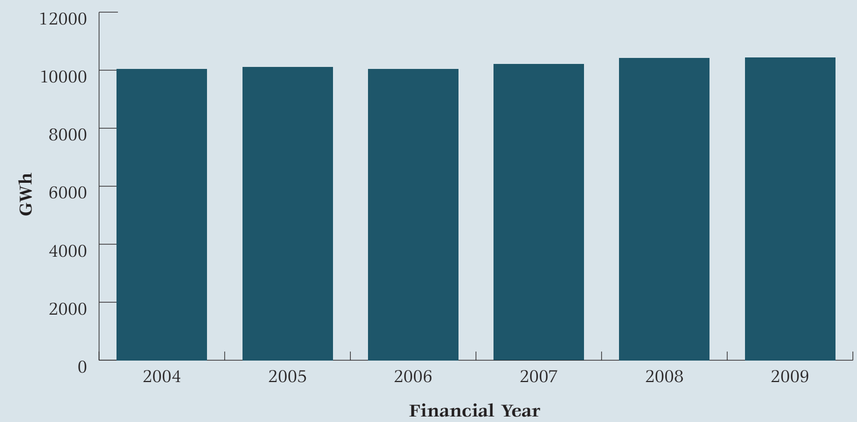

Figure 1: Electricity sales in Tasmania[5]

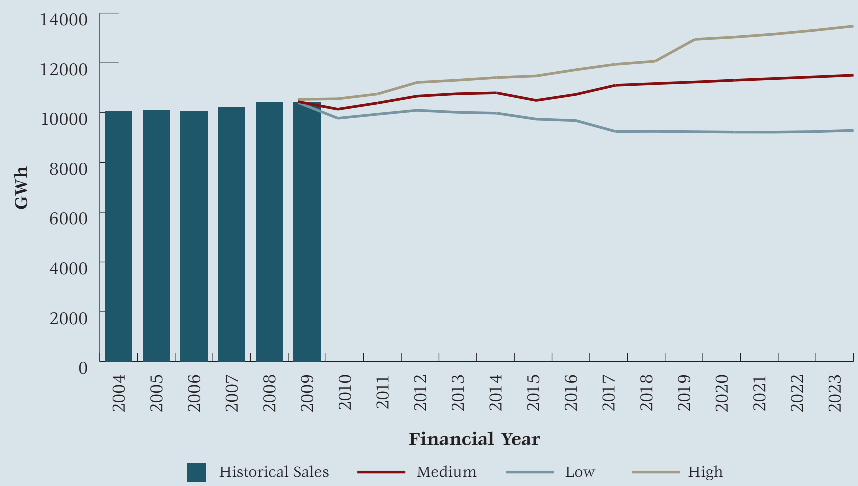

Figure 2: Forecast growth of electricity sales[7]

Current Tasmanian annual electricity consumption is estimated at 10,441 GWh,[2] comprising residential (19%) and commercial and industrial (81%).[3]

Figure 1 illustrates electricity sales in Tasmania from 2003-04 to 2008-09. The Office of the Tasmanian Economic Regulator notes that Tasmanian electricity consumption is dominated by sixteen large industrial customers in the metal smelting, mining, forestry and pulp and paper manufacturing sectors, accounting for around 60% of total energy consumption. Of these large consumers, four large industrial processing facilities account for around half of Tasmania's total electricity demand.[4]

As illustrated in Figure 2, business as usual electricity consumption in Tasmania is forecast to grow by an average of 0.69% annually to 2023, and annual consumption is projected to reach 11,504 GWh in the 'medium' scenario produced by Tasmania's transmission operator, Transend.[6]

Alternate 'high' and 'low' scenarios could see 2023 consumption at 13,477 GWh or 9,287 GWh respectively.

The 'high' scenario reflects lower carbon costs and more favourable economic conditions. Transend notes that "a considerable increase in energy growth is forecast in 2019–20 due to assumptions made on a new direct connect customer connecting to the Tasmanian network". The 'low' scenario reflects major reductions in future industrial energy consumption.

Electricity demand can also be expressed in capacity terms – effectively a measure of the instantaneous requirement for electricity. Current maximum demand

2 Transend 2009 (Medium electricity sales projection).
3 Derived from OTTER 2008.
4 OTTER 2008.
5 Derived from Transend 2009.
6 Transend 2009.
7 Transend 2009.

in the Tasmanian electricity system is 1,861 MW, achieved during winter,[8] unlike mainland states, where maximum demand occurs in summer, due to air conditioning load. Maximum demand is projected to grow at 1.42% annually, reaching 2,299 MW in 2020.[9]

As illustrated in Figure 3, demand in winter is typically higher than in summer predominantly due to space and water heating requirements.[10]

As noted previously, a number of external factors could influence future electricity demand. As illustrative examples, possible scenarios that could change these business as usual projections include the following:

- the State losing one or more major industrial companies due to an extended downturn in the resources sector or broader economy, leading to a substantial reduction in electricity demand. Conversely, new major industrial load in addition to currently planned developments (for example, a major user shifting national activity into Tasmania) could significantly increase demand
- the mass uptake of energy efficiency resulting from strong policy support
- a shift to electric cars – for example, the substitution of 50% of Tasmania's passenger vehicle fleet by electric vehicles as a result of high oil prices could increase electricity consumption by around 230 GWh/year,[12] equivalent to around 1.7% of projected total consumption in 2020.

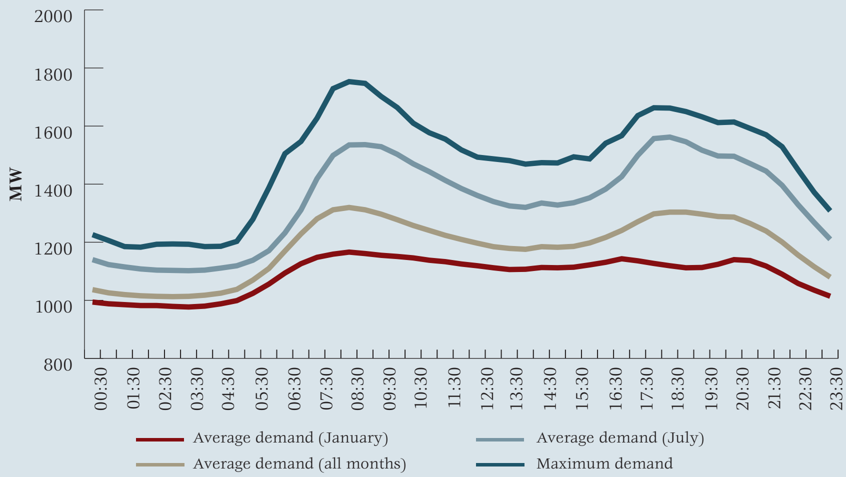

Figure 3: Average daily and maximum load profiles for Tasmania 2007-08[11]

8 Transend 2009.

9 Transend 2009 (Average annual growth rate for winter maximum demand under the medium growth scenario for a 10% probability of exceedance).

10 OTTER 2008.

11 AEMO 2009.

12 ABS 2006, ABS 2009, and estimated performance of electric cars.

3. ELECTRICITY SUPPLY OPTIONS

Key messages

- *There are a range of electricity supply and demand side options that will be part of Tasmania's electricity future. In the near term, additional generation capacity could be provided by biomass, hydro, gas and wind generation. In the longer term, technologies that are at an early stage in the technology innovation/ development process are likely to play an important role; these include solar energy, geothermal energy and marine energy, as well as a range of distributed generation technologies, including storage. Commercialisation of renewable energy options, in particular those that are at the pilot or demonstration stages, will require a supportive policy environment.*
- *New renewable energy development in Tasmania will play a key role in achieving the Tasmanian Government's target to reduce greenhouse gas emissions by 60% below 1990 levels by 2050, and the State's policy objective to facilitate significant renewable development, thereby becoming a net exporter of renewable and low-carbon electricity to the fossil fuel-dominated National Electricity Market. However, until technology costs are lowered through efficiencies of scale, local manufacturing and the 'learning' process, renewable energy technologies will not be commercially viable in the absence of policy support. The Commonwealth expanded Renewable Energy Target, as well as the proposed Carbon Pollution Reduction Scheme and other clean energy funding initiatives, are vital pre-requisites to achieving a higher level of renewable energy generation in both Tasmania and the mainland.*
- *Hydro Tasmania considers that hydro generation has the capacity to play an important role in contributing to the stability of the National Electricity Market as the proportion of variable renewable energy generation (wind and solar PV) increases in the future. Subject to economic viability, this could translate into new commercial opportunities for Tasmania's hydro generation capacity.*
- *The reduction of electricity consumption through energy efficiency has the capacity to make a very significant contribution to offsetting growth in electricity consumption, but realising the benefits is not without challenge. While numerous studies have highlighted the potential to cost effectively improve energy efficiency in the residential, commercial and industrial sectors, action to date has been limited due to a number of barriers, including information failures, misalignment of incentives, capital constraints and behavioural barriers, amongst others. Hydro Tasmania believes that new policy approaches above and beyond a national emissions trading scheme will be required to overcome these barriers.*

Much of Tasmania's electricity generation infrastructure originates from the Tasmanian Government's programme of hydro industrialisation during 1914 – 1990 designed to support electrification of the State and growth of energy intensive mineral processing operations. It commenced with the acquisition in 1914 of the hydro-electric system in the Central Highlands being constructed to provide electricity to the Electrolytic Zinc Company of Australasia, the Australian Commonwealth Carbide Company and the city of Hobart. Expansion of the electricity grid throughout Tasmania and the establishment of several mining ventures and pulp and paper industries saw strong growth in demand in the 1930s, followed by further growth in the 1940s and 50s as a result of the postwar rise in living standards. The 1960s saw rapid investment in generation capacity to attract large energy intensive industries such as aluminum smelting through access to a reliable and competitive electricity supply.[13] The last major development was the Anthony Power Scheme, completed in 1994.

More recently, new generation supply has been dominated by a single gas project, wind and mainland imports via the Basslink interconnector.

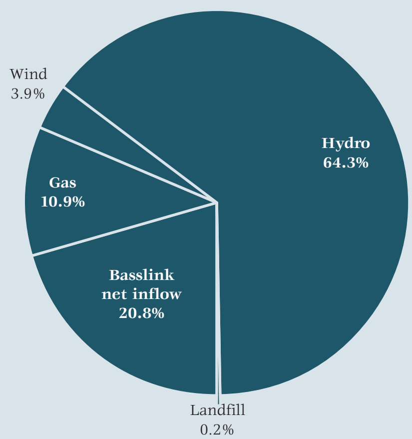

Figure 4: Tasmanian electricity generation mix 2007-08

13 DIER 2004.

Current grid connected electricity generation sources

Electricity production by major generation sources in the Tasmanian mainland in 2007–08[14] was approximately 11,049 GWh, made up of hydro-electricity (7,100 GWh), Basslink net imports (2,293 GWh), gas (1,200 GWh), wind (429 GWh) and landfill gas (27 GWh). The relative contributions of each fuel type are illustrated in Figure 4.

Hydro Tasmania notes that, due to drought and storage rebuild, generation in 2007-08 and 2008-09 is not representative of its expectations for the future or for its long-term output, which for annual planning purposes is 8,700 GWh.

Major generation sources in 2007-08 are detailed in Figure 5.

HYDRO-ELECTRICITY

Tasmanian hydro generation capacity is provided by 29 power stations (refer to Figure 6) using water storages in six major catchments:

- South Esk-Great Lake
- Mersey-Forth
- Derwent
- Pieman-Anthony
- King
- Gordon.

The system comprises two major storages (Lake Gordon/Lake Pedder and Great Lake), five seasonal storages which empty and fill over a year and a number of run-of-river storages with empty/fill cycles of between days and weeks.

At full capacity, Hydro Tasmania's reservoirs are able to store water equivalent to around 14,400 GWh of generation output; consequently hydro-electricity has traditionally dominated the supply mix. Lower water inflow resulting from the sustained drought has led to a progressive decrease in hydro generation in recent years.

Generator	Fuel Type	Capacity (MW)	Approximate 2007-08 output (GWh)
Hydro Tasmania	Hydro	2,270	7,100
Bell Bay[15]	Gas	240	1,169
Basslink		478[16]	2,293[17]
Roaring 40s	Wind	140	429
Aurora Energy Tamar Valley	Gas	105[18]	31
AGL Energy Services and Landfill Management Services	Landfill gas	3.8	27

Figure 5: Major generation sources in Tasmania 2007-08

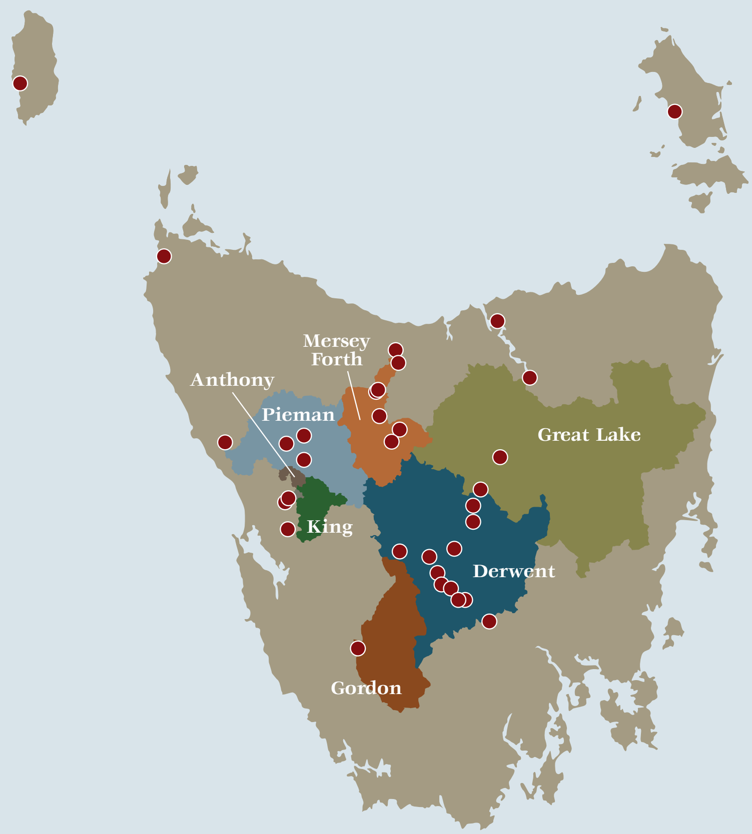

Figure 6: Major storage catchments and power stations in Tasmania

14 Excludes several smaller generators where consumption data is not readily available.

15 Decommissioned in early 2009.

16 Maximum import capacity – subject to system constraints.

17 Hydro Tasmania.

18 The three generating units have been upgraded from 35 MW to 43 MW each.

Analysis of inflow data by Hydro Tasmania indicates a progressive reduction in average inflows since the mid 1970s, with an acceleration of the trend in recent years. Figure 7 illustrates water inflows into the hydro catchments during 1924 – 2008. Average inflows in the ten years to 2008 were approximately 10% below average inflows in the preceding 20 year period (1976 – 1996), and 16% below average inflows in the 50 year period before that (1924 – 1975).

There is uncertainty as to how climate change will affect future outcomes. The Commonwealth Scientific and Industrial Research Organisatoon (CSIRO) and the Australian Bureau of Meteorology project drought occurrence to increase over most of Australia, with simulations showing up to 20% more drought months over most of Australia by 2030.

Analysis by the CSIRO, Hydro Tasmania and the Tasmanian Partnership for Advanced Computing has predicted a range of seasonal and regional variations across Tasmania to 2040 as a result of climate change. These include:[20]

- annual rainfall increasing by 7% to 11% in the west and central areas, and decreasing by around 8% in the north-east, with increased winter and early spring rainfall expected in all areas
- annual potential evaporation increasing in all areas except the west coast and adjacent highlands, where small decreases are indicated.

Research is underway to improve modelling of potential climate change impacts on the State, which may lead to different results.[21]

Water storage levels at any moment reflect the effects of water inflows, water release for environmental flows, hydro generation and irrigation. As water has needed to be released for hydro generation despite lower water inflows, net storage levels have progressively fallen since 2002, as illustrated in Figure 8.

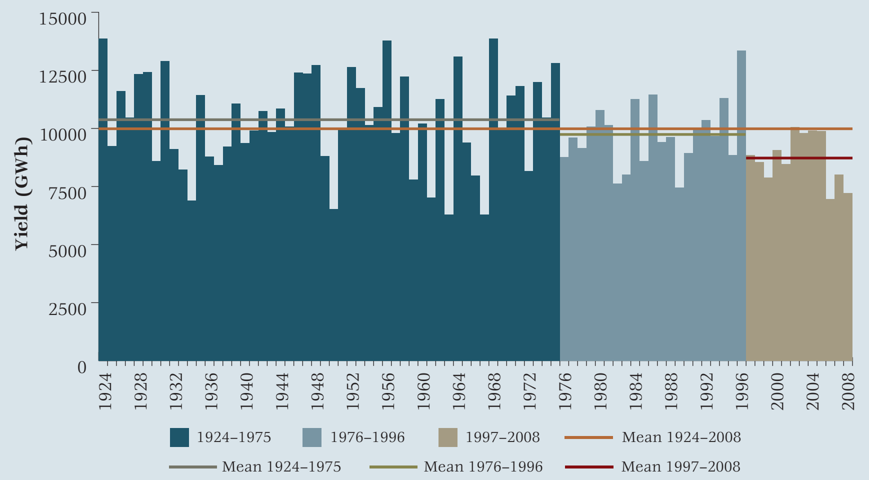

Figure 7: Historical inflows to the Hydro Tasmania system[19]

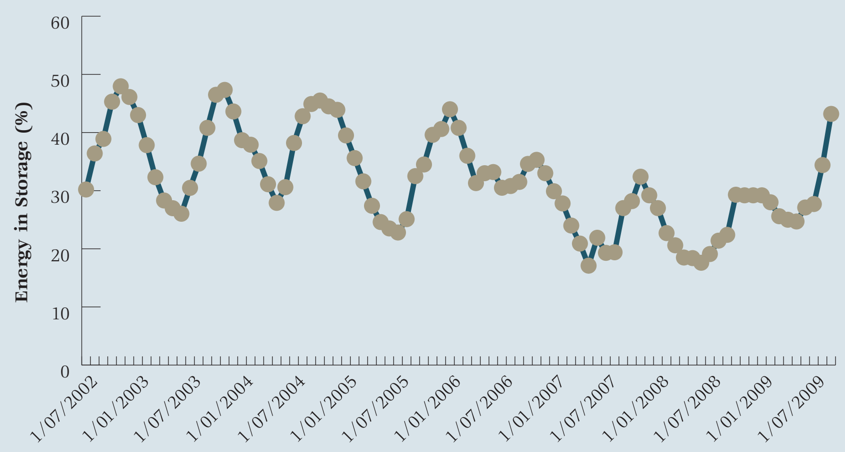

Figure 8: Energy in hydro storages[22]

Storage levels since 1 July 2008 have been maintained by Hydro Tasmania's decision to target storage rebuild to a prudent water management zone, resulting in more electricity being supplied over Basslink.

In conjunction with new generation sources and electricity market arrangements described in this document, Hydro Tasmania has embarked on a programme to rebuild water storage levels and improve output from existing capacity, discussed later in the document.

BASSLINK

In 2000, the Tasmanian Government entered into an agreement with National Grid Australia for the construction of an interconnector between Tasmania and Victoria, known as Basslink, which runs from the 500kV Loy Yang substation in Victoria, across Bass Strait to the 220kV George Town substation in Tasmania. The 290 kilometre undersea cable component is one of the longest undersea cables in the world.

19 Hydro Tasmania.

20 Tasmanian Climate Change Office 2008.

21 ACE CRC 2009.

22 Hydro Tasmania.

Basslink commenced commercial operations on 29 April 2006. It is owned and operated by Basslink Pty Ltd, a wholly owned subsidiary of CitySpring Infrastructure Management Pty Ltd which purchased the interconnector from National Grid Australia in August 2007. The current business model is illustrated in Figure 9.

The Basslink interconnector is a high voltage, direct current link with a continuous rating of 478 MW, but is capable of operating for periods at higher capacity. The link has a maximum short-term export capacity of 594 MW. Direct current (DC) electricity is transmitted via the sub-sea underground and overhead cables and into the converter stations, where it is converted into alternating current (AC) so that it can be connected to the state grids. This approach minimises the losses in the cable.

Basslink enhances security of supply in both Tasmania and Victoria. In Tasmania, it provides protection against the risk of energy shortages caused by prolonged drought over Hydro Tasmania's catchment areas, by offering an additional source of electricity supply. In Victoria, it provides an additional 594 MW of capacity to meet peak load demands. Basslink provides a two-way hedge for Tasmania. The increased capacity and security of supply in Tasmania removes a constraint on industry growth in Tasmania, while Basslink's export capacity allows the sale of any excess energy to the mainland.

Both the import and export operations are affected by the capability of the Tasmanian electricity system to maintain the system frequency in the event of the loss of the link.

Without the Frequency Control System Protection Scheme (FCSPS), the Tasmanian system would limit Basslink to 200 MW export and 144 MW import.

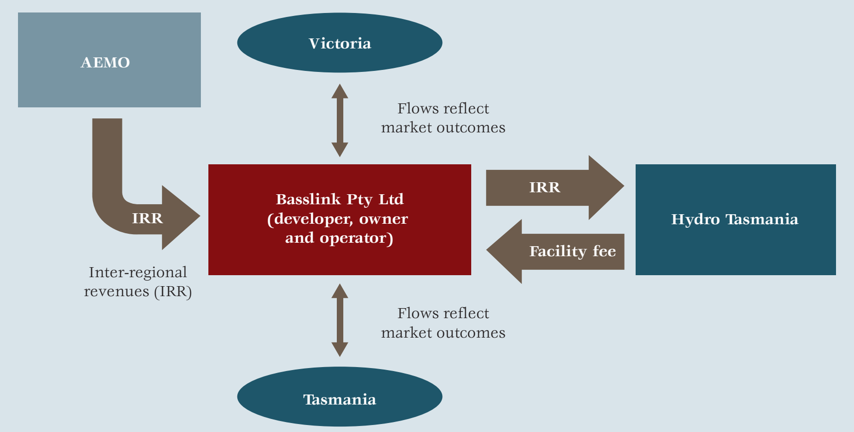

Figure 9: Current Basslink business model

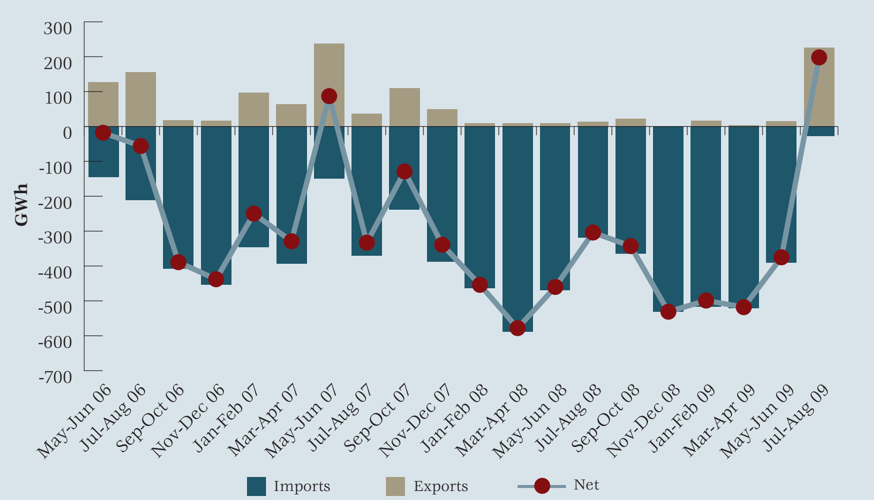

Figure 10: Recent Basslink flows[23]

The FCSPS, operated by the transmission network service provider (TNSP), trips remote generation and customer load to cover the Basslink contingency. This allows Basslink flows to 594 MW export and 478 MW import.

Basslink is "dispatched" by the Australian Energy Market Operator (AEMO) based on the offers made by generators in Tasmania and on the mainland and system security constraints (refer section 4 for more details on National Electricity Market operation).

As illustrated in Figure 10, during the period November 2007 to June 2009, Basslink was importing strongly due to the low water inflows experienced in Tasmania. During the 2007-08 financial year, Basslink supplied 2,520 GWh to Tasmania and 226 GWh to the Vic Region, and 2,642 GWh to Tasmania and 72 GWh to the Vic Region during the 2008-09 financial year.[24]

23 Hydro Tasmania.

24 Hydro Tasmania.

NATURAL GAS

In 2001, Duke Energy entered into a development agreement with the Tasmanian Government to bring natural gas to Tasmania. Following construction of the transmission pipeline in 2003, the Tasmanian Government entered into development agreements with Powerco Ltd (now Tas Gas Networks Pty Ltd) for the construction and operation of the gas distribution network. Gas for the emerging Tasmanian market is sourced primarily from the Gippsland Basin, offshore of south-east Victoria.

Excluding power generation, the total amount of natural gas delivered to Tasmanian customers is the equivalent of 520.2 GWh of electricity.[25] Capacity is not currently fully utilised, with significant ability to increase throughput without additional major capital expenditure. Liquid Petroleum Gas (LPG) is also used as an energy source by the residential, commercial and industrial sectors throughout Tasmania.

Current major gas generation capacity in Tasmania comprises the following gas turbines owned by Aurora Energy (Tamar Valley) Pty Ltd (AETV):[26]

- 210 MW combined cycle gas unit (CCGT) expected to be operational by end September 2009
- 60 MW open cycle gas turbine (OCGT) (operational)
- 3 x 43 MW OCGT (operational).

The two 120 MW Bell Bay Power Pty Ltd thermal generators, commissioned in 1971 (essentially for drought proofing) and later converted to natural gas (completed in 2002), were decommissioned in early 2009.

WIND ENERGY

Wind energy is one of the fastest growing forms of electricity generation. Globally, wind generation capacity has grown by an average of 30% each year over the last ten years.[27]

Utility scale wind energy developments in Tasmania were pioneered by Hydro Tasmania, initially on King Island. Current grid connected wind generation in Tasmania is provided by two wind farms, Woolnorth Bluff Point and Woolnorth Studland Bay, which have a combined capacity of 140 MW.[28] These developments are now owned by Roaring 40s – a 50/50 joint venture partnership between Hydro Tasmania and the China Light and Power (CLP) Group.

OTHER GENERATORS

Other electricity generation is contributed by a number of small scale generators. These include the following landfill gas, mini hydro and steam turbine generators:[29]

- landfill gas – Jackson Street, Glenorchy (2.0 MW); Launceston (1.1 MW); and McRobies Gully (2.0 MW)[30]
- mini hydro – Meander Dam (1.9 MW); Nieterana (2.2 MW); Parangana (0.8 MW)[31]
- cogeneration and distributed generation – TEMCO (10 MW);[32] Australian Paper (4 MW and 5 MW).[33]

25 OTTER 2008.
26 Capacity details from OTTER 2009.
27 Global Wind Energy Council (GWEC).
28 Transend 2008.
29 OTTER 2008.
30 Transend 2009.
31 Transend 2009.
32 Transend 2009.
33 OTTER 2009.

Proposed and potential electricity generation options

Future electricity generation in Tasmania could be provided by a range of generation technologies, some of which are currently in the very early stages of the technology innovation/development process. Additionally, the requirement for new generation capacity could be avoided by energy efficiency measures. This section provides a brief overview of each of these technology options, including reference to long run marginal costs (LRMC) and technology development status. There is wide variation in LRMC estimates for some technologies, with a notable lack of Tasmanian-specific data; additionally, figures are dependent on assumptions made in each particular study. Consequently, LRMC figures quoted generally refer to Australian averages.

For consistency, Hydro Tasmania has used, unless otherwise stated, LRMC estimates from ACIL Tasman[34] to ensure coherent referencing and a common source of data. Hydro Tasmania does not necessarily agree with or endorse this data as representing actual technology costs now or into the future.

WIND

Located in the path of prevailing westerly winds (Roaring 40s), Tasmania has world-class resources for the generation of wind power. The identification of suitable land for new wind farms is being undertaken by several wind farm developers and will require not only an area with a high and consistent wind speed but also good access to the grid and consideration for the minimisation of environmental and social impacts. Additional wind farms are planned for the State with a combined capacity of up to 1,025 MW. These are:

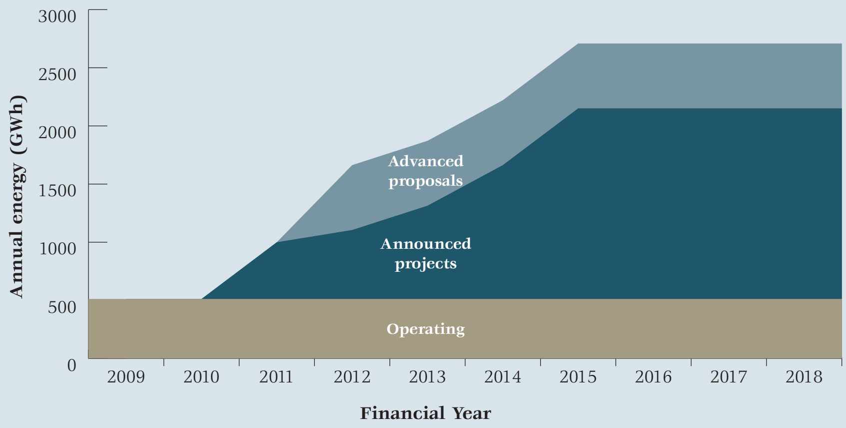

Figure 11: Future wind capacity in Tasmania[40]

- Musselroe Wind Farm (up to 140 MW), with an indicative commissioning time of mid 2010[35]
- Robbins Island and Jims Plains Wind Farms (up to 360 MW), with planned commissioning in stages from 2014[36]
- White Rock Wind Farm (up to 300 MW) due to be commissioned by June 2014[37]
- Cattle Hill Wind Farm (up to 225 MW) due to be commissioned by June 2012.[38]

LRMCs for wind generation are estimated at around $98/MWh,[39] with future costs dependent on global demand supply for wind turbines, commodity (in particular steel) prices, exchange rates and further reduction in technology costs.

The successful commissioning of announced and advanced project proposals has the potential to contribute over 2,500 GWh per annum of renewable energy, equivalent to approximately 21% of estimated demand in 2018.

HYDRO ENHANCEMENT OPPORTUNITIES

It is unlikely that additional large scale flooded hydro generation will be developed in Tasmania in the future. However, given the incentives provided by the expanded renewable energy target, the imposition of a price on carbon emissions and other funding programmes, there is scope for small scale, run-of-river projects and enhancements to existing generation plant.

Hydro Tasmania has embarked on a programme to recover 1,000 GWh of energy lost due to a reduction in inflows as a result of drought and potentially climate change over the past 12 years. This programme will include proposed enhancements to existing hydro stations including catchment diversions and diversion upgrades; new storages to act as regulating storages to capture higher inflows in winter; and raising existing storages; mini hydro schemes; and new power station development or redevelopment of existing power stations.

In addition, Cascade Renewable Energy Pty Ltd has been issued with a licence for 1.15 MW of electricity generation from an impulse type hydro turbine to be connected to the existing irrigation pipe from the Cascade Dam.[41]

34 ACIL Tasman 2008; ACIL Tasman 2009.
35 OTTER 2009.
36 Transend 2009.
37 AEMO 2009e.
38 EPA 2009b
39 ACIL Tasman 2008.
40 Based on data from NIEIR 2008. It must be noted that these projections were prepared in 2008 and that circumstances have changed considerably since.
41 OTTER 2009.

Hydro generation has the capacity to play an important role in contributing to the stability of the National Electricity Market (NEM) as the proportion of variable renewable energy generation (wind and solar) increases in the future. Subject to economic viability, this could translate into new commercial opportunities for Tasmania's hydro generation capacity. The Garnaut review noted that "the anticipated growth in variable supply technologies (wind and solar) and ongoing, above-average growth in peak demand mean that existing hydro-electric infrastructure will play an enhanced role as a provider of flexible and readily available stored energy to meet short-term demand peaks. This role could be substantially expanded through judicious investment aimed at making the hydro-electricity assets important balancing components in the eastern Australian system. Australia's main hydro-electric assets—in the Snowy Mountains and Tasmania—will have increased value, far beyond that suggested by their installed capacities alone."[42]

There may also be scope for pumped storage generation, where renewable energy generation can be used during off-peak times to pump released and stored water to dams above the power station, enabling the water to be re-used for power generation.

Tasmania's hydro assets are ageing. Over 40% of future hydro generation capacity will be provided by generation assets that are past their mid-life. If properly maintained, these stations will continue to provide renewable energy to meet market needs. Appropriate investment incentives, however, are required to implement upgrades and to counteract asset operational wear and ageing, and therefore to ensure that the required asset performance is achieved.

The LRMC of new hydro generation is estimated at $72/MWh.[43]

NATURAL GAS

Gas-fired generation, by virtue of lower greenhouse gas emissions intensity compared to coal, is expected to increase significantly in the NEM following the introduction of a price on carbon emissions.

In Tasmania, the new Tamar Valley Power Station, a 210 MW CCGT unit, will be fully commissioned by September 2009,[44] which will be supported by an additional 189 MW of OCGT capacity (1 X 60 MW plus 3 X 43 MW). Cumulative output from these units will depend on how they are dispatched into the NEM.

There is also potential for 'cogeneration' – the simultaneous production of electricity and heat within commercial and industrial facilities. Fonterra Australia Pty Ltd is proposing to install and operate a 2 MW gas-fired power and hot water cogeneration plant at its cheese production facility at Wynard. The plant will provide power and hot water to the facility and will reduce the use of the existing gas-fired boilers at the site.[45]

Tasmania is in the vicinity of proven gas reserves, but this does not necessarily guarantee commercial access to that gas. That is, any gas-fired generator would need to secure its gas supply. Esso Australia, along with joint venture partners BHP Billiton and Santos, is progressing a new gas and condensate field, Kipper, in the well-established long-term producing oil and gas fields of the Gippsland Basin. The Kipper project will be the biggest gas development on the eastern seaboard since the Esso and BHP discovery of the Bass Strait oil and gas fields 40 years ago. First gas production is expected in 2011.[46] Several other gas field developments are also underway in the Gippsland and Otway Basins and include a potential 965 PJ from the Longtom, Henry and Basker-Manta-Gummy Gas Projects.[47]

The estimated LRMC of new gas-fired generation ranges from $58/MWh for CCGT, excluding the price of carbon, through to $113/MWh for OCGT with a $25/t$CO_2$-e carbon price.[48]

BIOMASS

Biomass refers to biological material that can be used as fuel. Common biomass sources include woodchips, wood pellets, low-grade wood wastes, agricultural crop residues, organic wastes, amongst others. Biomass fuel is combusted or gasified in systems that produce heat, electricity, or both. The technology is regarded as mature.

There are several biomass projects that have been or are under consideration in Tasmania. These include Newood Huon's 35 MW wood waste plant at the proposed Huon Wood Centre[49] and power export from the proposed cogeneration plant at the proposed Gunns Bell Bay Pulp Mill (176 MW during winter and 184 MW during summer).[50] There is uncertainty regarding if/when these projects will be implemented. The principal challenge biomass generation projects face is access to reliable and competitive biomass resources.

The estimated LRMC of new biomass generation has been estimated to be approximately $70/MWh.[51] However, this would be highly variable depending on the resource used, its proximity to the generator and the generation technology employed.

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42 Garnaut, R 2008.
43 ACIL Tasman 2008.
44 Aurora Energy 2009.
45 EPA 2009.
46 Roarty, M 2008.
47 Department of Primary Industries 2009.
48 Derived from ACIL Tasman 2008; ACIL Tasman 2009.
49 Newood 2009.
50 AEMO 2009b.
51 ACIL Tasman 2008.

GEOTHERMAL

Geothermal energy is heat energy contained within the surface of the earth. Geothermal energy can be used for direct heat, or for generating electricity. Conventional geothermal systems use hot groundwater reaching the surface naturally in geologically active regions to produce electricity. More recently there has been a significant push to unlock the thermal energy embedded deep within the earth in Hot Dry Rock resources or Hot Sedimentary Aquifers through Engineered (or Enhanced) Geothermal Systems (EGS). While the technology holds much promise in Australia, it is yet to be demonstrated on a commercial scale.

The geothermal resource in Tasmania is still being evaluated. Active prospecting by Kuth Energy, Geopower and Geothermal Energy Tasmania[52] is underway. An indication of the potential resource in GWh terms is not possible until developers reach the resource proving stage. Early indications suggest that heat levels for the Hot Dry Rocks resource are of similar values to that found in the Cooper Basin[53] but with the advantage of good access to transmission infrastructure.

The LRMC for geothermal pilot and demonstration plants is believed to be in the order of $150 and $105/MWh[54] respectively, although the technology is currently at the pilot stage in Australia.

SOLAR

The use of solar energy for generating electricity is growing rapidly across the world as a result of supportive policy initiatives. Two broad technology approaches are being adopted. The first, and more commonly known, is the conversion of sunlight or concentrated sunlight by photovoltaic (PV) devices (solar panels). The second approach, known as solar thermal generation, uses concentrated solar radiation to produce heat (for example steam) for generating electricity. Both technologies have been proven on a commercial scale.

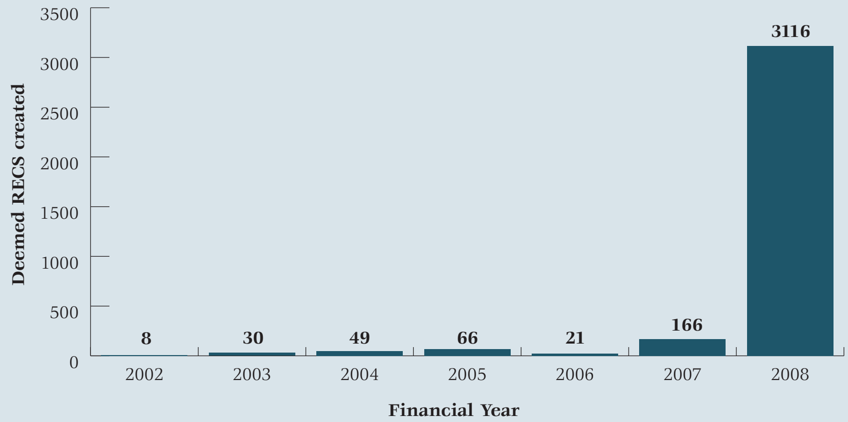

Figure 12: RECs created by small solar PV installations in Tasmania[55]

In the absence of energy storage, solar energy can only be tapped during sunlight hours, and consequently, from a grid connected perspective, conversion technologies have greater economic viability in regions with high sunlight exposure. Solar energy costs are expected to reduce significantly as global deployment increases.

There has been steep growth in solar PV installations in 2008 – reflected in the number of Renewable Energy Credits (RECs) created. As RECs are 'deemed' for future years, the numbers in Figure 12 reflect aggregate output over future years. However, given current technology costs, near term growth will depend heavily on Commonwealth and State Government funding programmes.

In 2008, the Tasmanian Government released a consultation paper[56] exploring options for a feed-in tariff for solar PV installations.

The LRMC for solar PV is around $333/MWh[57] and for solar thermal around $199/MWh[58], although technology costs are projected to fall significantly in the years ahead.

MARINE ENERGY

The generation of electricity from tidal energy, by water flowing into and out of gates and turbines installed along a dam or barrage built across a tidal bay or estuary, is well known. In recent years there has been growing interest in capturing the energy potential of ocean currents and waves, in particular *ocean current generation*, which involves tapping the energy in ocean currents through a range of technologies including fixed or floating underwater turbines, and *wave energy generation*, which covers a wide range of technologies that convert wave motion into energy. Both technologies are at the pilot/demonstration phase, with large scale commercial deployment not anticipated for many years.

Cost estimates for the generation technologies have not been assessed in Australia. However, studies overseas indicate costs in the range of $190/MW to $380/MW.[59]

52 DIER 2009.
53 Lewis, R 2008.
54 MMA 2008.
55 Based on data from the REC Registry.
56 DIER 2008.
57 ACIL Tasman 2008.
58 ACIL Tasman 2008.
59 IEA 2008.

Tasmania has a relatively good wave energy resource, particularly on the west coast.[60] BioPower systems, in collaboration with Hydro Tasmania, is progressing two projects in the Bass Strait islands, each of 250 kW.[61]

OTHER ENERGY SOURCES

There are substantial coal resources in Tasmania. Three black coal mines in Tasmania are estimated to contain a resource of 0.5 billion tonnes.[62] Any decision to produce coal-fired electricity in Tasmania would have to factor in the likely effect of future carbon imposts, the costs of adopting clean coal generation technologies (incorporating carbon capture and storage), the scale of viable coal-fired generation compared to Tasmanian market demand, the scope for other renewable energy options and environmental scrutiny during the permitting process. There are no proposed developments in Tasmania at this moment in time.

While the potential is unclear, Tasmania may have coal seam gas resources, which are rapidly becoming an attractive gas resource in some mainland states. Coal seam gas can be used to generate electricity with a greenhouse gas emissions impact lower than that from the combustion of coal in conventional generation technologies.

Implications of climate change and renewable energy policy

Subject to the passage of legislation, the Federal Government's proposed Carbon Pollution Reduction Scheme will place a price on greenhouse gas emissions within a large part of the Australian economy. In the electricity generation sector, this means an increase in the LRMC of fossil fuel-based technologies in proportion to their greenhouse gas emissions intensity. The LRMC of renewable energy technologies is unaffected by carbon cost imposts due to their zero emissions attributes.

The Tasmanian Government has committed to reducing State greenhouse gas emissions by 60% below 1990 levels by 2050.[63] Hydro Tasmania also notes the State's policy objective to facilitate significant renewable development, and to become a net exporter of renewable and low-carbon electricity to the fossil fuel-dominated NEM.[64]

New renewable energy development in Tasmania will play a key role in achieving this target. However, until technology costs are lowered through efficiencies of scale, local manufacturing and the technology 'learning' process, renewable energy developments will not be commercially viable in the absence of policy support. The Commonwealth expanded renewable energy target, together with the proposed national emissions trading scheme and other clean energy funding initiatives, are vital pre-requisites to achieving a higher level of renewable energy generation in both Tasmania and the mainland.

Demand side options

New electricity demand can be met by new generation capacity, or by reducing existing electricity consumption. The costs of doing so are in some cases less than the costs of building new generation capacity.

Energy efficiency should not be confused with power rationing. The former is the considered investment to achieve sustained reductions in electricity consumption without compromising utility and comfort. The latter is the forced reduction of consumption.

The reduction in electricity consumption through energy efficiency measures is widely acknowledged as being the least cost measure to reduce greenhouse gas emissions. While numerous studies have highlighted the potential to cost effectively improve energy efficiency in the residential, commercial and industrial sectors, action to date has been limited due to a number of barriers, including information failures, misalignment of incentives, capital constraints and behavioural barriers, amongst others.[65] New policy approaches above and beyond a national emissions trading scheme will be required to overcome these barriers.

Detailed information on the full potential from energy efficiency improvements in Tasmania is not available. However, national and State studies have clearly identified opportunities to cost effectively reduce electricity demand.

Residential Sector: A 2008 study estimates the energy efficiency potential in the residential sector in Australia to be between 13% and 73%.[66]

60 Carnegie 2008.
61 Biopower Systems 2009.
62 ACA 2009.
63 *Climate Change Act* 2008.
64 Tasmanian Climate Change Office 2008.
65 Climate Institute 2008.
66 MMA 2008b.

Commercial Sector: Buildings make up a significant proportion of electricity consumption in the commercial sector. A recent audit of Tasmanian Government commercial buildings found that it would be possible to reduce electricity consumption by 27%, with payback of eight years on average (ranging from six to 12 years).[67]

Industrial Sector: Aggregate data on industrial energy efficiency potential in Tasmania is not readily available. However, it is possible to make rough estimates by applying opportunities reported by major industrial users under the Energy Efficiency Opportunities (EEO) Programme. EEO reports are presented at the corporate group level for all energy sources, including electricity. An assessment of identified industrial energy efficiency opportunities by large industrial facilities in Tasmania reveals energy savings (for all sources including electricity) of 2% by projects, with a payback period of less than two years and a further 3% energy savings potential by projects, with payback periods of two to four years.[68]

Demand side options also include distributed generation, where small scale generators connect to the distribution network rather than to the transmission network. Distributed generation includes a wide variety of generation solutions such as residential solar PV systems, small scale 'micro' wind energy generation, cogeneration within commercial or industrial facilities, and potentially in the future, electric vehicles that are able to inject stored electricity into the distribution network when required.

67 PB 2008.

68 Department of Resources, Energy and Tourism 2009.

4. ELECTRICITY MARKET ARRANGEMENTS

Key messages

- *The current electricity market arrangements represent a significant departure from the past integrated industry, and present opportunities as well as risks to energy companies.*
- *Energy companies may need to pursue new avenues to compete and thrive in this new environment. Hydro Tasmania considers that this could include investing in generation, growing market share in the mainland and entering into new strategic partnerships that open up opportunities to develop and market new services to customers.*

Date	Power Consumption (GWh/year)
1 July 2006	>=20 GWh/yr
1 July 2007	>=4 GWh/yr
1 July 2008	>=0.75 GWh/yr
1 July 2009	>=0.15 GWh/yr
1 July 2010[70]	Under 0.15 GWh/yr

Figure 13: Tasmanian retail contestability timetable

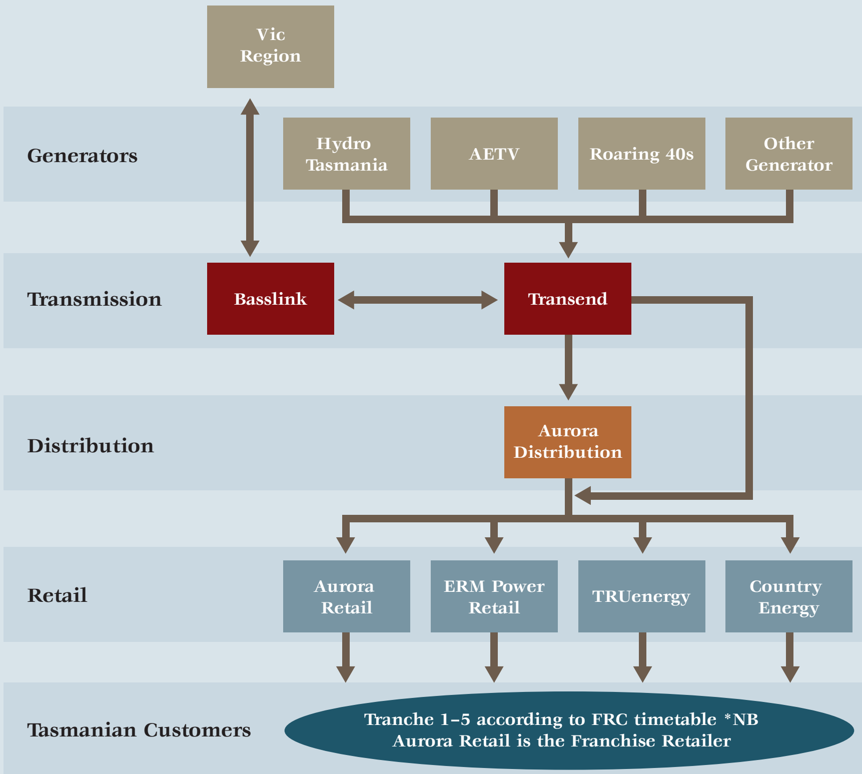

Figure 14: Current Tasmanian electricity industry structure

Evolution of industry structure

The purchase by the Tasmanian Government of a private hydro development in the Central Highlands in 1914 established the policy of public ownership of electricity assets which has continued to this day. Under this policy, the key industry functions of electricity generation, transmission and distribution were carried out by an integrated government entity – 'the Hydro-Electric Commission (HEC)'.[69] Historically, the responsibility for ensuring that there was sufficient electricity generation to meet electricity demand was effectively vested in this integrated entity.

69 DIER 2004.
70 Subject to decision by the Tasmanian Government on an assessment of benefits and costs.

Since the late 1990s, there have been significant changes under the State energy reform agenda. Key milestones include:

- disaggregation of the HEC into separate generation (Hydro Tasmania), transmission (Transend Networks) and distribution and retail (Aurora Energy) businesses in July 1998
- Tasmania's entry into the National Electricity Market (NEM) in May 2005
- the physical linking of Tasmania with the mainland via the Basslink interconnector in April 2006
- progressive deregulation of the retail market from July 2006 onwards,[71] where electricity consumers are able to select an electricity retailer of their choice under a staged timetable, as outlined in Figure 13.

Disaggregation of the HEC and Tasmania's entry into the NEM were critical steps in facilitating wholesale and retail competition – evidenced by today's industry structure which features multiple competing generation companies and electricity retailers, illustrated in Figure 14.

National Electricity Market and wholesale competition

OVERVIEW OF NEM[72]

The NEM was established as a wholesale electricity market for the supply of electricity produced by generators (sellers), to electricity retailers and certain end-users (wholesale buyers) in Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia in December 1998. Tasmania joined the NEM in May 2005. The NEM operates under rules and governance provisions of National Electricity Law and Statutory Rules, which include technical and economic aspects of the operation of the wholesale electricity market and the electricity network system.

The NEM was originally administered by the National Electricity Market Management Company Limited (NEMMCO) – a legally constituted corporation whose members included the governments of Queensland, New South Wales, the Australian Capital Territory, Victoria, South Australia and Tasmania. NEMMCO's highest priority was the management of power system security, which ensures security of supply in the event that a major generation unit or transmission interconnector fails.

Following recent national reforms, a new entity, the Australian Energy Market Operator (AEMO), commenced operations on 1 July 2009. The AEMO combines existing market operators, including NEMMCO, and will deliver gas and electricity market operation and planning functions (including an expanded transmission planning role) within a single organisation. The AEMO has been established as a not for profit, limited liability company under Corporations Law, with government holding 60% of membership and industry holding the remaining 40%. Government members include the state governments of Queensland, New South Wales, Victoria, South Australia and Tasmania, the Australian Capital Territory and the Commonwealth. Industry members include Australia's major energy generators and retailers. A review of the ownership structure will be undertaken three years after commencement.

Under NEM rules, offers from generation units are dispatched[73] to meet electricity demand for the lowest cost – commonly referred to as electricity 'pooling' or the 'spot market'. This process results in half hourly 'spot prices' in each region (which largely follow state boundaries). Wholesale buyers purchase electricity at spot prices, and all NEM sellers receive the spot price for electricity produced. Given these pooling arrangements, it is impossible to determine which generator produced the electricity purchased by a particular wholesale buyer.

Spot prices can be extremely volatile – varying from negative $1,000 to $10,000/MWh. Consequently, NEM generators and wholesale buyers enter into financial contracts (referred to as 'hedges') which provide sellers with certainty of price and buyers with certainty of cost. There is an active market in trading such financial contracts, which includes non-electricity market participants such as major banks and other financial market intermediaries.[74]

Future price expectations, reflected in forward financial contract prices, provide the signal for investment in new generation, which ensures that there is sufficient generation capacity in the market to meet future demand.

WHOLESALE COMPETITION IN THE NEM

The NEM has been designed to facilitate competition at the 'wholesale' level, which enables new electricity generators to enter the electricity market and/or major electricity users to purchase electricity directly from the NEM.

At the generation level, AEMO projections of supply and demand, the spot price and forward contract prices provide the market signals required to inform project proponents for new generation investment. These projects may include new entrants seeking to compete with industry incumbents.

71 For more details refer to http://www.power.tas.gov.au/

72 For more information on NEM, refer to www.aemo.com.au

73 Mandatory for generators greater than 30 MW.

74 Such players trade financial contracts without any involvement in trading physical electricity.

New electricity generators entering the market need to apply for an electricity generation licence from the relevant regulator, become a registered market participant with AEMO and, where applicable, be capable of being dispatched by the market operator. They are then in a position to sell their generation output directly into the NEM and receive the spot price or contract with a retailer or customer for the sale of electricity at the same connection point. Any exposure to electricity price and volume risk can be managed by entering into a wide variety of financial contracts with other electricity market players, including electricity retailers, financial market participants and major electricity users.

Smaller generators have the flexibility of not registering in the NEM and selling their output directly to an electricity retailer.

Subject to satisfying eligibility criteria, and meeting contestability requirements, the NEM also enables end users of electricity to purchase electricity directly from the wholesale market (rather than from a retailer) at the spot price. In this case they would typically use financial contracts to manage their price risk.

Retail competition

Deregulation of the retail market marks a step change in the Tasmanian electricity market.

Competition in the supply of electricity is made possible by the regulatory separation of activities associated with management of the electricity distribution network (commonly referred to as the network or 'wires' business) and activities associated with the purchase and sale of wholesale electricity from NEM (commonly referred to as electricity retailing). While Aurora Energy carries out both these functions in Tasmania, it is required to provide non-discriminatory access to its network to competing electricity retailers.

Retail competition is being phased in progressively (refer to Figure 13), with customers consuming over 150,000 kWh (0.15 GWh) currently able to choose their electricity supplier. While the Tasmanian Government has a policy position to introduce Full Retail Competition (FRC), and has nominated a start date of 1 July 2010, it has reserved its final decision on whether it will do so pending consideration of the assessment of benefits carried out by the Office of the Tasmanian Economic Regulator.

Deregulation of the retail market has led to three new electricity retailers entering the Tasmanian market. Statistics on the market share of each retailer in the competitive segment are not available due to commercial sensitivities.

Customers who are not yet able to choose their supplier will continue to be supplied by Aurora Energy, under a regulated tariff. The contribution of the various elements that make up the total cost of supply to these customers is illustrated in Figure 15.

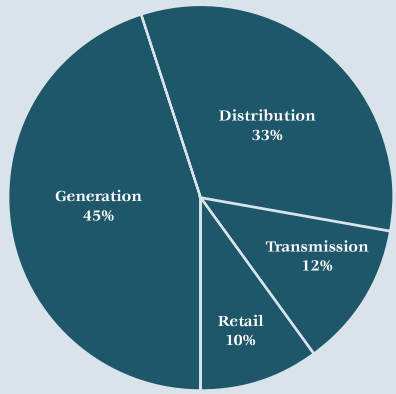

Figure 15: Components of costs of electricity supply for tariff customers in Tasmania[75]

Transmission and distribution costs, which account for around 45% of the total cost, will be common to all retailers, and retail costs are anticipated to contribute around 10% of the total cost. New electricity retailers in Tasmania have identified the following as being important considerations in determining whether they would be competitive in the Tasmanian market.[76]

- Accessing wholesale energy at reasonable cost.
- Having physical hedges, either within Tasmania or through Basslink.
- Achieving acceptable retail margins.
- Accessing sufficient customer data to make offers.
- Operating as a dual fuel retailer of electricity and gas.
- Operating in interstate markets.
- Having "critical mass", which retailers variously defined to be between 20,000 and 70,000 customers.

Finally, it must be recognised that the total market in Tasmania (approximately 273,000 customers)[77] is small compared to mainland markets (several million customers).

75 OTTER 2008b.

76 Network Advisory Services 2008.

77 OTTER 2008.

The costs to customers of implementing FRC must be balanced against the benefits, including the following.

- Customers will be able to choose between competing retail suppliers, and therefore will be able to choose between innovative offerings.
- Electricity retailers will be incentivised to develop and deploy products and services incorporating renewable and non-renewable energy sources, new communications, control and metering technologies that will allow customers to maximise the value of their electricity spend and improve greenhouse gas emissions outcomes and network infrastructure efficiency.
- Electricity retailers are likely to offer a range of 'smart' energy services including real time demand management and distributed generation, supported by smart communications and metering devices.

Implications for energy companies

The electricity market presents opportunities as well as risks to energy companies. Competition at both generation and retail levels means that Hydro Tasmania is competing with other generators – including Aurora Energy - and that Aurora Energy is already competing with other retail suppliers.

The experience in mainland and other overseas deregulated electricity markets is that vertical integration of generation and retail activities (i.e. where generation and retail activities are combined within so called 'gentailers') is an effective strategy for commercial success. Energy companies are likely to be facing well resourced, vertically integrated new entrants seeking to capture market share.

Energy companies must be in a position to respond competitively. This is likely to require them to seek out opportunities to invest in generation, grow market share and enter into new strategic partnerships that open up opportunities to develop and market new services to customers.

5. SECURITY OF SUPPLY

Key messages

- *The National Electricity Market (NEM) provides a comprehensive market and institutional framework to ensure that supply reliability is maintained in Tasmania at the lowest possible cost. Under this framework, responsibility for ensuring that there is sufficient generation capacity to meet future demand is effectively vested in the market, and not in any particular energy sector company – a fundamental change from the pre-electricity reform era, where until recently, Hydro Tasmania shouldered this responsibility.*
- *The new market driven framework greatly reduces the need for Government intervention in regard to managing the energy supply-demand balance; however, for market responses to occur, price signals must flow through to generators and end users.*
- *Current industry modelling indicates that the combination of current and proposed on-island generation plus Basslink imports provides a significant buffer against hydrological variability or other contingencies in the Tasmanian generation mix.*
- *Future supply-demand scenarios could range for example from (a) an under-supply situation; (b) a supply-demand equilibrium; or (c) an over-supply situation. New generation investment decisions should therefore be tested against multiple scenario outcomes rather than being predicated on a single supply-demand scenario. Basslink, through its ability to import or export, provides a valuable balancing capability against an under-supply or over-supply situation.*

Maintaining security of supply in the NEM

The Australian Energy Market Commission (AEMC),[78] an independent body established to undertake rule making and market development in the NEM, is required under the National Electricity Law to establish the Reliability Panel. The Panel is responsible for monitoring, reviewing and reporting on the safety, security and reliability of the national electricity system. The Panel is also responsible for establishing the Reliability Standard in the NEM. The Standard is expressed as the amount of energy at risk of not being supplied due to insufficient generation, transmission or demand reduction capacity (currently no more than 0.002% of annual regional energy consumption).

To monitor supply reliability in each region, the Australian Energy Market Operator (AEMO) calculates two benchmarks – the *minimum reserve level*, which is the minimum available spare generation capacity required to meet the Reliability Standard; and the *reserve margin*, which is the difference between the supply available to a region (including demand reduction and capacity available from other regions via interconnectors), and demand. A *reserve deficit* occurs when the reserve margin falls below the minimum reserve level.

AEMO assesses reserve margins on a dynamic basis over the short, medium and long term.

The short-term *Projected Assessment of System Adequacy* (PASA) process, updated every two hours, provides forecast information on the supply-demand balance for each half hour in each NEM region over the next seven days.

The medium-term PASA process is run at least once a week, and provides reserve forecast information for every day over the next two-year period.

The annual Statement of Opportunities presents AEMO's assessment of the future adequacy of NEM electricity supplies to meet projected demand for the next 10 years.

Finally, AEMO is developing an assessment of energy adequacy for the whole market. This was precipitated by the drought of 2007-08, and estimates the probability of energy shortfalls from either a lack of water for hydro generation, or a lack of cooling water for thermal plant. It will be implemented in 2010 and replace the existing quarterly Drought Report.

Together, these assessments provide a robust signaling framework for ensuring the continuity of electricity generation investment in each NEM region. AEMO has the authority to intervene in situations where market security is threatened, and restore market stability by directing generation operation and/or load shedding.

78 Established in 2005 to undertake rule making and market development functions for national electricity and gas markets.

Projected supply-demand balance in Tasmania

In its most recent annual planning report, Transend assessed the ability of the generating system to meet maximum demand in Tasmania under the following four scenarios.[79]

- Scenario 1 – all hydro, thermal and wind generators as per their full name-plate rating.
- Scenario 2 – all hydro, thermal and wind generators as per their full name-plate rating with Basslink in-service and two largest machines out-of-service.
- Scenario 3 – all hydro, thermal generators in-service operating at heir full name-plate rating and zero contribution from wind generators and Basslink and the two largest machines out-of-service.
- Scenario 4 – all thermal generators in-service as per their full name-plate rating, all hydro generators except for Gordon Power Station out-of-service, 5% wind contribution and 300 MW constraint on Basslink and one large generator out-of service.

The resulting projections of excess generation capacity are illustrated in Figure 16.

Transend's investigations suggest that generation capacity is able to meet projected demand until 2028 under all four scenarios.

As noted by AEMO in its 2008 Statement of Opportunities, consideration of generation capacity alone will not indicate a reserve shortfall resulting from energy limitations; given Tasmania's high dependence on hydro generation, it is therefore possible for reliability to be affected due to energy constraints (as opposed to capacity constraints).[81]

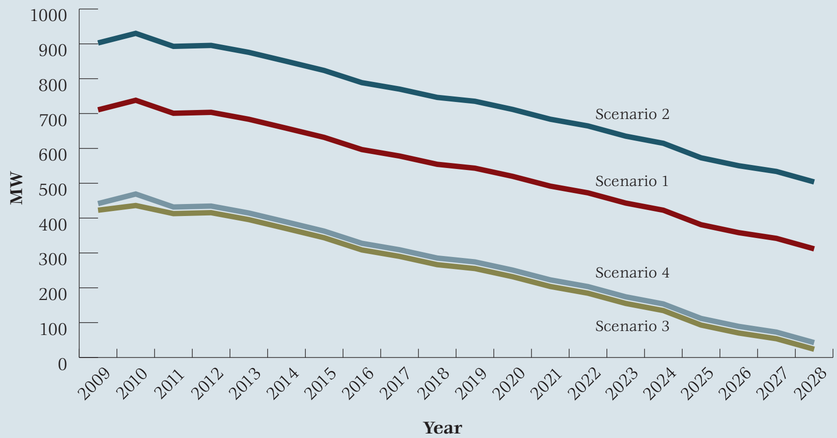

Figure 16: Projected excess generator capacity under generation scenarios[80]

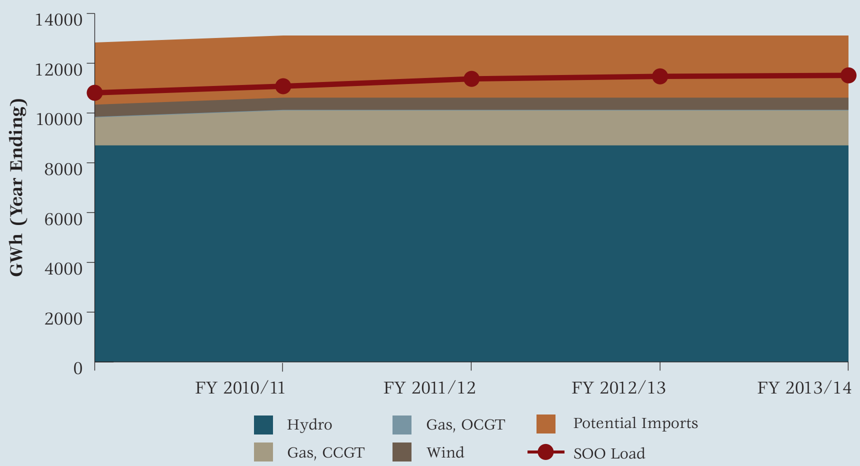

Figure 17: Projected supply and demand balance in Tasmania to 2014[83]

From an energy (as opposed to demand) perspective, Hydro Tasmania has developed a projection of the long-term supply and demand balance based on business as usual conditions – illustrated in Figure 17. This indicates that the combination of current and proposed on island generation plus Basslink imports[82] provides a significant buffer against hydrological variability or other contingencies in the Tasmanian generation mix.

The preceding assessment represents one of many possible supply-demand scenarios. A full examination of possible scenarios is outside the scope of this document. However, as an illustrative example, it is possible to construct several high level scenarios based on how supply and demand factors might interact in the future.

For example, key demand factors include the level of national and

79 Transend 2009.

80 Transend 2009.

81 NEMMCO 2008.

82 Based on historical averages.

83 Hydro Tasmania 2009. Based on: (a) hydro production of 8,700 GWh to match expected inflows; (b) capacity factors of: CCGT 80%, OCGT 5%, Wind 40%; (c) Basslink imports of 2,500 GWh; and (d) existing generation capacity only (eg. excludes Musselroe Wind Farm, Gunns Bell Bay Pulp Mill).

Tasmanian economic growth and by extension, the level of electricity-intensive industry investment in Tasmania, and the extent to which climate change policy driven investment in energy efficiency occurs.

Key supply factors include the level of water inflows into the hydro reservoirs and the extent of new renewable energy and gas generation investment. There are many other influencing factors of course, but these selected factors are sufficient to develop illustrative scenarios.

Excluding the impact of energy efficiency, the remaining variables could be represented by three independent scenario 'drivers' – economic growth, water inflows and the effectiveness of climate change policy in stimulating new renewable energy generation. Ascribing a simple 'high' or 'low' to each of these scenario drivers leads to the possibilities described in Figure 18. Again, this is a simplistic approach, but serves to illustrate the range of possible outcomes.

Core drivers that impact on supply-demand scenarios				
Ref	**Economic Growth and level of electricity intensive industry investment**	**Water inflows**	**Climate change policy effect on renewables development**	**Possible scenario outcome (aggregate energy balance)**
1	High	Low	Low	**Under-supply**
2	High	High	Low	**Supply meets demand**
3	High	Low	High	**Under-supply**
4	High	High	High	**Supply meets demand**
5	Low	Low	High	**Supply meets demand**
6	Low	High	Low	**Over-supply**
7	Low	High	High	**Over-supply**
8	Low	Low	Low	**Under-supply**

Figure 18: Illustrative supply-demand scenario outcomes

As illustrated, possible outcomes could range for example from (a) an under-supply situation; (b) a supply-demand equilibrium; or (c) an oversupply situation.

Implications for Tasmania

The NEM provides a robust market driven framework for ensuring the security of supply in participating jurisdictions, including Tasmania. The combination of spot market prices, forward financial contract prices and NEM reserve margin information is designed to provide clear signals for new generation investment. Under this framework, responsibility for ensuring that there is sufficient generation capacity to meet future demand is effectively vested in the market, and not in any particular energy sector company – a fundamental change from the pre-electricity reform era, where until recently, Hydro Tasmania shouldered this responsibility.

This market driven framework greatly reduces the need for Government intervention in regard to managing the energy supply-demand balance; however, for market responses to occur, price signals must flow through to generators and end users. The corollary of relying on market signals to drive investment in new generation is that Tasmanian wholesale electricity prices should be reflective of the cost of new generation.

Finally, electricity sector policy in regard to any new generation capacity must be tested against multiple scenario outcomes, rather than being predicated on a single scenario – such as, an under-supply scenario. Additionally, government policy can, to some extent, influence industry outcomes.

For example, of the three scenario drivers examined previously, some aspects are difficult to influence, including rainfall and the level of inflows; however, while economic growth is largely a function of international and national policy settings, State policy could have a material impact on the level of electricity-intensive industry investment in Tasmania. A similar argument applies to climate change policy to support new renewable energy generation as well as to achieve improved energy efficiency outcomes.

6. INCORPORATING NEW GENERATION – CHALLENGES AHEAD

Key messages

- *While natural increases in peak demand (particularly for heating and cooling) are a primary driver of transmission investment, the anticipated increase in renewable energy generation as a result of the legislated 20% Renewable Energy Target and forthcoming climate change driven policies – in particular, the Federal Government's proposed Carbon Pollution Reduction Scheme – also presents new transmission-related challenges in regard to (a) optimising transmission investment to support new renewable energy generators, and (b) addressing congestion on the shared transmission network which could lead to existing generation being 'constrained off'.*
- *Optimising transmission investment to support new renewable energy generation may be best addressed by the Australian Energy Market Commission's (AEMC) conceptual Network Extensions for Remote Generation (NERGs) proposal, which enables the construction of optimised connection assets to accommodate proposed renewable energy generation developments while ensuring risks to network service providers are managed. Resolving congestion on the shared transmission network is likely to require the introduction of a national congestion management regime to achieve orderly dispatch in the presence of network congestion.*
- *Hydro Tasmania considers that significant increases in small scale distributed generation, the potential for large numbers of electric vehicles requiring recharging, the emergence of next generation appliances that can be managed remotely or locally by households, and real-time pricing signals that provide incentives for consumers to alter their consumption patterns, will require smarter and more responsive electricity networks, as well as changes to network regulatory arrangements that incentivise them to actively pursue these options.*
- *Changes to the frequency operating standards and the Australian Energy Market Operator's (AEMO) changed assessment of inertia, which have come about with the commissioning of Aurora Energy's combined cycle gas generation, will increase the requirement for Frequency Control Ancillary Services (FCAS). Future changes in the market, in particular connection of variable generation, will further increase the need for FCAS, which suggests that energy costs could rise significantly.*
- *Increased demand for water from new irrigation developments will require greater water sharing between Hydro Tasmania and irrigators. The existing regulatory framework governing water allocation and trading provides a basis for the transfer of water to irrigators.*

Transmission access

Electricity transmission services in Tasmania are provided by Transend Networks Pty Ltd (Transend), a wholly State Government owned company. As stated in its 2008 Annual Report, during 2007-08 Transend started preparing strategic development plans comprising six regional development plans, a plan for the backbone of the network (the 220 kV transmission line corridors), a plan for generation developments and a plan for a second Basslink connection with Victoria. It notes that these plans provide the broad scope for the development projects that were included in its revenue proposal to the Australian Energy Regulator covering the period July 2009 to June 2014.[84]

While natural increases in peak demand (particularly for heating and cooling) are a primary driver of transmission investment, the anticipated increase in renewable energy generation as a result of the legislated 20% Renewable Energy Target (RET) and forthcoming climate change driven policies – in particular, the Federal Government's proposed Carbon Pollution Reduction Scheme (CPRS) - also presents new transmission-related challenges.

The AEMC, in its recent report on the impact of the RET and CPRS on the electricity market, observed that wind generation investment resulting from the RET is likely to be clustered in certain geographic areas that are remote from consumers and existing networks. It notes that the existing framework for connecting new renewable energy generation, which is based on bilateral negotiation, will make it difficult for network businesses to co-ordinate network connections. Furthermore, due to stranded asset risks, there are insufficient incentives for network service providers (NSPs) to build network connections

84 AER 2009.

to an efficient scale to accommodate anticipated future connections. "When connections cannot be co-ordinated or built to an efficient scale there is risk of inefficient duplication in network assets and potential delays in connection."[85]

The AEMC's conceptual proposal to develop Network Extensions for Remote Generation, which involves developing a new regime for planning, charging and revenue recovery for remote network extensions, is designed to address this problem.[86] Under this approach, the AEMO and NSPs would identify geographical areas with the best prospects for developing efficient outcomes in the NEM, NSPs, in conjunction with renewable energy generation proponents, would plan optimised connection assets, and NSPs would construct connection assets following connection applications by generators and agreement on revenue recovery.

The AEMC proposal is at an early stage of development. However, it represents a major step forward in addressing the challenges associated with connecting new renewable energy generation to the transmission system.

The envisaged remote renewable energy generation developments also have the potential to cause congestion on the existing shared transmission, which could lead to existing generation being 'constrained off', leading to adverse financial impacts on incumbent players. Resolution of this issue is likely to require the introduction of a national congestion management regime to achieve orderly dispatch in the presence of network congestion, and incentives for generators to fund augmentation of the shared transmission network, over and above that which is supported by the Regulatory Investment Test for Transmission – the process by which transmission businesses in the NEM assess the efficiency of network investment proposals.

Finally, the variable nature of renewable energy (in particular wind and solar) generation presents challenges for system security, as any sudden decrease in renewable energy generation output must be balanced by an immediate injection from other generation or instantaneous load reduction. The ability of generation to replace a sudden reduction in supply from a variable renewable source may be limited by the time taken for the incoming generation to start and increase its output to the required level. A range of measures have been implemented in the NEM to address this issue, including the "Semi-Dispatch" Rule and the Australian Wind Energy Forecasting System. The Semi-Dispatch Rule provides AEMO with a degree of control over the output of wind-powered generation through the dispatch process. The Australian Wind Energy Forecasting System provides information to all market participants on the likely output, and potential variations in outputs, from wind-powered generators, increasing the ability of the market, and AEMO, to manage the variability in output from wind energy generators.

Grid support

The role of electricity transmission and distribution networks to transport electricity produced by generators to consumers has remained unchanged since the inception of the electricity industry. However, significant increases in small scale distributed generation, the potential for large numbers of electric vehicles requiring recharging, the emergence of next generation appliances that can be managed remotely or locally by households, and real time pricing signals that provide incentives for consumers to alter their consumption patterns, will require smarter and more responsive electricity networks. In particular, the role of electricity networks may change fundamentally from being agents of transportation, to agents of integration.

The resulting electricity networks are referred to as 'intelligent' or 'smart' electricity grids, and work is currently underway internationally and nationally to explore issues associated with their development. In Australia, the Intelligent Grid Research Program[87] - a major collaborative research venture between the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and five Australian universities - is exploring the economic, environmental and social impacts and benefits of the large-scale deployment of intelligent grid technologies in Australian electricity networks. In May 2009, the Federal Government announced it will invest up to $100 million in partnership with the energy sector for the development of a new National Energy Efficiency Initiative, using 21st century technology to assist the transition to a low carbon economy by encouraging a smarter and more efficient energy network.

The widespread deployment of distributed generation and other demand side options has significant potential to avoid future capital expenditure for upgrading transmission and distribution infrastructure; however, it is widely acknowledged that the current national regulatory framework governing revenues of network businesses does not incentivise these businesses to actively pursue these options, and there have been many calls for changes to the regulatory framework. In this regard, a recent NSW report recommended that "the NSW Government should request that the AEMC change the National Electricity Rules to remove regulatory biases against distributed energy by:

85 AEMC 2009.

86 AEMC 2009.

87 For more details refer to http://igrid.net.au

- removing network regulatory incentives which are contrary to the consumer interest (such as the current link between network profits and customer electricity sales volume)
- allowing network businesses to invest in distributed energy options up to five years prior to the corresponding trigger point for network augmentation
- requiring network businesses to implement all available cost effective distributed energy options with lower greenhouse gas emissions prior to augmenting the network."[88]

System support

Apart from energy security, the power system also requires a range of system support services, including Frequency Control Ancillary Services (FCAS), used by AEMO to maintain the frequency on the electrical system to NEM frequency standards. AEMO achieves this by altering generation or demand through the purchase of two types of FCAS – Contingency FCAS and Regulation FCAS.

Contingency FCAS ensures that the power system is able to accommodate a failure of the largest operational unit. In Tasmania, this is currently limited to 144 MW (largest unit at Gordon Power Station). Connection of larger units requires special arrangements.

Regulation FCAS enables AEMO to manage instantaneous small variations in load/generation balance.

The quantity of FCAS required is dependent on the size and type of connected generating plant and the size of the largest contingency. Basslink is able to provide FCAS, which means that for much of the time FCAS can be sourced from the mainland if it is cheaper. The changes to the frequency operating standards and AEMO's changed assessment of inertia, which have come about with the commissioning of Aurora Energy's combined cycle gas generation, will increase the requirement for FCAS.

Future changes in the market – in particular connection of variable generation - will further increase the need for FCAS in the future.

From a system support perspective, Basslink appears as a (large 594 MW) load when it is exporting energy to the mainland and as a (large 478 MW) generating unit when importing into Tasmania. Because these sizes are larger than the permitted generation (144 MW), a special arrangement is required to ensure that the net system disturbance is restricted to within the allowable limits - known as the Frequency Control System Protection Scheme, which must be operational for import/export to occur.

A significant increase in wind energy will increase the volatility of very short run imbalances in supply and demand, increasing the volume of FCAS services required to maintain a given level of security and reliability. It is also possible that technological developments in the future might lead to an increasing volume of 'non scheduled' generation (for example "embedded" generation such as small solar installations), which would further increase the FCAS requirement.

These developments suggest that FCAS requirements (and thus energy costs) could rise significantly in the future, raising questions as to whether the current FCAS market design should be changed.

Access to water for hydro generation

Tasmania is endowed with generous water resources compared to the mainland. Despite a land area that is less than 1% of the nation, it is estimated to have around 11% of the nation's water resources and annual runoff.[89] Given that we live on the driest continent in the world, access to this valuable resource plays a key role in the State's economic well-being.

The water sector in Tasmania has undergone wide-ranging structural regulatory reforms in the past couple of years. This includes the establishment of three new local government-owned regional water and sewerage corporations and a common services corporation (Southern Water, Ben Lomond Water, Cradle Mountain Water and OnStream) and the establishment of the Tasmanian Irrigation Development Board (TIDB) to develop a series of major water infrastructure projects in Tasmania.

According to the most recent national statistics, water consumption in Tasmania in 2004-05 was 435 gigalitres (GL). Agriculture was the largest consumer of water, accounting for 59.4% of all water consumed, followed by households (16.0%), and manufacturing (11.3%).[90] The three regional corporations supply around 80% of Tasmania with fully treated water through a number of local councils. In 2007-08, such supplies accounted for around 102 GL.[91]

Water used for electricity generation is regarded as 'non-consumptive' as water is usually not lost from the catchment.[92] Stored water is managed to meet the needs of a range of users, including irrigation, recreation, electricity generation, downstream communities, thermoelectric plants, industries and in-stream users such as fisheries and wildlife habitats.

The majority of water for irrigation is sourced from unregulated watercourses under water licences. Other irrigation water is supplied via regulated irrigation schemes. The Department of Primary Industries and Water (DPIW) estimates

88 Rutovitz, J and Dunstan, C. 2009.
89 NWC 2005.
90 ABS 2009b.
91 OTTER 2009b.
92 Excluding evaporation from catchments.

that by 2015, Tasmania will need an additional 250 gigalitres (GL) of irrigation water per year – around a 50% increase on existing water allocations to the sector – to support growth in agriculture and to improve industry resilience to drought and climate change. Given the considerable scope to harvest water in the State, the Tasmanian Government has committed significant funding to progress a number of large scale irrigation developments.[93]

The TIDB will be responsible for progressing major irrigation development projects from the feasibility assessment stage to the construction and operational stages. They include the Midlands Water Scheme, Sassafras-Wesley Vale Irrigation Scheme, Forth River Irrigation Schemes (Mersey-Forth Water District), Meander Dam Pipelines, Shannon-Ouse-Clyde Project, North East Dams, Winnaleah Irrigation Scheme, Headquarters Road Dam, Meadstone Dam, Upper Macquarie Dam and Upper South Esk Dam.[94] Some of these projects will require water sharing arrangements with Hydro Tasmania under the arrangements described below.

Private investment in the sector is evidenced by the Macquarie Settlement Pipeline project in the Macquarie settlement region, which will deliver irrigation water from the Poatina Power Station reregulation pond to a number of farms.

The *Water Management Act 1999* (WMA) creates the statutory basis for the management and use of water in Tasmania. Under the WMA, water licences are issued for the extraction of water from surface water sources. Water licences are separated from land titles. A water allocation can be attached to a water licence, and stipulates the amount of water that can be extracted, and its use.

It is estimated that there are around 2,600 water licence holders,[95] including irrigators, bulk water suppliers, local councils and commercial users. Water is allocated according to different levels of 'surety' – which reflect the priority to extract water at times of low flow or water availability. For example, Level 1 surety water is reserved for the extraction of water for essential purposes (such as domestic use) and has greater than 95% reliability.[96]

Hydro Tasmania holds a special water licence that entitles it to all surface water in the declared Hydro-Electric Districts except for that water which was allocated to other users prior to 1 January 2000, or which is subject to legally binding agreements and legislation. Water under this special licence has a surety level of four, which means that other essential purposes (including domestic water, town water supplies and water for fire-fighting and stock) have higher surety rights to water than Hydro Tasmania. The special water licence expires in the year 2098, and cannot be suspended or cancelled unless approved by both Houses of Parliament.

The WMA establishes the basis for trading of water licences and water allocations.[97] Transfers of licences and water allocations can be permanent or for a limited period (temporary) through a lease arrangement for a stated period. DPIW notes that to date, limited water trading has occurred in Tasmania and the market place tends to be spatially disconnected as a result of the relatively small catchments in the State. The majority of water trading, other than that directly related to rural property sales, has occurred within the major irrigation schemes and through privately arranged physical transfers between landholders.

Following the 2003 agreement between Hydro Tasmania, DPIW and the Tasmanian Farmers and Graziers Association, there has been increased trading of water in the hydro-electric districts.

In 2004, the Council of Australian Governments (COAG) agreed to the National Water Initiative (NWI) – an overarching policy framework to guide water management in Australia. The Tasmanian Government became a party to the Agreement in June 2005. Under the NWI, governments – including the Tasmanian Government – have made commitments to:

- prepare water plans with provision for the environment
- deal with over-allocated or stressed water systems
- introduce registers of water rights and standards for water accounting
- expand the trade in water
- improve pricing for water storage and delivery
- meet and manage urban water demands.

The NWI agreement includes objectives, outcomes and agreed actions to be undertaken by governments across eight inter-related elements of water management, including *'Water markets and trading'* (progressing the removal of institutional barriers to trade in water) and *'Best practice water pricing'* (including facilitating the efficient functioning of water markets and giving effect to the principles of consumption-based pricing and full cost recovery).[98]

93 DPIWE 2009.
94 IRIS Tasmania 2009.
95 DPIWE 2005.
96 DPIWE 2009b.
97 For more information, refer to http://www.dpiw.tas.gov.au/inter.nsf/webpages/jmuy-5ve3mw?open
98 The Tasmanian Government's NWI Action Plan is set out in DPIWE 2006.

7. BASS STRAIT ISLANDS (BSI) GENERATION

Key messages

- *Due to geographic location and the electricity generation technologies deployed, the cost of supplying electricity on the Bass Strait islands is significantly higher than on mainland Tasmania. Even though the cost of electricity supply to customers is subsidised by the Tasmanian Government, price remains higher than regulated electricity tariffs in mainland Tasmania.*
- *Given the current reliance on diesel fuel and the anticipated increases in oil prices, it is beneficial to replace existing high-cost diesel generation with cost-effective renewable energy alternatives. In doing so, the Bass Strait islands have the potential to showcase the benefits of significant renewable energy generation, and create new opportunities for commercialising renewable energy technologies in Tasmania and other markets.*

Area	Major Generation Units
Flinders Island	Four diesel generating units (2 x 550 kW; 1 x 1,250 kW; 1 X 300 kW)
King Island	Four diesel generating units (1 X 1,200 kW; 3 X 1,600 kW) Five wind turbines (2 X 850 kW; 3 X 250 kW) Solar PV (94 kW) King Island Solar

Figure 19: Generation sources on Flinders and King Islands[99]

The Bass Strait islands include King and Flinders Islands. Electricity supply on these islands is the responsibility of Hydro Tasmania, and is generated principally using diesel and wind generation sources. Average annual generation is around 20 GWh, comprising 72.5% diesel; 27% wind and 0.5% solar.

Hydro Tasmania owns the main electricity assets on both islands, including generation and distribution infrastructure. Aurora Energy operates the system and provides retail services under contract to Hydro Tasmania.

There are approximately 1,300 electricity customers on King Island and 720 customers on Flinders Island.[100] The majority of load (65%) on King Island is business-related, with two large customers accounting for half of the business load. In contrast, the majority of load on Flinders Island is residential (58%), with no large business loads.[101] Given geographic location and the electricity generation technologies utilised, the cost of supplying electricity on the islands is significantly higher than on mainland Tasmania. While the cost of electricity supply to customers is subsidised by the Tasmanian Government ($6.6m in 2006-07),[102] price remains higher than regulated electricity tariffs in mainland Tasmania. The Bass Strait islands are not part of the NEM, and are therefore not subject to NEM regulatory arrangements.

In February 2007, the Tasmanian Government released a report on its review of Electricity Arrangements on the Bass Strait islands,[103] and in December 2007 the Treasurer requested the Government Prices Oversight Commission to undertake an electricity price inquiry for the Bass Strait islands. The Terms of Reference required the Commission to determine an efficient cost of supply on the islands, and to recommend tariff structures to apply on the islands. The principal challenge in designing a tariff structure for the Bass Strait islands is reconciling the potentially conflicting goals of providing an affordable electricity supply while ensuring that the pricing structure signals efficient use of electricity. The Commission released its draft report containing recommendations on tariff structure in June 2008.[104]
In August 2008, after consideration of submissions received in response to the Draft Report, the Commission delivered its Final Report to Government.

In the face of anticipated oil price increases in the future, the cost of supply on the islands is expected to increase.
It is therefore beneficial to replace existing high-cost diesel generation with cost-effective renewable energy alternatives.

99 Hydro Tasmania.
100 Hydro Tasmania.
101 Government Prices Oversight Commission 2008.
102 Government Prices Oversight Commission 2008.
103 Working Group of Officials 2007.
104 Government Prices Oversight Commission 2008.

There are significant opportunities to do so including: expanded wind and solar energy generation and the introduction of marine power, coupled with improvements in control technology to allow better power system integration of individual generation sources; the use of biofuels; implementation of enabling technologies such as frequency control resistors and short-term inertia, allowing achievement of 100% instantaneous renewable energy penetration; installation of energy storage technology; incorporating thermal storage and additional chemical battery storage with potential to meet both heat and electrical loads; Smart Grid - Demand Side Management (DSM) through the use of smart metering and remote load control; co-generation and tri-generation allowing further utilisation of waste heat.

Consequently, the Bass Strait islands have the potential to showcase the benefits of significant renewable energy generation. Achieving this will require overcoming a number of technical and commercial challenges, including system integration/connection, interruptability, storage, metering and demand side management. However, successful substitution will present opportunities to deploy such solutions in Tasmania and other markets.

REFERENCES

ABS (Australian Bureau of Statistics) 2006, 9208.0 - Survey of Motor Vehicle Use, Australia, 12 months ended 31 October 2006, ABS, Canberra
http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/9208.0Main+Features112%20months%20ended%2031%20October%202006?OpenDocument

ABS 2009, 9309.0 - Motor Vehicle Census, Australia, 31 Mar 2008, ABS, Canberra
http://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/9309.0

ABS 2009b, 1307.6 - Tasmanian State and Regional Indicators, ABS, Canberra
http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/F35BDA49E849C7A5CA2576010016E512?opendocument

ACA (Australian Coal Association) 2009, The Australian Coal Industry - Coal Resources, ACA, accessed from http://www.australiancoal.com.au/the-australian-coal-industry_coal-resources.aspx

ACE CRC (Antarctic Climate and Ecosystems Cooperative Research Centre) 2009, Climate Futures for Tasmania, ACE CRC, accessed from http://www.acecrc.org.au/drawpage.cgi?pid=climate_futures

ACIL Tasman 2008, Projected energy prices in selected world regions, Prepared for the Department of the Treasury, ACIL Tasman
http://www.treasury.gov.au/lowpollutionfuture/consultants_report/downloads/Projected_energy_prices_in_selected_world_regions.pdf

ACIL Tasman 2009, Fuel resource, new entry and generation costs in the NEM, Final Report, Prepared for the Inter-Regional Planning Committee, ACIL Tasman
http://www.aciltasman.com.au/images/pdf/419_0035.pdf

AEMC (Australian Energy Market Commission) 2009, Review of Energy Market Frameworks in light of Climate Change Policies: 2nd Interim Report, AEMC, Sydney
http://www.aemc.gov.au/Media/docs/Second%20Interim%20Report-5b4f2d74-8c01-4546-8805-c992d196e35f-0.PDF

AEMO (Australian Energy Market Operator) 2009, Aggregated Price & Demand: 2006 – 2010, AEMO, accessed from http://www.aemo.com.au/data/aggPD_2006to2010.html

AEMO 2009b, Proposed Generation Projects, AEMO, accessed from http://www.aemo.com.au/data/gendata_prop.shtml

AEMO 2009c, NEM Generator Registration Guide, AEMO
http://www.aemo.com.au/registration/0110-0009.pdf

AEMO 2009d, NEM Customer Registration Guide, AEMO
http://www.aemo.com.au/registration/0110-0010.pdf

AEMO 2009e, Electricity Statement of Opportunities, AEMO
http://www.aemo.com.au/planning/esoo2009.html

AER (Australian Energy Regulator) 2009, Transend Transmission Determination 2009–10 to 2013–14, Final Decision, AER, Melbourne
http://www.aer.gov.au/content/item.phtml?itemId=728071&nodeId=14efa347d3caaba7355c765a1bd5d759&fn=Transmission%20Determination%20(28%20April%202009).pdf

Aurora Energy 2009, Press release on 13 January 2009, accessed from
http://www.aurora.com.au/news/default.asp?file=13-january-2009.txt

Biopower Systems (BioPower Systems Pty. Ltd) 2009, Tasmanian Pilot Projects, Biopower Systems, accessed from
http://www.biopowersystems.com/projects.php

Carnegie (Carnegie Corporation Ltd) 2008, Submission to the Senate Joint Select Committee on Fuel and Energy, Carnegie, Perth
http://www.aph.gov.au/Senate/committee/fuelenergy_ctte/submissions/sub0029.pdf

Climate Change Act 2008, Climate Change (State Action) Act, An Act for certain measures to help the State address the challenges of climate change and contribute to the broader national and international response to those challenges and for related purposes, Tasmania
http://www.austlii.edu.au/au/legis/tas/consol_act/ccaa2008225/

Climate Institute (The Climate Institute) 2008, Australia's National Strategy for Energy Efficiency, Policy Paper, Climate Institute
http://www.unionfiles.com/green/Energy_%20Efficiency_%20Policy_%20Paper.pdf

Department of Primary Industries 2009, Oil & Gas Industry Activity: Field projects under development, accessed from
http://www.dpi.vic.gov.au/DPI/nrenmp.nsf/childdocs/-9B891A4E5A686707CA25746700190BAA-56D4D5E9AEF563E84A256A800011E5D6-4091419D117B5E654A2569B2002022F4?open

Department of Resources, Energy and Tourism 2009, Energy Efficiency Opportunities, Registered corporations' public reports, Department of Resources, Energy and Tourism, accessed from
http://www.ret.gov.au/energy/efficiency/eeo/participating_corporations/Pages/default.aspx

DIER (Department of Infrastructure, Energy and Resources) 2004, Powering Prosperity, Consolidating Tasmania's Energy Advantage, A Statement by the Minister for Infrastructure, Resources and Energy, DIER, Tasmania

DIER 2008, Feed-in Tariffs Discussion Paper, DIER, Tasmania
http://www.dier.tas.gov.au/__data/assets/pdf_file/0020/33851/feed_in_tariff_draft_discussion_paper.pdf

DIER 2009, accessed from http://www.dier.tas.gov.au/energy/renewable_energy

DPIWE (Department of Primary Industries Water and Environment) 2005, Water Governance Arrangements for Tasmania, Report To The National Water Commission, Water Resources Division, DPIWE, Tasmania
http://www.dpiw.tas.gov.au/inter.nsf/Attachments/JMUY-6KY3CM/$FILE/Water%20Governance%20Tasmania.pdf

DPIWE 2006, Implementation Plan for the National Water Initiative Tasmania, DPIWE, Tasmania
http://www.dpipwe.tas.gov.au/inter.nsf/WebPages/JMUY-6R78TG?open

DPIWE 2009, accessed from http://www.dpiw.tas.gov.au/inter.nsf/WebPages/SSKA-7FHVNA?open

DPIWE 2009b, accessed from http://www.dpiw.tas.gov.au/inter.nsf/WebPages/JMUY-4YA86N?open#SuretyLevels

EPA (Environment Protection Authority (TAS)) 2009, Fonterra Australia Pty Ltd-Cheese Factory Cogeneration Plant, Wynard, EPA, accessed from http://www.epa.tas.gov.au/index.aspx?base=1659

EPA (Environment Protection Authority (TAS)) 2009b, N.P. Power Pty Ltd - Cattle Hill Wind Farm (Lake Echo), accessed from http://www.epa.tas.gov.au/index.aspx?base=1843

Garnaut, R 2008, The Garnaut Climate Change Review Final Report, Cambridge University Press, Melbourne
http://www.garnautreview.org.au/domino/Web_Notes/Garnaut/garnautweb.nsf

Government Prices Oversight Commission 2008, Bass Strait islands Electricity Price Inquiry 2008, Draft Report, Government Prices Oversight Commission, Tasmania
http://www.economicregulator.tas.gov.au/domino/gpoc.nsf/LookupFiles/Bass_Strait_Islands_Electricity_Price_%20Inquiry_Draft%20Report_June2008_080619%20PDF%20version.PDF/$file/Bass_Strait_Islands_Electricity_Price_%20Inquiry_Draft%20Report_June2008_080619%20PDF%20version.PDF

IEA (International Energy Agency) 2008, Energy Technology Perspectives 2008: Scenarios and strategies to 2050, IEA, Paris
http://www.iea.org/W/bookshop/add.aspx?id=330

Infrastructure and Resource Information Service (IRIS Tasmania) 2009, accessed from
http://www.iris.tas.gov.au/infrastructure/water/major_projects

Lewis, R 2008, Securing a renewable energy future for Tasmania, Presentation to Tasmanian Energy Conference, Kuth Energy, Tasmania
http://www.kuthenergy.com/index.php?item=file&target=tasenergyconf

MMA (McLennan Magasanik Associates Pty Ltd) 2008, Installed capacity and generation from geothermal sources by 2020, Report to Australian Geothermal Energy Association, MMA, Melbourne
http://www.agea.org.au/media/docs/agea_finalreport.pdf

MMA 2008b, Defining a National Energy Efficiency Strategy, Stage 1 Report to the Climate Institute, MMA
http://www.climateinstitute.org.au/images/mmaeestrategy.pdf

NEMMCO 2008, Australia's National Electricity Market, Statement of Opportunities, NEMMCO
http://www.aemo.com.au/planning/soo2008.html

Network Advisory Services (Network Advisory Services Pty Ltd) 2008, Issues relating to the Public Benefit Assessment of the introduction of Full Retail Competition in the Tasmanian Electricity Market, Report to the Office of the Tasmanian Economic Regulator, Network Advisory Services, Tasmania
http://www.energyregulator.tas.gov.au/domino/otter.nsf/LookupFiles/Network_Advisory_Services_FRC_Tas_Electricity_Market_April_2008.pdf/$file/Network_Advisory_Services_FRC_Tas_Electricity_Market_April_2008.pdf

Newood (Newood Huon Pty Ltd) 2009, Huon Wood Centre Power Station, Newood, accessed from
http://www.southwoodresources.com.au/southwood/pages/project_power.html

NIEIR (National Institute of Economic and Industry Research) 2008, Projections of non-scheduled and exempted generation in the National Electricity Market, 2007-08 to 2019-20, A report for the National Electricity Market Management Company, NIEIR, Victoria

NWC (National Water Commission) 2005, Australian Water Resources 2005
http://www.water.gov.au/Publications/index.aspx?Menu=Level1_8

OTTER (Office of the Tasmanian Economic Regulator) 2008, Tasmanian Energy Supply Industry, Performance Report 2007-08, OTTER, Tasmania
http://www.energyregulator.tas.gov.au/domino/otter.nsf/8f46477f11c891c7ca256c4b001b41f2/7715a04d0c9ce4e7ca256cdd007d685c?OpenDocument

OTTER 2008b, Public Benefit Assessment for Electricity Retail Competition in Tasmania, Draft Report, OTTER, Tasmania
http://www.energyregulator.tas.gov.au/domino/otter.nsf/a08b00d12c2fae17ca256c4c0020929e/afc8374bc3868f18ca2571840082568b?OpenDocument

OTTER 2009, Electricity Licences Issued, accessed from
http://www.energyregulator.tas.gov.au/domino/otter.nsf/8f46477f11c891c7ca256c4b001b41f2/919e3c7e7a6c6a55ca256cb1001c846f?OpenDocument

OTTER 2009b, Tasmanian Water and Sewerage State of The Industry Report 2007-08, OTTER, Tasmania
http://www.economicregulator.tas.gov.au/domino/otter.nsf/LookupFiles/09_1202_Tasmanian_Water_and_Sewerage_State_of_the_Industry_Report_2007_08.pdf/$file/09_1202_Tasmanian_Water_and_Sewerage_State_of_the_Industry_Report_2007_08.pdf

PB (Parsons Brinckerhoff Australia Pty Limited) 2008, Tasmanian Government Greenhouse Gas Emissions Inventory, Reduction, Monitoring and Reporting Program, Part 3A: Energy Audit for Government Buildings, Report to Department of Premier and Cabinet, PB, Sydney
http://www.earnyourstars.tas.gov.au/__data/assets/pdf_file/0019/65305/Part_3A_Report_-_Tas_Govt_Greenhouse_Gas_Inventory_Project.pdf

Roarty, M 2008, 2008, Research Paper no. 25 2007–08, Australia's natural gas: issues and trends, Science, Technology, Environment and Resources Section, Parliamentary Library, Parliament of Australia, Canberra
www.aph.gov.au/library/Pubs/rp/2007-08/08rp25.htm#_Toc187990340

Rutovitz, J and Dunstan C. 2009, Meeting NSW Electricity Needs in a Carbon Constrained World: Lowering Costs and Emissions with Distributed Energy. (Prepared as part of Project 4 of the CSIRO Intelligent Grid Research Program by the Institute for Sustainable Futures, University of Technology Sydney)
http://igrid.net.au/sites/igrid.net.au/files/images/Meeting%20NSW%20Electricity%20Needs%20in%20a%20Carbon%20Constrained%20World%20(June%202009-1).pdf

Tasmanian Climate Change Office 2008, Tasmanian Framework for Action on Climate Change, Tasmanian Climate Change Office, Department of Premier and Cabinet, Tasmania
http://www.climatechange.tas.gov.au/

TasmaniaTogether2020, Tasmania Together Progress Board, Tasmania, accessed from
http://www.tasmaniatogether.tas.gov.au/reports_and_papers/documents/tasmania_together_revised_2006__recommendations_to_parliament/Tasmania_Together_Booklet_2006_final.pdf

Transend (Transend Networks Pty Ltd) 2008, Annual Planning Report, Transend, Tasmania
http://www.transend.com.au/files/D08-51503.pdf

Transend 2009, Annual Planning Report, Transend, Tasmania
http://www.transend.com.au/files/D09-69841.pdf

Working Group of Officials 2007, Review of Electricity Arrangements on the Bass Strait islands, Final Report, Working Group of Officials, Tasmania
http://www.economicregulator.tas.gov.au/domino/gpoc.nsf/LookupFiles/Review_of_Electricity_Arrangements_on_the_BSI_Working_Group_Final_Report_Oct_2007.pdf/$file/Review_of_Electricity_Arrangements_on_the_BSI_Working_Group_Final_Report_Oct_2007.pdf

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