Submission No: 101

29 June 2007

Committee Secretary
Standing Committee on Industry and Resources
House of Representatives
PO Box 6021
Parliament House
CANBERRA ACT 2600
AUSTRALIA

Dear Sir or Madam,

Re: Submission – Standing Committee on Industry and Resources Inquiry into the development of the non-fossil fuel energy industry in Australia

Thank you for the opportunity to contribute to the Standing Committee on Industry and Resources (the Committee) *Inquiry into the development of the non-fossil fuel energy industry in Australia: Case study into selected renewable energy sectors.* Please find attached Hydro Tasmania's submission.

Hydro Tasmania is the largest renewable energy generator in Australia, producing approximately 60% of Australia's renewable energy, and is internationally recognised for its expertise in sustainable hydro power production as well as wind energy production. Hydro Tasmania also continues to be actively involved in many aspects of renewable energy research and development. This includes investigating alternative renewable energy options, the development of Remote Area Power Supply (RAPS) and energy storage technologies (batteries, hydrogen and thermal storage). These energy storage developments are mainly focussed on remote area power supply applications and ancillary services provision.

Hydro Tasmania welcomes this inquiry and the recognition of the contribution that renewable technologies can make to Australia's energy economy. The predicted future growth in energy demand, necessity for greenhouse gas emission reductions and the challenge of energy security dictate the need for a thorough examination of all existing, near commercial and future energy sources.

Key issues raised in our submission include:

- Australia is home to some of the world's best renewable resources providing a natural advantage in wind, solar and wave resources;

- renewable energy technologies can and should play an important role in securing Australia's low emission energy future. These technologies currently span the full technology development curve, from emerging (research and development/pilot phase), pre-commercial (near full deployment), to proven and ready to deploy (commercial phase). Several technically proven, commercially available and environmentally acceptable renewable technologies represent real near zero emission options;

- by utilising a range of electricity generation options including renewable energy, Australia can begin to insure itself against volatility in supply markets and the ongoing and increased affects of climate change. A diversified and distributed energy mix ensures protection from supply constraints and can subsequently minimise price volatility;

- the Australian electricity network can support a significant additional deployment of renewable energy before any overall technical constraints might be expected. Australia's renewable energy electricity market share has declined from 23% in 1965 to less than 10% now. The intermittent nature of wind energy will not significantly affect the operation of the National Electricity Market (NEM) until wind energy penetration is at least 15 - 20% - a 10 fold increase on the current level of wind penetration;

- Hydro Tasmania has developed a plan with NEMMCO and the Tasmanian grid company Transend that will technically enable 450MW of wind development in Tasmania where overall demand peaks at around 1800MW and is frequently as low as 900MW overnight;

- as part of the overall energy mix, a diverse and geographically dispersed portfolio of renewable energy technologies minimises impacts of intermittency, as does the national electricity grid itself. The intermittent nature of some forms of renewable energy generation is further mitigated by the complementary natural storage of hydro power (8% of the NEM) and will be further overcome by emerging storage technology;

- the omission of hydro power in the Committee's terms of reference fails to recognise the significant role that hydro power will continue to play in Australia's future generation portfolio through continued operation and upgrades;

- the Mandatory Renewable Energy Target (MRET) was very successful in developing and growing the Australian wind industry. The decision not to extend the target has resulted in stalled renewable energy projects;

- the Australian renewable energy industry and especially the wind energy industry have significant expertise and projects currently waiting to be deployed;

- a suite of policy measures are necessary to encourage and accelerate the commercialisation of emerging technologies. This includes additional and ongoing funding support for emerging renewable and low emissions technologies to encourage Australian innovation and overcome the barriers to commercialisation;

- the introduction of a suitable price for carbon through an Emissions Trading Scheme (ETS) will encourage low cost emissions reductions, including the deployment of some renewable energy technologies that are on the cusp of full commercialisation. The deployment of pre-commercial renewable energy technologies will require complementary support measures to the ETS.

We welcome the opportunity to provide the Committee with further information about the contents of this submission or any other issues. Should you have anv queries or require further information, please contact Mr Alex Beckitt on

Yours sincerely

Andrew Catchpole
General Manager
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Hydro Tasmania

Standing Committee on Industry and Resources

Case study into selected renewable energy sectors

Hydro Tasmania Submission

Introduction

Hydro Tasmania is the largest renewable energy generator in Australia, producing approximately 60% of Australia's renewable energy, and is internationally recognised for its expertise in sustainable hydro power production as well as wind energy production.

Hydro Tasmania has particular expertise and experience in the research, assessment, development and/or deployment of wind power, hydro power, solar power and hydrogen. As a result our submissions will primarily focus on these technologies.

This submission will address the terms of reference by examining:

1. The current development of renewable technologies and their economic competitiveness including RAPS and energy storage;
2. Intermittency and grid Integration of renewable energy technologies;
3. The benefits of a diversified energy economy;
4. Existing renewable energy legislation and the impact it has had on the industry;
5. Technology development cycles and support requirements.

1. The current development of renewable technologies and their economic competitiveness including RAPS and energy storage.

Hydro Tasmania continues to be actively involved in many aspects of renewable energy research and development. This includes investments in hydrogen research, the development of Remote Area Power Supply (RAPS) and energy storage technologies.

The portfolio of renewable energy technologies is rapidly declining in costs and, with a sensible price on carbon combined with appropriate complementary measures, is likely to become cost convergent with incumbent energy generation in the near future. This is illustrated in Figure 1 below.

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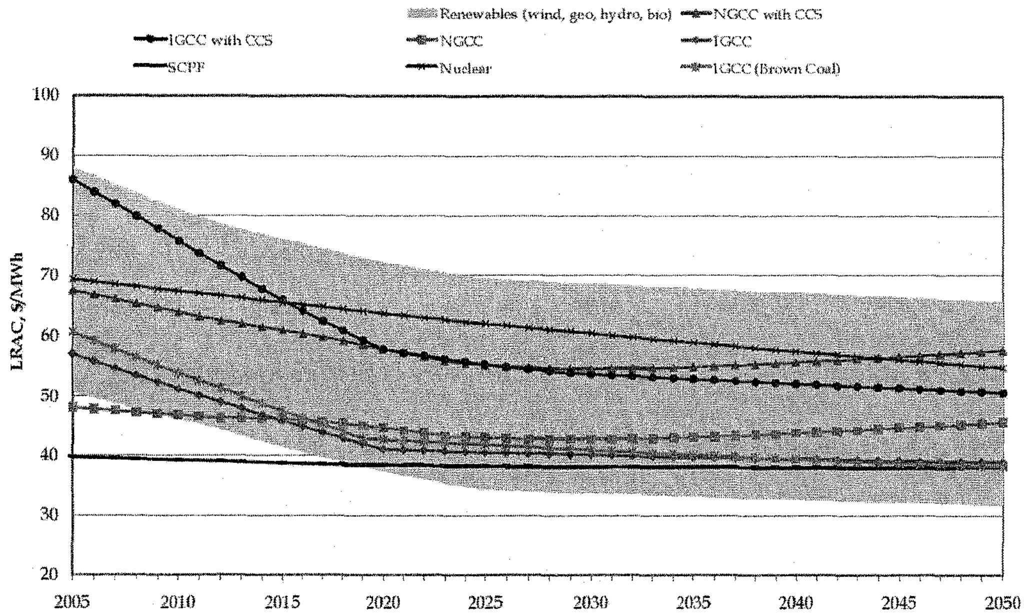
Figure 1: Total renewables cost envelope versus coal, gas and nuclear.



Source: REGA/MMA, 2006

Hydro Power

Generation of electricity from hydro power is a well established and important part of Australia's generation mix. Accounting for approximately 8% of electricity generated within Australia, hydro power has for many decades provided clean and reliable power to Australian homes. The benefits of hydro power in responding to the intermittency of other technologies and storing energy to meet these challenges are outlined later in this submission.

Any targeted increase in the overall contribution of low emission generation to Australia's energy supply must consider the maintenance of existing low emission assets such as large scale hydro power. The replacement of existing ageing low emission assets with equal or greater emissions intensive energy sources (for example, the decommissioning of aged hydro power plant and replaced with CCGT) may currently be more economically viable than refurbishment, while perversely this would increase carbon emissions as a result. For this reason, Hydro Tasmania believes that any inquiry into renewable energy sources should also include hydro power.

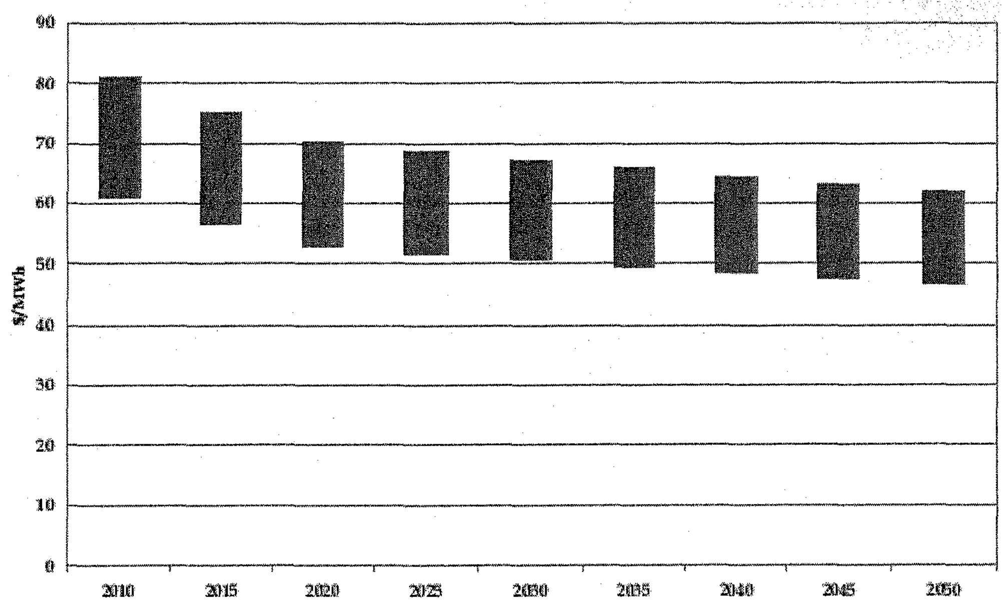
The ancillary service provided by hydro power in the NEM is crucial to achieving electricity generation at least cost. To avoid the replacement of hydro power assets with higher cost generation technology and loss of the storage capacity they supply, hydro power's continuing value to the electricity supply system must be recognised. The current electricity price may not in itself be sufficient for hydro assets to be maintained and refurbished to ensure their ongoing maximum contribution. An emissions trading scheme with a price on carbon will see an increase in the pool price but this alone may not be sufficient for many projects. Additional measures that support least cost increases of low emissions generation are likely to remain necessary.

As a result of MRET, from the 2002 financial year until the end of January 2006, Hydro Tasmania spent over $100 million on upgrades and refurbishments of existing hydro power stations. This included improving the condition and sustaining the generating capacity of assets that are in some cases more than 50 years old. This has secured approximately 1,800 GWh of energy per annum that was potentially at risk from closure of aging plant.

Future development of hydro power within Australia will occur both in the form of small scale hydro stations and with further upgrades and refurbishments of existing hydro power generators.

Cost predictions for small scale hydro power demonstrate a price range between $60-$80/MWh in 2010, falling to $50-$60 in 2050. This is illustrated in Figure 2 below. It is likely therefore that mini hydro will be cost competitive with existing fossil fuel technologies with a carbon price by at least 2050.

Figure 2: Mini-Hydro cost projections to 2050

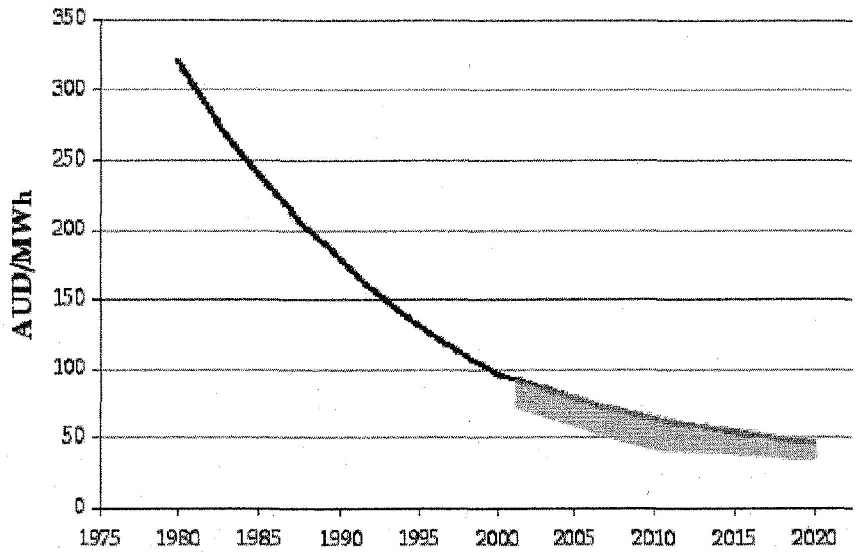


Source: MMA/ REGA, 2006.

Wind Power

The cost of wind power has decreased rapidly over the past 30 years, as the level of deployment has increased. Wind power is now one of the least cost renewable technologies and is forecast to cost converge with incumbent fossil fuel technologies (assuming emissions trading is in place) by 2020 as illustrated in Figure 3 below.

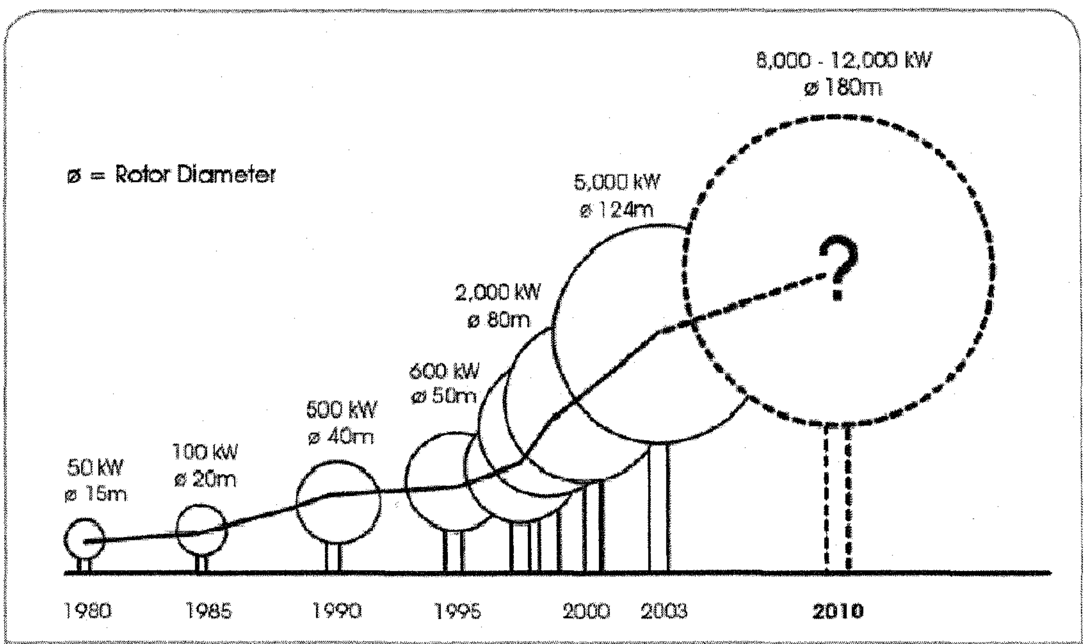
Figure 3: Historical Wind Energy Costs with Forecasts to 2020



***Source: AusWEA,* Cost Convergence of Wind Power and Conventional Generation in Australia June, 2004**

Wind has seen a significant increase in installed capacity in Australia in recent years, following an international trend. This has been accompanied by increases in turbine size with 5 to 10MW units currently being demonstrated in Europe.

Figure 4: Growth in Turbine Size



Growth in the size of commercial wind turbines. (European Commission, 2005)

Wind Power is developing at an increasing rate throughout the world. In 2006, 5 countries installed more than 1000MW of new wind; the US with 2,454 MW, followed by Germany (2,233 MW), India (1,840 MW), Spain (1,587 MW) and

China (1,347 MW). Denmark is a world leader in the wind industry with both a well developed wind generation portfolio and an export industry that supplies the world with wind turbines and parts. The electricity industry in Denmark now sources approximately 19% of electricity generated from wind, higher than any other nation. In comparison, Australia currently sources only 1.3%. The considerably higher wind energy penetration levels in Europe have been managed without significant impact on the nature and operation of the electricity market and offer a proven example of the significant role that wind can play in any Australia's generation portfolio.

Figure 5: System Installed Capacity and Wind Penetration

COUNTRY REGION	TNSP	SYSTEM MAX DEMAND (MW)	TOTAL GENERATION CAPACITY (MW)	INSTALLED WIND CAPACITY (MW)	WIND CAPACITY PENETRATION (%)
Western Denmark	Eltra	3,760	7,018	2,315	33.0
SA – 800 MW Case	***ElectraNet***	***3,296***	***4,246***	***800***	***18.8***
Germany	all	75,000	120,822	16,500	13.7
Spain	REE	37,212	59,866	8,000	13.4
SA – 400 MW Case	***ElectraNet***	***3,111***	***3,791***	***388***	***10.5***
Eire (ROI)	ESB NG	4,494	5,892	256	4.3
Scotland	SSE + SP	5,914	10,067	246	2.5
Alberta	AIES	7,880	11,900	255	2.1
Texas	ERCOT	59,080	82,320	1,396	1.7
Australia - 2006	all states	38,554	48,073	720	1.5
England/Wales/NI	NGT	55,400	64,000	698	1.1

Source: Planning Council Wind Report to Essential Services Commission of South Australia, 2005

In 2003, a report commissioned by the Australian Greenhouse Office found that the national electricity market could readily accept an installed wind capacity of 8000MW with appropriate siting, commercial wind output forecasting and the continual enhancement of interstate grid connectivity. It is generally regarded that Australia could have up to 20% of wind energy penetration in the market without any associated issues regarding variability of supply. This would equate to a ten-fold increase in wind capacity in Australia.

Australia has excellent wind resources. Capacity factors at wind farms in Australia are among the world's best with Tasmania especially benefiting from wind flows that have travelled uninterrupted for thousands of kilometres.

It is estimated that within Australia there are 2100MW worth of wind projects that have received planning approval. Furthermore, it is forecast that Australia's wind resources alone could provide at least 6000MW without factoring in solar, wave, geothermal and other developing technologies. The majority of these wind projects are still in the planning stage and will require an additional support mechanism to be developed.

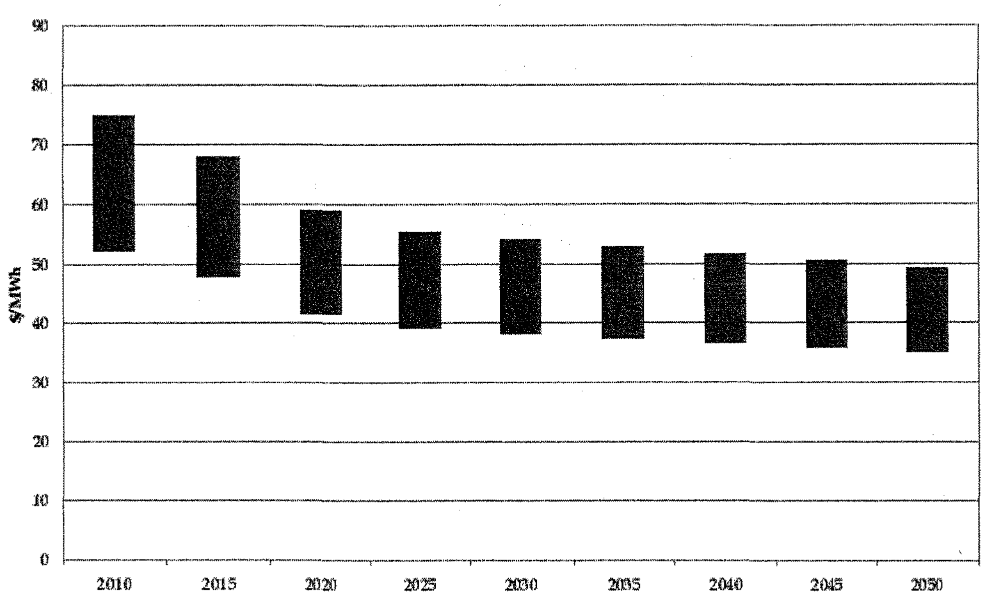
Despite some small, vocal opposition groups, there is significant and strong support for wind farms in many regional areas in Australia and particularly in Tasmania. Local regional communities have seen investment and jobs delivered to their areas as a result of MRET.

Many potential wind sites within Australia with excellent potential remain unexploited. The expanse of land and geographical distribution of potential sites will mean that weather patterns are never the same at all locations. This has significant benefit for wind's penetration into electricity grids as it will limit the variability of the resource over short time periods.

There has been a recent surge in demand for wind turbines, particularly from India and China which has resulted in a great expansion in the wind turbine manufacturing industry internationally especially in China. It is forecast that the increased scale of production internationally will lead to further downward pressure on deployment costs. This will be balanced by international demand for wind turbines and components creating a tight supply demand balance into the near future. However, the cost of wind generation is projected to fall sharply over the next decade as illustrated in the Figure 6 below.

Figure 6: Wind energy cost forecast: 2010-2050.

(a) Wind



Source: MMA/ REGA 2006

Through its joint venture company Roaring 40s, Hydro Tasmania has investments in wind farms in Australia, China and India. In Tasmania, Roaring 40s recently completed the Studland Bay wind farm adding to the existing Woolnorth Stage One development. The 3MW wind turbine generators being utilised at this site are the largest in the Southern hemisphere and have made the Roaring 40s installation the largest wind farm in Australia.

The success of Roaring 40s was driven in the early stages by MRET which allowed the company to develop the expertise required to enter the Chinese and Indian renewable energy markets. Roaring 40s will continue to direct the majority of its significant levels of investment to China and India, rather than Australia. This is due to the strong national policies towards renewable energy in these countries, rather than a lack of excellent projects within Australia. In fact, the Musselroe wind farm in north-eastern Tasmania has not been developed despite having some of the best wind resources in Australia. It is 'ready to go' with all planning approvals in place and would provide jobs and investment in a region which has recently suffered many job losses.

Hydro Tasmania believes that without appropriate incentives for low emissions generation in Australia, investment will continue to be lost overseas to the detriment of both Australia's greenhouse profile and the national economy.

Solar Energy

Relative State of Development

The most significant applications of solar energy in Australia are solar water heating and solar photovoltaic (PV) panels producing electricity for on and off grid locations. Both of these technologies are commercially proven with many years of operating experience and world wide deployment totalling many thousands of MWs. In Australia, however, despite one of the best solar resources in the world, the deployment of solar energy technologies lags significantly behind other countries such as Germany and Japan. For example, the total deployment of solar PV in Australia is currently 60 MW[1] whereas in Japan it is well over 1000 MW, despite a much lower solar resource.

The vast majority of solar energy applications in Australia are at a very small scale (< 10 kW), with very few sites exporting significant levels of power to the electricity grid. The planned 154 MW concentrating PV plant[2], to be developed by the Australian company Solar Systems in north-western Victoria, will be the first project in Australia that demonstrates the ability of solar energy to make a very large (> 100 MW) contribution to electricity supply.

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[1] International Energy Agency Photovoltaic Power Systems Programme (IEA PVPS), Cumulative installed PV as at the end of 2005. Accessed online June 2007 from http://www.iea-pvps.org

[2] Solar Systems website. Accessed online June 2007, from http://www.solarsystems.com.au/154MWVictorianProject.html

Solar thermal electricity generation is also significantly under developed in Australia. The Australian company, Solar Heat & Power, has demonstrated at the Liddell coal-fired power plant in NSW that solar thermal power has the potential to make an important contribution to Australia's electricity supply. Unfortunately the company was not able to secure the support required for a large (> 100 MW) stand alone generation plant in Australia and has relocated to the USA where investment support for solar energy is much higher, particularly in California. This is a disappointing result for Australia as solar thermal energy can be stored and therefore can produce 24 hour, non-interruptible power, if required. The development of a large solar thermal power plant in Australia that produced power all day and night would have been an important milestone for solar energy in Australia.

<u>Prospects for Economically Viable Generation, Storage and Transmission</u>

Solar Hot Water

Solar hot water is commercially viable in most of Australia, with payback periods normally in the range of five to eight years. With electricity and natural gas prices due to increase over the next five to ten years, the viability should become greater, shortening the payback period. The major obstacle to greater deployment remains the higher upfront cost of a solar hot water system.

As well as reducing demand for electricity and gas for water heating, demands on electricity infrastructure are also reduced. The financial benefits of this remain largely unrecognised. Hydro Tasmania believes support for the solar water heating industry should be increased; (eg. rebates for installation) and the installation on new residential, commercial and industrial buildings be encouraged through changes to the building standards; to ensure that Australia makes the most of this viable renewable energy technology.

Solar PV

Solar PV is currently only commercially viable, without subsidies, in off-grid locations. With the support of government rebates, residential and small commercial PV systems have payback periods of approximately 20 – 30 years depending on the location. The costs of solar PV, however, are expected to decline significantly over the next five to ten years, as new technologies and increased scale of manufacturing drive costs down further. Thin film solar, which can be manufactured in a "printing press" like process; and technologies such as ANU/Origin Energy's SLIVER™ cell, which uses significantly less silicon; are likely to lead to large cost reductions over time.

The cost reduction in producing solar PV cells, combined with increasing electricity prices, will make solar PV more competitive as a generation source. The fact that solar PV is a distributed source of electricity (similar to solar hot water which is distributed demand reduction) means that there are significant benefits gained by reducing peak loads and therefore the electricity infrastructure (transmission lines etc) required to support that infrastructure. The peak load reduction occurs because maximum electricity demand in Australia is predominantly associated with peak air-conditioning load in summer, and at the approximate time of this peak, solar PV systems are providing their peak output.

The introduction of higher solar PV buy-back tariffs based on time of day electricity generation, as proposed in states including NSW and SA, and the extension and increase of the Photovoltaic Rebate Program, will encourage greater installation of solar PV in those states. Further investment in R & D in solar PV technology is required to ensure that Australia continues to be at the forefront of technological development.

Concentrating Solar PV

Concentrating solar PV, as developed by Solar Systems, offers significant potential as a commercial generation source. The 154 MW plant in Victoria is estimated to produce electricity at approximately $150/MWh, which is approximately double the cost of wind power, but half the cost of standard solar PV. This cost is predicted to fall further (2015 onwards) as cheaper concentrating cells are manufactured and mass manufacture of the solar concentrators reduces costs.

This technology, as with standard PV, predominantly provides power during high value peak periods, and therefore is also assisting to reduce the required transmission and distribution infrastructure. This project is underpinned by both Commonwealth and State grants (through LETDF) as well as revenue from VRET.

Solar Thermal

Solar thermal power is currently undergoing a resurgence, following the successful installation of over 350 MW in California in the 1980s and 1990s, with large projects being developed in Spain and the USA. The estimated cost of generation for these new plants is in the order of $160 - $220/MWh, similar to concentrating PV, but solar thermal energy has the added benefit that it can be stored as heat and then converted into electricity as required.

In Australia, as mentioned previously, solar thermal energy is significantly underdeveloped given its high potential. Appropriate policy measures are necessary to provide financial incentive for large scale solar thermal projects and to ensure that the technology continues to develop and public confidence in the technology can grow through demonstrations of large scale renewable energy.

Wave Energy

<u>Relative State of Development</u>

Wave energy is currently transitioning from the R&D to the early commercialisation phase of development. There are many companies in the world developing wave energy conversion devices and the first of these are beginning to be commercially deployed in regions where strong Government support is available. In Portugal, the UK company, Ocean Power Delivery[3] (OPD) is developing the world's first commercial wave farm. The Aguçadoura wave farm consists of three of the OPD's Pelamis (750 kW) wave devices (total of 2.25 MW) The Pelamis has undergone years of development and

[3] Ocean Power Delivery website. Accessed online June 2007, from http://www.oceanpd.com/LatestNews/default.html

testing in the UK and is now being installed in Portugal to leverage from the significant incentives offered for wave energy in that country.

Prospects for Economically Viable Generation, Storage and Transmission
Wave energy is highly predictable over short time periods and therefore offers integration benefits for electricity generation. Thousands of MWs of wave energy could be incorporated into the Australian electricity network if the technology should the technology become commercially viable.

Australia has a large wave energy resource, mainly concentrated in the southern half of the country. Australia also has a small number of companies, such as Oceanlinx (the developer of a demonstration device at Newcastle) who are involved in developing their own wave energy technology.

Tidal Energy

Relative State of Development
Tidal energy has been deployed on a large scale in a very small number of locations in the world using tidal barrages. The technology is now undergoing a transformation as a number of companies seek to harness tidal current energy without building tidal barrages. One of the most advanced technologies is a tidal stream turbine, which resembles an underwater wind turbine, and captures energy from tidal current flow. This technology, like wave energy, is currently transitioning from the R&D to the early commercialisation phase of development.

Prospects for Economically Viable Generation, Storage and Transmission
Tidal energy, like wave energy is highly predictable, and therefore offers similar integration benefits for electricity generation. Australia's tidal stream resource is relatively unknown but it is likely that over 1000 MW of tidal energy could be developed if the technology becomes commercially viable.

Hydrogen

Relative State of Development
Hydrogen is not a source of energy, but rather an energy storage medium. International interest in hydrogen is focused on the potential for hydrogen as a new energy currency, effectively competing with electricity transmission and other energy mediums such as gases and liquids.

While renewable hydrogen can be produced from renewable energy in a number of ways, the predominant method at present is through the use of renewable electricity to split water (electrolyse) into hydrogen and oxygen. Hydrogen energy production from renewable electricity is technically proven but only currently commercially viable in a very small number of applications. Ongoing R&D and early commercialisation work is occurring around the world as the production of hydrogen from renewable energy is seen as a potential way to overcome the intermittency of some renewable energy generation devices.

One of the major opportunities Hydro Tasmania sees is the role hydrogen can play in bringing electricity into transport infrastructure and has consequently supported the establishment of the Hydrogen and Renewable Transport Laboratory (HART) at the University of Tasmania, investigating in particular renewable hydrogen internal combustion engine options and storage for wind/RAPS.

Prospects for Economically Viable Generation, Storage and Transmission

The potential for hydrogen energy to be a viable storage medium for renewable energy depends on further technological development. Further advances are required in:

- The efficiency of production of hydrogen from renewable energy;
- The cost of production, storage and distribution of hydrogen; and
- The energy density of hydrogen in storage.

Australia has enormous renewable energy resources and large scale integration (i.e. tens of thousands of MWs) may best be assisted in the future with the integrated use of hydrogen as energy storage medium.

Remote Area Power Supply (RAPS)

The use of renewable energy to provide RAPS offers opportunities for emerging renewable technologies to be cost competitive due to high local costs often from diesel generation. In the case of wind, the costs of generation are often significantly below current diesel generation costs such as on King Island where Hydro Tasmania operates the Huxley Wind Farm.

Hydro Tasmania is also collaborating with an Australian company CBD Energy Pty Ltd on a combined wind/thermal storage development and a 100kW solar installation on King Island.

Hydro Tasmania aims to create a model renewable energy system with the potential for 100% renewable energy supply through a combination of:

- Wind power (supported by the Australian Governments Remote Renewable Power Generation Program - RRPGP);
- Solar power
- Biodiesel
- Battery storage
- Thermal storage
- Advanced control systems

The continuing support for renewable technology in RAPS applications is important for the development and commercialisation of emerging technologies that cannot yet compete economically on a national scale. Furthermore, for technologies whose costs are already nearing full commercialisation, such as wind, renewable RAPS offers an opportunity to reduce greenhouse emissions while further developing the renewable energy industry.

Energy Storage

Hydro Tasmania has substantial, long term experience in developing, optimising and managing very substantial hydro energy storage facilities in Tasmania with an energy storage capacity of 15,000GWh or almost 18 months of Tasmanian demand.

Hydro Tasmania's other energy storage investigations include:

- Demonstration of a large Vanadium Redox Battery on King Island (supported by the Australian Governments Renewable Energy Commercialisation Program - RECP); and
- Development of the first commercial carbon block energy storage project in association with CBD Energy Pty Ltd.

Hydro Tasmania has also undertaken a hydrogen research program in collaboration with the University of Tasmania. This program has focussed on hydrogen production using renewable energy sources for use in stationary and transport applications. The use of hydrogen in internal combustion engines has been investigated with hybrid internal combustion engine vehicles being identified as the most viable hydrogen vehicle technology in the medium term.

An alternative pathway for renewable energy into the transport sector is plug-in hybrid vehicle. Hydro Tasmania has identified plug-in hybrids as a potentially lower cost, higher energy security and lower emission transport technology than other alternatives.

A preliminary proposal for development of a hydrogen vehicle and plug in hybrid vehicle demonstration project has been presented to the Australian Government for consideration.

Overall it is important to note that energy storage is not a barrier to development of large scale renewable energy infrastructure in Australia. Any technical constraints with the integration of intermittent generation sources will only arise when installed capacity increases significantly above existing levels.

2. Intermittency and Grid Integration of renewable energy technologies.

Hydro power supplies both competitive baseload power and high value peak capacity. This enables hydro power to play an important role in meeting the peaks of electricity demand in the NEM. Hydro Tasmania's water storages alone are capable of storing up to 18 months of Tasmania's total electricity needs. Through Basslink and the contribution of other schemes such as the Snowy Mountains Hydro-electric scheme, utilising hydro power storage potential can play an important role in overcoming any intermittency challenges from other renewable energy generation sources.

The 'intermittency' of wind and other renewable energy resources is often cited as a barrier to its economic integration into electricity markets. While the availability of wind power cannot be guaranteed, it can now be forecast quite accurately within the short timeframes required for balancing electricity supply. Furthermore, while an individual wind farm's output can be changeable, the aggregate output from wind farms distributed throughout the electricity grid is much smoother. The probability of having no wind power available in the grid is greatly reduced if many geographical locations are considered. This is a distinct possibility within Australia due to the large number and diversity of potential wind sites available.

South Australia is leading the way in Australian wind development, sourcing approximately 9% of its electricity from wind farms. Once again, this has been done without significantly impacting the operation of the electricity grid. It also needs to be recognised that the SA system is one of the most constrained systems for managing intermittency of renewable energy due to being a small system, having a lack of existing storage and limited interconnections.

Hydro Tasmania has developed a plan with NEMMCO and the Tasmanian grid company Transend that will technically enable 450MW of wind development in Tasmania where overall demand peaks at around 1800MW and is frequently as low as 900MW overnight. This plan was based on modification to operational priorities of existing generators with very minor additional operating costs and no new investment.

Hydro Tasmania's King Island Wind Project currently has a generation capacity of 2.45MW. The significance of this project is that at high winds and low demand, the generation from these turbines exceeds the total electricity demand for the island. Through a series of innovative solutions, Hydro Tasmania has created an environment where wind is providing up to 70% of demand instantaneously and around 35% on average.

For precise prediction of the wind energy available in the national electricity grid, NEMMCO is currently replacing their intermediate wind energy forecasting tool with a comprehensive tool which will allow accurate forecasting of individual wind farms over a short, medium and long term period (5min, 30min, 1hour and 4hours forecast). The development and the implementation of the new system are conducted under the initiative of the Australian Government's Energy White Paper for a centralised Australians Wind Energy Forecasting System. This will further overcome any challenges presented from intermittent wind.

3. **The benefits of a diversified energy economy.**

In recent years there has been a growing awareness and understanding of climate change as a global issue, its potential impact and the need to act now to contribute toward avoiding its most serious affects. This presents a significant challenge given Australia's economy is one of the most carbon intensive per capita in the world. In 2005, Australian electricity generation accounted for 194.3 Mt of CO_2-e or 34.7% of national emissions[4]. Reducing

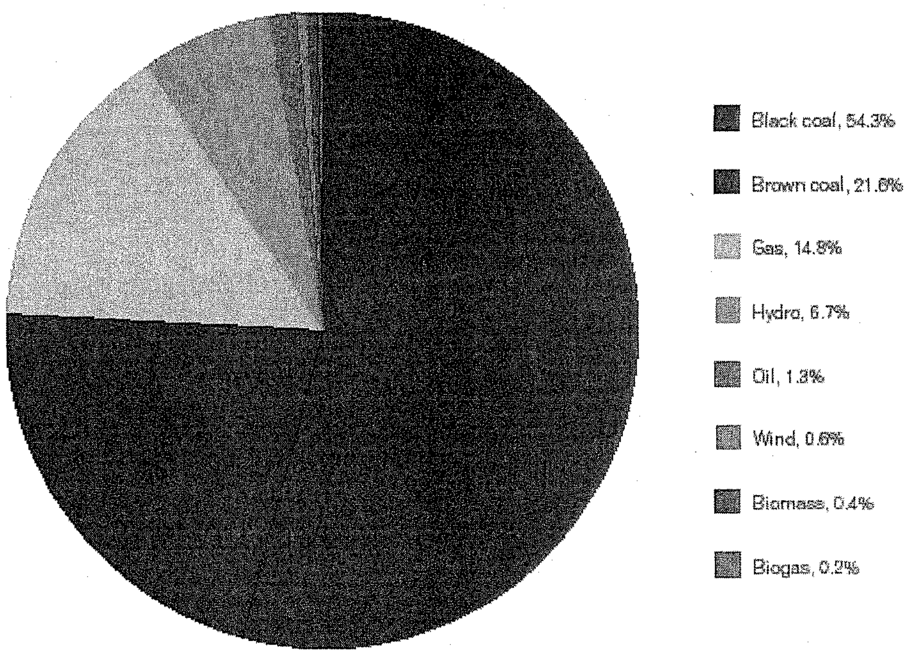
[4] Australian National Greenhouse Gas Inventory 2005

emissions from electricity generation will make a significant contribution to reducing Australia's greenhouse gas inventory. To facilitate this, all possible low emissions technologies and their potential contribution should be examined including renewable generation.

Annual energy demand is predicted to rise to 614TWh[5] by 2050 compared with current demand of 234TWh. This increased demand for energy will require new power stations throughout Australia. Without investment in low and zero emissions technologies it is likely that Australia's emissions profile will rise further, negating any positive moves in other sectors of the economy to reduce emissions. Emissions trading, when combined with complementary support measures (detailed below) can provide the economic driver necessary for this transition.

The current period of drought that continues to affect Australia has greatly impacted on the electricity sector. Water storages for hydro dams are at record lows with Hydro Tasmania's storages experiencing 10 years of below average inflows and currently at their lowest level since 1968. The shortage of water has also impacted significantly on traditional coal powered plants, with water restrictions forcing some fossil fuel base generators to run below optimal capacity. This has collectively resulted in dramatic rises in electricity prices and also highlights the current vulnerability of Australia's energy infrastructure to climatic variations. Current climate change expectations and in particular predicted ongoing water shortages are only likely to exacerbate this situation, particularly given Australia's high level of reliance on fossil fuel based generation as depicted in Figure 7 below.

Figure 7: Australian electricity generation by fuel, 2004-2005.



Source: UMPNER Report, 2006.

[5] Department of Environment and Heritage 2005

A diversified and distributed energy mix ensures protection from supply constraints and can subsequently minimise price volatility. By utilising a range of electricity generation options including renewable energy, Australia can insure itself against volatility in supply markets and the ongoing and increased affects of climate change.

4. Existing Renewable Energy Legislation and the impact it has had on the industry.

The Federal Government's Mandatory Renewable Energy Target (MRET) has been a significant driver of Australia's renewable energy industry, and an important driver in Hydro Tasmania's activities, including enabling Roaring 40s to develop the expertise required to successfully enter the Chinese and Indian renewable energy market.

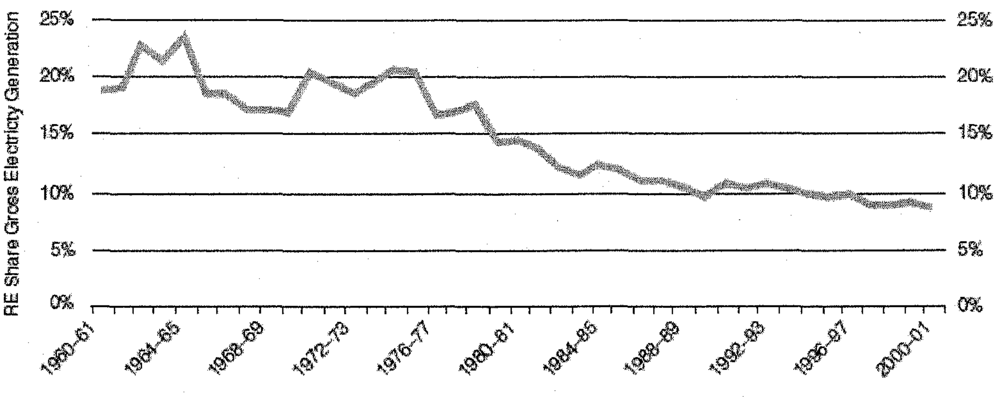
In its first years of operation, the MRET initiated enough additional new renewable generation to achieve the target of 9,500GWh for 2020. This is evidence that the MRET was an effective price transfer mechanism (rather than a fiscal subsidy) that brought economic development along with real greenhouse gas emissions reduction. It also demonstrates the numerous renewable energy opportunities that exist within Australia and that the skills required to grow this industry are already well developed nationally.

The decision not to extend the MRET target of 9,500GWh by 2020 has seen a number of stalled renewable projects with knock-on effects including job losses such as at the $14 million Vestas factory at Wynyard Tasmania which previously employed 70 people.

The percentage of Australia's electricity produced from renewable generation has declined significantly from around 23% in 1965 to 10.5% in 1997. The initial intention of MRET was to increase this percentage by 2%. However, due to rising electricity consumption it is predicted that without new measures renewable generation will only account for 8.5% of national electricity generated[6] in 2020. This is illustrated in Figure 8 below.

[6] REGA 2004

Figure 8: Relative Renewable Energy share of Electricity Generation (1960-2001)



Source: MRET Review Report 2003

State Based Renewable Energy Targets

With the exhaustion of the MRET incentives, both the Victorian and New South Wales State Governments have further facilitated renewable energy development through the establishment of the Victorian Renewable Energy Target (VRET) and the New South Wales Renewable Energy Target (NRET) schemes. Both of these targets aim to continue the momentum achieved under MRET and support further renewable energy deployment.

Hydro Tasmania welcomes the progress already made within Victoria and plans for NRET. Furthermore, the recent announcements by Western Australia, Queensland and South Australia that they will introduce their own renewable energy targets reaffirms both the value of the renewable energy industry and continued effectiveness of targets as an important market mechanism.

While Hydro Tasmania welcomes the positive contribution that these states are making to renewable energy in Australia, we believe that a national scheme such as an extended and expanded MRET (or similar low emissions driver) would be a more efficient mechanism. Such a measure would need to incorporate and build upon both the existing MRET and the various state-based measures.

These mechanisms can complement emissions trading as discussed below.

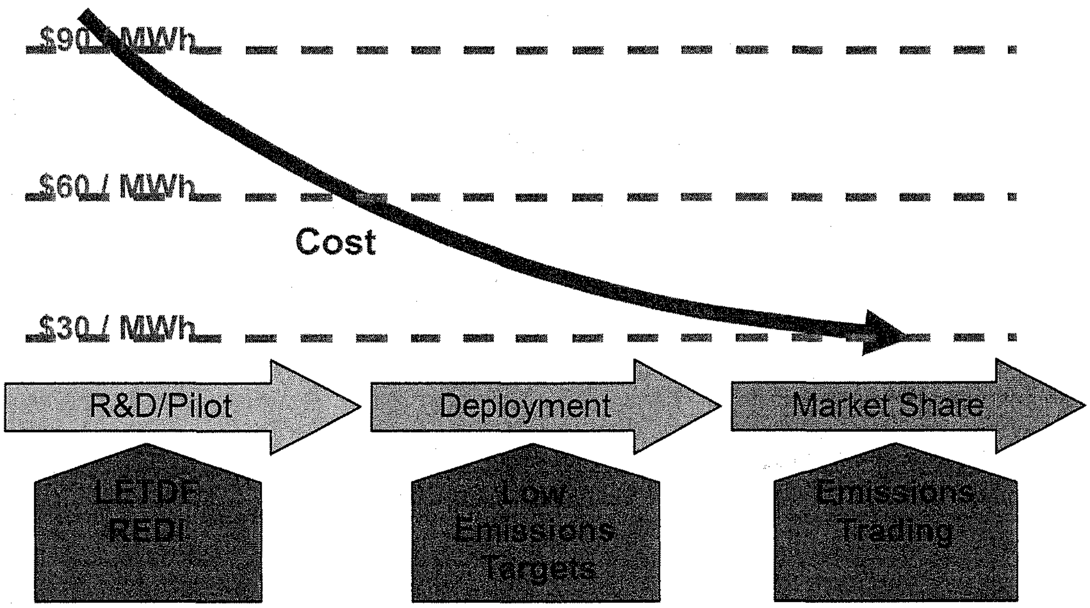
5. Technology development cycles and support requirements.

The above details the vast potential for renewable energy technologies within Australia. However, each technology requires targeted support measures to ensure that this potential is realised and renewable energy can play an increasing role in meeting Australia's future energy needs, while reducing greenhouse gas emissions.

Hydro Tasmania believes that a range of support mechanisms are necessary to progress each of these low and zero emissions energy technologies, including renewables, along the technology development curve and ultimately ensure mass deployment. This will commence with grants and funding at the research and development/pilot stage. Ongoing government commitment to such programs, including LETDF, form part of an overall strategy to bring new technologies from concept to deployment and commercialisation.

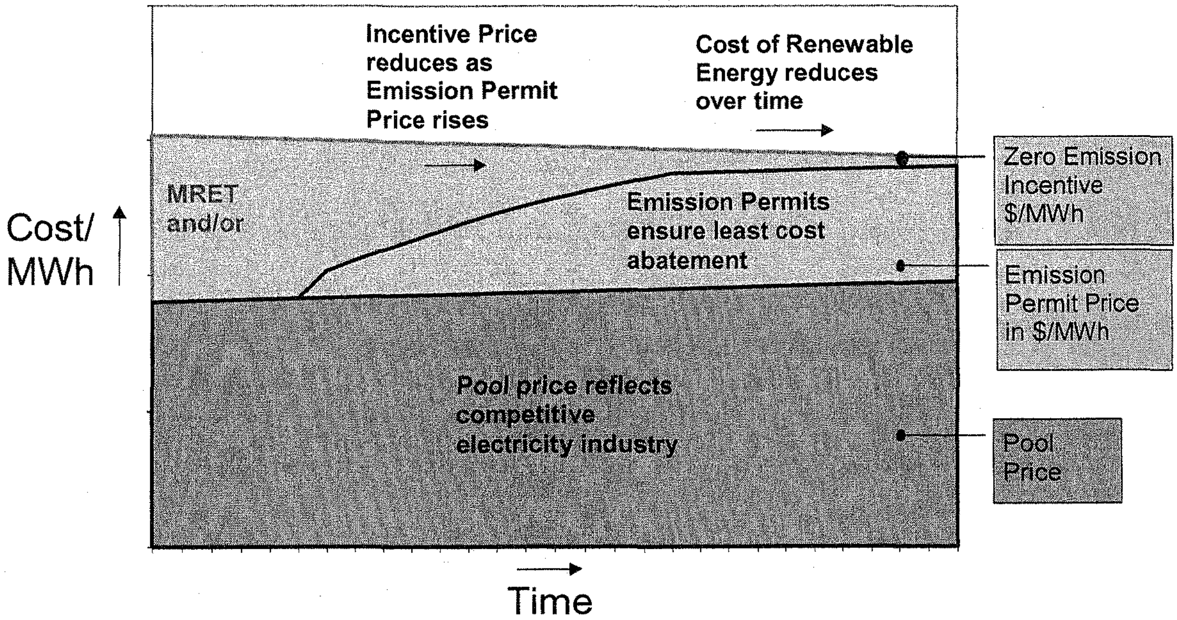
Appropriate support mechanisms, as illustrated in the figure below, are necessary to ensure emerging technologies are supported at all stages of development. These support mechanisms will provide the necessary incentives to bring technologies, including, carbon capture and storage, renewable energy and energy storage, from research and development through to full scale deployment and commercialisation.

Figure 9: Portfolio of measures necessary for technology development



Hydro Tasmania believes that an extended renewable energy target or similar low-emissions mechanism can co-exist with emissions trading until such point as there is cost convergence, as illustrated in Figure 10 below, and then phased out. As the cost of carbon is truly reflected in the economy, the need for complementary measures will decrease.

Figure 10: Complementary nature of MRET and ETS



Conclusion

Hydro Tasmania has long established expertise and experience developing renewable energy technologies. These technologies have secured Australia's energy supply and made a valuable contribution to minimising Australia's greenhouse gas emissions.

While the overall contribution of renewable energy supply toward Australia's total requirements has fallen over the past decades, many countries are making significant increases in renewable energy. Australia has an abundant renewable energy resource and the expertise and capacity to significantly increase the existing level of renewable energy deployed within Australia.

These are ready to be deployed now in Australia with very little adjustment to the national electricity grid and its operations. A portfolio of technologies deployed across a geographically dispersed region, supported by emerging storage solutions and existing large hydro power storage capacity can deliver a significant portion of Australia's energy supply in a safe, secure and environmentally friendly manner.

While a range of renewable energy technologies are in different phases of the technology development cycle, the current mix of incentives for commercialisation of these technologies is insufficient. A comprehensive suite of policy measures is essential to provide appropriate incentives for continued research and development/pilots of emerging technologies as well as their deployment and full commercialisation.