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Encouraging renewable energy in Australia in the electricity sector: A purely market based approach or a mix of policy measures?

Final Report

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ACRONYMS & ABBREVIATIONS

AP6	Asia-Pacific Partnership on Clean Development and Climate
BCA	Business Council of Australia
CPRS	Carbon Pollution Reduction Scheme
CCS	Carbon Capture & Storage
CEEM	Centre for Energy and Environmental Markets
COAG	Council of Australian Governments
CSTP	Concentrating Solar Thermal Power
EIF	Energy Innovation Fund
ETS	Emissions Trading Scheme
EU – ETS	European Union – Emissions Trading Scheme
FIT	Feed-In Tariff
GGAS	NSW Greenhouse Gas Abatement Scheme
GWh	Gigawatt-hours
ITC	Investment Tax Credits
kVA	Kilovolt-amps
kWh	Kilowatt-hours
LETDF	Low Emissions Technology Demonstration Fund
MMA	McLennan Magasanik Associates
MRET	Mandatory Renewable Energy Target
MWh	Megawatt-hours
NCCF	National Clean Coal Fund
NEM	National Electricity Market
NGO	Non Government Organisation
NRET	NSW Renewable Energy Target
PV	Photovoltaic
R&D	Research and Development
REC	Renewable Energy Certificate
REF	Renewable Energy Fund
RET	Renewable Energy Target
RGGI	Regional Greenhouse Gas Initiative (US)
RO	Renewables Obligation (UK)
VRET	Victorian Renewable Energy Target

EXECUTIVE SUMMARY

The development of renewable energy as a sustainable energy source is extremely important in the face of climate change and growing energy instability worldwide. Despite the critical nature of reducing emissions, and the country's vast renewable energy potential, Australia has lagged behind other developed countries in the deployment of renewable energy. This can predominantly be linked to past policy inaction, compared to more extensive policies overseas. This report considers the impacts of various policy measures on the innovation and adoption of renewable energy in Australia, with a focus on electricity. The effectiveness of emissions trading as the primary policy measure is explored and consideration is given to the ideal policy mix to support renewable energy, with a focus on the potential impacts for the deployment of wind energy and solar thermal power generation.

The key policy objective that is met by renewable energy policy is greenhouse gas emission reduction. Stringent long term targets are going to require a significant percentage of renewable energy in order to meet emissions reductions. However, renewable energy can also meet other policy objectives such as energy security, job creation, development of a renewable energy export industry and other environmental benefits. Despite its importance, there are a number of barriers to innovation and adoption of renewable energy that need to be considered when making policy decisions. These include issues such as the path dependence and technological lock-in of fossil fuels, higher costs, technology immaturity, higher perceived investment risk and grid connection issues.

Current Australian policy experience in promoting renewable energies has been limited with slow development of a renewable energy industry in Australia. Probably the most notable effect was via the Mandatory Renewable Energy Target (MRET) which led to an increase in wind energy, however this stagnated as soon as the minimal targets were saturated. Following this, the Howard government's focus was technology spending on low emissions technology which failed to provide much incentive for renewable energy. Policy efforts internationally, particularly in the European Union (EU), have had a much greater impact on the development of renewable energy. Policies that have been specifically targeted to renewable energy such as renewable energy targets and feed-in tariffs, have driven renewable energy growth, however concerns have been raised in regard to the effectiveness of the European Union – Emissions Trading Scheme (EU-ETS).

The Australian Government is now in the process of implementing a greater range of policy measures to promote renewable energy. These include the Carbon Pollution Reduction Scheme (CPRS) to start in 2010, an expanded Renewable Energy Target (RET) of 20% of electricity by 2020, and direct funding for renewable energy technologies. While this is a positive step for renewable energy, there are still a number of concerns regarding the effectiveness of some of the policy measures. Renewable energy stakeholder views on the appropriate policy mix vary, however there is a general consensus that it is important to put a price on carbon and that emissions trading can support this goal. Despite this, an emissions trading scheme (ETS) was not considered likely to generate a carbon price high enough to promote the innovation and adoption of renewable energy until at least 2020. Therefore it was considered necessary by the interviewees for additional policy measures to target renewable energy technologies in the various stages of maturity.

In conclusion, the key findings are that emissions trading is insufficient as the primary policy measure as it only targets one area, namely internalisation of emissions costs. Emissions trading on its own will not promote the most cost effective choices for emissions abatement over the longer term due to imperfect markets, learning effects and other significant barriers to the innovation and adoption of renewable energy. In addition, renewable energy technologies can provide additional benefits that cannot be supported by emissions trading alone. Therefore, a mix of policy measures is likely to be required which target the various policy objectives and barriers to renewable energy technologies at various levels of maturity.

1 INTRODUCTION

1.1 Research Topic

Encouraging renewable energy in Australia in the electricity sector: A purely market based approach or a mix of policy measures?

This project considers impacts of various policy measures on innovation and adoption of renewable energy in Australia, with a particular focus on the electricity sector. The key areas to be addressed include:

- Exploration of the effectiveness of a purely market based approach such as emissions trading as the primary policy measure, with particular consideration of the impact this would have on the innovation and adoption of renewable energy.
- Review of a possible mix of policy measures and their ability to facilitate innovation and adoption of renewable energy including comparison of impacts on wind and solar thermal technologies.

A selection of renewable energy stakeholder views on the appropriate policy mix will also be considered.

1.2 Limitations and Boundaries

This project has been undertaken to satisfy 2 subjects (12 Units of Credit) out of 12 required subjects as part of the Master of Environmental Management at the University of New South Wales.

Limitations and boundaries are:

- The project will only address policy measures that are relevant to innovation and adoption of renewable energy, with a focus on the electricity sector. Other measures such as energy efficiency or low emissions technology are considered important, but are outside the scope of this review.
- Emissions trading will be reviewed in terms of its effectiveness for promoting innovation and adoption of renewable energy. This project does not intend to be a full critique of an Emissions Trading Scheme (ETS) or the proposed Australian Carbon Pollution Reduction Scheme (CPRS).
- Policy measures will be considered in terms of their effectiveness in overcoming key barriers to encourage the adoption and innovation of renewable energy. Detailed review of the design of particular policy measures including comprehensive comparison of international schemes is outside the scope of this report.
- Interviews are intended to provide perspectives from particular stakeholders in the renewable energy area, rather than an analysis of the full range of views on the topic.
- Not all renewable energy technologies will be considered in detail. The analysis will focus on wind energy and solar thermal power generation in order to compare renewable energy at different levels of maturity and cost.

2 METHODOLOGY

In order to address the research topic, a significant amount of the information is being obtained through critical analysis of the arguments presented in literature, supported by a limited number of semi-structured interviews. The review of information collected is divided into two key areas.

The first part involves a review of literature relating to policy drivers for renewable energy, policy support mechanisms and policy impacts specific to wind and solar thermal power.

The second part involves a consideration of renewable energy stakeholder views and expertise on the Australian policy approach towards climate change mitigation in terms of whether a purely market based approach or a mix of policy measures will provide support for the adoption and innovation of renewable energy.

Following this the results of the literature review and stakeholder interviews are discussed in terms of the research topic.

The semi-structured interviews are used to complement the variety of information and views found in literature. Given the limited scope of the project, it is not feasible to interview a sufficient sample size to understand the full range of stakeholder views on the topic. However, the interviews can provide a deeper insight into the views of a number of key stakeholders who have generated significant experience and knowledge in the area of renewable energy policy. Research ethics approval for this project is detailed in Appendix A.

Table 1 highlights the interviews that were conducted and Appendix B provides an overview of the key topics for discussion as part of the semi-structured interview process.

Table 1: Schedule of Interviews

Name	Position	Type	Date
John Kaye	Greens MP, Legislative Parliament of NSW	Face to face	21st August 2008
John Connor	CEO, The Climate Institute	Face to face	22nd August 2008
Alan Pears	Senior Lecturer Environment & Planning, RMIT	Phone	8th September 2008
Frank Jotzo	ANU Research Fellow & advisor to the Garnaut Report	Phone	8th September 2008
Iain MacGill	Joint Director (Engineering), Centre for Energy and Environmental Markets - CEEM	Phone	29th January 2009
Artur Zawadski	Manager, Business Development & Project Delivery, Wizard Power	Phone	29th January 2009
Peter Meurs	Managing Director, EcoNomics, WorleyParsons	Phone	3rd February 2009
Mark Diesendorf	Institute of Environmental Studies, UNSW	Phone	10th February 2009
Andrew Durran	Executive Director, EPURON	Phone	12th February 2009

3 LITERATURE REVIEW

The literature review provides an overview of key areas supporting the research topic. A background is provided on why policy support is important for promoting the innovation and adoption of renewable energy and the key policy support mechanisms for renewable energy are reviewed in an Australian context. Finally, potential impacts of policy mechanisms are discussed in terms of the development of wind energy and solar thermal power generation.

3.1 Policy Drivers for Renewable Energy

This section reviews a range of different drivers for the innovation and adoption of renewable energy. These include policy objectives promoting the benefits that renewable energy can provide and also the necessity to provide assistance for overcoming the various barriers to the innovation and adoption of renewable energy.

3.1.1 Renewable Energy Benefits and Policy Objectives

A key policy objective for the development of renewable energy is greenhouse gas reduction, however there are other important objectives including ensuring energy security, job creation, development of a renewable energy manufacturing and export industry and other environmental benefits. These areas are discussed in more detail below.

Greenhouse gas emission reduction

Greenhouse gas emission reduction is one of the greatest drivers for the adoption of renewable energy. Many studies have been conducted to show that meaningful targets for greenhouse gas are possible, and renewable energy development plays an important part in this abatement. Examples of emissions abatement modelling includes:

- “A Clean Energy Future for Australia” provides scenarios for a 50% reduction in greenhouse gas emissions by 2040 compared with 2001 emissions. The scenarios focus on high percentages of renewable energy sourced from biomass, wind and solar, backed up with natural gas (Saddler et al. 2004, 2007).
- Diesendorf’s “Path to a Low Carbon Future” reviews a 30% reduction by 2020 compared with 1990 levels. This model includes increases from 2004 to 2020 of 10% wind power, 8% bioelectricity, 2.5% solar thermal, 2.5% solar PV and 7.5% geothermal (Diesendorf 2007a).
- The Climate Institute provide a pathway for 25% emission reductions by 2020 below 1990 levels. This model assumes renewable energy growth as per the government’s 20% renewable energy targets drawn from geothermal, wind and concentrated solar thermal. They indicate a higher level of abatement from Carbon Capture and Storage (CCS) (Climate Institute 2008).
- “Energy [r]evolution: outlook for Australia” indicates that there should be 40% reduction from 1990 levels by 2020 and cut by two thirds by 2040. They highlight that it will be possible to achieve 40% of Australia’s electricity generation from renewable energy in 2020 to help meet this target with the major contributors being wind and solar, but also rapidly emerging technologies such as ocean energy, geothermal and concentrated solar thermal (Greenpeace 2008).
- McKinsey and Company model possibilities for 30% reduction by 2020 below 1990 levels and 60% reduction by 2030. In terms of renewable energy, this model assumes 15% generation of power from onshore wind, 8% from geothermal, but also highlights a significant proportion of power abatement from Carbon Capture and Storage (CCS) (McKinsey & Company 2008).

These models vary considerably, but they all indicate that significant investment in renewable energy is required, predominantly with technologies that are currently available for short term targets. All models conclude that renewable energy plays an important part in greenhouse gas abatement.

Energy security

In the face of rising oil prices and finite nature of fossil fuel reserves, renewable energy will provide a long term stable solution to the provision of energy (Sonneborn 2004). The small scale and dispersed nature of renewable energy can also lead to benefits in terms of overall energy security. There is not a dependence on individual large power plants. This is particularly important in rural areas where energy costs are higher and there is insufficient diversity of supply (MMA 2007a; Sorrell & Sijm 2003).

Australia has been highlighted as enjoying a high level of energy security due to its significant oil, gas and coal reserves (Australian Government 2004), however more recent analysis indicates that Australia reached its peak in oil production by around 2000 and subsequently its self sufficiency in oil is rapidly declining. Australia is likely to become much more dependent on less stable imports from the Middle east as reserves in the Asia-Pacific region also decline (Wesley 2007). In addition, Australia stands to be impacted by future global energy crises linked to political and economic instability (Wesley 2007). Local renewable energy sources can help to reduce dependency on unstable global fuel markets.

Job creation

A report by CSIRO indicates that implementing policies to transition to sustainability will contribute to overall job growth which is projected to be in the order of 2.5 to 3.3 million jobs over the next few decades. Job increases due to sustainability initiatives are forecast to be around 230,000 to 340,000 over business as usual, in the transport, construction, agriculture, manufacturing and mining sectors (CSIRO 2008). In addition a report commissioned by the Australian Conservation Foundation and the ACTU highlights that with the right effort, an additional 500,000 jobs, over and above business as usual, can also be created by 2030 in markets relating to renewable energy, energy efficiency, sustainable water systems, biomaterials, green buildings and waste and recycling (ACF & ACTU 2008). However, to facilitate this job growth, both reports highlight the importance of policy and funding being directed at retraining and restructuring of job markets.

Manufacturing is the largest employer in the Australian economy with almost a million full time jobs, however industry growth has stalled over the last decade. The Australian Manufacturing Workers Union (AMWU 2008) has highlighted the benefits of developing Australia’s renewable energy industry in order to expand and increase economic growth and job opportunities in the manufacturing industry.

Renewable energy export industry

As global development of renewable energy intensifies, there will be opportunity for developing export potential in the area of renewable industries (Sorrell & Sijm 2003). Effort put into developing renewable energy technology presents significant opportunities for exporting technologies and potentially energy to fast growing markets in Asia-Pacific such as China and India (MMA 2006). Delayed action could result in reduced market share in global renewable energy markets (AMWU 2008).

Strong renewable energy markets in Germany provide a good example of how well-directed environmental policy has led to the development of viable domestic markets and has in turn allowed German business to be extremely successful in exporting expertise and technology to the global market (ACF & ACTU 2008).

Other environmental benefits

Many sustainable renewable energy sources have additional environmental benefits when compared to current sources of energy. For example coal, which is the largest source from which electricity is generated in Australia causes a range of negative environmental impacts from mining, transportation and combustion in addition to greenhouse gas emissions including air pollution, high water use, water pollution, land degradation and results in significant waste (Diesendorf 2007b). Renewable energy sources, such as micro hydro, solar PV and wind have been demonstrated to provide environmental benefits over fossil fuel alternatives including the reduction of air pollution such as sulphur dioxide and nitrogen oxide and reduction of water pollution (Akella et al. 2009).

3.1.2 Barriers to Innovation and Adoption of Renewable Energy

There are a number of market failures or barriers to the adoption of renewable energy that need to be considered in the development of policy to encourage innovation and adoption of renewable energy. Some of the issues that present a barrier to renewable energy include environmental externalities, path dependence & lock in, learning effects & scale economies (relative to entrenched technologies), knowledge & early mover spillovers, investor risk premiums, fossil fuel subsidies and also grid connection.

Environmental Externalities

Historically a significant market failure is that environmental costs, including greenhouse gas emissions, have not been considered in the overall costs of energy. High emissions industries such as coal-fired generation currently emit greenhouse gases with no direct cost to the energy generator or consumer, despite the significant environmental cost associated with emissions. Internalisation of emissions cost into energy pricing could help to make renewable energy cost competitive with fossil fuels. Until a price is put on carbon, this represents a barrier to the innovation and adoption of renewable energy.

Path dependence and lock-in

Technological development is influenced by the setting in which it develops. Whether a particular technology will be taken up depends on the path of development, which is impacted by the initial market characteristics, the institutional and regulatory factors that are present at the time of introduction and also what the consumer expects from the technology (Foxon 2007). The specific conditions present at a particular time will favour some technologies over others and these technologies will be the ones that are adopted. The more a technology is adopted, the more it is likely to be adopted, as it can benefit from economies of scale and learning effects that help to reduce costs and strengthen institutional relationships. This can lead to lock-in of particular technologies that gained an early lead in the market due to historical advantages and lock-out of new technologies (Arthur 1989; del Río & Unruh 2007; Foxon 2007).

Fossil fuels have had the benefit of developing and expanding in the absence of any internalisation of health and environmental costs and have also enjoyed significant government support and subsidies throughout their development (Riedy 2007; Sonneborn 2004). Unlike products that provided a new service, such as mobile phones and computers, renewable energy technologies must compete with pre-existing fossil fuel technologies that already provide energy services and are effectively locked-in to the market (del Río & Unruh 2007; Mallon 2006). Additional constraints to technology adoption are present in the fact that renewable technologies must follow the existing development paths that have been established for fossil fuels which are supported by existing social organisations and institutions (del Río & Unruh 2007). Fuel supply infrastructure, maintenance services and financial services are also well established to support fossil fuel industries (del Río & Unruh 2007; Sonneborn 2004).

When designing policy to encourage a switch to "low emissions technology", it is important to consider that the most efficient technologies are not necessarily those locked-in. Technologies that have short term advantages are more likely to be adopted and therefore be "locked-in", while technologies which are more likely to have long term advantages may be "locked-out" (OECD & IEA 2003). For example if an emissions trading scheme is introduced in Australia with a low permit price, gas fired power stations are likely to be locked-in as this is the cheapest available technology that is cleaner than coal and melds with existing infrastructure and institutions. This may further lock-out renewable energy that can provide a sustainable energy source with long term emissions abatement benefits. The cost of switching to "locked out" technologies also becomes more prohibitive as time goes on (Sorrell & Sijm 2003).

Learning effects & Scale Economies

New technologies tend to be more expensive at the outset, however they can become more cost effective over time due to learning effects, including learning by doing and learning by research. Learning by doing relates to the fact that technologies become more efficient as they are used in practice, due to feedback between market experience and further technical development. Technologies can also benefit from scale economies where production costs reduce when a greater number of units are produced. Experience shows that unit costs of technologies decrease as total unit volume rises and this occurs faster for less mature technologies (OECD & IEA 2003).

Innovation and learning activities often relate to the relationships between actors, agents and institutions where there are many opportunities for learning by doing, using and interacting (Smit et al. 2007). Other factors that can be improved by increasing the number of projects, include aspects such as resource assessment, siting, planning, project proposals, financial arrangements and negotiating power-purchase contracts which can help to reduce the price per kilowatt-hour for renewable energy projects (Beck et al. 2004)

Learning by research is also important as technologies that are classified as evolving, for example wind, have been shown to have significant gains in terms of both learning by doing and learning by research and the results of the two cannot be substituted (Jamasb 2007). While research and development (R&D) is important to developing new technologies, it does not capture the gains that occur from learning by doing. Promising new technologies need to be given the opportunity to learn in the market place and as highlighted in the previous discussion, deferring decisions to deploy them will risk locking out these technologies (Kallbekken & Rive 2007).

Early mover spill-overs

Early adopters of new technologies create benefits which can spill over to other firms who are then able to exploit these benefits, however the early adopters wear all of the initial costs. These benefits include provision of knowledge on characteristics and applicability of new technologies as well as improvements due to "learning by doing" (MMA 2007a). Concern regarding early mover spill-overs is one of the key reasons why firms under invest in R&D for new technologies (OECD & IEA 2003).

Investor risk premiums

Investors apply risk premiums to new technologies due to uncertainty over the potential performance of new technologies (MMA 2007a). High capital costs of renewable energy may lead to higher investment premiums as investors are concerned about risking higher up front costs (Beck et al. 2004). Investors are also unable to gain benefit for intangible social benefits that renewable energy can provide (Sorrell & Sijm 2003).

Technologies may be perceived as risky if used in new application or region even if there is experience with them elsewhere. This will lead to requirements for increased rates of return or place more stringent requirements on new technologies. This can also lead to prejudice by utilities against planning for these types of technologies (Beck et al. 2004).

Fossil fuel subsidies

Subsidies for fossil fuels come in a number of forms including direct payments, tax breaks, R&D spending, liability insurance, project finance and other government practices (Beck et al. 2004; Riedy 2007). The total volume of subsidies in energy and transport in Australia has been estimated to be between $9.3 billion and $10.1 billion during 2005-6, with less than 4% of these identified subsidies providing support for renewable energy and energy efficiency (Riedy 2007). In calculation of these figures, a subsidy is considered to exist when "government action or inaction lowers the cost of production, raises prices received by producers or prevents full cost recovery for a service" (Riedy 2007, piii). One example of a subsidy is in the form of a reduced price for coal provided to coal fired power stations calculated to be between $450 million to $1.1 billion in 2005-2006. This subsidy is calculated based on the fact that coal fired power stations are receiving coal for less than international market rates (Riedy 2007). Although some of this price difference is likely to be accounted for due to plant location and coal quality, the research on which this is based indicated that the price difference was in some part linked to government intervention (Riedy 2007). There is also evidence of coal suppliers seeking shorter contracts and greater export price parity indicating that they consider current domestic prices to be too low (Centennial Coal 2009).

Grid Connection

Allocation of full grid costs to developers of new renewable energy projects can present a significant barrier to installation of new renewable energy generation capacity (Diesendorf 2007b; Swider et al. 2008). In addition, utilities may set interconnection requirements that are unreasonable for small generators and add significantly to their expense (Beck et al. 2004). Renewable energy projects may not be able to go ahead if existing grid infrastructure cannot support them and costs of grid expansion are too high.

3.2 Renewable Policy Support Mechanisms

This section reviews the key policy support mechanisms relevant to the innovation and adoption of renewable energy, with a particular focus on renewable electricity, including an emissions trading scheme, the renewable energy target, government funding, feed-in tariffs, grid connection policies and a number of other important policy issues.

3.2.1 Emissions Trading Scheme

A key factor influencing whether an Emissions Trading Scheme (ETS) will encourage innovation and adoption of renewable energy relates to the overall effectiveness of the scheme and the stringency of the emissions targets. Australia is set to introduce the Carbon Pollution Reduction Scheme (CPRS) on 1 July 2010, provided legislation passes through Parliament. According to the White Paper this will be a cap and trade scheme, requiring greenhouse gas emitters to acquire a permit for each tonne of carbon that they emit. The total number of permits available will be limited by the government in order to meet emissions targets (Australian Government 2008b). Although this discussion does not attempt to provide a full critique of the proposed scheme, the likely effectiveness of emissions trading is reviewed in terms of the limited experience in Australia and the European Union – Emissions Trading Scheme (EU-ETS).

Australia has some previous experience with emissions credit trading in the form of the NSW Greenhouse Gas Abatement Scheme (NSW-GGAS). Although the scheme has been running for a reasonable period of time, the effectiveness of this scheme has been questioned in terms of its ability to ensure abatement over and above what would have occurred. The main criticisms are due to a range of design choices and governance issues

(Passey et al. 2008). The NSW-GGAS is a baseline and credit scheme, so the lessons learned cannot be directly applied to the CPRS, however it does highlight the importance of getting scheme design right and ensuring good governance.

The EU-ETS provides the best example of a large scale cap and trade ETS that has been in effect since 2005, so some lessons can be drawn from their experience. Phase I of the operation of the EU-ETS (2005-2007) was predominantly a learning phase. This phase highlighted significant issues that may undermine the fairness and effectiveness of the scheme including high levels of free allocation and over allocation of permits.

A key issue relates to the way that permits have been allocated in the first two phases of the scheme. Under the EU-ETS, almost all of the allowances were given away for free based on previous emissions, known as grandfathering, rather than requiring firms to purchase them as part of an auction. Even when received for free, if possible the cost of permits used to offset emissions are passed onto the consumer. This is due to the opportunity cost of not being able to sell these permits on the carbon market. This has resulted in windfall profits for those firms that received free allocation of permits (Betz & Sato 2006). Additionally, a number of studies have found that free allocation of permits can be directly correlated with the appreciation of the company share price (Oberndorfer 2009; Veith et al. 2009). This highlights that firms are not just being compensated for their increased regulatory burden, but are actually receiving windfall profits (Veith et al. 2009). Electricity companies that compete in domestic markets are most likely to benefit from windfall profits as they are more easily able to pass on costs to the consumer, for example when compared to trade exposed industries (Egenhofer 2007). Windfall gains may artificially inflate the value of a high emissions generator relative to a low or no emissions generator.

Another issue with phase I of the EU-ETS relates to emission target setting and the fact that permits were over allocated. This can partly be put down to time pressure in developing the scheme and difficulties in accurately reporting and verifying emissions, particularly when the method of allocation provided an incentive for firms to overstate their emissions to receive a greater number of permits. This over allocation of permits resulted in the permit price crashing when emissions information and verification became more concrete, resulting in significant price volatility (Betz 2006; Betz & Sato 2006). This highlights the importance of having effective information on current actual emissions and also setting targets well below the business as usual levels, so as to avoid the price volatility that occurred with the EU-ETS (Egenhofer 2007). Low permit price or price volatility has significant consequences for renewable energy as it reduces the incentive to invest in renewable energy and contributes to uncertainty. Price impacts have been modelled for the EU-ETS which demonstrated that current and projected carbon prices alone are insufficient to generate investment into wind energy and that the price would need to reach at least 40 Euros per tonne of CO_2 before investment would become attractive (Blanco & Rodrigues 2008).

Similar issues are likely to be faced in the early stages of the CPRS. The White Paper indicates that there will be a significant number of permits being allocated freely to some of the energy intensive industries including trade-exposed industries as well as coal fired generators. Coal fired generators will receive free permits to the value of around $3.9 billion over the first 5 years of the scheme (Australian Government 2008a, p13-21). As part of this assistance, there is the option of withholding the last 2 years of support following a review of windfall gains, however the White Paper also highlights the complexity of this type of review (Australian Government 2008a, p13-40). Therefore it may difficult to prevent windfall gains. Free allocation may make continued investment in those emissions intensive industries more attractive and if companies are over compensated this reduces potential revenue from the scheme which could be directed towards low emissions technology, such as renewable energy, or other measures such as energy efficiency.

In addition, the targets set under the CPRS are low with a proposed unconditional 5% reduction below 2000 levels by 2020, up to a possible 15% reduction, depending on the level of international action (Australian Government 2008b, p4-1). If a 5% target is put in place, then the carbon price at introduction is estimated to be $23 per tonne of CO_2-equivalent, reaching $35 (2005 dollar equivalent) by 2020. Alternatively for the 15% target the carbon price is estimated to start at $32 per tonne and go up to $50 by 2020 (Australian Government 2008b, p4-25). In isolation, these types of carbon prices may not be sufficiently high to generate significant investment into renewable energy in the early stages of the scheme. In addition, if the baseline emissions levels to which the targets are applied are overestimated in the initial stages of the scheme, then there is a risk that there could even be a price decrease once this information is clarified, as occurred with the EU-ETS.

The Australian Government responded to some of the criticisms of the CPRS indicating that Australia is off to a late start in tackling climate change. The importance of providing assistance to high emissions industries is highlighted to ensure a smooth transition for Australian jobs and to prevent carbon leakage if high emissions industries move overseas. Also in regard to the level of targets proposed, it is highlighted that the scheme will ensure that emissions are up to 30 percent lower in 2020 than they would have been without the scheme and that Australia will be in a much better position than it would be with no scheme in place at all (Wong 2009). In early 2009, there was significant political disagreement in regard to the CPRS with the Greens indicating that the target was not strong enough and too much support was being given to polluters. The Opposition was also questioning whether an ETS was in fact still the appropriate scheme given that the National Party and some members of the Liberal Party were opposed to an ETS (Coorey 2009). This highlights potential concern as to whether agreement will even be reached in order to pass the CPRS through the Senate and provides greater uncertainty to business, including renewable energy investment.

3.2.2 Renewable Energy Target

A Renewable Energy Target (RET) involves mandating a percentage or a specific amount of electricity that is required to be met by renewable energy technologies. Although specifics of scheme design may differ, renewable energy targets, also known as renewable tradeable quotas, renewable portfolio standards or tradeable green certificates have become increasingly common in OECD countries as a means to promote deployment of renewable energy (Agnolucci 2007a).

Australia was one of the first to implement a mandatory target scheme with the introduction of the Mandatory Renewable Energy Target (MRET) in 2001, requiring that an additional 9,500 gigawatt-hours per year of renewable energy to be produced by 2010. This was initially proposed as a blanket 2% increase in renewable energy generation, however industry pressure and lobbying resulted in a fixed amount of electricity being set to provide greater certainty in electricity price increases. Due to increases in energy demand, this would amount in real terms to an increase of about 0.2% in renewable energy by 2010 (Kelly 2007; Kent & Mercer 2006).

The MRET scheme involves the issue of a Renewable Energy Certificate (REC) for each megawatt-hour of electricity produced by an accredited renewable energy generator. Liable parties, electricity wholesalers, retailers and large purchasers, are required to obtain and surrender RECs to meet their proportion of the annual target, based on the percentage of electricity they purchase in that year, however anyone can purchase RECs similar to the share market. Liable parties receive a penalty of $40 per megawatt-hour for any shortfall in RECs to meet their target (Kent & Mercer 2006). The sale of RECs provides additional income for renewable energy generators and therefore encourages greater investment; however the actual REC price has fluctuated considerably contributing to market uncertainty.

After initial steady increases in REC prices to 2004 reaching almost $40, the REC market experienced a steady decline to late 2006, with spot prices falling well below $20 (Tambling et al. 2003). The early price rises have been linked to a minimum price being required to get initial projects off the ground and to the 2003 MRET review which recommended an increase in the renewable energy target. Price declines were initially influenced by the lack of mention of MRET expansion in the 2004 energy White Paper and the Liberal Party being returned to government in late 2004 with the perception that targets would not be expanded. Further declines in REC prices occurred as it became clear that the market was oversupplied in 2005-6 and the scheme was not going to be expanded. Prices recovered in late 2006 with the anticipation of new schemes such as the Victorian Renewable Energy Target (VRET) and the NSW Victorian Renewable Energy Target (NRET) (IES 2007; MMA 2007b).

Wind energy has experienced rapid growth since the introduction of MRET in 2001 and MRET helped to improve the viability of many new projects (MMA 2006). However, commercialisation incentives for renewable energy projects through MRET were exhausted once the renewable energy targets were saturated and the scheme failed to be expanded, resulting in the reduction of investment into new renewable energy projects (Diesendorf 2007b; MMA 2006).

International schemes, similar to MRET, have also shown success in encouraging adoption of lower-cost renewable energy technologies. The UK provides an example of a form of renewable energy target known as a Renewable Obligation (RO). The RO system is similar to the MRET as it requires electricity providers to acquire ‘renewable obligation certificates’ (ROCs) to meet targets, or else they face a penalty fee (Toke 2007). This scheme has significantly expanded wind energy in the UK, although it has also been criticised as being an expensive way to encourage renewable energy when compared to other mechanisms such as feed-in tariffs (Toke et al. 2008).

Analysis of experiences in a number of different countries in Europe has found that feed-in tariffs can contribute to greater penetration of renewable energy at lower cost than tradeable green certificates under a RET scheme (Fouquet & Johansson 2008; Toke & Lauber 2007). However other analysis indicates that both mechanisms are important in promoting renewable energy deployment. Detailed comparison of effectiveness is extremely complex and linked to individual design considerations and the policy context (Agnolucci 2007a; Ringel 2006). This highlights that a RET scheme can only be an effective policy mechanism if the scheme is well designed within the appropriate policy context.

Australia is currently in the process of designing the 20% expanded RET scheme to be implemented in mid 2009. This would expand the current MRET scheme by around approximately 45,000 Gigawatt-hours per year to add to the existing 15,000 Gigawatt-hours per year of current renewable energy generation, which is mostly hydro (COAG 2008a). Draft legislation for the scheme has now been published and discussion is currently underway as to whether to exclude emission-intensive trade-exposed industries from the scheme (COAG 2008b). These industries account for around 10 to 15% of the total electricity consumption, so this would have a significant impact on price increases to other consumers. A review was commissioned by the government to examine the benefits and costs of the expanded RET (Gerardi 2009). Key findings from this review were as follows:

- If the CPRS is introduced, certificate prices under the existing MRET/VRET are likely to fall.
- Under the expanded RET, certificate prices will start at around $70 per Megawatt hour and then will fall over time. The high price is required initially for early investors to be able to recoup their costs.

- The majority of the renewable energy expansion would come from wind, followed by hot rock geothermal, assuming that the latter is commercially available at the time.
- Renewable energy generation will reach around 53,300 Gigawatt-hours per year by 2020, approximately 20% of overall electricity generation. In the absence of the RET, the same level of renewable generation would not be reached until 2035.
- Retail electricity prices are projected to rise about 3% to 2020 with a small reduction in GDP of 0.04%.

The expanded RET presents significant opportunities for the development of renewable energy so long as the design does not undermine the long term effectiveness of the scheme.

3.2.3 Interaction between Emissions Trading and Renewable Energy Targets

Research highlights that there is potential for both synergies and conflicts in the interactions of renewable energy promotion policies and emissions trading. A key difference between these two types of polices is that emissions trading is technology neutral and tends to favour cheapest available supply technologies, while renewable support policies target specific technologies at different levels of maturity. Renewable energy technologies are generally high cost. Therefore, on its own emissions trading is unlikely to provide incentive for their deployment unless emissions reduction targets are very ambitious (del Río González 2007).

International Modelling

Del Rio Gonzalez (2008b) has reviewed a number of studies conducted internationally, based on theoretical models and case studies, where a renewable energy target and an emissions target co-exist. In this situation increasing the renewable energy quota will not affect the emissions level, but it will contribute to reducing the emissions permit price, as renewable energy generators are not required to purchase permits. Therefore the price passed onto the consumer may be balanced out by the reduced cost of permits overall and the higher cost of renewable energy. Modelling indicates that renewable energy targets should be set between 10% to 20% of total electricity generation for the greatest cost saving advantage (del Río González 2007).

In terms of modelling overall costs, if learning effects and economies of scale are considered, delaying the implementation of currently more expensive low emissions technologies with high potential, for example solar thermal, will result in a higher cost over the longer term. This was shown to occur even at fairly low rates of learning by doing (del Río González 2008b).

Australian Modelling

Similar studies have been conducted in Australia to look at the interaction between emissions trading and the renewable energy target commissioned on one side by the petroleum lobby groups and on the other side by environmental groups.

A model by CRA International (2007) commissioned by the Australian Petroleum Production & Exploration Association indicates that use of a renewable energy target in conjunction with emissions trading will lead to increased cost of emissions abatement. This model covers a period up to 2020 and is based on a soft start with fairly low emissions targets. It does not incorporate any assumptions for learning by doing and uses a flat rate for capacity factor/ efficiency for the period up to 2020. Renewable energy technologies are priced at roughly double that of gas or coal over this time period. This model focuses on macro-economic comparison over the period to 2020 and does not consider other potential costs and benefits.

An alternative model proposed by McLennan Magasanik Associates (2008), commissioned by The Climate Institute, indicates that combining a renewable emissions trading with emissions trading will lead to more cost effective emissions abatement over the longer term. The model indicates that a renewable energy target has a greater cost reduction impact in a soft start scenario, where the carbon price starts at around $15 per tonne up to $35 per tonne of C02 in 2020 (MMA 2008). Key differences in the MMA model are that it looks at a longer timeframe to 2050 and also considers the effects of “learning by doing”. The Productivity Commission (2008) has previously criticised learning by doing assumptions as being overoptimistic, however these criticisms do not give Australia much credit for undertaking innovation. MMA (2008) highlight that Australia has potential for learning by doing due to the different wind regimes in Australia to those in Europe, new pyrolsis and gasification technologies for biomass and geothermal hot rocks technology. In addition, there are opportunities for learning effects that relate to local conditions, supplier relationships, financing and institutions. Innovation and learning effects often relate to relationships between agents and institutions where there are opportunities for learning by doing, using and interacting (Smit et al. 2007). Within this framework there are likely to be many opportunities for learning by doing in the Australian context.

Although the MMA modelling includes estimates of “learning by doing”, it is not possible to capture the full impacts relating to historical path dependence, technological lock-in and potential for lock-out due to delayed implementation of renewables. Due to the intangible nature, it is also not possible to capture other social benefits that may come with the implementation of renewable energy.

3.2.4 Government Funding

Government funding is a key technology promotion policy and provides an important mechanism for encouraging innovation into emerging technologies that require additional research and development. The Garnaut review (Garnaut 2008) indicated that funding into low emissions technologies was low in Australia when compared to other OECD countries and that funding should be increased to $3 billion per year by 2013. There is a strong case for providing funding to support promising technologies in pilot, demonstration and first commercial projects by matching industry dollar for dollar.

Funding is predominantly a technology push policy that focuses on increasing supply as compared to demand pull policies such as an ETS, RET or feed-in tariffs which provide incentive for investment and adoption. While technology push policies are seen as important to overcoming barriers to innovation and R&D, they are generally not considered sufficient in the absence of policies to stimulate investment and demand into the technologies.

The Howard government had a significant focus on technology promotion policies, in the absence of other significant policies to address climate change. Technology promotion was predominantly through government funding from 2004 through to 2007, both domestically and as part of the international AP6 partnership. In the 2004 Federal Government energy white paper, it is indicated that the MRET would not be expanded, but that the focus would instead be on a $500 million Low Emissions Technology Demonstration Fund (LETDF) that would be aimed at a broader range of low emissions technologies over 15 years, $100 million for other strategic renewable energy development and also the solar cities program (Australian Government 2004; Kelly 2007). However, despite the fact that the LETDF was targeted towards renewable energy in the White Paper, the actual assessment criteria were focused on those technologies which underpin the value of Australia’s “resource base”, making renewable energy support seem unlikely (Kelly 2007). Five projects were approved under LETDF in the first round of funding with a contribution of $260 million by the government towards carbon capture or clean coal projects and $50 million dollars towards a concentrated solar power project (DRET 2008).

Australia was also involved in the Asia-Pacific Partnership on Clean Development and Climate (AP6), a voluntary agreement to promote clean energy technology. This was initiated by the Bush and Howard governments as an alternative to the Kyoto protocol and firm emissions abatement targets. The AP6 focused on investment into technology innovation, however the level of funding put forward was criticised for falling well short of funding levels needed. The Australian government only contributed a few hundred million dollars, with the US contributing even less (Pezzey et al. 2008). Although investment into R&D is needed, this type of policy measure is not considered sufficient to generate the amount of private investment that is required to make significant emissions cuts.

With the change of Federal Government in late 2007, the indication was that the policy focus would change from technology funding to a mix of funding and demand pull policies such as the CPRS and the expanded RET. The LETDF was replaced with other funds that provided support for both renewable energy and clean coal, but under separate funding arrangements which provided clearer boundaries as to where funding could be applied. The renewable energy funds included the $150 million Energy Innovation Fund (EIF) to promote clean energy research into solar energies, energy storage and hydrogen and the $500 million Renewable Energy Fund (REF) to help develop renewable energy markets. The REF is made up of a renewable energy demonstration program, second generation biofuels research and geothermal drilling (Ferguson 2008). This REF is also equal to the amount pledged for the National Clean Coal Fund (NCCF) (Ferguson 2008). However, despite the fact that there are now more significant dedicated renewable energy funds, there is still significant funding going to fossil fuels, for example the $500 million clean coal fund and the $100 million per year clean coal institute. This is in addition to historical funding under the Howard government. In addition, as of March 2009 zero funding had been allocated from the EIF and the REF, apart from $50 million for geothermal drilling.

A study into US government spending on energy technologies reviewed the level of government spending in relation to improved performance of particular technologies. It found that the spending that was being allocated to fossil fuels was excessive. There did not appear to be performance improvements from the R&D spending and performance was actually declining despite the high investment (Schilling & Esmundo 2009). On the contrary, it found that renewable energy sources have been significantly underfunded relative to potential payoffs, particularly for wind and geothermal energy. The authors indicated that with modest investment, these technologies would become economically comparable to fossil over a period of time (Schilling & Esmundo 2009).

3.2.5 Feed-In Tariffs

Feed-in tariffs are a policy mechanism that puts a legal obligation on utility companies to pay a premium rate for electricity provided by renewable energy generators. The extra cost of electricity is then shared across all electricity users (World Future Council 2007). A feed-in tariff can help overcome many of the market entry barriers for renewables including those relating to costs and pricing, legal and regulatory and also investment uncertainty. The tariff can be set at different rates for different technologies and lowered over time so as to ensure ongoing competition and technological efficiency as well as consideration of economies of scale and cost reductions due to learning effects (World Future Council 2007). Feed-in tariffs can be either gross or net metered. Gross metering provides payment for all of the electricity produced, while net metering pays only for any excess electricity that is produced and does not pay for electricity that is consumed onsite (Garnaut 2008). The choice between gross and net metered schemes has the most significant impact on schemes which are aimed at the household level, where the majority of electricity generated is consumed and therefore net metered schemes would not provide much benefit.

Feed-in tariffs have been demonstrated to be a successful policy measure in Germany, generating investment into technologies such as wind, solar PV and biomass. This is linked to a strong policy commitment with high feed-in tariff levels. Feed-in tariffs are seen to provide a high level of certainty to investors and to be transparent and flexible (Gan et al. 2007; Wüstenhagen & Bilharz 2006). One of the success factors correlated with the German feed-in tariff system is that it was set at a significant level and has been stable for a number of years. Systems which are inherently unstable or change every few years as, for example, in the Netherlands, are less likely to promote successful results (Toke et al. 2008). Spain can also attribute significant growth in wind energy to their feed-in tariff system (del Río González 2008a; del Río & Gual 2007; Toke et al. 2008).

Australia has experience with feed-in tariffs in the form of a number of state based schemes generally aimed at small scale renewable energy provision such as household solar PV, with the exception of the ACT, discussed further below. Schemes currently exist in ACT, QLD, South Australia, Victoria and they have also been piloted as part of the Alice Springs solar cities program (Senate 2008). They are under consideration in NSW and Western Australia. All of the state schemes vary in design as highlighted in Table 2 below.

Table 2: Current Australian FIT schemes (Source: Senate 2008)

Location	Size limits to individual installations	Limits or caps to scheme	Net or gross	New or existing	Value of FIT	Eligible sources
South Australia	<10kVA single phase / <30kVA three phase	Review at 2.5 years or when 10MW installed	Net	Both	44 c / kWh (minimum)	PV only
Victoria	2kW	Limit of 100MW	Net	Both	60 c / kWh (approx 4 times retail)	PV only
Queensland	<10kVA single phase / <30kVA three phase	Review at 8MW installed	Net	Both	44 c / kWh	PV only
ACT	None, but tariff reduces for large installations	None	Gross	Both	3.88 * retail tariff	Solar and wind
Alice Springs Solar Cities	Not known	Limit of 225 installations	Gross	New only	45 c / kWh	PV only

All schemes are net metered except for the ACT scheme and the Alice Springs solar cities pilot, which are gross metered. ACT provides the most comprehensive scheme covering both solar and wind, where initial legislation posed no limit to installation size. An amendment bill was announced in February 2009 to limit individual installations to a maximum capacity of 30 kilowatt-hours per year (Corbell 2009; Legislative Assembly for the ACT 2009). However, the ACT Minister for Energy indicated that there was still the intention to implement feed-in tariffs for large scale generation, once full implications and design are considered (Corbell 2009).

On a national scale there have been some efforts to promote a national feed-in tariff scheme, backed by strong industry, consumer and government support (Senate 2008). The Australian Greens put forward the Renewable Energy (Electricity) Amendment (Feed-In-Tariff) Bill 2008 (Milne 2008). This prompted an inquiry by the Senate into a national feed-in tariff scheme. While this inquiry recommended that the bill not proceed, it noted the strong support for the scheme and recommended that development of a national FIT proceed as quickly as possible through the Council of Australian Governments (COAG) (Senate 2008). Around the same time, COAG released a fairly simplistic document highlighting national principles for feed-in tariff schemes which indicated that feed-in tariffs could be used to provide transitional support for small renewable generators (COAG 2008c). As part of the Senate inquiry, the Greens raised concerns that if Australia is to have an effective national feed-in tariff within a reasonable timeframe, then it should be managed directly by the federal government, similar to policies such as the MRET, rather than being delegated to COAG (Senate 2008).

Currently it is unlikely that a national feed-in tariff would be implemented any time in the near future given the focus on the expanded RET and there is little interest expressed by the Federal Government.

3.2.6 Grid Connection

Grid connection can present a significant policy challenge in the adoption of renewable energy technologies. It can be difficult to allocate grid expansion costs to a single renewable energy generator due to complexities in grid management, for example changes in generation and demand at one point can cause congestion in another. The current regulatory regime in Australia requires that those connecting to the grid are liable for covering costs up to the point of connection. This presents a significant barrier as first movers are faced with the significant initial outlay from which others can then benefit. Electricity market reform in Australia has recommended the introduction of a “national transmission planner” with the role of coming up with a strategic transmission plan which will support Australia’s long term energy needs. Proposals do not yet include any discussion of financial support for new generators (Garnaut 2008).

Germany, the Netherlands and Slovenia have a policy approach to grid connection costs which generally means that renewable energy generators pay only for the cost of connecting a plant to the electricity grid and not for grid reinforcement. However, Germany has recently taken a policy initiative in terms of offshore wind development, whereby grid operators will be responsible for costs of a new offshore grid, rather than the renewable energy generators. This measure, in conjunction with their feed-in tariff systems will provide significant incentive for offshore wind development in Germany (Swider et al. 2008).

In making policy decisions as to whether to fund all or some of the transmission costs for renewable energy projects, it is important to have mechanisms in place to consider the efficiency of constructing transmission lines for one project over another. This is particularly critical for Australia due to the large distances relative to a small population. Faundez (2008) has developed a model which estimates efficiency of renewable energy based on transport distance and productivity of area for renewable generation. This type of analysis could be useful for planning grid connection support on a project basis, however Australia will greatly benefit from more cohesive infrastructure planning for transmission infrastructure.

3.2.7 Other Policy Mechanisms

In addition to the policy support mechanisms mentioned above, others are also considered important and are mentioned briefly below.

Tax Incentives or Accelerated Depreciation

Tax incentives or deductions, also known as accelerated depreciation, provide the capacity for selected industries to claim bigger tax deductions for the cost of their investments into capital equipment in the early years of a project. This increases the after tax profit of investors and can provide a significant incentive to invest (Richardson 2008). Similar schemes involving investment tax credits have been very effective in the US, particularly for solar thermal (SEIA 2008b). In Australia, mining and airlines currently receive the most significant accelerated depreciation. However, this is at odds with goals to reduce emissions and similar mechanisms could help to encourage investment into renewable energy (Richardson 2008).

Worker Re-training

The Australian Manufacturing Workers Union (AMWU 2008) highlight concerns that an over-reliance on market mechanisms can present problems as they may lead to a more rapid displacement of jobs from high emissions industry resulting in unemployment. This concern is linked to past experience in the manufacturing industry with significant jobs lost through free trade agreements. Therefore, they highlight the importance of additional policy measures to help in the transition of workers in high emissions industries to proven clean energy industries, such as renewable energy. This would require a significant level of government intervention to ensure that this is achieved in a manner that will avoid negative displacement of workers.

Photovoltaic rebate program

The photovoltaic rebate program, now known as the Solar Homes and Communities Plan, provides rebates to households and community building owners who install photovoltaic systems, either stand alone or grid connected. This scheme pays up to $8,000 for new systems and $5,000 for extensions of old systems (DEWHA 2008; MMA 2006). Means testing was introduced to the scheme in May 2008 and there was much criticism generated that this would create significant reduction in purchase of solar photovoltaic systems (ABC News 2008). This scheme is going to be phased out altogether in mid 2009 and replaced with a Solar Credits program that is covered under the expanded RET where solar installations on household and community buildings will be able to receive the value for 15 years worth of REC's in advance (DEWHA 2009).

GreenPower

The GreenPower scheme provides an accreditation for renewable energy generation to be produced to a certain standard. Households and companies can elect to pay more for their electricity so that a proportion can be generated by accredited GreenPower. This program has helped develop new investment into solar and wind farms (GreenPower 2008).

Planning processes for renewable energy projects

Processes for planning approval of projects can have an impact on the proliferation of renewable energy projects. Experience in Germany, Denmark and Spain has shown that processes which include early collaboration with stakeholders and the community can help to establish support for wind energy projects (Toke et al. 2008). If planning and governance is conducted at different levels to implementation, issues are likely to arise unless sufficient collaboration is included in the process. Locally planned and collaborative projects have been shown to have greater success rates unless opposition is significant (Toke et al. 2008).

Community Renewable Energy Programs

The concept of 'community renewables' is becoming more important with support in mainstream policy in EU, for example funding in the UK under the Community Renewables Initiative and Scottish Community Renewables Network (Walker & Devine-Wright 2008).

Many of the wind farms in Germany, Denmark and the Netherlands are characterised by local ownership, rather than corporate ownership. This has provided benefits in gaining local planning approval, as local owners are able to use local networks and counteract objections to projects in terms of issues relating to landscape and noise. This type of approach is characterised by high levels of farmer co-operative activity in these countries. Countries which do not have this level of activity, for example the UK, have not had similar levels of locally owned and run wind farm projects (Toke et al. 2008).

In the UK it has been highlighted that community based renewable projects are more likely to be accepted than large scale projects with top down styles of management, however to become a prevalent method of management, much greater levels of institutional support are required to help manage community projects (Rogers et al. 2008).

3.3 Technology Specific Policy Impacts

This section provides a high level review of wind power and solar thermal power generation in terms of the impact of various policy mechanisms on their deployment. These technologies are selected to demonstrate impacts on a relatively low cost “evolving” renewable technology and a higher cost “emerging” renewable technology. Although solar thermal power generation has been around for a while, many new and possibly improved solar thermal technologies are emerging.

3.3.1 Wind Power

Wind energy is currently one of the most substantial renewable energy industries in the world. The world wind industry report indicated that worldwide capacity reached 121,188 megawatts (MW) at the end of 2008, with 27,261 MW added in 2008. In 2008, the countries with the greatest installed wind capacity were the USA, Germany, Spain, China and India. Total installed capacity in Australia at the end of 2008 was 1,494 MW with 676 MW capacity added in 2008, compared to only limited growth in 2007. This above average growth in 2008 was linked to positive anticipation of the new government’s policies to encourage deployment renewable energy and further robust growth in Australia is expected in the coming years (WWEA 2009).

Wind energy is currently the most cost effective of all non-hydro renewable energy technologies, with estimates by the American Wind Energy Association that excellent sites are generating wind for less than 5 US cents per kilowatt-hour (AWEA 2009). Cost of wind farms decreases as the annual mean wind speed, turbine size and wind farm size increases. Future wind energy costs are likely to decrease as annual sales increase internationally and in Australia, although there were temporary increases in costs in 2006 due to inability of manufacturers to meet the rapid growth in demand for wind turbines (Diesendorf 2007b).

A number of different policies have been linked to the rapid deployment of wind and will be instrumental in increasing future deployment. Studies have indicated that different levels of wind deployment are dependent on both the natural levels of wind available and also the supportive policy mechanisms that have been put in place (Menz & Vachon 2006). The main policies accounting for significant wind deployment worldwide have been renewable energy targets and feed-in tariffs. So far, there has been no significant evidence that emissions trading has played a part in the development of wind industries, although it may have an impact in the future. As discussed in Section 3.2.1 on emissions trading, the EU-ETS is unlikely to help with wind energy deployment until carbon prices reach around €40 per tonne (Blanco & Rodrigues 2008).

As discussed in Section 3.2.2, the MRET has been the most significant early driver for wind energy in Australia, however this slowed down once the Howard Government failed to expand and extend the MRET. Other countries have also experienced rapid growth in wind with policies similar to a renewable energy target, such as with the UK Renewables Obligation and similar renewable portfolio standards (RPS) have been found to be an effective measure in promoting wind (Menz & Vachon 2006).

A stable feed-in tariff has proven to be one of the most successful mechanisms for promoting a wind energy market large enough to support local manufacturing (Lewis & Wiser 2007). In addition, while both mechanisms have been successful in promoting wind a review of the renewable obligation in the UK and the German feed-in tariff, demonstrated that the German feed-in tariff has resulted in cheaper prices paid for the wind energy delivered and also contributed to greater competition and more deployment (Butler &

Neuhoff 2008). Feed-in tariffs are seen to provide the greatest certainty to institutions financing wind projects as utilities are obliged to purchase electricity at a certain rate (Schmitz 2008). However as has been seen in some cases, uncertainty in regard to policy direction, can lead to feed-in tariffs being ineffective as investors discount the future value of the feed-in tariff. Instability in the Danish feed-in tariff led to a slowing of wind development in Denmark (Agnolucci 2007b)

In Australia the expanded RET is likely to be the most significant driver for wind energy and will require rapid rates of deployment. A significant issue for this increased deployment is in regard to the impact on communities where wind farms will be implemented. The NSW government has relaxed development controls in designated 'wind precincts' to make it easier to implement wind farms, however there is concern over the way that community opposition is being handled (Robins 2009). Although the exact circumstances are different, lessons can be learned from the European approach which recommends high levels of collaboration and strong inclusive participatory frameworks, which has led to greater societal acceptance (Hindmarsh & Matthews 2008). Some of the policy recommendations that stem from a review of the situation in Europe focus on bringing local communities back into the process to contribute to the success of wind farm development. These include support mechanisms which focus on providing additional income sources and employment to local communities which are going to be directly impacted by the development of a wind farm such as reduced electricity prices, local employment and profits being directed towards activities in the local community (Szarka 2006). Co-operative private ownership of windfarms by communities creates the greatest buy in and is linked with higher levels of deployment in Denmark (Meyer 2007).

3.3.2 Solar Thermal Power

Solar thermal power, also known as Concentrated Solar Thermal Power (CSTP) generally involves the use of concentrating solar radiation to produce steam or hot air which can then be used in conventional power cycles for electricity generation (Muller-Steinhagen & Trieb 2004). A variety of different types of collectors and technologies are used in the process, however the principles remain the same. Examples of some of the different systems include the parabolic trough, power tower and Fresnel focusing (Diesendorf 2007b).

Solar thermal power has been around commercially in some form since the early 80's, however the worldwide installed capacity is currently much lower than other renewable energy technologies such as wind energy. Since 2006, commercial solar thermal technologies have re-emerged and started to experience growth, which has been linked to both favourable policies and new technological improvements. World capacity figures are approximate and vary between studies. Estimates include 457 MW (Earth Policy Institute 2009) and 430 MW (DESERTEC-Australia 2009). Projections for 2012 are in the order of 6,400 MW, which are much lower capacities than for wind. Currently large-scale commercial activity exists in only a few places where policy support exists with key areas being Spain and South-West USA (Wolff et al. 2008).

The cost of concentrated solar power in California was estimated to be around 12.7 to 13.6 US cents/ kilowatt-hour in early 2008 excluding transmission (Del Chiaro et al. 2008). Similar costs are projected in Europe (Ummel & Wheeler 2008). This was considered cost competitive when compared to new nuclear power projects which were 15.2 US cents/ kilowatt-hour and gasified coal power plants that capture their carbon dioxide which were estimated to be 16.9 US cents/kilowatt-hour. Solar thermal was still estimated to be more expensive than wind and biogas, but has the advantage of being able to provide peak load power when low-cost thermal storage is incorporated (Del Chiaro et al. 2008). New technologies such as Linear Fresnel reflector systems, such as developed by Ausra, also have the potential to bring down costs as these technologies are produced with less expensive materials. In addition, increased scale economies and learning benefits will bring costs down as production volume and deployment increases (Del Chiaro et al. 2008; Mills & Morgan 2007). A study of solar thermal in Europe and the Middle East and North Africa region showed that solar thermal could become cost competitive in 10 years with the addition of subsidies in the order of $20 billion to implement 20 gigawatts by 2020 (Ummel & Wheeler 2008).

Solar thermal is currently undertaking rapid development in Spain, predominantly due to the favourable support mechanisms that are in place, specifically a 0.27€ per kilowatt hour feed-in tariff and the ability to combine with gas power (Caldés et al. 2009). Projects under development and construction in Spain currently exceed government targets for 2010 of 500 MW installed capacity. This development has been found to have a remarkable effect on demand for goods and services and also employment in Spain (Caldés et al. 2009).

In the US, much of the success in solar thermal is driven by solar investment tax credits put in place in January 2006 for both residential and commercial solar installations. Around 5,400 MW installed capacity of solar thermal power was estimated to be in various stages of development or production in the US in 2008, but much of this was on hold until it was confirmed in October 2008 that tax credits would be extended until 2016, providing greater certainty to investors (SEIA 2008a). Investment tax credits (ITC) reduce the overall liability of individuals and businesses that invest in solar energy generation technology by around 30%. With the extension of the ITC, an additional US$325 billion is expected to be invested into solar projects by 2016 and 440,000 permanent jobs created (SEIA 2008b). A significant barrier to the deployment of much of the solar thermal capacity and wind in the US still exists due to insufficient transmission lines (AWEA & SEIA 2009). There is also some concern over the rate of solar thermal power generation expansion due to the potential impact on fragile desert ecosystems (Marquis 2009). It is important that these types of issues are considered in the planning process.

Development of solar thermal in Australia has predominantly been in the form of pilot and demonstration projects, however with the likely introduction of new policy support, greater commercial interest is now being generated. There are a number of policy initiatives which may have an impact on the development of solar thermal including government funding, the expanded RET and the introduction of the CPRS.

The Australian Solar Institute which has been established to utilise $100 million government funding over a 4 year period has the goal of advancing both solar thermal and PV technologies in Australia (Department of Resources Energy & Tourism 2008). Although this is a positive step, compared to the overall cost of solar thermal projects and the fact that funding is shared with PV, this amount of money is likely to have limited impact.

The expanded RET presents significant possibilities for the development of solar thermal, depending on levels of competition with other technologies such as wind energy. Significant commercial projects have been proposed on the basis of the introduction of the RET. For example WorleyParsons have set ambitious targets for the development of solar thermal power generation, with plans to implement a $1.2 billion 250 MW solar thermal power plant by around 2011 and around 8,500 MW installed capacity by 2020 which would meet almost half of the expanded RET (WorleyParsons & EcoNomics 2008). Wizard Power is another example of a company who is currently involved in constructing a demonstration solar thermal power project in Whyalla, South Australia, utilising Australian National University technology. There are plans to expand to a 100 Megawatt commercial plant in the second half of 2009 and they are also looking at other commercial solar thermal projects (Sustainability Australia's Future 2009). However given the significant level of investment that these types of projects will require, the implementation of these projects in the near future is dependent on the expanded RET being formally established quickly.

4 STAKEHOLDER PERSPECTIVES

This section provides an overview of a range of renewable energy stakeholder views on the importance of key potential policy options required to help develop the innovation and adoption of renewable energy. Stakeholders interviewed either have an interest in renewable energy or are directly involved in the renewable energy industry. The semi structured interview outline is provided in Appendix B.

4.1 Emissions Trading Scheme

Interviewees were asked to express their thoughts on the use of an Emissions Trading Scheme as the primary policy measure and the impact that this would have on renewable energy. Frank Jotzo (Interview, September 2008), ANU research fellow and advisor to the Garnaut review, highlighted that the Australian policy context puts an emphasis on market solutions and cost effectiveness with a focus on price signals and that this goes hand in hand with the need for a sizable reduction of greenhouse gas emissions. This approach puts an emphasis on cost effective emission reductions, however it may create tensions with policy objectives intended to promote the development of renewables. Renewable energy may meet policy objectives other than just low cost CO2 emissions in the short term.

While all of the stakeholders interviewed here agreed that a price on carbon was necessary and an effective ETS could help to achieve this, it was seen as unlikely to have much effect on the innovation and adoption of renewable energy over the short term, making other policies critical if one of the goals is to promote renewable energy. For instance, John Connor (Interview, August 2008), CEO of The Climate Institute, indicated that emissions trading was a necessary part of the policy mix as it was low risk and cost effective, however highlighted that it was insufficient in the face of technological uncertainty and difficulties for new technologies to break into the market.

John Kaye (Interview, August 2008), Greens MP in the NSW Legislative Council, felt that the focus on emission's trading for meeting abatement targets at least cost to the community failed to take a long term view of cost effectiveness over the next 50 years. Although some form of carbon pricing would be necessary, there are renewable energy technologies that currently have no cost effective niche and would not make it. Kaye felt that most of the objections raised against additional policy measures relate to electricity purchase price impacts on large, mainly industrial consumers and concerns over consequent loss of profits. Alan Pears (Interview, September 2008), a senior lecturer at the RMIT University in Melbourne, who has worked on policy strategies with government, business and community groups, also questions the short term benefits of the ETS, when free permits, unlimited importing of low priced international permits and price caps will mean low carbon prices. In the context of emerging technologies, until there are stable and well agreed market prices at reasonable levels, investors will automatically apply a risk premium to these projects, and the level of the price effect will be too small to influence purchasing.

Key reasons highlighted by interviewees as to why emissions trading would be insufficient for promoting renewable energy in the short term included concerns over the overall effectiveness of the CPRS and also that initial carbon prices were not expected to be high enough to encourage investment into renewable energy.

A key point raised was that the CPRS is a new scheme and there will be an initial learning phase. Iain MacGill, (Interview, January 2009) Joint Director of the Centre for Energy and Environmental Markets, highlighted that while it is extremely important to have a price on carbon, emissions trading is a strategy that is currently unproven. There is uncertainty in the future and nature of the policy and policy effectiveness can vary in different countries due to a wide range of factors. It is particularly problematic to use an experimental policy as your primary policy instrument if you wish to achieve assured action on climate change. Andrew Durran (Interview, February 2009), Executive Director of EPURON, indicated that although emissions trading is not going to have much of an impact on renewables in the short to medium term, it is vital that we start straight away, as it is important to have a target and a system in place for learning.

Mark Diesendorf, (Interview, February 2009) from the Institute of Environmental Studies at UNSW, expressed concerns with the current design, stating that the CPRS may actually do more harm than good. Diesendorf indicated that it is unlikely to be effective for encouraging renewable energy in the first 5 years and almost seems to be designed to exclude renewables. Key weaknesses highlighted were the low abatement targets, the initial permit price cap and also the levels of free allocation including coal fired power stations, which was likely to translate into windfall profits.

There was a level of uncertainty amongst interviewees as to the exact carbon price that would make investment into renewable energy attractive due to the number of different variables involved. However, most interviewees indicated that the carbon price would have to be in the order of $40 to $50 per tonne of CO2 before lower cost renewables would start to attract investment, in the absence of other policies. Iain MacGill also highlighted that it was important to consider the projections of future prices as this will be what industry and investors are planning around. The future price will depend on a number of factors, the more important being future targets and faith in the government and its policy intent and effectiveness into the future.

Andrew Durran indicated that the typical price for wind power is currently $90 to $100 per Megawatt hour and around $50 per Megawatt hour for coal without emissions trading, therefore there is around a $40-$50 gap for wind to become cost competitive. EPURON has been involved in previous implementation of commercial windfarms and has around 4000 Megawatts of wind power projects in various stages of proposal or development.

Peter Meurs (Interview, February 2009), Managing Director of EcoNomics at WorleyParsons and Artur Zawadski (Interview, January 2009), Manager of Business Development & Project Development at Wizard Power, indicated that a carbon price of $40 is likely to start encouraging commercial investment into solar thermal power projects. Both WorleyParsons and Wizard Power are involved in the potential commercialisation of solar thermal (see Section 3.3.2).

Most interviewees felt that prices would be too low in the short term to encourage innovation and adoption of renewable energy. Mark Diesendorf indicated that the initial price of $20-23 according to modelling may not even be enough to encourage further development of gas fired power. John Connor, Andrew Durran and Alan Pears all indicated that carbon prices are unlikely to start having a significant impact on renewables until at least 2020. This was generally considered too late to start acting to implement renewable energy and most felt that other policy mechanisms are critical.

4.2 Renewable Energy Targets

Most of the interviewees highlighted that the Renewable Energy Target (RET) was the most important mechanism currently proposed for promoting the innovation and adoption of renewable energy, however feed-in tariffs were cited as a good alternative to a RET by a number of interviewees including Mark Diesendorf, Artur Zawadski and Peter Meurs.

Andrew Durran highlighted that the RET is vital to the renewable energy industry and that thousands of jobs currently depend on it. Durran highlighted that the industry is capable of delivering 3 or 4 times the proposed targets. Although design could be better, the target is needed as soon as possible. Durran believes that the target is small compared to possible capacity and the target could be saturated by 2015, exposing the industry to uncertainty. If there is no process in place for reviewing and expanding the target before 2015, then the industry will face a similar stop/start situation that it did with the last MRET and this will lead to businesses having to shut down which will add cost, time and jeopardise jobs.

Alan Pears from RMIT highlighted the importance of the 20% renewable energy target scheme to drive investment in renewable energy until the carbon price levels from the CPRS become sufficiently high to drive investment. Pears believes there will be a natural evolution where the renewable energy target is met prior to 2020, at which point the price of renewable energy certificates will start to collapse and the carbon price will firm up, taking over from the RET.

Despite the support for a RET, there were also a number of concerns raised. Iain MacGill indicated that the RET could work well if the design is right. It worked well previously in Australia, but a similar scheme in the UK demonstrated poor effectiveness and efficiency. MacGill believes that the current design for the expanded renewable energy target has some serious flaws, which risk poor effectiveness, efficiency and equity outcomes and there needs to be targets with some clear mechanisms for how to achieve them. Peter Meurs also raised a concern about the renewable energy target in that it does not indicate when the power is generated and so all of the power to meet the target could be generated at night which does not support peak power requirements. In this instance, feed-in tariffs provide more flexibility.

Andrew Durran's main concern was that industry faced some uncertainty with the RET as it is difficult to estimate the volume of planned renewable energy projects in the works. Given the long lead time of many renewable energy projects, this could lead to projects missing out on the last available REC's and then being out of pocket significant project costs to date. Of particular concern for estimating volumes is due to the inclusion of solar hot water heaters. This distorts the RET and makes it even more difficult to work out volumes. Mark Diesendorf also indicated that the inclusion of solar hot water was of concern and could undermine the value of the scheme. Another factor that Diesendorf indicated could undermine the scheme was if high-emissions trade-exposed industries were excluded from paying for REC's as this would drive prices up for other consumers.

There was also some discussion over whether the target should just be limited to renewable energy. Frank Jotzo highlighted that policies are implemented that are specific to renewable energy, it is important to consider what types of benefits renewable energy can provide over other forms of clean energy. This needs to be clearly articulated as part of policy objectives.

The RET may also favour particular technologies. Frank Jotzo pointed out that the expanded RET is likely to be dominated by wind. Jotzo highlighted that it is important to think of energy policy support in terms of the R&D that was required for individual technologies and how to drive this investment. Jotzo also indicated that including wind in the RET would not provide much benefit as wind is already significantly advanced in Europe. If the aim is to support the development of renewable technologies, then the focus should be on less mature technologies, for example geothermal and solar thermal. John Kaye also indicated that wind is now sufficiently mature that it would dominate MRET and that other mechanisms would be needed to incubate and develop other emerging technologies. In addition targets should be more orientated towards particular industries, rather than just utilising blanket targets. Both Frank Jotzo and John Kaye discussed this in terms of development of an export industry in Australia. John Kaye highlighted that development of renewable export industries was an area in which Australia is lagging behind.

Both Mark Diesendorf and Alan Pears highlighted that the RET is a market based system which is designed to implement the cheapest renewable energy technologies. Wind is currently the cheapest renewable technology and will therefore be favoured. Diesendorf indicated the only way to change this is to have different targets for different technologies. Alan Pears indicated that because the RET is a market based mechanism it can actually be difficult to pick who the winners will be. In relation to early MRET targets, early analysis predicted that the major winner would be the biomass industry and that wind would be a much smaller player. However wind energy investment got motivated quickly and gazumped biomass industries. Pears highlighted that there is a large amount of work going on with wave energy and if these industries get motivated and are appropriately backed by business investment they could surprise everyone. Pears also commented that as with any market based system, it is important to ensure that other criteria are met to ensure that options are environmentally and socially adequate. It is difficult to predict who will lead the market, and smart business people move fast and are the overall winners.

Andrew Durran believes that it makes sense that the RET should favour lowest cost technologies, although he does agree that wind will win out. Durran believes that solar thermal will have difficulty competing in the timeframe, particularly as the target is likely to be saturated by 2015. Durran indicated that if you want to support solar thermal, then it should be further supplemented in the form of grants or alternative support rather than distorting the RET markets. Peter Meurs also believes that a key advantage of the RET is that it doesn't specifically back particular renewable technologies, however is more confident that the RET will help to encourage investment into alternatives including solar thermal.

A final concern was highlighted by John Kaye in regard to the political expediency of renewable energy targets. Kaye highlighted that although a commitment has been made to implement a renewable energy target, the new government is well into their term and the target is still a way off being finalised. This introduces concerns that initiatives such as the expanded Renewable Energy Target may still be uncertain due to factors such as lobbying over design issues, legislation being stalled in the Senate and also a change in government before the scheme is well entrenched.

4.3 Government Funding

Government funding is considered an important part of the policy mix, however many raised concerns that the funds would not have much overall impact and that other policy measures will have greater success in promoting renewables. There were mixed opinions as to what the policy mix should be.

Frank Jotzo believes that there is a strong case for funding combined with an emissions trading scheme. The carbon price will help to push low cost technologies and this combined with targeted funding to overcome externalities could provide a better approach than MRET and may avoid some of the issues relating to over reliance on wind technology. Jotzo also indicated that there is a strong case for technology spending and diffusion, but that it needs to be well targeted.

John Kaye highlighted that funds need to be insulated from Carbon Capture and Storage (CCS) as this should not be in competition with renewable energy. Funding should be focused on development of particular industries and money used strategically. As Australia is late into the market funding should be focused into areas where Australia can gain competitive advantage, with a view to export technology.

Artur Zawadski highlighted that just 3 to 4 renewable energy projects could very quickly consume the grants available, leaving no opportunity for technologies and projects that are not yet ready to proceed. In addition, funding fails to provide an incentive for follow-on projects utilising the successfully demonstrated technologies. Instead, it could actually facilitate moving these technologies offshore, as they will become more bankable in countries with feed-in tariffs and tax incentives once they are proven at scale in Australia. A more sustainable and strategic way to get new technologies up to scale is to establish market mechanisms that incentivise investment in innovative technologies. This then gets around the one-off factor.

Mark Diesendorf also commented that the renewable energy funding could be gone quickly with large renewable energy projects such as solar farms. He also believed that other mechanisms were more suited to encouraging solar such as tax incentives, similar to the US. The $100 million for development of the solar institute was a good start, however this will be spent over 4 years and nothing has been spent as of yet. Diesendorf was also concerned about the high level of funding that is being spent on CCS versus solar or other renewables.

Peter Meurs indicated that funding may have some impact, however getting the first $1.2 billion solar thermal power project in place will require more than just funding assistance. Also, while government funding is important, it does put the government in a position where they have to pick winners and technologies that look good on paper will be selected.

Andrew Durran also commented that funding targeted to commercialisation research is a difficult area to get right. It requires picking a technology that looks real and getting it into the market. Most projects tend to fail in Australia, except for limited examples including Suntech from UNSW, which ended up being developed in China. While the research can have positive results, this often fails in practice. It is difficult to know who to fund. The process could be improved by use of an industry panel to help pick the projects, with people carefully chosen for the role.

Iain MacGill commented that the level of effort looks ridiculous when compared to the amount being spent by some other countries. We don't see anywhere near the serious investment in renewables that is really required. However, there may be drivers other than climate change in other countries that have contributed to the faster development of renewables

4.4 Feed-In Tariffs

Feed-in tariffs generally received an extremely positive response from interviewees, particularly from those in the renewable energy industry. However, there were also some concerns raised.

Frank Jotzo highlighted that feed-in tariffs give the opportunity to very directly distinguish between different technologies, however there are concerns over inefficiencies if tariffs for particular technologies are set too high – an example being heavy investment in PV driven by feed-in tariffs in Germany where the technology has comparatively low energy yields. There is also potential for negative interaction between a RET and feed-in tariffs. If both are used in conjunction there is opportunity for double dipping, which does not necessarily make good policy sense.

John Kaye was of the opinion that feed-in tariffs are a policy measure that makes sense as they can help with the incubation of particular industries. Kaye pointed to the longer term benefits of developing renewable energy industries across a range of technologies. However John Connor (Australian Government 2008b) highlighted that feed-in tariffs are an expensive approach. He believes that a more sustainable spread is needed that does not focus on one single technology.

Alan Pears highlighted that there are some benefits to up front once off payments over and above ongoing payments, such as feed-in tariffs. Rational businesses will discount future revenue by 20% per year, so when reviewing ongoing subsidies within a business case, payments in 5 years will be valued at zero. An upfront subsidy will be lower cost and may provide a better tool for promoting investment decision making. However, ongoing incentives encourage reliable ongoing performance, so a combination of up-front and ongoing incentives seems likely to be most effective.

Peter Meurs commented that feed-in tariffs provide a clever way of getting a lot of investment quickly without the government having to come up with the dollars and they provide a clear market signal for 10 to 15 years. Countries that use feed-in tariffs have been very successful at stimulating renewable energy investment. Feed-in tariffs can provide significant levels of flexibility. For example, they can be tuned in to the amount of power produced and the time of day. This is important when the goal is to be able to support peakload requirements as you can set higher tariffs for peak times. It is also possible to modify the tariff once the desired level of power is reached and by then the infrastructure is in place. The maintenance costs of solar thermal power are very cheap, so once infrastructure is in place it will be able to compete with other technologies.

Artur Zawadski was also very positive about the possibilities of feed-in tariffs. As demonstrated in other countries such as Spain and India, having a guaranteed price for renewable electricity over an economic lifecycle makes investment in these technologies more attractive. Feed-in tariffs can be tailored to particular technologies. You are able to set targets by engineering the incentive in the right way. Feed-in tariffs are also compatible with a carbon pricing scheme. You can correlate the two and reduce tariffs as the carbon price goes up. In addition, overseas financial institutions are now very comfortable with dealing with feed-in tariffs. Use of this type of policy support in Australia will help to make financial institutions more comfortable in investing in renewable energy.

Mark Diesendorf commented that experience in countries such as Germany, Spain, Portugal and Italy has shown that feed-in tariffs can be effective and they are also supported by the public. However the federal government appear to have lost interest in feed-in tariffs.

Andrew Durran saw feed-in tariffs as an excellent way to support PV in Australia. A serious feed-in tariff support system for PV would be better than the current rebate system which is inefficient. In terms of support for large scale renewables, Durran believes that both a RET or feed-in tariffs could provide the required support if the design is effective, however is important to consider that we already have a RET in place, so it makes sense to get that working properly.

Iain MacGill commented that feed-in tariffs have a proven track record to drive deployment, however with significant levels of deployment they become much harder to support. Mark Diesendorf provided the example of PV, where it would not be possible for everyone in the A.C.T. to have PV on their rooftop as prices would go from 12-14c per kilowatt hour to 44c per kilowatt hour.

Iain MacGill also raised concerns that certain feed-in tariff designs take renewable energy markets out of the mainstream electricity markets which could cause impacts on the rest of the electricity industry. If we are serious about renewable energy, then they can't be in their own reality and need to be incorporated into the real market. MacGill commented that the Spanish feed-in tariff system provides a good design example, where a feed-in tariff is described as a premium above the current price. This is a compromise, which provides a secure revenue and may be preferable to a market based mechanism.

4.5 Grid Connection

Grid connection was generally considered an important area where a lot more effort is needed, particularly in terms of better overall planning for transmission infrastructure in Australia to support new energy sources.

Mark Diesendorf commented on the importance of adding new links to the grid and strengthening existing links. For instance, the wind power capacity of South Australia could be greatly increased by strengthening the SA-NSW and SA-Vic links. A change in the overall system is also required where the government pays for new transmission links rather than the individual project developer. We also need to make the grid a smarter carrier with smart meters at the customer end and also greater control for adding new technologies. The US provides a good example with their SmartGrid.

Peter Meurs commented that connection was a significant barrier to renewable energy projects. WorleyParsons have been involved in mapping energy sources around the country with their networks which has indicated a number of good locations and opportunities for joint investment. Proper planning and joint projects can help to open up some excellent new solar thermal and geothermal sites. An intelligent approach is needed to plan transmission infrastructure on a national basis. Planning is currently haphazard and responds to immediate energy demand and the network is not running efficiently.

Andrew Durran indicated that transmission costs need to be borne by the developer, to ensure that the market chooses the most cost effective solution. There is certainly an imbalance with transmission funding in that plants that were built 20 years ago have had free transmission, however the solution is not to just give transmission away for free to far away sites, or the system won’t be efficient. There are also inefficiencies where 100km of transmission line services a town that only requires 30 megawatts that could be better serviced by a local energy project. These types of grid issues need to be reviewed on a project specific basis.

Durran also commented that there were significant inefficiencies with the grid connection application and design process implemented in NSW by TransGrid, which is not tailored to new renewable energy generators. This is hampered in part by the National Electricity Market (NEM) rules which, for example, preclude release of essential data in relation to technical generator characteristics to the market, leading to design bottlenecks within the network service providers. There is lots of room to improve on code rules and processes. This is the small policy end which is difficult to get right and there is not much interest.

4.6 Other Policy Issues Raised

4.6.1 Voluntary Actions

Alan Pears raised an important point whereby Voluntary activities are not recognised as additional abatement under the CPRS, which will reduce incentives for voluntary action if not adequately considered in policy. For example, if Greenpower contributes to Australia’s overall emissions reduction targets, then individuals who purchase Greenpower will be freeing up more permits for large emitters and essentially subsidising their ability to pollute. This reduces voluntary motivation for emission reduction, including motivation for individuals who wish to promote renewable energies.

Garnaut (Garnaut 2008) does raise the issue of voluntary initiatives being cannibalised by emissions trading, but no solutions are proposed in this document, except that it is possible for voluntary purchase and surrender of offset credits which can contribute to reduced emissions. The voluntary purchase and surrender of CPRS or Kyoto permits is also the only voluntary action issue proposed as part of the Government’s CPRS (Australian Government 2008b). Pears highlighted that this does not adequately reflect the current diversity and drivers behind voluntary action.

4.6.2 Community based projects

John Kaye highlighted the need for ownership institutions that work with communities as people are more likely to object to the actual or predicted impacts of wind turbines installed and operated in their surrounds by an external company than they are if they have a financial interest in the project and a direct say in the siting of the turbines. Alan Pears also raised some interesting points about promoting regional opportunities, for example Bendigo spends approximately $250 million on energy requirements, sent to entities outside the region, which could be mobilised into a business opportunity for producing alternative energy to meet local energy requirements with excess generation exported at a profit. This type of project involves mobilising regional councils along with regional economic development and is a different group of people to community projects run by community groups.

5 DISCUSSION

This section provides a discussion of the research topic with information drawn from the literature review and stakeholder perspectives. The first part of the discussion explores the effectiveness of emissions trading as the primary policy measure with a consideration of the impacts on the adoption and innovation of renewable energy, with a focus on the electricity sector. The second part then reviews the possible mix of policy measures and their ability to facilitate innovation and adoption of renewable energy technologies in the electricity sector, comparing impacts for wind energy and solar thermal power generation.

5.1 Emissions Trading: A “purely” market based approach?

Emissions trading is a market based mechanism, that has been given increasing attention as the primary policy measure for combating climate change due its perceived ability to promote emissions reductions at least cost. While it is important to put a price on carbon, there are a number of concerns relating to the effectiveness and efficiency of emissions trading and its ability to promote the innovation and adoption of renewable energy in the electricity sector. These concerns are linked to issues that stem from imperfect markets, market design issues and the importance of long term cost effectiveness. Renewable energy is also considered to support policy objectives other than just emissions abatement.

Imperfect Markets

While it is absolutely necessary to put a price on carbon, the expectation that emissions trading will achieve abatement at the least cost assumes a perfect market. Perfect markets do not exist and therefore market failures and barriers require government intervention (Section 3.1.2). While there are many principles of a perfect market, a few of the key principles are highlighted below. These include the expectation that participants will display rational behaviour, that there should be no externalities or unexploited economies of scale in a perfect market and that there should be access to perfect information (Andrew 2008).

Under conditions of market failure, market participants will not necessarily exhibit rational behaviour and participants tend to take a short term view in order to satisfy immediate needs, rather than maximising their long term best interests. Participants may anticipate that future emissions allowances will face greater restrictions, however they are unlikely to engage in near-term technology development required to meet future limits. The market will tend to invest in technologies that meet short-term financial goals rather than long term objectives, which are generally discounted (OECD & IEA 2003).

In addition, some technologies will experience advantages that do not necessarily ensure the selection of the most efficient technologies long term. Once these technologies are implemented they will benefit from learning by doing and improved scale economies that will lock them in. For example, under an ETS with a low carbon price gas-fired power may be locked-in due to present advantages such as easy integration with existing fossil fuel infrastructure and processes and an initially low carbon price that does not reflect the full costs.

An ETS cannot help overcome full externalities for various technologies. These include early mover spill-overs and costs associated with grid connection, where the early companies implementing particular technologies create benefits that can be enjoyed by other companies including increased knowledge, technological improvements due to learning by doing and implementation of shared infrastructure.

A perfect market also assumes that there are no unexploited scale economies, however technologies that have not yet been deployed on a sufficient scale, will not be operating at the lowest possible cost. As unit volume increases, unit cost will decrease, although the rates will vary for different technologies. Costs also reduce with technological and process improvements that stem from learning by doing. Emerging renewable technologies such as solar thermal are yet to benefit from significant scale economies which will lead to reduced cost and wind, classed as an evolving technology, still has significant potential for cost reductions.

Finally, for a perfect market it is also necessary for there to be perfect information which requires that there are no ambiguities and uncertainties in the market. As was discussed in relation to the EU-ETS (Section 3.2.1), imperfect information regarding emissions early on in the scheme resulted in significant price volatility once improved information came to light. Unequal access to information can also result in inequities in the market where those with significant knowledge can benefit from greater market knowledge (Andrew 2008).

These types of market imperfections or failures are unable to be addressed with a carbon price alone, particularly in the early stages of the scheme, where prices will be lower and require additional policy to assist in mitigation.

Scheme Design and Effectiveness

Although an ETS is a market based mechanism, it is combined with regulation that dictates the market rules and governance. For an ETS to be effective, it requires that the market to be well designed. With the introduction of the CPRS in Australia, it is expected that the market will require a certain period of time for learning, while the system is established in a local context. The EU-ETS underwent a learning phase of three years which demonstrated significant issues that were anticipated prior to the start of the scheme. These issues were primarily linked to free allocation of permits contributing to windfall profits as well as the over allocation of permits which contributed to price volatility. These types of issues are also likely in the CPRS which is making use of free allocation and there are likely to be conservative targets in the first instance (Section 3.2.1).

Another contributing factor to issues with scheme design stems from public policy design processes being exposed to significant lobbying. Lobbying can result in those groups with the strongest networks, financial resources and capacity to participate gaining an advantage in the design of the scheme. For example, free allocation of permits has been increased over time due to a significant lobbying process.

Lobbying also has an impact on the selection of targets with significant tensions between lobby groups that support emissions-intensive industry that want to protect existing businesses and jobs versus environmental Non Government Organisation's (NGO) that are requesting targets that will have a real impact on emission reduction. The lobbying process for the CPRS has resulted in the proposal of conservative targets. This means that in the short term carbon prices are unlikely to be high enough to encourage the innovation and adoption of renewable energy.

The point at which the carbon price becomes high enough to be effective is characterised by uncertainty due to the high number of variables associated with uptake of various different modes of renewable energy. However, local estimates indicate that the carbon price needs to be between $40-$50 in Australia, before it will start to have an impact on the investment into renewable energy (Section 4.1). These levels of prices are unlikely to be politically feasible in the early stages of emissions trading. The targets under the CPRS are indicated to be somewhere between 5 to 15% of 2000 levels by 2020. Modelling indicates that even under the 15% target, carbon prices will reach $50 only by 2020 and only $35 under the 5% target (Australian Government 2008b). Therefore in absence of other policies the CPRS alone is unlikely to generate any significant investment into renewable energy until after 2020.

Importance of policies to encourage Renewable Energy

Emissions trading takes a short-term least-cost focus. However, policies to encourage investment into the innovation and adoption of renewable energy technologies now, can help to ensure cost effectiveness over the longer term. International research has demonstrated that there can be positive synergy over the long term between emissions trading and policies that promote renewable energy technologies, leading to overall cost reductions (Section 3.2.3). In addition, it has been modelled in an Australian context that combining emissions trading with a renewable energy target will lead to some overall cost improvements over the longer term when it is assumed that immature technologies experience "learning by doing" (Section 3.2.3).

A focus on emissions trading at the expense of other policy measures doesn't take into consideration the other benefits that renewable energy can provide. Renewable energy can also help meet a range of other policy benefits such as energy security and diversity, job creation, reinvigoration of local manufacturing industries, creation of new export markets and provide other environmental benefits and social benefits over fossil fuel technologies (Section 3.1.1). However, some of these benefits are contested. Energy security is considered to be fairly stable in Australia due to the significant supply of fossil fuels, however Australia's is dependent on global market prices and fossil fuel imports are on the increase. In addition, concerns are often raised over job security, however research shows greater potential levels of employment and the focus needs to be on re-skilling of displaced workers (Section 3.1.1). In addition, contrary to popular belief, renewable energy is also able to contribute to base-load power. This has been supported by research which has demonstrated potential for wind power to meet base-load power when it is geographically distributed in various locations with different wind regimes (Diesendorf 2007c, 2007b). In addition, solar thermal power generation with low-cost thermal storage provides additional promise for base-load power along with sufficient diversity into a range of different renewable energy sources.

In the short term, the carbon price generated by an ETS is unlikely to be high enough to encourage investment in renewable energy. While it will make the first steps towards internalising the cost of emissions, there are also other market failures and barriers that cannot be overcome with a carbon price alone. Given the importance of developing a renewable energy industry, other policy support mechanisms are going to be necessary.

5.2 A mix of policy measures: Impacts on wind and solar thermal

The discussion in 5.1 highlighted that an ETS is unlikely to generate a carbon price high enough to encourage the innovation and adoption of renewable energy until at least 2020. Therefore a mix of supporting policies is required in order to promote renewable energy. Policy mechanisms considered in this discussion include the Renewable Energy Target (RET), Government funding, feed-in tariffs, investment credits and also grid connection.

In deciding on the appropriate policy mix it is necessary to find a balance between technology neutral approaches that encourage short-term least-cost technology and targeted technology policies to address market failures and barriers faced at different levels of maturity. Targeted technology policy is often criticised as "picking winners" given that selecting successful technologies can be difficult and open to influence by lobbying groups. However, there is a case for providing targeted support for individual technologies depending on their level of maturity and export industry development potential. Different maturation stages in the innovation process require different types of support. This has been a successful strategy overseas, particularly in Germany where policy has been extensively targeted towards the development of individual technologies. This has helped to cement a strong renewable energy industry with export capabilities. The level of support has also been consistently reviewed to suit growing levels of maturity for particular technologies (Jacobsson & Lauber 2006).

Renewable Energy Target

A RET is considered a critical mechanism for the promotion of renewable energy. It has been important in the early development of a wind industry in Australia and there are a number of positive examples of increased renewable energy deployment overseas (Section 3.2.2). In terms of current Australian policy, the expanded RET shows the greatest promise for renewable energy expansion in Australia with a target of 20%. However, while a RET has the potential for technology targeted design, it is important to consider that, in its pure form, the RET is a market based mechanism which encourages the development of least-cost renewable energy technologies. Therefore a RET is likely to face some market failures and barriers in a similar way to the ETS.

As with the ETS, a RET will encourage short-term least-cost development within a potential portfolio of renewable energy technologies. This does not necessarily ensure that renewable energy technologies with the greatest long term potential will be selected. In Australia, the expanded RET is most likely to be dominated by wind energy as this is currently the lowest cost renewable energy technology. There are a number of concerns that stem from wind energy taking up the bulk of the target. Firstly, wind energy could become locked-in at the expense of other less mature renewable technologies. A few stakeholders raised concerns that wind energy has already reached a certain level of maturity worldwide and that it would exclude more immature technologies from the RET that may have greater export potential in Australia (Section 4.2). Secondly, if one of the advantages of renewable energy is to provide diversity of supply, then it is important to encourage technologies in addition to wind, for example solar thermal. Diversity of supply will help to minimise negative impacts of any single technology and also provides more reliable base-load power.

Although wind has experienced the most rapid growth and cost reductions when compared to other renewable energy technologies, wind is still classed as an evolving technology, which is at the stage of innovation where the greatest gains can be achieved from learning by doing (Jamasb 2007). There is still significant untapped potential for wind energy expansion in Australia including development of local wind turbine manufacturing industries. The stalling of the local wind manufacturing industry after the failure of the Howard Government to extend the MRET also indicates that the industry still needs support. It has only started to recover during 2008 with the introduction of the VRET and anticipation of the expanded RET at a Federal level (Section 3.3.1).

Another market failure experienced by the RET is due to imperfect information. It is going to be difficult for project developers and investors to predict the capacity of renewable energy that is under development. Capacity estimates are aggravated by the inclusion of domestic solar hot water, where volumes will be difficult to calculate. In addition, this will contribute to greater uncertainty for investors as the targets become close to be being met (Section 4.2).

As highlighted by Andrew Durran in the interviews, with the number of potential wind projects in various stages of proposal and the proposed inclusion of solar hot water in the scheme, there is a good chance that RET targets could be met as early as 2015 (Section 4.2). This has serious implications for industry. Firstly, it contributes to greater market uncertainty for the longer term. If the target is reached in 2015, then the carbon price is unlikely to be strong enough to take over as the main incentive for investment. This could result in a stalling of the market, as occurred with the MRET, causing manufacturers and developers to shut down, adding to the cost of future wind development. Secondly, this will present greater risk to other technologies which have longer lead times, for example solar thermal power generation. Although the RET is likely to motivate the implementation of the first commercial solar thermal plants, if the target is saturated by 2015, continued deployment would be likely to stagnate.

There are various possibilities for dealing with some of the issues that arise out of the RET. One option is to redesign the RET to have separate targets for different technologies, while the other is to keep the RET in its pure form and then provide feed-in tariffs and other targeted support for the more expensive renewable energy technologies. In addition, some certainty should be provided as to what the policy action will be if the target is saturated prior to 2020.

Given the above discussion, while the expanded RET is likely to be a sufficient driver for deployment of wind in the near term; it is likely that solar thermal power as well as other emerging technologies will need some additional support targeted to the level of maturity. Possibilities include government funding, feed-in tariffs and/or investment tax credits.

Government funding

Government funding is fairly widely supported as a mechanism for overcoming market externalities associated with early mover spillovers (Section 3.2.4). In this case funding would be provided for pilot, demonstration or first commercial projects. This means that solar thermal is likely to be eligible. While, this is considered important, funding levels in Australia were criticised by some stakeholders as being insufficient to encourage the innovation and adoption of renewable energy at the rates required (Section 4.3).

Government funding has been criticised due to its necessity to pick winners. As described earlier this is a difficult process that is affected by lobbying. In Australia, there has been a low success rate for translating R&D and pilot projects into commercially successful technology. This may in part be due to the level of funding being insufficient, however could also be linked to the selection process. One suggestion in the interviews was that the process could benefit from use of an experienced industry panel to provide advice on technology funding (Section 4.3).

While government funding for solar thermal may support some of the early commercial projects in Australia, it will not help to stimulate the volume of investment required to establish a viable solar thermal industry. To start taking full benefit for learning by doing and scale economies, investment will need to be much more significant. Given the low installed capacity worldwide, this may be a technology where Australia has export potential, however it would be necessary to ramp up quickly. Given the issues reviewed in this discussion, additional incentives may be required to stimulate demand in addition to the RET and government funding for early projects.

Feed-in tariffs

Feed-in tariffs provide a flexible mechanism that is proven for encouraging the increased deployment of renewable energy. Feed-in tariffs have been used extensively in the EU to promote the deployment of wind and other renewable energy technologies. They have also been responsible for expanding the commercialisation solar thermal power generation in Spain. In addition, international research indicates that feed-in tariffs can be more cost effective than a RET (Section 3.2.5).

Feed-in tariffs provide a good mechanism for supporting technologies that are in the early stages of commercialisation, but are yet to benefit from economies of scale or learning by doing. Well designed feed-in tariffs can provide an on-going incentive to keep the technology operating under optimal performance. There are a number of other positive aspects relating to the flexibility of feed-in tariffs. Firstly, feed-in tariffs can be tuned to different technologies by setting different tariff rates for each technology. Secondly, it is possible to set different tariffs at different times of the day which can help to support peak power loads. Thirdly, feed-in tariffs can be reviewed on a regular basis and can be reduced when the technology starts to benefit from learning by doing and scale economies. The overall flexibility of feed-in tariffs means that they can be fine-tuned to meet specific policy objectives (Section 4.4).

Despite the potential benefits, there are also some concerns. It is important to consider that businesses will discount future benefits when making decisions which will reduce the impact of a feed-in tariff over the longer term. Feed-in tariffs are also a technology targeted policy and therefore they face all of the issues surrounding the need to pick winners. It is important that they are carefully designed and subject to on-going review which requires a good understanding of each of the technologies being supported and their cost profiles. If the feed-in tariff is poorly designed or too generous, technologies may become too far removed from real markets and fail to become more efficient. Therefore it is extremely important to get the design right, provide long term certainty and ensure that the tariff rate is in some way pegged to the market price for electricity with a transparent process for on-going review (Section 4.4).

While wind energy can clearly benefit from a feed-in tariff, this is unlikely to be necessary in Australia if wind energy is driven by the expanded RET. On the other hand, solar thermal power generation could significantly benefit from a well designed feed-in tariff. However, while feed-in tariffs may provide benefits and have received a strong response from industry, they are unlikely to be implemented in the near future at the Federal level due to government focus on the CPRS and the expanded RET.

Other policy support

In the absence of a feed-in tariff to provide additional support to solar thermal power generation, this technology could benefit from an investment tax credit or similar. This mechanism provides considerable certainty for investors and has been responsible for the significant deployment of solar thermal power generation in south west USA.

With the expansion of any renewable energy technologies, there can still be significant environmental and social consequences. It is important to ensure that these are not ignored. For wind energy, ensuring appropriate levels of community involvement and buy-in is critical. This may include mechanisms which ensure some form of compensation for local communities where wind farms are located, for example reduced electricity prices (Section 3.3.1). With solar thermal, as these are often large scale desert projects, it is important to consider the potential impact on fragile desert ecosystems (Section 3.3.2)

Currently the cost of grid expansion presents significant issues for renewable energy technology. First movers are disadvantaged by having to pay the full cost of connection, while additional generators can benefit from the installed infrastructure (Section 3.2.6). A range of renewable energy technologies including wind energy, solar thermal, geothermal and bioelectricity could benefit from an improved approach to managing and financing grid connections. It is critical to have a strategic plan for future grid expansion to take advantage of the expansion of renewable energy sources (Section 4.5).

No single policy mechanism is going to meet all policy objectives or overcome all market failures and policy barriers. Therefore, it is important to get the policy mix right to encourage a viable renewable energy industry and support technologies with high potential in the various stages of maturity.

6 CONCLUSIONS AND RECOMMENDATIONS

Part 1 of the research topic involved exploration of the effectiveness of a pure market based approach such as emissions trading as the primary policy measure, with particular consideration of the impact that this would have on the innovation and adoption of renewable energy in the electricity sector. Key findings indicate that emissions trading is insufficient as the primary policy measure. While it may provide the least cost solution to emissions abatement in the short term, it does not provide the most cost effective solution over the longer term. It also fails to overcome many of other market failures and barriers that are faced by technologies in various stages of maturity. Renewable energy also has other benefits, some of which are intangible and cannot be measured in simple economic terms and can contribute to other policy objectives.

While it is important to put a price on carbon, emissions trading alone is unlikely to provide sufficient incentive to invest in renewable energy in the short term, as permit prices may not reach a high enough price level until at least 2020. Therefore, other policy measures are needed in addition to emissions trading. Despite concerns over picking winners, there is a strong case for policy that is targeted to different levels of technology maturity. However, this requires sufficient technological knowledge and industry support.

Part 2 of the research topic reviews the possible mix of policy measures and their ability to facilitate the innovation and adoption of renewable energy in the electricity sector, including a comparison of impacts on wind energy and solar thermal power generation. New initiatives by the Government to implement the 20% expanded RET and provide targeted funding to renewable energy are considered a positive step forward, but may not be sufficient to promote the necessary diversity in renewable energy.

Wind and solar thermal require different levels of policy support, with solar thermal power generation being less mature and higher cost than wind. The expanded RET is likely to provide the most promising policy support for the continued development of wind, however a few considerations remain. Firstly it is important to ensure market certainty and therefore targets should be reviewed regularly to assess whether the scheme needs to be expanded or additional support is required. Secondly, there should be greater emphasis on community involvement policies which provide direct benefit to communities directly impacted by renewable energy developments, for example in the form of reduced electricity prices.

Solar thermal is expected to gain some benefit from the expanded RET with the first few commercial solar thermal power plants being built, however additional policy measures are considered important. As this technology is yet to be commercialised in Australia, solar thermal is likely to be eligible for government funding. However, funding levels are currently insufficient and would need to be increased to have any significant impact. Given that funding programs have mixed success, if there is a serious objective to expand solar thermal, then stronger policy support will be required to stimulate investment. This could come in the form of a well designed feed-in tariff or some form of investment tax credit as is used in the US. Renewable energy technologies, including wind and solar thermal, will also benefit from more comprehensive strategic planning of transmission infrastructure and financing to assist with the construction of transmission infrastructure required to support increased levels of renewable energy.

Australia is entering an era where there are exciting opportunities in the area of renewable energy. Given the rapid growth in renewable energy industries worldwide, the success of our local renewable energy industry depends on decisions being made now to design and implement the best possible mix of policy support mechanisms. Successful deployment of a mix of renewable energy is a critical component of a sustainable Australian economy in the future.

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APPENDIX A: ETHICS APPROVAL

Ethics approval was granted for this project on 11 August 2008 by the UNSW Human Research Ethics Advisory Panel (HREA) as the project was considered to be of minimal ethical impact. The approval reference number is 08/2008/34.

APPENDIX B: SEMI-STRUCTURED INTERVIEW OUTLINE

The following topic areas were covered as part of the semi-structured interviews:

Interviewee background

- Established prior to interview by conducting Internet search including review of key publications where available

View's on an Emissions Trading System (ETS)

- Views on an ETS as the primary policy measure for emissions abatement
- Views on price required to be reached before an ETS will help to promote innovation and adoption of renewable energy

View's on the Mandatory Renewable Energy Target (MRET) Scheme

- Views on whether this policy measure is appropriate
- Views on interaction with an ETS
- Views on appropriate target
- Views on whether individual technologies are favoured

Other policy measures to promote renewable energy

Views on additional policy measures discussed depending on knowledge/ interest levels:

- Government funds for renewable energy including Renewable Energy Fund and Energy Innovation Fund
- Feed-In tariffs
- Government subsidies (Fossil fuels/ Renewable energy)
- Grid connection regulation and pricing
- Discussion of any other policy measures as deemed important to the interviewee