GOVERNMENT OF WESTERN AUSTRALIA

MINISTER FOR ENERGY; RESOURCES; INDUSTRY AND ENTERPRISE

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House of Representatives Standing Committee
On Industry and Resources
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Dear Mr Chafer

STANDING COMMITTEE ON INDUSTRY AND RESOURCES - CASE STUDY INTO RENEWABLE ENERGY IN AUSTRALIA

Thank you for the opportunity to contribute to the Standing Committee for Industry and Resources inquiry into the development of the non-fossil fuel energy industry.

Enclosed is the Western Australian Government's submission to the inquiry for the case study into renewable energy.

Western Australia has an interest in increasing the uptake of renewable generation and welcomes the exploration of measures to achieve this objective.

Yours sincerely

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Att

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Introduction

The Government of Western Australia welcomes the opportunity to provide input to the Senate Standing Committee on Industry and Resources' inquiry into the non-fossil fuel energy industry in Australia.

It is broadly recognised that there is a need to reduce greenhouse gas emissions significantly over the next few decades. Western Australia has set a target of 60% reduction of year 2000 emissions by 2050. Generator assets are typically long lived in some circumstances with an operating life in excess of 30 years. The capacity of the energy sector to decarbonise will take considerable time and effort and a gradual transition is required to ensure the economic impact is managed.

Renewable energy can contribute to reducing emissions through carbon free energy supply, independent of energy security concerns and fuel price volatility. The Western Australian Government supports measures that will promote the use of new or existing technologies based on a range of factors including competitiveness, return on investment and life span of the technology.

To ensure consistency, broad scale renewable energy support measures are best implemented nationally. However, where national action is seen to be lagging, the States have a role in ensuring that the development of the renewable energy industry does not stall. This may come at the price of national consistency in measures, duplication of effort and less clarity for companies operating across jurisdictional boundaries.

State Governments may however be better placed to implement measures to leverage and, ultimately, optimise the overall level and nature of support within their jurisdictions to reflect their individual circumstances and priorities.

Western Australia has an interest in the establishment of measures that support the development of strategic low emissions technologies across the technology development chain including renewable energy technologies. The technology development chain can be described as research and development, demonstration, commercialisation and widespread diffusion.

The policy environment within economies can have a significant impact on the capacity of technology developers to capture opportunities that challenges like climate change pose. There are a number of emerging renewable energy technologies that may provide a strategic benefit to Western Australia, and thereby to Australia as a whole. These include wave energy, biomass and geothermal energy.

This submission will provide an overview of some of the key technologies specific to Western Australia and impediments to further uptake, outline the Western Australian Government's current renewable energy policy framework and a policy rationale to address critical barriers to renewable energy.

Renewable Technologies and Their Potential in Western Australia

Biomass Energy and Biofuels

Biomass is a renewable resource and its substitution for fossil fuels will result in a decrease in net greenhouse gas emissions. A range of woody biomass sources are either currently available in WA, mainly as low-value by-products from existing forestry

enterprises, or may be developed in the future as a by-product from multi-product woody crops or grown specifically as energy crops. In the latter two cases, these crops may also provide an economic driver to help control dryland salinity in farmland.

Apart from private firewood consumption, which is not considered in this submission, biomass is currently mainly used for electricity production. There are around 180 MW of biomass fuelled generation projects proposed in Western Australia with most at advanced stages of planning or at the feedstock contract stage.

Western Australia also has good potential to support a biofuels industry due to its significant grain production and extensive grain producing area. The State has many comparative advantages for a future biofuels industry, including efficient and low-cost production of grain, small population and a modest domestic market and surplus of grains. The grains industry has the capacity to be a major contributor to the future biofuels industry in the State. There are a number of proposed biofuels manufacturing plants as well as some existing operations. In the future, biomass could also be used for liquid bio fuel production, once certain technological hurdles are overcome.

Resource Base

Wheat and to a lesser extent canola and perhaps mustard will be the main feed stocks for biofuels in the short term. Western Australia also has considerable lignocellulose resources (straw, timber, tree plantations and waste timber products) with potential as "second generation" feedstock. Diversification of biofuels feed stocks into woody material has potential to further reduce environmental pressures through reduced greenhouse gas emissions and enhanced dryland salinity management.

A range of biomass resources are currently available in WA including manufacturing residues and urban waste. However, the major resources occur in forestry and farming. Forestry resources occur mainly in areas with greater than 600 mm/year rainfall and close to the coast and processing facilities and include:

- Long-rotation plantations: WA has an estate of 60,000 ha of *Pinus radiata* and 44,000 ha of *P. pinaster* (DAFF, 2006), with residues produced from thinning and harvesting operations.
- Short-rotation plantations: WA has an estate of 258,000 ha of *Eucalyptus globulus* plantations (DAFF, 2006), grown with rotation lengths of around 10 years. Approximately 10-15,000 ha is harvested annually with these producing residues in the form of tops, branches and bark.

It should be noted that some of the material in plantations has already been allocated to proposed new stationary energy production or the production of manufactured wood products. The short rotation plantations are all privately owned and increasing in area by about 10,000 ha/year.

A range of new reforestation programs are being pursued in lower rainfall areas of WA, with the aim of not only restoring landscape hydrology, but also providing regional development and employment opportunities through the development of new industries.

Some of these programs will depend on multiple sources of income (e.g. multiple products and environmental services) to obtain full profitability. Revenue from lower value biomass fractions will allow their more extensive adoption and help make a greater contribution to salinity control.

Strategic Tree Farming

The Western Australian Government is implementing a farmland reforestation program in collaboration with the Commonwealth Government and regional Natural Resource

Management groups in the medium rainfall zone (500-700 mm/year). This comprises a range of species including *E. saligna* and *E. cladocalyx* in rotations of 30-40 years. These will produce biomass in the form of thinnings as well as harvest and processing residues. 18,000 ha of plantations are being established between 2005 and 2008 as part of this program, which will be forerunner of more extensive future activity.

Mallee as a Coppice Crop

Around 12,000 ha of mallee eucalypt belts have been established in the WA wheatbelt. Potential products include activated carbon from the wood fraction, eucalyptus oil from the leaves, bioenergy from the residues and carbon sequestration. A demonstration processing plant was trialled at Narrogin in 2005/2006. The developer, Verve Energy, has recently called for expressions of interest from potential partners to build a commercial scale plant (approx 5 MW). It is estimated that 10 million tonnes of biomass can be produced from mallees each year, on a sustainable basis (Bartle et. al., 2007).

Phased trees

Proof of concept has recently been completed by the state's Forest Products Commission (FPC), with Joint Venture Agroforestry Program funding, on the use of 3 year long phases of trees as part of a rotation within existing farming systems to restore the hydrological balance over broad areas (Harper et al., 2007). This is similar to bioenergy systems used in the USA with sycamore (*Plantus occidentalis*) (Devine et. al., 2002). This system could produce up to 8.6 million tonnes of biomass a year on a sustainable basis across the WA wheatbelt (Harper et. al., 2006).

Bioenergy production will be a useful adjunct to carbon sequestration systems that rely on the production of wood. In these systems, bioenergy will provide a market for thinnings and prunings that are part of standard silvicultural management. For mallee and phase tree systems, bioenergy harvests will considerably reduce the net carbon sequestration possible on a site.

Explicit estimates of the energy yield, on a per hectare basis, for these different growing systems have not been developed for this region. Such estimates have similarities to studies of wood yield and carbon sequestration at regional (Harper et. al., 2003) and catchment levels (Harper et. al., 2005) that have already been completed.

Current WA Government Support Activities

The Western Australian Government established a Biofuels Taskforce in February 2006 to examine options that would foster the development of the Western Australian biofuels industry.

The Taskforce Terms of Reference included:

- Review and address the opportunities and impediments to the development of a biofuels industry in Western Australia;
- Increasing consumer acceptance and use of biofuels;
- Using biofuels as cost-effective alternatives to petrol/diesel, particularly in regional areas;
- Maximising Western Australia's participation in providing biofuels to meet the Commonwealth Government's renewable fuel target
- Maximising Western Australia's opportunity to leverage funds from Commonwealth Government funding programs related to biofuels;
- Provision of a consultation mechanism with industry and the Commonwealth Government; and

- Promoting a whole of Government and industry approach to the use of biofuels.

The Taskforce presented the report to the Minister for Agriculture and Food in April 2007. The report proposed 24 recommendations to assist the future development of a biofuels industry in Western Australia. The report examined potential feed stocks for the short and medium term and how Western Australia can best bring them to market. It examined how the State Government can assist the industry to avoid infrastructure and education/awareness difficulties and address environmental concerns.

Key recommendations from the Taskforce report aiding potential development of Biomass production are;

- That the State Government fund research and development into new and improved feedstock and technologies that have the potential for widespread commercial use in Western Australia and would be both economically and environmentally sustainable.
- That the State Government update the current pastoral tenure and diversification permit arrangements to enable more flexible and timely diversification opportunities for feedstock and biofuels.

The Minister for Agriculture and Food released the report on 9th May for public consultation until 15th July after which Hon Kim Chance will submit the final report to Cabinet. A copy of the report is included in Attachment A.

The FPC has entered into fuel supply contracts with proponents of a number of biomass fuelled renewable energy projects using direct combustion technology. These projects will be based on forestry residues with generation capacity based in Perth, Bunbury and Albany.

Technological developments being undertaken in WA, that are relevant to the development of a sustainable biomass resource, include research programs into:

- Determination of sustainable biomass yields and optimizing profitability from plantations (e.g. *P. pinaster* and *P. radiata*) and mallees (FPC, Department of Environment and Conservation (DEC)).
- Developing methods of integrating trees into farmland for multiple purposes including bioenergy and wood production, and land conservation benefits (FPC, DEC, Department of Agriculture and Food Western Australia, DAFWA).
- Developing technologies for conversion of woody material into liquid biofuels (Curtin University, DEC). The FPC is also associated with research within the CRC for Wood Innovations at Melbourne University investigating improved pyrolysis procedures for recovering alcohols and phenols from lignocellulosic material.

Some of these research activities are also being undertaken as collaborative programs within the CRC for Future Farm Industries and the CRC for Forestry.

Future Opportunities for Bioenergy

Wheat is the major grain crop produced in Western Australia and is suitable for ethanol production. The Western Australian Department of Food and Agriculture does not anticipate that the generation of biofuels from food crops will have a significant impact on food or livestock sectors. However, experience in other parts of the world suggest that a cautious approach is warranted. There is potential for research and development to develop new wheat varieties more suitable for biofuel production. New varieties with lower water demand or greater salt tolerance could also help mitigate future salinity and climate change constraints.

Further research and development on the following crops and feed stocks will improve the economics and sustainability of biofuels:

- High yielding wheat varieties with a higher starch content and/or capacity to cope with stressors such as salinity, waterlogging, drought and microelement toxicities.
- Alternative oilseed crops for biodiesel such as mustard, camelina and crambe.
- Feed stocks suited to land currently unsuitable for agricultural production such as saline tolerant crops.
- Feed stocks that may target non-financial objectives, for example natural resource management objectives from woody feed stocks or species primarily used for land reclamation.

In all cases, the likelihood of utilisation of a feedstock will predominantly be determined by the economic feasibility of biofuel production from the relevant feedstock.

With the advancement of technology, feed stocks sources will change over time. Therefore further research and funding is required to develop improved grains, oilseeds, tree species and other options such as algae.

Considerable technical impediments associated with the use of biodiesel and ethanol in the current vehicle fleet suggests caution is required with policy levers and regulation in the short term (refer to Attachment A for more information).

While much of the biomass-related activity to date has concentrated on the use of woody biomass for electricity production, there is also considerable potential to use these materials in the production of liquid bio-fuels. This potential has been outlined in the recent report to the WA Government by the WA Biofuels Taskforce.

Liquid fuel production from the woody biomass systems being trialled in WA will be complementary to existing food production, by making farming systems more sustainable. This is in contrast to systems that use food grains, or rely on the conversion of arable land to energy crops. The woody systems are also likely to be suitable for lands that are no longer capable of sustaining agriculture. Furthermore, woody crops require much less energy input in production giving them a fourfold advantage over grain crops when expressed as a ratio of energy contained in the product to the energy consumed in production (Bartle et. al., 2007).

There is a large, concerted international research and development program on deriving liquid biofuels from woody materials. This is based on the recognition that the development of these second-generation technologies will allow biofuels to have a bigger role in the world energy economy than technologies based on fuels from grains. In contrast to grains where ethanol is readily produced by conventional fermentation from sugars and starches, ethanol and other biofuels can also be derived from other much cheaper cellulosic or woody materials. Feed stocks can include trees, woody crops and agricultural wastes such as bagasse and straw. There are two main approaches to producing biofuels from woody materials – either fermentation or gasification. The latter can produce petrol substitutes like ethanol or long-chain hydrocarbons as diesel substitutes.

Hydrogen

Overview on Findings of Hydrogen Fuel Cell Bus Trial and Prospects for Hydrogen Supply from Renewable Sources

Perth is involved in a global study on the use of hydrogen as a fuel for public transport. The BP oil refinery at Kwinana produces hydrogen used in the Perth trial. The hydrogen is made during the process of refining crude oil and is a by product, some of which is used to produce low sulphur fuel. The hydrogen used in fuel cells is required to be exceptionally pure which adds to the costs of producing hydrogen.

Hydrogen compression is expensive (albeit less expensive in both energy and monetary terms than liquefaction) and a technological challenge due to the smallness of gas molecules and hydrogen's tendency to make certain metals brittle. It appears that cost-effective reliable compressors are beginning to become available. The results of the London Fuel Cell Bus Trial may provide some promising results. There is an opportunity for Australia to play a leading role in this research, as gas handling is a natural strength of Australia.

There is still some uncertainty as to the optimal 'scale' for production of hydrogen. Some technologies (electrolysers) simply connect multiple standard-sized modules to deliver increased capacity. This approach does not appear to be delivering economies of scale necessary to bring the price of production down. The study findings suggest that a different approach is necessary for large scale production. A key factor that needs addressing is the high capital and maintenance costs for hydrogen production and utilisation.

Potential for Hydrogen as a Transport Fuel

Hydrogen produced from renewable sources is expensive in comparison with producing it from conventional fuels. Fuel cell technologies are expensive, as are hydrogen internal combustion engines. However, as conventional fuel prices increase it is possible that hydrogen will become more cost effective. On this basis, further research and investment in hydrogen is warranted, but primarily in relation to stationary energy applications and bus fleets in the first instance, followed by heavy vehicles, and lastly, for cars and other light vehicles. Hydrogen may also become more cost competitive as a transport fuel if hydrogen use in the stationary energy sector (e.g. as a by-product from clean coal production) contributes to economies of scale that would reduce the fuel production costs.

Geothermal

Western Australia has a large capacity base in major resource projects. Many of the skill sets required for developing geothermal resources such as geological prospecting and deep drilling expertise already exist in abundance in Western Australia.

The State is undertaking a review of geothermal prospecting to determine potentially suitable places to establish geothermal power facilities. The Western Australian Government is also in the process of developing a legislative framework to support the future exploitation of geothermal resources.

Tidal Energy

Western Australia has good tidal resources in the northern part of the State. A project was proposed near the town of Derby. The proposal was not found to be economically viable with a high capital cost, low population and low energy demand. Furthermore, the project did not receive environmental approvals. The Western Australian Government commissioned an independent review of the project proposed for Derby and a copy of the final report is enclosed in Attachment C.

Solar

Following discussions with members of the photovoltaic (PV) industry, the Minister for Energy asked the Office of Energy to establish an informal working group with PV industry, electricity sector and Government representatives. The purpose of the working group is to provide a forum for the Government and industry to work together to identify and address barriers to the uptake of PV systems connected to the South West Interconnected System (SWIS) and regional grids. The working group will report to the Minister for Energy on its findings and make recommendations on potential options for addressing barriers to the uptake of grid-connect PV systems.

The Office commissioned consultants to quantify the benefits that PV systems can offer, such as reducing peak electricity demand, and consider the impacts of PV generation on electricity systems and to assess the barriers preventing it from taking full advantage of existing market opportunities.

Wave

The Western Australian Government has supported the development of an innovative wave power project with the capacity to generate electricity or high pressure water suitable for desalination. The trial of the first stage of the design demonstrated proof of concept and a second pre-commercialisation stage is currently being tested.

The Government is also facilitating stakeholder discussions and funding for feasibility research for the St Andrews Development Wave Power Project at Yanchep. Ocean Power Technology Australasia and the Tokyu Corporation are investigating the staged development of a wave power station to generate electricity and associated technology opportunities.

Wind

Wind is estimated to generate near 60% of Western Australia's total renewable electricity generation. Growth in wind has been supported largely by the Commonwealth Government's Mandatory Renewable Energy Target. Western Australia has good wind resources but to date has a relatively low level of geographic diversity in major projects. Of Western Australia's major wind farm projects, nearly 90% of capacity is connected to a single transmission line, taking all spare capacity on that line. A number of other wind farms have also been proposed in the same region.

Western Australia's state owned generation company, Verve Energy, is understood to have provided a submission to this Inquiry on a high penetration Diesel/Wind system. This Diesel/Wind system is a ground breaking innovative technology capable of supporting very high penetration rates (up to 50%) of intermittent wind generation in small town-sized electricity grids.

Impediments to Adoption

Price Externalities

The current economic framework has a number of price externalities that constitute a barrier to the widespread diffusion of renewable energy. Carbon is probably the most significant of these price externalities. While emissions trading will provide a price signal to internalise the carbon cost, depending on the ramp rate, it may be some time before the price is high enough to support renewable energy projects. Modelling undertaken for

the National Emissions Trading Scheme suggests that a relatively high carbon price is required in order to make renewable energy competitive with conventional electricity generation. Modelling undertaken in Western Australia for renewable energy targets also support this finding.

Other examples of price externalities that renewable energy may ameliorate include dryland salinity and atmospheric emissions as well as the associated health impacts.

These price externalities contribute to the price differential between renewable energy and conventional fossil fuel alternatives. The cost differential between renewable and conventional generation remains the principal barrier to widespread diffusion. As a result private investment in renewable energy is not likely to occur on anything greater than a philanthropic scale (through programs like GreenPower), in the absence of additional policy mechanisms, until such time that cuts in carbon emissions drive the cost of energy to a point where renewable generation is cost competitive.

Impediments to Bioenergy and Biofuels Production

There are a number of potential barriers to wide scale bio-fuels production. These issues are largely economic in nature and are related to production capacity and the geographic distribution of areas under cultivation.

State production of oilseed crops is limited. Current canola production of approximately 500,000 tonnes is only sufficient to service about 5 per cent of the diesel market. Other local feed stocks such as tallow and used cooking oil are also limited. In order to achieve economies of scale necessary to support the industry, oilseed production needs to increase or alternative feed stocks developed to supply biodiesel into the large diesel market.

The mining industry consumes around 30% of diesel fuel in Western Australia and is geographically removed from major cultivation centres being predominantly located in the northern region of the State, away from the majority of biodiesel feedstock which is located in the south west of the State. As a consequence, the delivery costs for biofuels may be higher than for conventional fuels unless new feed stocks can be cultivated in the Pilbara and Kimberley region to service the mining industry.

Network Impacts from Intermittent Generation

Wind is currently one of the most cost effective forms of renewable energy. The Mandatory Renewable Energy Target has driven a significant increase in this form of intermittent generation.

The intermittency of wind generation also creates issues from a locational perspective. Areas that generally have high wind speeds may not be optimally aligned with demand and transmission; i.e. where current networks have low transmission capacities. In such circumstances, the development of a large wind farm may require significant and expensive capital investment in transmission infrastructure to distribute the energy generated. However, there are circumstances where significant transmission capacity is being developed near areas with good resources for intermittent generation. One example is the upgrade to the 330kV line from Pinjar to Geraldton, the site of Western Australia's two largest wind farms.

Where wind farms are located or are proposed in a geographically concentrated area, similar climate and particularly wind conditions may see a compounding of intermittent energy generation with swings in generation causing significant stability problems for a

network. Greater geographic diversity in intermittent generation project development may improve overall network stability.

Intermittent generation poses challenges to smaller networks like the SWIS that can easily become saturated with intermittent generation, particularly at times of low load such as overnight. This could potentially limit the application of this technology. The Western Australian Government commissioned a study into the potential for intermittent generation on the SWIS (E-Connect, 2005). A copy of the report is enclosed in Appendix B.

This study concluded that as intermittent generation made an increasing contribution to the generation mix, system management issues arise. Below a penetration rate of 10% system management for frequency control is not significant. When the penetration rate approaches 20%, additional frequency control is required and impacts on market participants. Above 30% the cost impost of frequency control ancillary services becomes a more significant component of electricity costs.

High penetration rates of intermittent generation would pose a particular challenge for Western Australia's SWIS system. The SWIS is relatively small and loosely meshed. It operates over large areas in relation to the amount of energy distributed when compared to the networks in many developed economies with high energy demand and larger populations.

Bearing in mind that users of electricity networks should equitably bear the costs of their connections, there may be a need to strategically manage the future development of electricity grids. While network design and investment has been appropriate for the electricity generation and supply needs to date, future network investment may need to be planned with future generation investment in mind. This may include generators and networks improving their capacity to connect and manage issues caused by intermittency. Strategic planning to optimise the geographic location of projects on networks may be one option.

Policy Framework

Environmental Externalities

There are a range of price externalities that impact on the competitiveness of renewable energy. There is a case to further develop policies that integrate environmental service benefits as well as the cost of carbon with renewable energy industry development, such as Stewardship Payments for ecosystem services. Addressing price externalities is a necessary step in creating a more level playing field for renewable generators. A national approach to these issues is considered the best way for this to occur.

Energy Security and Import Dependence

Renewable energy offers a buffer for the economy against price volatility in fuel supply, reduces import dependence and improve Australia's energy security.

Mandatory Support Schemes

The pursuit of renewable energy technologies, despite the comparatively high carbon abatement costs, should be a long term strategic priority. Currently, renewable energy technologies are the most proven supply side zero emissions abatement options and

over the long term may provide the only sustainable form of stationary energy generation.

Renewable technologies have the potential to contribute significantly to future deep cuts in emissions if the cost of generation can be brought within the range of other forms of abatement and low emissions technologies. Mandatory obligations for renewable energy generation that are based on competitive processes are one means of driving down the costs of renewable energy over the longer term (Ek and Söderholm, 2005). Mandatory targets also deliver greenhouse gas emissions savings now, may assist in reducing the cost of future deep cuts in emissions, prepare networks for higher levels of intermittent renewable generation and act as a risk management strategy against potentially higher costs or delays in the deployment of other low emissions technologies.

Renewable energy is generally an expensive form of abatement compared with offsets and fuel substitution activities. However, most renewable energy technologies are relatively new and over time, as demand grows, it can be expected that the cost will come down. There is a case to strategically support these emerging energy supply options where a significant domestic industry could develop through the provision of financial and market based incentives for renewable energy development and generation.

Government intervention to support the renewable energy industry is justified on carbon policy grounds in the same way that investment in other low emissions technologies such as clean coal is justified. However, unlike clean coal technologies, renewable generation provides a long term sustainable energy supply option that is available now.

There is a finite potential for low cost abatement like fuel substitution and offsets. As emissions reductions become more severe, carbon prices will need rise to meet the cost of more expensive forms of abatement if these targets are to be achieved.

Renewable generation also provides a hedge against the risk that other low emissions generation technologies, like clean coal, are not available, take longer than expected to prove or cost significantly more than anticipated. Fostering diversity in available low emission generation technologies increases certainty in the capacity of the economy to achieve long term greenhouse gas reduction targets while maintaining growth.

Technologies can be expected to fall in cost as a function of economies of scale, learning by doing and new technical innovation. Some aspects of the cost reductions such as economies of scale may be transferable between economies. Other areas where cost reductions can be achieved are less transferable . Examples of site specific factors that can impact on the cost curve for renewable generation include managing intermittency on electricity grids, establishing supply chains, establishing forecasting capacity and financial and market support infrastructure.

Network capacity to support wide scale intermittent generation

In Western Australia around 75 per cent of the State's energy consumers live in and around the Perth metropolitan area, but most of the larger and traditional sources of fuel for energy are located some distance away – coal around Collie and gas in the north west and mid west of the State. Most of the better sources of renewable energy are also some distance from population centres, with large wind farms located on the south coast of Western Australia or to the north of Perth. This geographic separation of the principle sources of supply and demand for energy is a major consideration for all energy projects.

Conventional base load generation is optimised for large scale production. The design of electricity grids has a tendency to reflect this with publicly supported generation and

network assets amortised over large production quantities. Large generators can better spread the capital costs of investment and so lower the cost of delivery per megawatt hour.

Infrastructure costs however can be a central factor for the economics of smaller projects. High transmission connection costs have to be spread over smaller capital and revenue bases.

Generally, most of the fossil fuel energy generation projects are relatively large (around 400 MW) while most of the renewable energy generation projects are much smaller (less than 100 MW and often less than 50 MW). The size of renewable energy projects is increasing however there are other parameters that limit the extent to which they can grow. The smaller scale of many renewable energy projects is however often suited to specific and localised demand for energy. This includes cases where embedded generation and photovoltaic systems can be installed to meet the energy needs of some consumers in either stand alone situations or are easily connected to the SWIS.

Western Australia's SWIS is an extensive network, stretching around 1,000 kms from Kalbarri in the north to Albany in the south and around 800 kms from Perth in the west to Kalgoorlie in the east. The combination of geographic separation of energy sources from demand or load centres and the loosely meshed nature of the SWIS can be a particular challenge to the grid integration of renewable energy projects.

In addition, the SWIS is isolated from the other interconnected systems such as the national grid in eastern Australia. Western Australia lacks significant energy storage like hydro and connections with other electricity networks. These factors reduce the range of options available to network managers to maintain network reliability when connecting large amounts of intermittent generation sources.

Supply chains

Supply chains can take some time to develop. This can be relatively short in terms of manufacturing plant or relatively long in the case of biomass. Woody forms of biomass can not be established in short periods of time. Energy crops like oil mallees can take some years to become established to a point where they are able to support widespread biomass energy production. Farmers may also need to learn how to cultivate and harvest energy crops as well as establish the necessary quality standards for widespread diffusion. There may not be sufficient clarity in the forward market for carbon to provide an adequate signal to invest in energy crops.

When the cost of abatement under emissions trading reaches a point sufficiently high to support widespread adoption of these technologies, the capacity to supply may not be optimally developed. There is a risk that in order to secure abatement the market may need to go to the next most expensive technology. Without strategic support for technologies that Australia has a particular advantage in, the overall cost to achieve deep cuts in emissions may increase.

Forecasting

Developing wind forecasting methods to integrate into energy markets is one means of reducing the risk for project development, the cost of generation and the impact of intermittency on electricity networks.

The Commonwealth Government through NEMMCO is developing a wind forecasting model for the National Electricity Market. It is essential that this system is able to be implemented in the SWIS and that the same level of support is provided to the Western Australian system manager to implement it.

Industry Development

Government's have a role in establishing a business environment that supports private investment in new areas of industrial activity. The Western Australian Government is committed to diversifying its economy and currently applies a range of policy measures, like innovation funding, to address barriers to development.

It should be noted that the impact of renewable energy industry development initiatives will be enhanced by an economic environment that supports a domestic market. Without such an environment, there is little incentive to invest in renewable technologies.

The role of such funding addresses market impediments and generally targets small to medium enterprises and emerging technology companies. Innovation funding is an effective tool to address impediments that ultimately impact on a firm's finances or viability such as where:

- The risk to reward ratio is too high, funding will change the risk profile and allow access to commercial finance;
- Seed funding will help to achieve the appropriate funding ratios when investors will only contribute funds to a set level;
- Funding reduces cash flow problems due to the time difference between discovery of a technology and market penetration;
- Funding assistance helps to cover infrastructure costs that may be disproportionate to cash flow levels in small research organisations; and
- Funding may provide access to skills shortfalls that need to be addressed, such as management and investment knowledge, in highly technical or scientific areas of activity.

Planning Issues

Overview of Planning Policy in Relation to Renewable Generation

The Western Australian Government, through the Department of Planning and Infrastructure (DPI) and the Western Australian Planning Commission (WAPC), have planning strategies and policies in place to guide development of renewable energy projects and reduce the impact of urbanisation. These include:

- Guidelines for Wind Farm Development (Planning Bulletin 67). This Planning Bulletin is intended to provide local government, other relevant approval authorities and wind farm developers with a guide to the planning framework for the balanced assessment of land-based wind farm developments throughout the State of Western Australia.
- Part 2 of the State Planning Strategy, sets the goal to minimise the environmental impact of energy consumption. Urban and subdivision design can promote the reduction in use of fossil fuels through energy efficient housing, the use of solar-design principles and promote the use of alternative fuels.
- State Planning Policy 3.1 (Residential Design Codes Draft Variation 1.) Design for climate requirements addresses solar access for adjoining sites with development designed with regard for the need to protect solar access for neighbouring properties taking account the potential to overshadow solar heating and electricity generation devices.

- DPI/WAPC has other planning policies relating to energy reduction strategies including the solar orientation of buildings, the optimal use of freight transport modes, and the use of alternatives to the private vehicle for personal transport (TravelSmart).

Transmission and Distribution Network Planning

An incremental approach to connecting a stream of renewable energy projects to networks can create less than optimal outcomes in the absence of an overall framework for system planning and development.

The key issue for network system planning is to align the technical expertise of network operators with the range of technological energy solutions that are emerging in the increasingly favourable climate for renewable energy. However, electricity network operators can be constrained by operational charters which limit their role to complying with guidelines for connecting individual projects.

To optimise the development of the renewable energy industry, its technology progress and its contribution to the provision of energy supplies, a more strategic approach may be required for technology development within long term planning frameworks.

Given the critical role that networks play in the development of the energy sector, network operators are well placed to take leadership in providing energy solutions, in close cooperation and collaboration with government and industry.

Planning for greater penetration of renewable energy generation within electricity networks should be a high priority for network operators. Consideration must also be given to ensuring that electricity networks can adapt to greater levels of intermittent generation, within the context that users should pay for the impact they have on the system. The management of demand in the context of achieving greater renewable energy generation, development of improved forecasting reliability, and research and development into storage technologies are also key priority issues.

To address some of the emerging technological and regulatory issues at a state and national level, working forums may need to be established:

- To explore technological options for development of renewable energy technologies eg fuel switching or energy storage solutions that may address network operators concerns about intermittent generation as well as improve the commercial viability of some renewable energy projects.
- Guidelines could be developed to identify optimum locations and specific opportunities for particular types of renewable energy projects so that proponents of such projects develop more commercially viable propositions that can be developed in speedier timeframes.
- Longer term indicative planning strategies could be developed between networks and the renewable energy industry.

Regulatory Infrastructure Investment Test

A new Regulatory Test became operational from 1 July 2007 and applies to all infrastructure projects augmenting the SWIS. Proposals for distribution networks with a capital cost of over $5 million or transmission capital cost of over $15 million must demonstrate that network enhancement is the best economic outcome compared with alternatives such as embedded generation and demand management that defers or offsets the need for additional capital investment. Net benefits are measured in present

value terms and, to the extent that it is possible to do so, include benefits to generators, transporters and consumers of electricity.

The Economic Regulation Authority (ERA) must assess all proposals for major network augmentation to ensure compliance with the Test before the augmentation can proceed. The ERA may also invite submissions on a proposed major augmentation, including submissions on alternatives to the proposed augmentation. The electricity market rules also provide a process whereby the Independent Market Operator (IMO) can also call for public proposals on alternatives.

The Regulatory Test ensures that there are more opportunities to investigate the options for renewable energy in Western Australia to meet the growing demand for energy services.

Renewable Energy Support Mechanisms

Support for Emerging Technologies: Research, Development and Demonstration

Australia has a good resource base and proven capacity for fostering innovation in the renewable energy sector. Maintaining academic and private research capacity will improve the ability of the economy to capture the opportunities arising from climate change. Supporting the technical base for innovation may also reduce the overall cost to the economy of meeting the challenges of climate change by either developing new technologies or adapting other technologies to Australian conditions.

The Federal Government has a role in ensuring that the research base in both universities and research institutions receive sufficient funding to research strategic technologies and that adequate incentives are in place for the private sector to invest in research, development and demonstration.

Current support work by the Western Australian Government related to research development and demonstration includes:

- **Low Emissions Energy Development Fund:** The Low Emissions Energy Development Fund is a $36.5 million fund aimed at leveraging investment in the commercialisation stages of renewable and low emissions energy technologies.
- **SEDO Grants Program:** The Sustainable Energy Development Office (SEDO) Grants Program provides grants of up to $50,000 for community-based sustainable energy projects and sustainable energy research and development projects. The Grants program has provided funding to the innovative Integrated Wood Processing plant and CETO wave energy system as well as to feasibility studies for a range of projects.
- **Centre of Excellence:** The Government is assessing a proposal by the Research Institute for Sustainable Energy (RISE), Murdoch University and Curtin University for Centre of Excellence funding to establish a Centre for Research into Energy for Sustainable Transport (CREST).
- **Innovation Capability Development Scheme:** The WA Innovation Capability Development Scheme Capital Access grants program provides support to WA companies seeking to attract significant investment funding to support the development and commercialisation of innovative products and services. A number of firms have used the funding to seek Commonwealth government

funding for energy related projects, for example through the Renewable Energy Development Initiative program.

Government Specific Actions

Climate Change Action Statement

On 6 May Premier Alan Carpenter released the Climate Change Action Statement. This statement outlines the Western Australian Government's long term greenhouse gas reduction targets and strategies that will contribute to achieving them. The statement established a target of 15% by 2020 increasing to 20% by 2025 of electricity sold on the main electricity grid to come from renewable sources. This will require a significant expansion in the installed renewable energy capacity in Western Australia. At this time, the Government is still considering the appropriate mechanism for delivering the target.

The statement also commits the Government to strengthening minimum building standards. The new standards termed Five Star Plus establishes solar hot water systems as one of only three types of hot water services permitted in new residential buildings.

The Premier's Climate Change Action Statement also commits Government to encourage customer generated renewable energy through working with utilities to reduce the 'red tape' burden and the provision of appropriate financial compensation.

Government Renewable Energy Purchase

On 5 February 2007, Premier Alan Carpenter committed the Western Australian Government to purchasing 20% of electricity consumed in its operations from renewable sources by 2010. The purchase seeks to support the development of the Western Australian renewable energy industry as well as provide an example to the community on how individuals and corporations can take responsibility for their energy related greenhouse gas emissions.

Public Housing

Western Australia has had a policy to install solar hot water systems in Government regional officers housing north of the 26th Parallel since 1988. This policy was extended to Homeswest's (Western Australia's public housing authority) family housing north of the 26th parallel in 2002.

Incentive Programs (Technology Diffusion)

The Western Australian Government provides and administers a number of incentive programs to support the uptake of renewable energy in the state.

Solar water heaters subsidy scheme

A rebate of $500 for natural gas boosted systems and $700 for LPG boosted systems in areas that do not have access to natural gas. The program has been instrumental in changing the market penetration of gas boosted solar water heaters in new homes from close to zero to around ten percent.

Solar Schools

The Solar Schools Program provides rebates for Western Australian Government schools to install solar energy systems. Schools can claim rebates of 80%, up to $10,000, for solar energy systems. In addition to reducing the greenhouse gas emitted from schools, the program is also designed to use the systems as an educational tool. The program seeks to teach students and increase community awareness of sustainable energy, increase the uptake of renewable energy in regional and remote areas and lead to long term reductions in greenhouse gas emissions.

Renewable Energy Production Subsidy

The Renewable Energy Production Subsidy was designed to increase the attractiveness of Western Australia as an investment location for renewable energy producers by subsidising the cost of production. The subsidy is a transitional measure for generators to assist adjustment to reforms in the Western Australian electricity market.

Renewable Remote Power Generation Program

The Renewable Remote Power Generation Program (RRPGP) provides rebates for renewable energy systems used in 'off-grid' areas, renewable energy systems used in 'fringe of grid' areas and energy efficiency projects in off-grid areas.

The objectives of the program are to:

- Help provide an effective electricity supply to remote users;
- Assist the development of the Australian renewable energy industry;
- Help meet the energy infrastructure needs of indigenous communities; and
- Lead to long term greenhouse gas reductions.

The program is funded by the Commonwealth Government and administered in Western Australia by the Sustainable Energy Development Office.

In Western Australia the RRPGP includes various sub-programs targeting different types or sizes of renewable energy systems and energy efficiency projects. Funding is also available for large renewable energy power systems and for industry support projects.

Subprograms of the RRPGP relevant to renewable energy include the following:

- Remote Area Power Supply Program;
- Renewable Energy Water Pumping Program;
- Rural Renewable Energy Program; and
- Large Off-grid Projects.

Photovoltaic Rebate Program

The Photovoltaic Rebate Program provides rebates for photovoltaic (PV or solar) power systems serving homes, schools, community buildings and new residential developments. Rebates are available both for systems connected to the electricity grid and for stand-alone systems.

The objectives of the Photovoltaic Rebate Program are to encourage the long-term use of PV technology, reduce greenhouse emissions, assist in the development of the Australian PV industry and increase awareness of renewable energy.

The Commonwealth Government provides funding for the Photovoltaic Rebate Program. In Western Australia, the Sustainable Energy Development Office has previously administered the program on behalf of the Australian Greenhouse Office.

Country Housing Authority Loan Program

This program supplements the Remote Area Power Supply grants program (a sub program of the RRPGP) and provides loans for farmers and pastoralists installing renewable energy generators. These loans make it easier to secure counter funding for the grant program. The loan program funds up to 50% of the cost of renewable energy systems eligible for rebates under the Remote Area Power Supply program.

Industry Development and Commercialisation

The Western Australian Government provides a number of services that support local innovation and commercialisation that will serve to strengthen the renewable energy industry. Industry development initiatives provided include:

- The Office of Science, Technology and Innovation supports the research and innovation environment in WA by enhancing the State's science base, facilitating industry and research institution access to capital and human resources, management expertise; research and development skills, commercialisation support, and by raising awareness of the State's innovation and scientific endeavour.
- The Innovation Centre WA provides the infrastructure and services to support innovative organisations, whether they are start-up companies, mature industrial enterprises, research institutes or government agencies.
- The Department of Industry and Resources provides support to State Government organisations to identify, develop, manage and commercialise their intellectual property to assist in the accrual of benefits to the State arising from that intellectual property.
- The State Government is currently developing specialised Technology Parks in line with its four pillars of information and communication technology, biotechnology, renewable energy and marine and defence.

Industry development is lead in Western Australia by the Department of Industry and Resources. The Department's activities include:

- Enhancing market access for producers of renewable energy by:
    - encouraging the use of renewable energy in resource industry developments; and
    - liaising between proponents and government agencies to help secure access to suitable land for new developments.
- Promoting the expansion of locally produced products and services by:
    - encouraging technology owners and manufacturers to consider Western Australia as a production site for equipment;
    - encouraging service providers to make Western Australia a regional headquarter;
    - providing support to help existing manufacturers to develop innovative extensions of their products to maintain competitiveness; and

- assisting producers with cost sensitive products to develop strategies to become micro-multinationals using strategies to protect and expand their WA headquartered business.

While development of renewable technologies will be promoted through the existing programs, there are specific initiatives underway that will provide the critical support needed by industry.

The Department of Industry and Resources is currently developing a Renewable Energy Industry Development Strategy (REIDS). The renewable energy industry needs to be developed in a responsible way, assessing all of the available options ensuring that the outcome is viable long term and contributes to continued social and economic growth. REIDS will address critical issues, such as:

- Research and development;
- Encouraging renewable energy technology development;
- Demonstrations to consumers and industry;
- Capacity building and commercialisation support;
- Infrastructure support;
- Collaboration with other Government agencies, academic institutions, industry firms and associations;
- Regulatory and legislative initiatives;
- Investment attraction and facilitation; and
- Export development.

The Western Australian Government also maintains a network of international trade offices to assist in marketing the State's industry that will assist in identifying and developing potential export markets. These trade offices are able to assist potential exporters by:

- Providing country trade information;
- Advising on market entry strategies;
- Providing statistical and market analysis;
- Identifying business opportunities in established and emerging markets;
- Business matching;
- Promoting international trade and investment relations with Western Australia; and
- Coordinating WA's input into Federal Trade Agreements and negotiations.

More general industry development support provided by the Western Australian Government that is applicable to the renewable energy industry includes:

- **Investment Attraction:** The Department of Industry and Resources' Investment Attraction branch, in the Department of Industry and Resources, is working with various firms who are investigating low emission technology investment opportunities in Western Australia. Potential projects include biofuels proposals; the possibility of developing an Eco Industrial Park for agricultural waste; and the manufacture of photovoltaic products or components.
- **Environment Industry Directory:** The Department of Industry and Resources has compiled and published a directory of environment industry businesses in WA – the Environment Industry Directory. This is available in hardcopy and on

the web. This directory lists energy efficiency and renewable energy suppliers in WA. It forms a basis for information dissemination regarding renewable energy business development opportunities.

- **Renewable Energy Handbook:** The Sustainable Energy Development Office has produced a handbook for renewable project developers and local government authorities on the necessary steps to establish renewable energy projects in Western Australia and includes overviews on planning and approvals processes.
- **Support for the WA Sustainable Energy Association Inc (WASEA):** The Department of Industry and Resources supports the activities of WASEA as the leading industry body representing the sustainable energy sector in WA. Funding support for WASEA under the Industry Association and Bilateral Business Organisation Development Scheme was sought to facilitate a broader agreed program of industry development initiatives in response to identify industry growth potential.
- **Industry and Export Development:** The Department of Industry and Resources consolidates information from across the Department and State Government and formulates the best approach to expanding these industries and making them export ready. The department also provides one on one advice and contacts to assist renewable energy companies progress proposals. This includes emerging renewable energy industry and the identification of key international markets, business opportunities and networks to allow maximisation of export opportunities.
- **Greenhouse Foresight Study:** Undertaking a sectoral analysis of greenhouse emission sources in Western Australia and consulting with industry on current and potential greenhouse technologies, goods and services. This process will also identify current export markets and markets of interest.

Conclusions

Renewable energy holds great promise to reduce Australia's greenhouse gas emissions. Medium and long term success in making deep cuts in emissions will rely upon major technological innovation and change which will require sustained support and investment in solutions beyond the low cost efficiency and offset options favoured by short term cost effectiveness. In addition there are strong reasons of energy security and international fuel price risks in favour of developing alternative sources of energy.

Australia has a strategic interest in supporting the renewable industry from technology inception through to a commercially deliverable product. Governments will continue to have a role in ensuring that opportunities where Australia has a natural advantage or strategic interest in developing are captured to the greatest extent possible. Supporting the renewable energy industry will improve Australia's ability to capitalise on new market opportunities climate change presents. Not providing adequate support to the renewable energy industry risks increasing the impact on the economy to achieve deep cuts in greenhouse gas emissions.

The market opportunities emerging internationally, especially in the Asian region, are growing very rapidly and offer exceptional potential for high value expertise based export earnings in the future.

While carbon pricing will create a more favourable investment environment and reduce the gap between conventional fossil fuel energy resources, it may not fully close the

price differential for some time. Despite renewable generation not being least cost abatement, there is justification for policy intervention to support renewable generation in terms of the immediate greenhouse benefits it offers and as a risk management strategy.

The following table outlines the key needs of the renewable energy industry in Australia. It outlines the role of national and state governments and the indicative time frame within which action should be undertaken.

Table 1: Renewable Energy Barriers and Needs and associated policy roles of national and state governments

Industry Requirement or Barrier	National Role	State Role	Timing Implications
Industry Development			
Price externalities (e.g. carbon)	• Ensure nationally consistent mechanisms are in place to address price externalities and ensure appropriate investment price signals are provided.	• Where national action is lagging, price externalities should be addressed collaboratively at the state level. • Address any state specific price externalities.	Intermediate term
Mandatory Renewable Energy Support Schemes (Renewable Energy Vs Fossil Fuel Cost differential)	• Best implemented at the national level to ensure least cost projects established and greatest national consistency. • Quantify the benefits of learning by doing activities that would result from Australian targets and schemes.	• Consider implementing at state level if national action lagging. • Ensure that energy markets are appropriately responsive to future changes in generation portfolios. • Ensure that regulatory systems are in place to support appropriate investment in renewable energy projects.	Near term
Electricity network design	• Ensure nationally consistent mechanisms are in place to address price externalities and ensure appropriate investment price signals are provided.	• Provide strategic direction on long term energy supply strategy. • Ensure that future investment in electricity networks is compatible with future generation investment.	Long term investment with near term strategic planning

Industry Requirement or Barrier	National Role	State Role	Timing Implications
Research and development	• Incentives for research, development and demonstration. • Support universities and other research institutions. • Funding programs for strategic research and development. • Support technology trials and demonstration projects. • Provide sound investment environment for expenditure on research and development.	• Top up funding for strategic projects or research institutions • Funding programs for strategic research and development • Assist locally strategic research projects obtain national funding • Support technology trials and demonstration projects	Long term ongoing investment

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