Industry Policy Considerations

6.1 MRET, as discussed in Chapter 1, was announced by the Prime Minister as part of the *Safeguarding The Future* package of greenhouse gas abatement measures. Unlike some other greenhouse policies such as the Greenhouse Gas Abatement Program, which aims to generate greenhouse emission reductions in the near-term, MRET is primarily a long term greenhouse measure, achieved through development of industry capacity.

6.2 MRET is also not the least cost abatement option currently available. Instead, MRET seeks to change the electricity generation mix in Australia and, in so doing contribute towards greenhouse gas abatement in the longer term.

6.3 It is clear that the achievement of these longer term objectives is premised on the establishment of a competitive, increasingly efficient renewable energy industry which can, over time, compete with fossil fuels. As a result, the success of MRET as an abatement measure is dependent on its success in fostering the development of a cost effective industry in Australia.

6.4 Economically sustainable industry development requires ongoing demand at a level sufficient to achieve the critical mass required to underpin the necessary capital investment in both generation and support facilities for transmission and manufacturing. Any revisions to MRET should take into consideration the threshold level of demand to make viable, efficient businesses possible.

6.5 This chapter discusses MRET as an industry development measure and provides the base for the following chapters, in which the Review Panel will recommend changes that will increase the measure's effectiveness in developing a cost effective industry.

The renewable energy action agenda

6.6 The flagship industry policy related to the renewable energy industry is the Renewable Energy Action Agenda.[184] Action agendas are partnerships between the Australian Government and industry, with the primary focus of increasing the growth prospects of an industry sector by identifying the steps needed to develop and enhance the sector's sustainable competitive advantages.

6.7 Action agendas have been implemented across as many as 29 different sectors, with each action agenda typically establishing industry goals and objectives and identifying strategies by which they can be achieved.

6.8 The Renewable Energy Action Agenda (the Action Agenda) came into effect in June 2000, following a discussion process among government and industry participants. The industry's key vision, as described in the Action Agenda, is 'to achieve a sustainable and internationally competitive renewable energy industry which has annual sales of $4 billion by 2010'.[185]

6.9 Implicit in the adoption of this target was that the achievement of the target would require a decade of strong growth equivalent to 25 per cent per annum and about half of the overall sales target being met from exports.

6.10 In announcing the Action Agenda, the then Minister for Industry, the Hon. Nick Minchin said:

> *[...] the growth of this industry will deliver multiple benefits to Australia—social economic and environmental. Development of the renewable energy industry will provide jobs, exports and greenhouse gas abatement, particularly in rural and regional areas.*

6.11 The Action Agenda vision adopts five key strategies:

- market development
- building community commitment
- building industry capability
- setting the policy framework
- encouraging a culture of innovation.

[184] *New Era, New Energy*—Renewable Energy Action Agenda, June 2000, Department of Industry, Tourism and Resources

[185] *New Era, New Energy*—Renewable Energy Action Agenda, p19

6.12 The final strategy, 'Encouraging a culture of innovation,' has led to the release of the Renewable Energy Technology Roadmap, an integral part of the Action Agenda and therefore an important contributor to the competitiveness of the industry. The Roadmap identifies R&D priorities for the industry.

6.13 The Action Agenda has also resulted in the development of the Renewable Energy Exporters' Network that seeks to develop export opportunities for the industry and export readiness among industry operators.

6.14 The success of the Action Agenda is critically dependent upon MRET. Initiative 1 of the Action Agenda related to its market development strategy and has as its objective 'to leverage the effect of the mandatory renewable electricity requirement and other government support programs into sustainable business opportunities for Australian renewable energy companies'.[186] The Action Agenda states:

> *The mandated renewable electricity requirement and the other Government programs seeking to commercialise renewable energy and/or grow the market for renewable energy […] will provide the most immediate and significant boost to the domestic market. How the industry ensures that maximum value is derived from these measures is critical.*[187]

6.15 In its second progress report, the Implementation Group responsible for oversighting the Action Agenda highlighted the importance of MRET to the Action Agenda and the investments that had been achieved.

6.16 Other Australian Government programs that provide support for renewables include:

- The Renewable Energy Equity Fund (REEF) that provides venture capital for small, innovative renewable energy companies.
- The Renewable Energy Industry Development Program (REID), a competitive grants program which has now committed all of its funding.
- The Renewable Energy Commercialisation Program (RECP), a competitive grants program for renewables projects at the commercialisation stage. This program has also now committed all of its funding.

[186] *New Era, New Energy*, Renewable Energy Action Agenda, p26

[187] *New Era, New Energy*, Renewable Energy Action Agenda, p25

Renewable energy industry competitiveness

6.17 The Second Reading Speech for the legislation included, as one of the MRET measure's objectives, the development of 'an ongoing base for commercially competitive renewable energy.' During its consultation process, the Review Panel met with a large number of renewable energy companies, all of whom suggested that MRET was critical to their business success.

6.18 It was evident from submissions and discussions that some sectors of the industry, such as the hydro sector are, either already commercially competitive, or are close to reaching commercial competitiveness with coal and natural gas. The remaining renewable energy industries are all currently reliant for their profitability and indeed their viability, upon MRET or, in the absence of MRET, upon some other government subsidy scheme.

6.19 It should be borne in mind, however, that renewables in Australia are competing with coal and gas, which in Australia are abundant and cheap. Australian renewables may be as efficient as overseas renewable energy generators, yet still struggle to become competitive against cheap Australian fossil fuels.

6.20 MRET effectively provides a subsidy to renewable energy generators, but the size of this subsidy is in part affected by market factors. That is, renewable energy generators are able to trade RECs with liable parties, with the REC price set by the terms of this trade. This price measures the extent of the subsidy to the renewable energy industry.

6.21 Calculating the renewable energy certificate price is a complex matter, because RECs are not traded on a market floor, and prices are not transparent, although for those actively involved in the market there seems to be a reasonable understanding of the spot and future prices prevailing. In addition, many sales of RECs are actually bundled with sales of energy, so that it is difficult to definitively assess the REC price component.

6.22 To give an indication of the variability of renewable energy certificate prices, the Review Panel became aware of prices for solar hot water RECs as low as $16, while at the other end of the scale BP Solar has offered to pay a rebate amounting to $80 per REC to customers purchasing its photovoltaic (PV) systems. On average, though, current REC prices are widely accepted as approximately $37 or $38. As a result, in dollar terms, the implicit MRET subsidy is about $37 per MWh.

6.23 This subsidy can be compared with the average pool prices paid for electricity. In its submission, the Electricity Supply Association of Australia stated that 'over 12 months to date, volume weighted pool prices averaged $45 per MWh in New South Wales, $34 per MWh in Victoria and $49 per MWh in Queensland'.[188]

[188] Electricity Supply Association of Australia, submission 107, p3

6.24 Based on these figures, it appears that the subsidy to the renewables industry is equivalent to around 100 per cent of the average pool price.

6.25 The most significant challenge for the commercial competitiveness of renewable energy is cost. The Renewable Energy Technology Roadmap notes that 'despite the technical feasibility and environmental attractiveness of many renewable energy technologies, their market uptake to date has been limited, mainly due to uncompetitive pricing'.[189] The following table, adapted in part from information contained in the Roadmap,[190] indicates the quantum of the pricing issue:

Table 6—Cost of producing electricity, by source[191]

TechnologyCost ($/MWh)	
Coal	15–60
Natural Gas	35–60
Solar Hot Water	40–70
Large Scale Hydro	40–100
Biomass Electricity	50–75
Large Scale Wind	60–80
Solar Thermal Electric	120–180
Photovoltaics	200–400

6.26 Table 6 indicates that the more common forms of renewable energy still have a considerable cost disadvantage compared to coal and natural gas. However, the Review Panel notes that price is not the only factor in market competitiveness:

> *The cost of the product, while fundamental, is obviously not the only factor determining customers' purchase choices. Typically the renewable energy industry has focused its efforts on price reductions and has achieved some significant successes. Improvements in cost competitiveness have not necessarily translated into increasing demand, however, as the prices of competitive products have also fallen. The focus on cost competitiveness has also ignored the other important factors which influence customer thinking.*[192]

[189] Renewable Energy Technology Roadmap, p92

[190] Renewable Energy Technology Roadmap, p94

[191] Table 6 source; Renewable Energy Technology Roadmap

[192] *New Era, New Energy*—Renewable Energy Action Agenda, p25

6.27 In this context, the Renewable Energy Action Agenda also incorporates strategies to engage those other factors affecting competitiveness, such as the marketing of 'green energy', additional customer and competitor research, energy labelling, and exploiting niche markets.

6.28 In submissions and consultations, the Review Panel received a wide range of views regarding the sustainable competitiveness of the renewable energy industry. Some submissions took the view that it is still too early to tell whether the MRET measure is likely to result in a commercially competitive industry.[193] Of those who expressed a more firm view, there were two main positions that MRET:

- needs to be enhanced if it is to result in a commercially competitive industry
- is unlikely in any circumstances to result in a commercially competitive industry

6.29 No submissions supported the view that MRET in its current form would result in a commercially competitive renewable energy industry. Those submissions which were most enthusiastic about the future of the renewable energy industry in Australia were also those recommending changes to the measure.

6.30 The first main view, that MRET must be enhanced in order to produce an industry which would be commercially competitive in a market which included a price for carbon, was described by Origin Energy in the following terms:

> *Renewable generation in the longer term is likely to be commercially competitive when [carbon emission] externalities are considered and the scale of operation grows sufficiently to reduce manufacturing and supply costs. Despite a decline in the cost of some renewable energy projects, Origin believes that at the current 9500 GWh target, the Act will not provide sufficient impetus for large scale manufacturing of, for example, wind turbines in Australia—and this will be necessary to achieve a commercially competitive renewable generation sector.*[194]

6.31 Other submissions, including Western Power and AusWEA[195], also contended that an increase in the MRET target would lead to increased industry competitiveness. AusWEA concurred with Origin's view that a domestic renewable energy manufacturing industry was important to the industry's ongoing sustainability.

6.32 A number of submissions argued that renewable energy would become cheaper over time, provided a strong MRET measure remained in place in order to foster market growth. BCSE, for instance, noted:

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[193] Electricity Supply Association of Australia, submission 107; TXU, submission 218

[194] Origin Energy, submission 170, p14

[195] Western Power, submission 70; Australian Wind Energy Association, submission 198

As Australia's renewable energy industry is coming from a low level of installed capacity (other than hydro which is essentially fully developed), building a healthy domestic market is central to achieving unit economies such that installed costs can be significantly reduced over time. As an example, the international experience for solar PV shows that installed costs fall by 18 per cent real for every doubling of installed capacity. Similarly, the installed cost of wind energy has fallen by 5 per cent per annum for the last five years and this trend is expected to continue. The solar hot water heater industry projects costs to fall by 20 per cent to 2010 with the expansion of the industry at its current rate.[196]

6.33 On the other hand, a number of other submissions argued that MRET is unlikely to result in a competitive renewable energy industry. Electricity using industries in particular suggested that the MRET measure is artificially supporting a renewable energy industry and therefore creating unreasonable market distortions. The Minerals Council of Australia stated:

assuming MRET continues in place, a key policy design principle to achieve this industry development objective should be that the implementing measure provide a clear indication of the time frame over which the industry concerned is expected to improve its productive and technical efficiency to put it on a firm, commercially competitive footing. The current MRET design fails to provide such an incentive.[197]

6.34 The Australian Gas Association drew attention to the effect MRET may have on other relatively low emission forms of electricity generation:

The MRET scheme in effect sets out to 'pick winners' by advantaging technologies defined as renewable and this results in market distortions [and] less development in some other industry. Indeed the deliberate target of the scheme is to displace 'high emission' energy sources with 'low emission' renewable energy. However, perhaps unintentionally, the MRET scheme also displaces development in other 'non-targeted' industries [such as] cogeneration, distributed generation, natural gas water heaters and natural gas generally.[198]

6.35 This view was also shared by a number of electricity generators, many of whom have significant investment in fossil fuel generation, but are also looking to diversify into renewable energy sources. Macquarie Generation stated:

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196 Australian Business Council for Sustainable Energy, submission 165, p7

197 Minerals Council of Australia, submission 231, pp11–12

198 Australian Gas Association, submission 115, p6

> *To be commercially competitive, renewable energy sources will require continued subsidies, either from this or some other measure. There is concern in the industry that when the MRET stops, renewable energy investment will cease and commercial viability will not eventuate … if renewable energy projects were competing on energy returns alone, in the absence of the incentive of the REC revenue, many would not be commercially viable.*[199]

6.36 The renewable energy industry must use the opportunity created by MRET to reduce its costs and take advantage of non-price factors to improve competitiveness, if it is to establish the base for a commercially competitive industry. However, while non-price factors may be important, price competitiveness is still the major challenge for the industry.

The competitive position of renewable energy sectors

6.37 Given the importance of price competitiveness to the future development of the industry, and the diversity of sectors that make up the renewable energy industry, the Review Panel considers that some discussion of the competitive position and prospects of the key renewable energy sectors is warranted.

Hydroelectricity

6.38 Hydroelectricity is the oldest and most mature form of commercial renewable energy, and the only form of renewable energy which is price competitive with fossil fuels under current market conditions. Hydroelectricity is created when water is propelled (usually by gravity) through a water-spun turbine generator. Typically, large-scale hydroelectric projects involve one or more large water storage areas (dams), with the turbine fed by water released from the dam.

6.39 Installed large hydroelectricity schemes (over ten MW capacity) contributed around 6600 MW capacity to the electricity industry in 2002. 'Small hydro' systems, which often rely on run-of-the-river flows rather than dam storage, contribute an additional 300 MW capacity.

6.40 While hydroelectricity is currently by far the largest source of renewable energy in Australia, most available hydro resources are already developed in Australia. As a consequence, no further large-scale developments are anticipated, with increases in output expected to come from increased efficiency, rather than from new, large-scale developments.

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[199] Macquarie Generation, submission 112, p5

6.41 Hydroelectricity is price competitive with fossil fuels for two reasons. First, the price of generation is marginally higher than for fossil fuels but the range of generation prices for coal and large hydro do overlap. Secondly, hydro facilities are able to very quickly adjust their power output to supply peak load power to the NEM. This 'peaking' power brings a much higher price than the 'baseload' power which is part of the customary daily bidding process in the NEM.

6.42 Coal, on the other hand, is unable to quickly adjust its power output, so must accept the lower prices associated with supplying 'baseload' power. As a result, hydro power can obtain larger than usual prices against reasonably competitive costs of production, leading to substantial competitiveness.

6.43 Because hydro power is a relatively mature technology, development tends to be incremental, and based on systematic upgrades of existing plant. This is reflected in the future actions for large-scale hydro contained in the Renewable Energy Technology Roadmap.[200]

6.44 As a result, hydro power is not expected to show the cost reductions which are expected for other, less mature technologies as they expand into the Australian energy market. Rather, costs are expected to be stable, leaving hydroelectricity to continue as a commercially competitive form of renewable energy.

Wind power

6.45 Wind power is generated when the kinetic energy of wind is used to drive the blades of high technology wind turbines, creating mechanical energy. AusWEA describes the process as follows:

> *Almost all wind turbines producing electricity consist of rotor blades which rotate around a horizontal hub. The hub is connected to a gearbox and generator, which are located inside the nacelle. The nacelle is the large part at the top of the tower where all the electrical components are located. Most wind turbines have three blades which face into the wind; the wind turns the blades round, this spins the shaft, which connects to a generator and this is where the electricity is made.*[201]

6.46 Installed capacity of wind generators in Australia is currently 195 MW. Depending on a number of factors—including the outcome of this review—the sector is predicted to expand substantially. AusWEA reported that 227 MW capacity is currently under construction, with an additional 63 MW out to tender. AusWEA also drew attention to additional projects amounting to 2789 MW that have been proposed.

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[200] Renewable Energy Technology Roadmap, pp58–63

[201] Australian Wind Energy Association website at www.auswea.com.au/about/faq.htm

6.47 However, evidence received from AusWEA itself requesting additional MRET support—along with various commercial, regulatory and other impediments identified by a range of interested parties—suggests that this figure may be aspirational rather than realistic.

6.48 Wind power is not currently price competitive with electricity generated from fossil fuels. The costs of production are around $60 to $80 per MWh. This is equivalent to the highest costs for coal based generation. In addition, wind energy is delivered to the grid as baseload electricity, paid for on the basis of power purchase agreements with retailers. Wind generators are therefore unable to take advantage of the higher spot market prices obtained by suppliers of peaking power.

6.49 Wind power is baseload power because, unlike hydro, wind generators are unable to choose when to generate—when the wind blows, the plant generates. Wind generators are therefore unable to ration their resources to be delivered at the most lucrative moment.

6.50 A number of interested parties suggested during consultations that the cost of wind generation will fall, over coming years as technology improves and economies of scale are achieved through domestic industry development.

6.51 However, there was little consensus in submissions and consultations as to the likely rate of 'cost convergence', with some economic modelling suggesting that, as the most favourable wind sites are utilised and less favourable sites are developed, the cost of wind may in fact increase.[202]

6.52 These costs could decrease further if the wind industry in Australia reaches a sufficient size to enable the local manufacturing of generating equipment. Wind towers are usually already manufactured locally, and Vestas has established a plant in Tasmania to assemble nacelles.[203] NEG Micon has also made the conditional decision to establish a blade manufacturing plant in Portland, Victoria. NEG Micon outlined the benefit of local manufacture in making the local wind industry more competitive:

> *We are committed to maximizing local content in our product. We do this because it enables us to keep costs and exposure to foreign exchange risks down for our clients, improves availability of spare parts locally, and enables us to give something back to the communities who are hosting wind farms.*[204]

[202] McLennan Magasanik Associates Report for the Review Panel

[203] Nacelles are the 'casing' at the top of the tower, which contain the generating equipment.

[204] NEG Micon Australia, submission 202, p6

6.53 While wind is a relatively mature technology, it is also undergoing rapid technological advancement, as suggested by its declining cost curve. Most of the international research and development effort into the actual generation technology is taking place outside Australia. The Renewable Energy Technology Roadmap, for instance, states:

> *Australia is not an active participant in the current process of improvement and refinement of the technology and equipment for wind generation. Denmark, Germany and some other European countries dominate this activity. There is currently little Australian R&D in large wind turbines.*[205]

6.54 However, Australia has undertaken some successful research associated with the development of the wind industry. For instance, the CSIRO has developed a number of products, now marketed by Windlab Systems,[206] that enable sophisticated mapping of wind resources, in order to reduce the costs associated with prospecting for commercial quantities of wind. *WindScape* is a high-resolution wind mapping tool that assists in the selection of wind farm sites. The product is being used overseas, and has significant export growth potential.

6.55 However, overall the Review Panel considers that the wind industry has a considerable task ahead, if it is to become competitive as a renewable energy sector in its own right. This task may be helped by cost savings associated with local manufacture. However as discussed in Chapter 4, it is currently unknown what the national grid's capacity will be to absorb significant quantities of intermittent generation.

6.56 This problem can be ameliorated to an extent, but only at a cost, due to the need for more transmission lines and the maintenance of an increased 'spinning reserve' in the grid. Both of these factors may impose further cost penalties on wind generation.

Photovoltaic Power

6.57 Photovoltaics (PV) are semiconductor devices that convert light directly to electricity. They are usually, thought not exclusively made from silicon doped with traces of other elements. Output is low voltage direct current.[207] Unlike other forms of generation, PV includes no moving parts, which in turn means that PV generation equipment is relatively easy to maintain and can for this reason be successfully used by households.

6.58 PV is not price competitive with fossil fuels and is among the most expensive forms of renewable energy, costing upwards of $200 per MWh. Given that PV requires no fuel and little maintenance, almost all of this cost comes from the initial capital cost of purchasing and installing a solar cell array.

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[205] Renewable Energy Technology Roadmap, p85

[206] www.windlabsystems.com

[207] This process is described in much greater detail by the Key Centre for Photovoltaic Engineering at http://www.pv.unsw.edu.au/info/solarcel.html

6.59 Programs such as the Australian Government's Photovoltaic Rebate Program are designed to partially offset this initial cost. In addition, the 'deeming' provisions of MRET provide 5 years worth of RECs upfront. This provides the purchaser with an income from RECs at the same time as the major capital expenditure is made.

6.60 Costs for PV systems are trending downwards, falling by around seven per cent per annum over the past five years, but given the relatively high current costs and the falling costs of other forms of renewable energy, PV is unlikely to be cost competitive in the foreseeable future. However, when PV is used as an embedded generator on the distribution network, it competes with the retail costs of electricity, thus improving its competitive position.

6.61 Currently, installed capacity of PV in Australia is about 40 MW and production is close to 50 MW per year of which about 70 per cent is exported.

6.62 As at 18 August 2003, only 169 PV systems have been registered by ORER as eligible generators under MRET.

6.63 While these figures are small, it should be remembered that large-scale generation from PV is still a very immature industry when compared to hydro and wind industries. As a result, the focus of global activity in PV is very much on research and development, with Australia among the world leaders in the development of new PV technologies:

> *Australia has been at the leading edge of PV R&D for the last twenty years. There are several Australian technologies which have the potential to dramatically reduce the cost of solar cells.*[208]

6.64 One example of Australian PV development, by Origin Energy and the Australian National University's Centre for Sustainable Energy Systems[209], is that of 'Sliver Cell' technology, which reduces by 90 per cent the quantity of silicon[210] required to manufacture solar cells.

6.65 While much of the focus in the PV sector remains at the R&D stage, the commercial viability of PV is being largely driven by its suitability as a generator of small-scale, off-grid electricity, especially in remote areas. BP Solar stated:

> *Creating PV 'micro-grids' or 'mini-grids' will be a key development. These systems, about 50–100MW in size, use PV and diesel technology to supply small towns and settlements that are not grid connected, particularly for Aboriginal communities. Displacing diesel fuel in electricity generation is the next major market for which PV will be economically viable in the near future.*[211]

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[208] Renewable Energy Technology Roadmap, p85

[209] Professor Blakers, Australian National University, submission 7

[210] An expensive component of solar cells and therefore a major driver of high costs.

[211] BP Solar, submission 193, Attachment 3, p2

6.66 Nevertheless small grid-connected residential systems are the fastest growing area of PV sales worldwide. In 1990 grid connected systems were just 2 per cent of the PV market whereas by 2002 they were 51 per cent.[212] Australia has not kept pace with this rapid growth, but, in the last four years, grid-connected sales have more than doubled—from a very low base.[213]

6.67 The Renewable Energy Technology Roadmap has identified off-grid strength as a source of solid commercial and export competitiveness for the PV industry:

> *PV is already a significant export industry for Australia. PV systems, especially for remote area power supply, are one of the few applications where Australia has a clear comparative advantage. This is because, unlike other developed countries, Australian has a significant domestic market for such systems in off-grid regions. Australian firms have learned through experience gained in supplying the domestic market how to make robust and reliable systems. This experience is directly transferable to supplying markets in developing countries where demand exists for similar systems for village power supply in off-grid locations.*[214]

6.68 Overall, the Review Panel considers that the PV industry in Australia has performed well in international terms both in R&D and in the commercialisation. This is evidenced by BP Solar's presence in Australia as one of three global manufacturing operations with strong export sales to Asian markets. There is also evidence that other manufacturers, such as Pacific Solar, have export potential. This potential needs to be balanced by a recognition that PV remains a long way from commercial competitiveness with other energy sources.

Bioenergy

6.69 Bioenergy is energy created from the combustion or digestion of biomass (or fuels derived from biomass). There are a range of types of bioenergy used to generate electricity, such as:

- wood, which is combusted directly
- bagasse (a waste from sugar refining)
- biogas extracted from human and animal wastes, in particular from municipal waste water (sewage)
- energy crops grown specifically for use as energy fuel
- industrial waste, especially scraps from the food industry and 'black liquor' from the pulp and paper industry.

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[212] *Renewable Energy World Review* Issue 2003–2004, 'PV Market Update', p84

[213] Dr Muriel Watt (2003), *Trends in Australian Photovoltaic Applications*

[214] Renewable Energy Technology Roadmap, pp67–68

6.70 The price competitiveness of bioenergy obviously differs substantially depending on the resource and technology utilised. Bagasse is price competitive at around $45 per MWh utilising new technology—and can be cheaper if the bagasse is co-fired with wood waste. Wood waste co-fired with coal in a conventional boiler can be a cheap power source. Forest residue and wood waste burnt in a purpose built facility can be quite expensive (around $75 per MWh) and is sensitive to fuel transport distances. However, the costs associated with both of these forms of generation are expected to fall in coming years. Biogas from municipal waste water is also relatively price competitive (at around $35–$40 per MWh) but these systems are typically quite small.

6.71 A further cost effective renewable energy opportunity, which is already being exploited and may have further potential, is the use of biomass waste for co-firing in conventional boilers. This technology is attractive because the energy generation facilities are already in place. Another benefit is that the capital required to generate renewable energy is confined to the cost of recovery, transport and fuel preparation.

6.72 The biggest challenge to bioenergy (from a regulatory, technical and financial perspective) is the acquisition of fuel. This is a limiting factor for bioenergy, as it is for any other fuel-reliant technology. These technologies cannot increase the availability of fuel from a single source, except by promoting additional waste. The use of woody biomass as a fuel faces particular challenges, as the Roadmap notes:

> *The major barrier facing the use of woody biomass fuels in Australia is the issue of ecological sustainability. There is considerable environmental opposition to increased or even continued harvesting of native forests, and this is reflected in the decision by environmental groups to oppose the use of logging residues from native forests and native forest sawmill wastes. This opposition has adversely affected the development of bioenergy projects, including those using biomass resources not derived from native forests.*[215]

6.73 The issue of wood wastes, in particular those from native forests, will be addressed in detail in Chapter 8. At this point, it is sufficient to note that access to fuel is an important challenge confronting the industry.

6.74 Biomass from bagasse cogeneration was expected to be a major beneficiary during the development of MRET, with over 50 per cent of the projected market share by 2010. However, this is now unlikely given the recent difficulties experienced by the sugar industry and the contention by sugar producers that while MRET is supportive of bagasse based cogeneration schemes, it does not provide sufficient incentive for larger-scale developments to proceed, unless as part of a factory expansion or a necessary upgrade of boiler plant.[216]

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[215] Renewable Energy Technology Roadmap, p32

[216] Bundaberg Sugar Ltd, CSR Ltd, Mackay Sugar Co-operative Association Ltd, submission 239

6.75 R&D within the sector currently appears to be quite diffuse, but might generally be categorised as focusing either on feedstock or on conversion technologies. Feedstock R&D includes the development of improved crops, including dedicated energy crops (though these currently appear to be uneconomic) and improved methods of harvesting feedstock and transporting it to the generator. New conversion technologies include high-efficiency furnaces, along with more advanced processes such as gasification and fast pyrolysis.[217]

6.76 Exports are not a focus of the bioenergy sector. Exports are undertaken by individual companies rather than in accordance with any sector-wide strategy. Over the longer term, there may also be opportunities arising from large-scale bagasse cogeneration for Australia to gain export opportunities in countries with less developed cogeneration facilities.

6.77 The competitiveness of biomass projects may vary considerably according to the biomass source and that its longer term competitiveness and development potential may be constrained both by resource availability factors or, in the case of bagasse, by other sugar industry factors.

Solar water heaters

6.78 Solar water heaters are different to other MRET technologies because they do not generate electricity. They circulate water (or some other heat transfer medium) through their collection plates, allowing the water to be directly heated by the warmth of the sun.

6.79 They are usually coupled with either gas or electric hot water heating systems, so that when insufficient heat is generated from the sun, the hot water does not fail—the backup system simply takes over.

6.80 Solar water heaters are not electricity generators but they participate in MRET on the basis that newly installed solar water systems which replace electric hot water systems displace the electricity which would have been consumed had the electric system continued in operation.

6.81 Solar water heaters obtain RECs at the time of installation, through a deeming process. This deeming process is more complicated than for rooftop PV, and the number of RECs obtained depends on factors such as the location of the rooftop system and type of the solar water heater being installed. Solar hot water heaters are typically eligible for between 10 and 64 RECs.[218]

[217] A chemical process which converts solid biomass into a stable liquid fuel.

[218] For more detailed information see the Office of the Renewable Energy Regulator website at http://www.orer.gov.au/factsheets/generators.html

6.82 Solar water heaters are a relatively mature technology in Australia, and have been in operation since the 1950s. However, the development of the solar hot water sector has been strong since the implementation of MRET with 30 per cent per annum growth in the sector.[219] However, due to factors such as cost, conservatism, and the perceived aesthetic impact of a solar hot water system on a residential rooftop, the overall level of market penetration has been low, and remains at about four per cent.

6.83 Most State and Territory governments have also implemented rebate schemes to support the installation of solar hot water systems, and these interact with MRET to varying extents.

6.84 The solar hot water sector is also competitive in international markets with approximately one-third of domestic production sold into export markets during 2002 to 2003.

6.85 However, R&D in the solar hot water sector does not appear to be strong. The Renewable Energy Technology Roadmap notes:

> *Given the maturity of the technology, improvements will be incremental, with economies of scale potentially emerging in the future if demand increases. There appear to be a few opportunities to improve traditional solar hot water designs. It may prove possible to improve aesthetics to some degree or to increase the solar contribution by artificial intelligence techniques that adapt use of the back-up heat source to evolving water usage and weather patterns. Significant enhancements in cost effectiveness and aesthetics appear to be needed for the solar hot water industry to substantially increase its residential market share.*[220]

6.86 Overall, the Review Panel considers that the solar water heater industry in Australia is internationally competitive and that it has significant opportunities to improve its market share, both domestically and in international markets. This potential would be maximised by continuing improvements in R&D, a theme addressed more directly later in this Chapter.

Landfill gas[221]

6.87 When organic matter is placed in landfills it begins to break down. This decomposition produces landfill gas, which is largely methane (40 to 60 per cent) and carbon dioxide (20 to 40 per cent). Both of these are greenhouse gases, although methane has 21 times the global warming potential of carbon dioxide. This decomposition process can continue for twenty years and during that time, the gas may build up and then find a natural 'vent' to the atmosphere.

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[219] Rheem Australia Pty Ltd, submission 25

[220] Renewable Energy Technology Roadmap, p81

[221] Much of the information in this section was provided to the Review Panel by LMS.

6.88 Landfill gas generation involves capturing this methane and using it as a fuel source for electricity generation. This can be done either by drilling into a pre-existing landfill or by setting pipes in place before the landfill becomes operational. The methane then becomes a relatively normal combustible fuel used in a generator or for co-firing in a conventional power station.

6.89 The main greenhouse benefit from this process is obtained when the methane is combusted, because the waste product from this combustion is carbon dioxide, which is still a greenhouse gas but which, as noted above, is much less potent.

6.90 R&D in the landfill gas sector is an evolving process. During its consultations, the Review Panel visited the Swanbank ReOrganic project, a massive landfill gas project in south-east Queensland. During this visit the continuing R&D into 'biocells' and catalysts to produce methane from landfills more consistently and at higher volumes was noted.

6.91 Overall, the Review Panel considers that energy from landfill gas is now a relatively mature technology, which is competitive once certain thresholds of methane production are reached.

Emerging forms of renewable energy

6.92 There are a number of other forms of renewable energy which are in their early stages of development but which could make a substantial contribution to the achievement of MRET's objectives. These include:

- **Solar Thermal Power**—uses solar radiation as a heat source as input to a heat engine that drives a traditional electricity generator. The efficiency of the heat engine increases with temperature. Low temperature solar collectors are flat plates and solar ponds and high temperature systems use parabolic and dish concentrators, power towers and solar chimneys.
- **Geothermal Power**—uses geothermal 'hot dry rocks' to heat steam to high temperatures, directing that steam through a turbine as it vents to the atmosphere. Geodynamics Limited is currently developing a major geothermal project in the Cooper Basin in South Australia.
- **Wave Power** and **Tidal Power**—convert the tidal or wave movement of water into mechanical energy, which then drives a generator. These have obvious potential given Australia's thousands of kilometres of shoreline, however research in this area is still in its very early stages here.

Conclusion

6.93 As noted in Chapter 2, the usual indicators of industry development suggest that the renewables industry has grown under MRET. Sales have risen substantially and exports have grown well from a small base.

6.94 Employment has increased, but may flatten unless manufacturing facilities are implemented in Australia. Investment has been strong, but under current MRET settings is expected to virtually cease in 2007.

6.95 MRET has been a significant driver of this industry growth to date by effectively providing an implicit subsidy of around 100 per cent over the average pool price, which helps overcome the relatively poor cost-competitiveness of renewables compared with energy generated from fossil fuels.

6.96 For the foreseeable future, many renewable energy sources and technologies will not be competitive in the Australian market without MRET or a similar scheme.

6.97 Over the longer term, MRET can play an important role in helping the industry to develop, and a number of renewable technologies may well become more competitive over the life of the MRET scheme.

6.98 The Review Panel has given consideration to possible alternative approaches to industry development, for example, direct subsidies to companies funded from consolidated revenue instead of additional electricity charges being applied to electricity users. However, such approaches are less reliable and subject to periodic changes, for example in the annual budget process, and thus provide much less certainty for the investment community than a scheme mandated by legislation over a specified time period.

6.99 Any significant change in approach to industry development, such as moving away from MRET as a vehicle for industry assistance would be widely seen as a breach of faith by the Government with adverse consequences for investor confidence about the durability and reliability of any alternative industry assistance arrangements.

MRET as a vehicle for industry development

6.100 During the consultation process, the Review Panel was asked 'why should special assistance be given to the renewable energy industry compared with other industries?'

6.101 The issue of why renewables should attract special attention is legitimate, particularly as the rationale frequently used to justify industry specific programs such as: national security; the need for self sufficiency; employment considerations; unfair competition; or intrinsic natural advantages that require nurturing, are not really applicable to the renewable energy industry.

6.102 Claims of the potential for developing a major export industry are viewed with some scepticism. However, the industry itself is adamant that opportunities exist. A precedent for such optimism is the example of Spain where, over a comparatively short period of time, the wind industry has moved from being affiliated with the Danish company, Vestas, to being able to boast the fourth largest wind energy manufacturer in the world (Gamesa Eolica).

6.103 In addition, through BP Solar, which also operates in Australia, Spain now produces around 30 per cent of European PV cells and modules. In large part, these successes have come about through government support in the development of a large domestic market and proximity to export markets with high prices, demonstrating the importance of significant local sales to the growth of a viable renewable energy industry.

6.104 However, for most renewable energy technologies, at this early stage in the operation of MRET, there is little evidence in Australia of exclusive intellectual property, significant research efforts, natural cost competitiveness or market advantages. Solar PV provides the only exception. Niche exports may become viable but little evidence exists to date that the industry could be a major world player.

6.105 Notwithstanding these considerations, the Review Panel has identified several other factors in support of the provision of continued assistance, at least until the point in time is reached when the industry can demonstrate whether it can be competitive in the long term:

- Internationally, pressures will continue to be exerted on Australia to act responsibly in regard to restraining its greenhouse emissions. While renewable energy is not the most cost effective means of reducing such emissions, it can play a significant part, and once other avenues have been fully exploited and technologies such as CO_2 sequestration come into contention, it will become increasingly commercially attractive.
- In the event that a penalty is imposed on carbon, renewable energy will become an attractive long term proposition even earlier. The site, technology and resource assessments currently taking place under the MRET scheme take time and the current scheme, with the recommended amendments of the Review Panel, will ensure a measured approach to investment and infrastructure development. It is conceivable that at some stage in the future it might be politically or economically impossible to proceed with a new fossil fuel power station to meet growing electricity demand and the relatively modest investment now being proposed to support alternative renewable technologies will be seen as having been a prudent insurance against an uncertain future.

- Unlike most other proposals for government sponsored industry assistance, there appears to be widespread public willingness to pay a modest amount for supporting renewable energy initiatives. Few seekers of government assistance in other sectors would be able to claim that a substantial majority of their customers are prepared to pay more for what they purchase, so as to ensure the local industry develops.
- The renewable energy industry can claim with some justification that it is not faced with a level playing field when it comes to competing with fossil fuel developments. In the past State governments and electricity consumers have invested heavily in the transmission and distribution infrastructure that coal and gas power stations currently use. This infrastructure would be generally still available for relatively minor incremental capital for any expansion. Renewable generators need to be located near their energy source, which is not always located close to existing transmission networks so they can incur significant additional capital imposts.
- The Australian Government, together with State and Territory governments, actively encourage rural and regional development, particularly the creation of jobs outside metropolitan areas. In some cases they even invest in schemes to facilitate local employment. By their nature, renewable energy facilities are most likely to be located in rural areas. This in turn supports local job creation both in a direct and indirect way. When located on agricultural land, they are capable of coexisting with other forms of primary production and provide farmers with a secure cash flow that is independent of their traditional seasonal and market sensitivities. Conceivably, in some areas renewable energy production could reduce the need for other forms of government assistance.
- Biomass-based energy production can also provide flow on benefits for farmers such as salinity mitigation through the planting of trees or a reduction in weed eradication costs by harvesting the weeds for energy production instead.

6.106 On the basis of these considerations, the Review Panel concludes that there are factors supporting the development of a renewable energy industry not applicable to other industries seeking government assistance. Nothing arising from these factors would negate the need for the renewables industry to relentlessly work on driving its costs down and improving its commercial competitiveness, but they do appear to distinguish it sufficiently to allow it time to demonstrate that it can be viable in the longer term.

6.107 The rationale for MRET as an industry development scheme has underpinned discussion in this Chapter. A fundamental requirement for any industry to be selected for special support is the need for a clear understanding of how success will be determined.

6.108 In the case of the MRET measure, while there may be a range of objectives that can be defined, the over-riding requirement must be that renewable energy at some time in the future must be broadly competitive on a cost basis with other forms of energy generation.

6.109 Most renewable technologies have had a reducing cost trajectory for the past decade. While the Review Panel acknowledges that there is no guarantee that this trend will continue, the information provided suggests that further significant cost improvements are possible.

6.110 Future cost improvements can be expected to arise principally through technology change, in terms of larger size and more efficient generating units, particularly in the wind industry. Other factors will arise from the benefits of local manufacture, which can achieve significant cost savings.

6.111 Industry costs will also reduce with the benefits of scale and maturity. As more renewable projects are established, the risk premium currently factored into financing costs is likely to fall. The cost of the additional transmission infrastructure required can also be reduced by spreading the cost over a broader base.

6.112 Offsetting the potential cost improvements is the probability that the cheapest projects are likely to be constructed first. The best water resources for hydro power have already been used and among current wind projects, priority is being given to the highest yield wind sites closest to transmission infrastructure. The most prospective biomass investments are being based on the cheapest available fuel resources.

6.113 This preferential 'picking the low hanging fruit' approach to investment is a powerful reason for not increasing the target more than is needed to provide a critical mass of demand to allow industry development to proceed. A high early target will only result in bringing about projects with a high intrinsic cost. This would hinder the achievement of the longer term goal of renewable energy becoming competitive with other forms of generation.

6.114 For the renewable energy industry to become cost competitive over the longer term, and justify the support afforded it by the MRET measure, it must develop at a rate that will allow full advantage to be taken of technology improvements now in the pipeline. A feature of some renewable generators (wind and solar principally at present) is the fact that the cost structure is determined at the design stage and opportunities for cost reductions subsequently are small.

6.115 Under present settings, the major impediment to MRET as an industry development policy is that the investment necessary to meet the 2010 target will have been substantially completed by 2007, as developers rush to maximise the RECs they can create before the measure ends in 2020.

6.116 The absence of an ongoing demand for new projects is likely to freeze the industry in its current state and remove any incentives for the establishment of local manufacturing facilities or local research and development to increase the cost effectiveness of the renewable industry.

6.117 Overall, the Review Panel considers that if MRET is to be given the opportunity to underpin a viable, cost effective industry in Australia there must be ongoing demand for new projects in the period after 2010.

Recommendation 3

MRET to be enhanced to support continued development of the renewable energy industry after 2007.

Improving research and development

6.118 Research and development (R&D) is a critical element in the development of a competitive industry. As a result, policy to develop the renewable energy industry must address the question of R&D. At present, most renewable technology is purchased or licensed from overseas, an inevitable consequence of the small scale of the current industry and most industry participants.

6.119 The state of R&D in the renewable energy industry in Australia is not encouraging.

6.120 Many submissions alluded to small and declining investment in research, development, demonstration and commercialisation for renewable technologies in Australia. The former ERDC and Co-operative Research Centre for Renewable Energy are no longer operating. The CSIRO's research effort in renewables is mainly confined to geothermal energy and the completion of the Renewable Energy Commercialisation Program means there is no new government funding directly targeting the commercialisation of new renewable technologies. University research centres have also reduced their research into renewable energy due to funding restrictions.

6.121 In addition, comments from corporatised or privatised electricity generators indicate that they too have reduced their commitment to R&D.

6.122 Countering this trend is a recognition that more needs to be done through initiatives such as the new Centre for Energy and Greenhouse Technologies established in Victoria.

6.123 A major impediment to R&D has clearly been the lack of a renewable energy industry base with sufficient financial capacity to support the research, development and demonstration effort and to exploit the outcomes of the R&D. Australia has in many industry sectors, a history of world-class research being unable to find a local firm interested or capable of carrying through to commercial success technology developed through publicly funded programs.

6.124 If the primary objective of continuing and enhancing MRET is to afford the renewable energy industry the opportunity to demonstrate that it is capable of developing into a viable industry sector in its own right, the sector must be underpinned by robust R&D.

6.125 While it could be argued that existing government research funding schemes (for example, R&D START, Australian Research Council Linkage Grants and CSIRO contract research) are available to the renewable energy industry, most of these are competitive schemes and all require matching funding from industry. Only profitable companies can benefit from the R&D tax concession. The embryonic nature of the renewables industry limits its capacity to participate in these assistance measures.

6.126 Much renewables industry development to date has been project-financed, leaving little scope for longer term, higher-risk investment in areas such as research. As a consequence, there would be merit in exploring how MRET might be utilised to support appropriate R&D expenditure.

6.127 Neither the Review Panel's Terms of Reference, nor the range of submissions received and the consultations held, allowed a comprehensive or balanced view to be formed on how R&D investment could (or should) be linked to MRET.

6.128 Some ideas were canvassed such as the option to modify the MRET measure to allow RECs to be created through investment in renewable energy R&D projects approved by the Regulator. Income from RECs is currently only available to accredited power stations so this would mean expanding the range of eligible organisations. Such a measure to support R&D activity to obtain RECs would be consistent with MRET's industry development objective and could be targeted only to those companies who could provide a commercial platform for successful research outcomes.

6.129 While much of the limited R&D undertaken into renewables is currently undertaken in research institutions (particularly in solar-PV), a number of renewables companies are using their income from RECs to fund R&D activities. Rheem (Solahart) provides one example:

> *[MRET] has generated considerable investment in R&D, manufacturing, marketing, sales, installation and service infrastructure in metropolitan and regional areas.*[222]

6.130 Some interested parties suggested that the impact of MRET on R&D would be enhanced if shortfall payments were applied directly to R&D activities in the industry. This would have parallels with the MRET-style scheme operating in the UK. Powercorp, for instance, submitted:

> *If the review committee were to recommend (as has been done in the UK) that penalty payments received were to be returned as a bonus payment to investors surrendering certificates from real projects then the impact on the commercial success of these projects would be very substantial. In this way early entrant developers are rewarded with higher returns, there is no additional cost to Government or electrical retailer.*[223]

6.131 While Powercorp did not expressly link the payments to R&D, other submissions did so. For instance, the Northern Territory Greens stated:

> *If the development of renewable energy proves more expensive than anticipated, revenues from MRET penalties should be devoted to R&D into renewable technologies and funding for further renewable energy projects and policies.*[224]

6.132 While the Review Panel can see the attraction of keeping the penalty payments inside the industry; in reality, a scheme such as this would risk being counterproductive. Under ideal circumstances, the Review Panel would wish to see full compliance by liable parties, with all of those liabilities to be met by the surrender of RECs. Under such circumstances, the income from penalty payments would be negligible (and variable) and would not constitute a stable or viable base for continued R&D.

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[222] Rheem Solahart, submission 25, p5

[223] Powercorp, submission 2, p2

[224] NT Greens, submission 120, p12

6.133 A number of new renewable technologies—tidal, wave, geothermal, and solar thermal—have not yet reached commercial viability, but they demonstrate great potential. These technologies are primarily being developed by technology-based enterprises, however, they but will be unable to obtain RECs until they begin actually generating electricity. Should R&D support be increased before commissioning, the likelihood of commercial success would be enhanced, because the technology risk would be reduced.

6.134 Despite the apparent lack of direct R&D support for the industry, it is apparent that the existence of MRET as a potential future source of income for new projects has increased their investment attractiveness. CVC REEF for example, specialises in investments in early-stage technologies and sees MRET as an important part of its investment environment:

> *CVC REEF Limited provides venture capital and management support to innovative, early stage businesses in the Renewable Energy sector, investing capital sourced from both the Commonwealth Government and private investors. As such we have a very real interest in the future of the MRET initiative, as it is a central feature of the environment in which our potential investees operate or plan to operate.*[225]

6.135 A number of technology-based companies provided submissions to the Panel. Geodynamics Limited for example, is developing 'renewable geothermal energy from hot dry rocks'.[226] This innovative process has the potential to produce massive quantities of energy (275 MW capacity initially, with much greater capacity to expand) with no emissions of greenhouse gases. With respect to MRET, Geodynamics states:

> *The Act has been a key factor in Geodynamics' plans to generate electricity from hot dry rocks as a renewable energy source. The long term certainty provided by the Act has facilitated investor confidence. In particular, Geodynamics' shareholders have acquired shares based on the financial support provided by the Act.*
>
> *While the technology used to generate HDR geothermal electricity is well established in other industries (petroleum and conventional geothermal electricity), the overall application of HDR is still in its infancy. In this context, Government policy can play a critical role in stimulating the initial development of HDR with financial incentives and allowing future renewable energy support to be obtained.*[227]

[225] CVC REEF, submission 100, p1

[226] Geodynamics, submission 215, p1

[227] Geodynamics, submission 215, p8

6.136 Another company engaged in innovative new renewable energy technology is EnviroMission Ltd, which is developing solar thermal energy based on a solar tower with an installed capacity of 200 MW. EnviroMission states:

> *Present indications are that the project will be developed as bankable. However the project's prospective bankers indicate that much hinges on the ongoing certainty of the MRET measure and the associated industry confidence that flows from this. Without such clear-cut long term confidence the project could collapse in Australia, only to be taken up by competing countries.*[228]

Recommendation 4

A review to be undertaken with a view to raising the level of research and development (R&D) in renewable energy. This review to consider whether MRET should, or could, be used as a vehicle to stimulate more investment in renewables R&D.

Other industry development measures

6.137 Overall, the Review Panel concludes that in enhancing MRET as an industry development measure, an increase in research and development is necessary. It is beyond the Terms of Reference of this Review to determine how this should be achieved. More comprehensive study is necessary.

6.138 Over recent years, government support for the renewables industry beyond the R&D is reflected in a number of renewable energy programs that complement MRET by focusing on early stage industry development. This is entirely appropriate as MRET cannot of itself address the impediments to industry development across the many sectors of renewable energy at their various stages of development.

6.139 Some government assistance programs have focused on the commercialisation of technology (R&D START and the Renewable Energy Commercialisation Program) and others on the venture capital market or deployment of renewable technologies in niche markets (the Renewable Energy Equity Fund, the Photovoltaic Rebate Program, and the Renewable Remote Power Generation Program).

[228] EnviroMission, submission 191, p2

6.140 The emphasis on early-stage development and commercialisation of technology remains sound. However, the relatively low level of current public and private research funding for earlier-stage research is impeding the development of recognised Australian expertise and the exploitation of opportunities for Australia to exploit its renewable energy resources base, for example, in the wind, solar, wave, tidal, hot dry rocks, and biomass sectors.

6.141 There are perceptions within the industry that, over recent years, government support for the industry has been fragmented, with a stop-start approach to program funding. These perceptions have created mixed signals and adversely affected investor confidence in the industry.

6.142 The Review Panel considers that there is a need for reform of government programs so that funds can be made available in those areas most needed to foster industry development, rather than continuing on with a series of quite specific programs with very specific objectives. Greater funding certainty would also be highly desirable.

6.143 Such reform is essential if the Government is to realise the potential of renewable energy to play an important and significant niche role in Australia's future energy mix.

Recommendation 5

Australian Government renewable energy industry development programs to be reviewed with a view to improving the integration and focus of program support and that the funding levels be maintained on an ongoing basis.