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# THE VICTORIAN RENEWABLE ENERGY TARGET:
# AN ANALYSIS OF ITS IMPACTS AND RATIONALE



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**Cover images clockwise from top left:**
Solar powered light in regional Victoria, Pacific Hydro's wind farm at Challicum Hills near Ararat and AGL's Sewage Gas Facility at Werribee.

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## Introduction

In November 2005 the Victorian Government announced it would look to implement its own market-based scheme to stimulate investment in new renewable energy power plants. The scheme would aim to have 10 per cent of Victoria's electricity consumption supplied by renewable energy sources by 2010, consistent with the government's policy commitment.

This paper analyses the impacts and rationale of the scheme to assess what it means for Victoria in terms of employment, investment, industry competitiveness, cost to consumers, greenhouse emissions and electricity production.

## The case for change

***Greenhouse gas emissions produced from the burning of fossil fuels such as coal cause global warming which poses a serious threat to human welfare.***
The overriding rationale behind the Victorian government's renewable energy policy initiative is the need to develop a sound long-term response to address the serious threat posed by human-induced global warming. Rising concentrations of greenhouse gases in the atmosphere, of which carbon dioxide is the most significant, are having a discernible impact on Earth's climate leading to global warming. Current concentrations of greenhouse gases are higher than any period in the past 650,000 years[i].

Based on current projections and analyses published by respected scientific institutions – among them the CSIRO, the US National Academy of Science and the Intergovernmental Panel on Climate Change - continued emissions of greenhouse gases are likely to drive rapid increases in global temperature (when compared to the records of the distant past) with dramatic consequences, such as:

- More infrequent but more severe rainfall, exacerbating droughts and floods
- More powerful and damaging storms
- Spread of tropical diseases
- More severe bushfires
- More heat waves
- Rising sea levels with a greater risk of storm surges.

Australia is already witnessing some of these dramatic changes. In fact 2005 was the hottest year on record for the country according to the Australian Bureau of Meteorology. "The drought," once a problem thought confined to the bush, has increasingly become a problem for urban populations in the form of strict water restrictions in our major cities and towns. On January 18, 2003, out-of-control bushfires, fuelled by prolonged drought and forest-litter, extended into the suburbs of Canberra, killing four people, thousands of domestic and wild animals, and destroying 500 homes. Insured losses in the ACT fires were estimated at $250 million by then Assistant Treasurer, Helen Coonan. More recently, powerful storms have damaged farms, buildings, roads and tourist icons across Northern Australia. The costs of Cyclone Larry have been estimated at $1.5 billion by the Queensland Government[ii]

These extreme weather events pose a serious threat to human health and welfare in Australia and around the world. The World Heath Organisation (WHO) estimates

global warming is already leading to 150,000 extra deaths and five million illnesses a year. WHO expects these figures to double within 30 years[iii].

***Victoria's electricity supply is the most polluting in the developed world***

Victoria is heavily dependent on the burning of coal for electricity, leading to significant greenhouse emissions. Coal accounts for 95 per cent of Victoria's electricity generation. This compares with only 74 per cent for the rest of Australia (refer to Figure 1). As a result Victoria has the highest greenhouse emissions per unit of electricity produced in the whole of Australia - and is the most polluting in the developed world (refer to Figure 2).

This has serious implications for Victoria's future energy policy and it is critical that the state moves to diversify away from coal for power generation. The implementation of the renewable target is an important initiative that starts to better position Victoria for a carbon constrained future.

*Figure 1. Victorian electricity market share by fuel compared to rest of Australia*

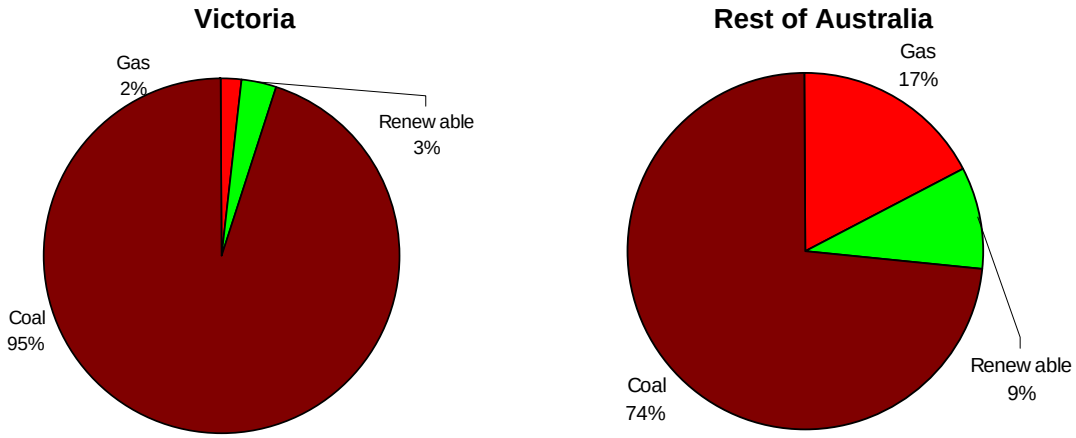
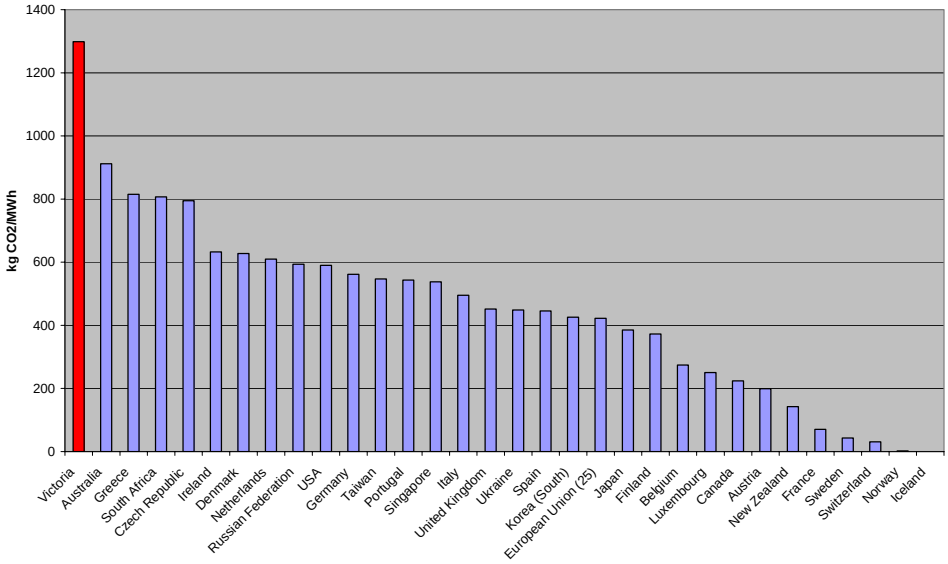
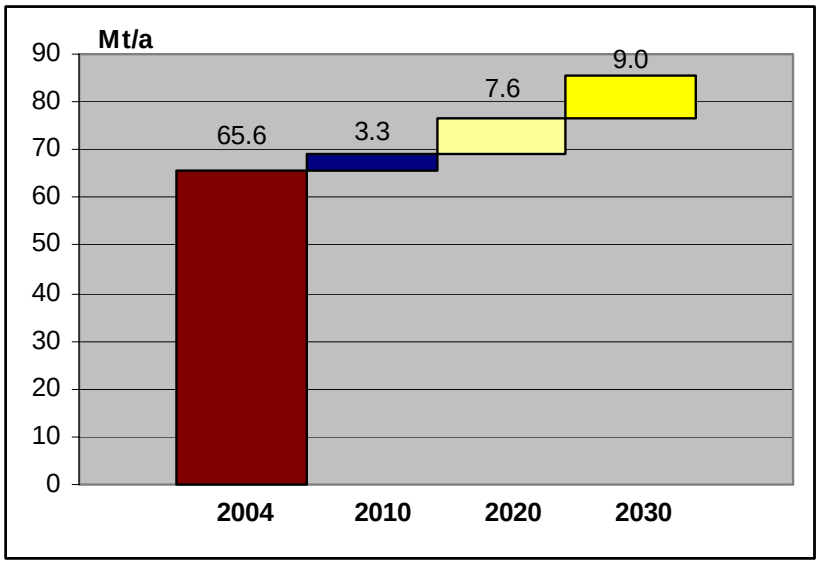


*Figure 2. Victorian greenhouse emissions per unit of electricity compared internationally*[iv]




According to projections from the Australian Bureau of Agricultural and Resource Economics (ABARE), Victoria's greenhouse emissions will grow by 30% to 2030 in the absence of implementation of new government policies. To just stabilise emissions (that is, stop them from growing) requires action to deliver reductions of 3.3 million tonnes per annum by 2010 and then a further 7.6 million tonnes per annum by 2020. Importantly, however, emissions need to reduce significantly – stabilisation is only a necessary first step.

*Figure 3. Greenhouse Emissions from Electricity Generation in Victoria*



***Renewable energy is a tried and tested, zero-emission source of electricity***
Renewable energy power technologies such as wind, bioenergy (electricity derived from plant matter), hydro and solar have been used for decades. The technology is well understood and reliable. Unexpected break-downs are typically less than that of coal-fired power. Plants using these technologies can be built quite quickly to achieve large reductions in greenhouse emissions. South Australia will soon have 15% of its electricity supplied from renewable energy, when only six years ago its share was virtually zero. Denmark has also achieved a dramatic change. In 1990 renewables supplied only 3.2% of its electricity generation; now renewable energy supplies more than 17%[v]. Hydro power has been with us since the turn of the 20th century, while bio-energy is also tried and tested using conventional power generation technologies. Bio-energy supplies over 13% of Finland's electricity needs[vi].

Renewable power projects in Victoria currently produce 1.6 million megawatt hours (MWh) of electricity which is equivalent to around 3 per cent of Victoria's power needs. There are 42 projects currently operating utilising a number of technologies and renewable fuels and represent a combined capacity of 844 megawatts (MW). A summary by technology is included as Table 1.

In addition there were three projects with a combined capacity of 41 MW that were under construction at 31 December 2005.

*Table 1. Current Victorian Renewable Power Projects Operational as at 31 December 2005*

| Generation Type | Installed Capacity (MW) | No of Projects |
|---|---|---|
| Wind | 103.7 | 4 |
| Sewage Gas | 3.8 | 2 |
| Hydro | 649.8 | 23 |
| Landfill Gas | 31.8 | 10 |
| Other Biomass | 54.7 | 2 |
| Solar PV | 0.2 | 1 |
| | **844.0** | **42** |

Note: Generation projects less than 100 kW have been excluded

## What the 10% renewable energy scheme will deliver

***How the Victorian Renewable Target will work***
Currently Victoria generates around 1.6 million megawatt hours of renewable electricity every year which is equivalent to about 3 per cent of Victoria's consumption. To give effect to the Victorian Government's policy commitment, legislation will be needed that will require each electricity retailer to source additional renewable power generation so that by 2010 renewables accounts for 10 per cent of consumption. According to government analysis this would require an additional 2.5 million megawatt hours (MWh) of renewable electricity per year which is enough

power for 400,000 households. This is equivalent to meeting the future energy needs of 22% of Victorian households - without any greenhouse gas emissions. The government is yet to release details of the legislation however we expect that it will be consistent with the national renewables scheme, the Mandatory Renewable Energy Target (MRET). To the extent that a retailer fails to meet its obligation then it is expected that the retailer will be required to pay a penalty. The scheme is also expected to operate via a competitive market in supplying renewable energy to meet this target demand.

This competitive model (referred to as *market-based*) means that the projects likely to go ahead will be those that can supply this market at the cheapest possible price, and will include a mixture of wind, hydro and biomass. In addition the scheme will provide a small incentive to encourage the installation of solar panels on a number of households.

As renewable power is currently more expensive than coal-fired generation (when pollution costs are ignored), electricity retailers will pass through the additional cost to their customers.

*Pacific Hydro's Yambuk wind project near Portland is currently being commissioned.*

*Yambuk has a capacity of 30 MW and forms part of the larger Portland wind project*.

***Job creation and investment***

The Australian Business Council for Sustainable Energy (BCSE) maintains a register of all operating and prospective renewable projects. It has reviewed this register to assess the renewable energy projects likely to benefit from the Victorian scheme.

*Energy Developments Brooklyn landfill gas project (2.2. MW).*

*Methane is captured from the Brooklyn landfill and used in an engine to produce electricity*.

Table 2 below lists projects at the most advanced stage of development for which detailed information was available. This is by no means the complete list of projects being considered in Victoria, but provides an excellent indication of the economic benefits that the industry provides. Importantly, the projects tend to be located in regional and rural Victoria, areas that are in most need of the jobs and investment that the scheme will provide.

The data has been collected largely from engineering and economic assessments undertaken by the companies directly involved in developing these projects. In addition to the projects identified we estimate that there are more than 1000 MW of renewable generation projects at an earlier development stage.

*Table 2. Victorian Renewable Energy Power Projects at advanced levels of development*[1]

| Project | Capacity | Electricity generation (MWh) | No. of homes powered | Total direct Australian investment (millions) | Total investment stimulus incl. flow-on effects | Direct construction & manufacturing jobs | Indirect job creation | Total jobs during construction |
|---|---|---|---|---|---|---|---|---|
| Portland Wind Project (including Yambuk) | 195MW | 680,000 | 113,333 | $287.0 | $574.0 | 946 | 2954 | 3900 |
| Waubra Wind Farm | 192MW | 672,768 | 112,128 | $130.4 | $260.8 | 237 | 500 | 737 |
| Kiewa Hydro expansion (Bogong) | 130MW | 94,000 | 15,667 | $93.6 | $187.2 | 200 | 600 | 800 |
| Dollar Wind Farm | 79MW | 242,820 | 40,470 | $81.7 | $139.0 | 408.5 | 450 | 858.5 |
| Macarthur Wind Farm | 330MW | 1,009,940 | 168,323 | $456.0 | $912.0 | 1520 | 3040 | 4560 |
| **TOTAL** | **926MW** | **2,699,528** | **449,921** | **$1,048.7** | **$2,073.0** | **3,312** | **7,544** | **10,856** |

The economic story presented by the projects above is impressive. Taken together they are comparable to any major infrastructure project undertaken recently in Australia. These five projects alone will easily produce enough power to meet the Victorian 10% target.

The direct investment in Australian-based manufacturers and service companies will be more than $1 billion, with flow-on stimulus of more than $2 billion throughout the economy. We expect most of this will be soaked up in Victoria. More than 3,300 jobs will be created in the construction of these projects with flow-on jobs of 7,500 due to expenditure associated with these 3,300 jobs, providing a total employment stimulus of over 10,000 jobs.

[1] Note: this table does not represent BCSE's assessment of the most likely projects to proceed under the Victorian scheme, just those for which detailed planning information is available.

*Vesta's wind turbine blade manufacturing facility at Portland came into operation in August 2005. The plant produces blades which weigh up to 7.5 tonnes and measure 40 metres in length and are made from a combination of wood, glass, resin and carbon.*

*The plant produces blades for the domestic and export market and directly employs 70 local people. Many more people are employed by suppliers and service providers to the plant.*

It should be noted that there are also substantial opportunities for bioenergy projects in Victoria which are not listed in table 1. Some of the more advanced potential projects include a plantation wood waste plant in Dartmoor near the South Australian border that would provide 200 jobs in construction, a bio-gas plant in Dandenong that would convert garden waste into energy and a bioenergy project in Morwell that would involve a $28 million capital expenditure stimulus.

Also worth noting are the payments to landholders who will host wind turbines on their land. According to Pacific Hydro, a significant renewable energy project developer, the Victorian scheme can be expected to deliver $80 million in payments to landholders over the life of the projects, providing an important reliable supplementary income to their farming activities.

***The scheme will halt greenhouse emissions growth from electricity***

The Victorian renewable energy scheme will be an important step towards addressing the greenhouse pollution problem of Victoria's electricity supply by halting the growth in emissions over the stimulus period of the scheme. From 2007 to 2010 VenCorp, the Victorian Government planner for electricity supply, estimates that annual electricity consumption will grow by about 1.4 million megawatt hours and by a little over 2.5 million MWh by 2012. By implementing this scheme the Victorian Government will ensure this growth in electricity demand will be greenhouse-emissions free, halting growth in greenhouse emissions from electricity for the next five years.

Any economic analyses of a scheme such as Victoria's needs to recognise these avoided greenhouse emissions have a significant economic value. The Kyoto Protocol, which binds participating countries to emissions limits, has led to the creation of an international emissions trading scheme that places a market value on greenhouse gas abatement. Under the European Union's scheme, a permit for one tonne of carbon dioxide (the primary greenhouse gas) for delivery in 2008, has traded between $30 to $50 per tonne over the last six months.

By displacing 2.5 million MWh of fossil-fuel electricity, the Victorian scheme is avoiding over 3.5 million tonnes of greenhouse emissions annually with a market value of over $140 million per annum (based on an average price of $40 per tonne.

## The cost impact of the scheme

Under the Federal Government's Mandatory Renewable Energy Target (MRET) with its target of 9500 GWh, a Renewable Energy Certificate (equivalent to 1 MWh of renewable energy) trades at about $24. This represents the extra cost of renewable energy over conventional electricity. But it is unlikely that new Victorian renewable energy projects will be viable at such a price and we expect a price premium of about $35 to $40 per MWh is more likely.

For the average residential household this works out to less than a $1 per month and is only a 1.3% increase on their current electricity costs. Calculations behind this impact are detailed in Table 3 below.

*Table 3. Likely cost impact of the Victorian Renewable Energy Target for the average residential household*

| | | |
|---|---|---|
| **A** | Extra renewables generation (MWh) | 2,500,000 |
| **B** | Total Victorian electricity consumption in 2010 (MWh) | 48,000,000 |
| **C** | Incremental increase of renewables in total electricity (A ÷ B) | 5.21% |
| **D** | Extra cost for Victorian Renewable Energy Certificate | $35.00 |
| **E** | Overall increase per MWh across entire electricity supply (C x D) | $1.82 |
| **F** | Average household electricity consumption (MWh) | 6.265 |
| **G** | Extra cost per year (F x E) | $11.42 |
| **H** | Average retail price per MWh | $140.00 |
| **I** | Percentage change in average household bill (G ÷ (F x H)) | 1.3% |

In terms of businesses, electricity costs are typically a small proportion of most industry sectors' material costs. Thus the small increase in electricity costs associated with the scheme will be of insignificant consequence. The average delivered electricity price for business consumers is around $86.60 per MWh. The incremental percentage difference is illustrated in Table 4.

*Table 4. Incremental difference in delivered electricity price for business*

| | |
|---|---|
| Overall increase per MWh across entire electricity supply | $1.82 |
| Average current price per MWh delivered | $86.60[vii] |
| Percentage increase in price due to renewables target | 2.10% |

So how significant is this price rise in the overall scheme of Victorian businesses' operations?

The National Institute of Economic and Industry Research has analysed the cost of electricity as an overall proportion of Victorian industry sectors' overall material costs. These figures have been incorporated into Table 5 below and when combined with data from the table above, illustrate the insignificant impact of the Victorian renewables scheme. Not a single sector would experience an increase in overall costs above two tenths of a percent and the average across all sectors is a 0.04% increase in overall costs.

*Table 5. Impact of Victorian Renewable Target upon business material costs*

| Industry Sector | Electricity as proportion of overall material costs | Net impact of renewable energy target on costs |
|---|---|---|
| Agriculture, forestry and fishing | 1.6% | 0.03% |
| Mining | 2.7% | 0.06% |
| Food, beverages and tobacco | 0.8% | 0.02% |
| Textile, clothing, footwear and leather | 2.2% | 0.05% |
| Wood, paper and printing | 1.6% | 0.03% |
| Petroleum, coal and chemical | 0.9% | 0.02% |
| non-metallic mineral products | 1.7% | 0.04% |
| Metal products | 4.3% | 0.09% |
| Machinery and equipment | 0.5% | 0.01% |
| Other manufacturing | 0.1% | 0.00% |
| Water, sewage and drainage | 5.5% | 0.12% |
| Construction | 0.1% | 0.00% |
| Wholesale and retail trade | 1.4% | 0.03% |
| Railway transport | 3.5% | 0.07% |
| Other transport services and storage | 0.2% | 0.00% |
| Communications | 0.9% | 0.02% |
| Finance, insurance, property and business services | 0.5% | 0.01% |
| Government administration and defence | 3.6% | 0.08% |
| Education, health and community services | 2.1% | 0.04% |
| Accommodation, cultural and personal services | 2.3% | 0.05% |
| **Average** | **1.8%** | **0.04%** |

In addition this scheme is likely to have a slightly depressive effect on the wholesale pool price as renewable energy capacity is induced into market.

## Reliability of supply, back-up and efficiency

Claims surrounding the need for back-up of renewable energy illustrate a poor understanding of the inherent technical characteristics of how electricity markets operate. Electricity is different to many other product markets because it can not be cheaply stored at present. What this means is that electricity markets operate in a state of over-capacity for the vast majority of the time where a significant proportion of power plants stand idle. These plants are only to be operated once demand goes over a certain level or when another generator fails. For example in Victoria, averaged out over the period of the year, about 30% of plant capacity lies idle as back-up. In NSW it's more like 40% and the same in Queensland, while in WA it's over 50%[viii]. Because all generators typically experience unplanned failures and because demand substantially varies, one needs to operate the market in a state of permanent back-up with capacity held in reserve. The reserve level (the minimum amount of back-up) is governed by the biggest generator existing in the market just in case it breaks down. In Victoria's case this is the large coal plant.

The Victorian Renewable Energy Target will make little if any difference to Victoria's electricity back-up requirements.

To illustrate this with a real-world example, the amount of renewables in South Australia has increased from virtually zero five years ago to 15% of generation next year. This has not resulted in any change to the level of system reserves.

***Aren't renewables highly inefficient?***

It is true that some renewable plant will spend times not in operation due to variability in weather (although not bioenergy which can operate continuously). But at the same time they utilise a resource that is free and clean. Wind power typically recovers the energy that went into producing the windmill within 6 months of operation but it will last for something like 20-25 years.

Coal-fired plants involve substantial inefficiencies in the use of a resource that is not free. Coal-fired plants convert only 30% of the energy in coal into useful electricity, and then they need to consume 10% of this electricity produced just to operate the power station. Then they lose a further 5-10% of the electricity transporting it to the customer.

'Inefficiency' really depends on how you look at the issue.

## Conclusion

The rest of the world has recognised the importance of reducing greenhouse emissions and is already putting schemes in place that mean pollution *will* carry a cost – whether Australia likes it or not. The European Union has an emissions trading scheme that values one tonne of carbon dioxide at more than A$30 per tonne. Although the US Federal Government has been slow to take leadership on greenhouse, it is under increasing pressure: America's two largest states in economic terms, New York and California, are both about to impose their own greenhouse emissions trading schemes (with several other states participating) independent of the Federal Government. Japan and Canada have already implemented their own requirements.

Unless Australia cuts itself off from the world economy, it cannot continue to make investment and policy decisions that ignore the cost of greenhouse gas emissions.

The Victorian Government confronts a significant challenge in transitioning the state towards a less greenhouse intensive economy. The implementation of a 10% renewable energy scheme is an affordable and significant step forward. Indeed there is more than sufficient renewable energy resources available in Victoria to go towards 20% renewables by the end of the next decade.

In addition to greenhouse benefits the Victorian scheme will drive the development of major power projects that will create substantial employment opportunities and investment in the Victorian and Australian economy.

In combination with the renewable energy target, the Victorian Government will need to implement an emissions trading scheme to cap greenhouse emissions which will encourage greater use of natural gas for power supply (half the greenhouse emissions of coal). And the government should also put greater emphasis into improving energy efficiency via a combination of regulation (which is well under way) and incentives.

[i] Siegenthaler, Stocker, Monnin, Lüthi, Schwander, Stauffer, Raynaud, Barnola, Fischer, Masson-Delmotte, Jouzel (2005) 'Stable Carbon Cycle–Climate Relationship During the Late Pleistocene', *Science*, 25 November 2005: Vol. 310. no. 5752, pp. 1313 - 1317

[ii] ABC News Online, 'Larry to cost $1.5b, Beattie says' March 26, 2006, http://www.abc.net.au/news/newsitems/200603/s1601192.htm

[iii] Jonathan A. Patz, Diarmid Campbell-Lendrum, Tracey Holloway and Jonathan A. Foley (2005) Impact of regional climate change on human health, *Nature* 438, 310-317 (17 November 2005)

[iv] World Resources Institute (2005) Climate Analysis Indicators Tool (CAIT)-Excel, version 3.0, available at: http://cait.wri.org

[v] International Energy Agency (2004) *Renewables Information (2004 Edition)*, International Energy Agency, Paris, France. Available from www.iea.org/books

[vi] International Energy Agency (2004) *Renewables Information (2004 Edition)*, International Energy Agency, Paris, France. Available from www.iea.org/books

[vii] Australian Bureau of Agricultural and Resource Economics (2005) *Energy in Australia 2005,* available from www.abareeconomics.gov.au

[viii] Electricity Supply Association of Australia (2005) *Electricity Gas Australia 2005*