A Bright Future:

25% Renewable Energy for Australia by 2020

AUSTRALIAN CONSERVATION FOUNDATION

GREENPEACE

CLIMATE ACTION NETWORK AUSTRALIA

A Bright Future: 25% Renewable Energy for Australia by 2020

A report by:
Australian Conservation Foundation, Greenpeace Australia Pacific, and Climate Action Network Australia

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The views expressed are those of the authors.

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EXECUTIVE SUMMARY

Climate change threatens the human, economic, and environmental future of Australia. Temperatures are set to rise by up to 6°C by 2100 unless we act now. Even a 1°C rise would see drought increase by up to 70 per cent in NSW, and regular bleaching of over half of the Great Barrier Reef. The actions we take, or fail to take, in the next five years will decide whether we cross the threshold of dangerous climate change.

Any plan for deep cuts in greenhouse emissions entails a major roll-out of renewable energy technologies. Countries around the world have introduced ambitious renewable energy targets to reduce emissions and ensure that they get a slice of the rapidly growing renewable energy market. Australia is missing this opportunity.

A 25 per cent by 2020 legislated renewable energy target would see Australia join the global clean energy revolution. Combined with medium energy efficiency measures, the target would conservatively deliver:

- 16,600 new jobs,
- $33 billion in new investment,
- 15,000 MW new renewable capacity,
- 69 million tonnes reduction in electricity sector greenhouse emissions (almost as much as the total emissions from road transport), and
- enough renewable electricity to power every home in Australia.

More than 17,000 Australians are already employed in renewable energy or energy efficiency, despite the lack of government support for these industries. A 25 per cent target would increase the number of clean energy jobs to over 33,000.

Australia has plentiful renewable energy resources, and a quarter of our electricity could easily be supplied by a mixture of hydropower, bioenergy, wind, and solar. This would prepare us for a further transition to clean energy after 2020.

With a 25 per cent renewable energy target, our electricity prices would still remain among the cheapest in the world. A 25 per cent target, coupled with medium energy efficiency measures, would add around $64 to the average household annual electricity bill, or $1.25 per week. In contrast, current projections for business as usual electricity use could see average household electricity bills increase by $234 per year.

In order to make sure that we realise these benefits, Australia needs:

- A national legislated target for 25 per cent of electricity to come from renewable energy by 2020.
- A national target for zero electricity growth by 2010, followed by annual average reductions reaching at least 1.5 per cent by 2020, and supporting measures to achieve it.
- Urgent amendment of National Electricity Market regulation so network expansion costs can only be passed on to consumers if companies demonstrate that demand management or energy efficiency are not alternatives.
- A fixed price for solar PV electricity going into the electricity grid (called a ‘feed-in tariff’), sufficient to ensure householder investment.

In addition to the renewable energy and energy efficiency targets, other actions will be required to reduce electricity sector emissions to 30% below 1990 levels. Introducing a price on carbon, improving the efficiency of fossil fuel power stations, significantly increasing co-generation, and fuel switching will all be necessary.

INTRODUCTION

Climate change is the greatest environmental threat that we face, with temperatures in Australia set to rise by up to 6°C by 2100 unless we act now.[1] When global temperatures were just 5°C cooler the world was in the grip of the last major ice age. Even a 1°C rise would see drought increase by up to 70 per cent in NSW, and could regularly bleach over half of the Great Barrier Reef.[2]

The actions that we take, or fail to take, in the next five years will decide whether we stay within a 2°C global temperature rise, widely considered the threshold for dangerous climate change. Recent science shows that global emissions must start falling from about 2010 and reach 70–80 per cent below 1990 levels by 2050 to give us a two to one chance of staying below this threshold.[3,4] Developed countries are responsible for a higher share of the global target since they have contributed to 76 per cent of emissions to date and have much higher emissions per person.[5] This principle of fairness is enshrined in the UN Framework Convention on Climate Change, which Australia has signed. Modelling shows developed countries like Australia need to reduce emissions by at least 30 per cent below 1990 levels by 2020, and at least 80 per cent below 1990 levels by 2050 to stay below the 2°C threshold.[6]

The electricity sector is responsible for more than a third of Australian emissions of 565 million tonnes.[7] With current policies, electricity emissions will reach 260 million tonnes by 2020, more than double 1990 levels.[a] Generating a quarter of our electricity from renewable energy and reversing electricity growth from 2010 onwards by ambitious energy efficiency measures would reduce overall electricity emissions to 160 million tonnes.[b] The reduction of about 100 million tonnes (compared to business as usual) would be equivalent to removing all the road transport in Australia.

Support policies are needed now to secure Australia's share in the boom in renewable energy occurring globally. Existing coal-fired generators will reach retirement age over the next thirty years, and Australia needs a flourishing renewable industry to make a seamless transition to zero emission electricity generation.

Provided we put Australia on track for sustained renewable energy development, costs should fall to below the cost of fossil fuels over the next fifteen years.[8] If we do not keep pace with developments in other parts of the world, we relegate Australia to becoming a renewable technology importer and lose the chance to move to a clean energy economy.

[a] This allows for the effects of the MRET, NRET, VRET, and the South Australian renewable target, but assumes that current projections for electricity growth continue unabated.

[b] This is the 'high energy efficiency' scenario described in this report.

RENEWABLE ENERGY TARGETS – THE GLOBAL PICTURE

Worldwide investment in new renewable energy was $US38 billion in 2005.[9] Governments globally are realising that legislated targets for renewable energy drive a shift in investment towards clean energy, creating new industries and pushing down the price of renewable energy.

Over 40 nations have introduced legislated renewable energy targets, which are largely responsible for the extremely high growth rates. For example, grid connected solar PV grew by 55 per cent during 2005, and wind power by 24 per cent.[10] Figure 1 compares some of the legislated targets in place around the globe to the renewable electricity those countries had in 1997, and Table 1 lists some targets.

The Australian renewable target only just keeps pace with electricity growth. In 2010 renewable electricity will be around the 1997 level of 10.5%. With current policies renewable electricity would still be around 10% in 2020.

Figure 1: Renewable electricity in selected countries: 1997 generation and 2010 targets[c]

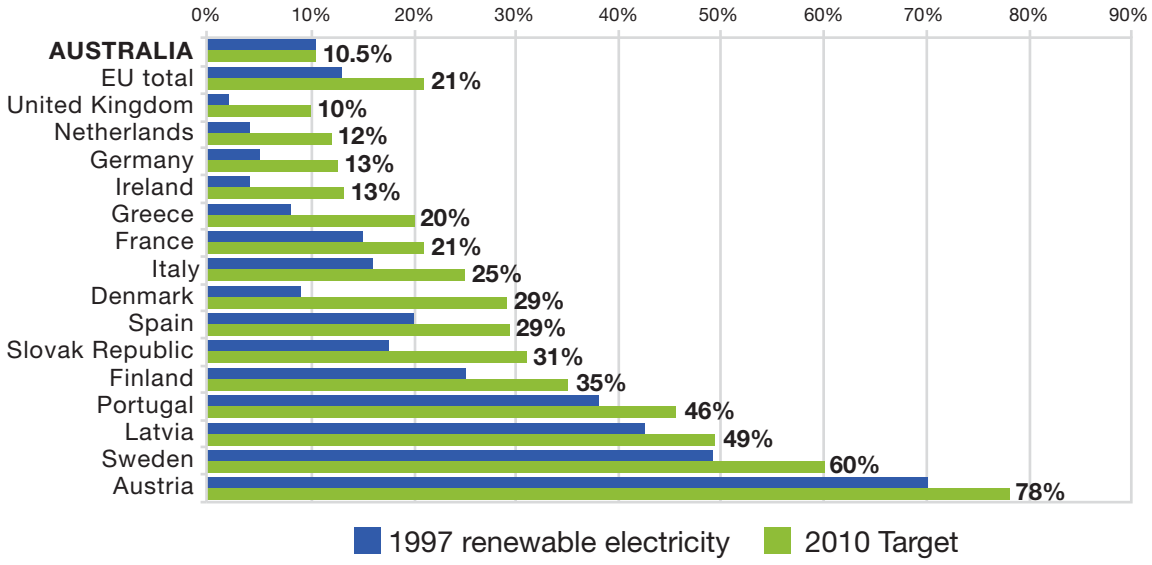


Table 1: International legislated renewable energy targets

COUNTRY	TARGET
European Union nations	Aggregate target of 21% of electricity by 2010
Austria	78% by 2010
Spain	29.4% by 2010
United Kingdom	10% by 2010
Germany	12.5% by 2010
France	21% by 2010
Some US State Targets	
California	20% by 2010 and 33% by 2020
Nevada	20% by 2015
New York	24% by 2013
China	15% by 2020

In addition to national targets, state and provincial governments in the US, Canada, India, and now Australia are also driving the growth of renewable energy. Some of the states with the highest energy use and population have the highest renewable energy targets. For example California has a target of 20 per cent by 2010, and New York has a target of 24 per cent by 2013. These major economies have introduced renewable energy targets, not only to reduce their greenhouse pollution levels, but to create vibrant new industries and jobs.

[c] Source: http://www.ren21.net

RENEWABLE ENERGY TARGETS – THE NATIONAL PICTURE

Australia was one of the first nations to have a legislated renewable energy target. The national Mandatory Renewable Energy Target (MRET) guaranteed 9500 GWh of new renewable energy generation by 2010.

The growth in Australia's electricity consumption means this is effectively a 'stand still' target. In 1997 Australia generated 10.5 per cent of electricity from renewable energy, and in 2010 we will still get only 10.5 per cent from renewable energy. Unfortunately, the Federal Government ignored the recommendation of its own independent review panel and failed to increase the MRET target in 2004, even though it was clear an extended target could easily be met within the original cost estimate.

The MRET legislation has underpinned the growth of Australia's renewable energy industry over the past five years. However, the MRET will reach its target three years ahead of schedule. Beyond 2007, MRET provides no further market mechanism to encourage new renewable energy projects.

In the absence of an expanded Federal renewable energy target, some state governments have realised the industry development and environmental benefits of renewable energy and introduced their own targets. The spiralling growth in electricity use means that even with state targets, renewable electricity could still only provide 10 per cent of renewable electricity nationally by 2020. In the same period, Denmark will have increased renewable electricity supply from around 8 per cent to nearly 30 per cent.

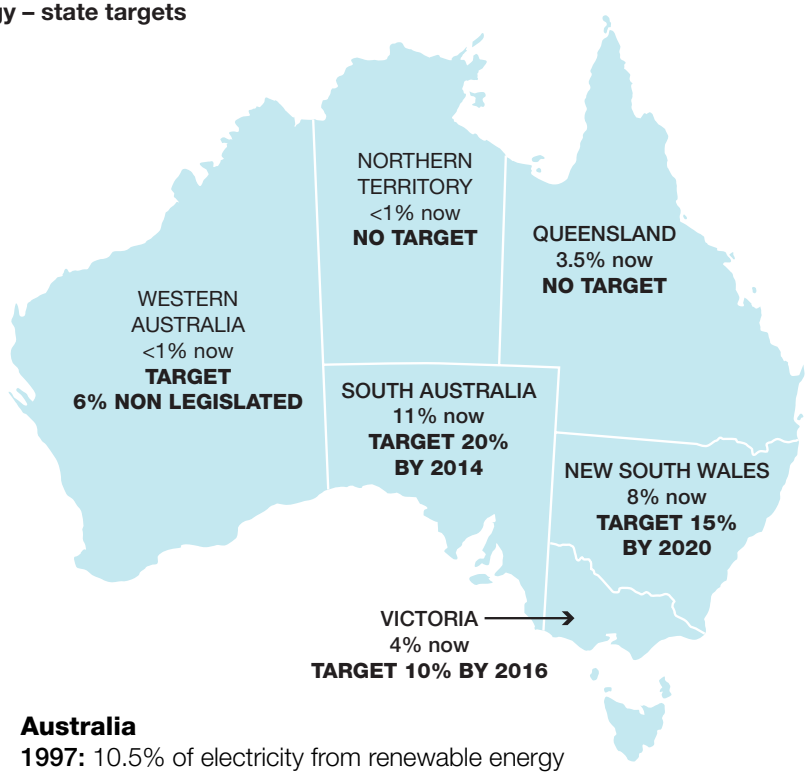
Victoria:
In September 2006 the Victorian Government introduced a legislated 10 per cent renewable energy by 2016 target (the Victorian Renewable Energy Target, or VRET) to maintain the growth of renewable energy in Victoria. In the three weeks that followed the introduction of Victoria's legislation, over $1 billion worth of new renewable energy projects were announced. The target is for an additional 3274 GWh by 2016, which must be sourced from projects within Victoria.

South Australia:
South Australia has a legislated 20 per cent renewable energy by 2014 target, although it is unclear what mechanism will deliver new renewable energy projects (aside from some solar projects which will be encouraged by a solar feed-in tariff.) It is also unclear how the mechanism will ensure the target is additional to the national, Victoria and NSW mandatory targets.

Western Australia:
Western Australia has a non-legislated 6 per cent renewable energy by 2010 target for the South West grid.

New South Wales:
New South Wales has stated it will introduce a legislated renewable energy target for 15 per cent of electricity by 2020. The intention is not to restrict this to projects within NSW. The target proposed is an additional 7250 GWh by 2020.

Figure 2: Renewable energy – state targets



Australia
1997: 10.5% of electricity from renewable energy
2010: national target for extra 9500 GWh, still only 10.5%

How much will existing targets deliver?

If ABARE electricity consumption growth projections are realised, existing targets for renewable energy would provide only 10 per cent of our electricity in 2020. If medium energy efficiency policies reduced overall consumption in 2020 to 290,000 GWh, rather than the 335,700 GWh currently projected, existing renewable targets would deliver 11 per cent, while high energy efficiency policies with existing targets would deliver 14 per cent (see Table 4 for the assumed electricity growth rates with medium and high energy efficiency).

Table 2 shows the percentage of electricity coming from renewable energy which existing policies would deliver in each case (business as usual electricity growth, medium energy efficiency, and high energy efficiency), and Table 3 shows the amount each policy delivers.

Current national and state renewable energy targets are expected to deliver 14,700 GWh additional renewable electricity in 2020, in addition to the existing renewable generation of 18,300 GWh.

Table 2: Australian electricity from renewables in 2020 with current policies

	Electricity growth as usual	Medium energy efficiency policies	High energy efficiency policies
Additional from existing renewable energy policies (MRET, NRET, VRET and SA target)	4%	5%	6%
Existing renewable electricity 2007	5%	6%	8%
Percentage of electricity from renewable energy in 2020	10%	11%	14%

Table 3: Renewable electricity – current targets for 2020

Target	How the target is framed	GWh additional to current generation expected in 2020	Comments
Federal Mandatory Renewable Energy Target	9500 GWh by 2020	3000 GWh	This assumes solar water heating supplies 20% of the 9500 MRET target in 2020, as it does now.
Victorian Renewable Energy Target	3274 GWh by 2016	3274 GWh	
NSW Renewable Energy Target	7250 GWh by 2020	7250 GWh	There is a review planned, so the target could be raised.
South Australian Renewable Energy Target	20% by 2014	1230 GWh	There are no details of the mechanism, so this assumes: i) SA consumes a constant percentage of Australian electricity, ii) Half of the extra capacity is additional to other targets.
TOTAL		**14,754 GWh**	

The mechanisms for an expanded national target should ensure there is no double counting between state and national targets.

Furthermore, solar water heating should be excluded from the renewable electricity target, and supported more directly through energy efficiency policies (for example, mandating minimum performance standards for water heating).

WHAT DOES AUSTRALIA STAND TO LOSE IF WE DON'T ACT?

The global market for renewable energy reached annual investment of $US38 billion in 2005, up from about $US8 billion in 2000. Australia is missing out on jobs and economic development by turning its back on the clean energy revolution occurring around the world and failing to support these new industries.

Despite the small scale of renewable energy development in Australia, there are already nearly 5000 people employed in the industry nationally. This includes 1300 in the PV industry, just under 1000 in wind, 900 in bioenergy, and 1500 in hydro.[11]

Australia has unrivalled solar, wind, and geothermal resources, and led the world in the development of solar technology. We run the risk of throwing away these natural advantages as companies move overseas because of the lack of market support. In a 2006 review of international markets for attractiveness to renewable energy investors, Australia ranked sixteenth – fourth from the bottom.[12]

The lack of support policies for renewable energy is already costing Australian jobs and investment. This section lists some of the renewable energy companies that have already left Australia for greater offshore opportunities. Australia's policies today will determine whether we will be a technology importer or exporter, as we move to an increasingly carbon constrained world.

Solar

Solar Heat and Power Pty was set up in 2002 to commercialise solar thermal concentrator technology developed at the University of Sydney in 1995. A successful 25 MW pilot project is operating at the Liddell coal-fired power plant in NSW. In January this year the company relocated to the US after failing to get support for large scale stand alone generation in Australia and securing $41 million in US investment.

"Some of the largest investors and power companies in the USA have realised that solar thermal power is a probable replacement for coal, nuclear and oil. They believe this will be very big business and power companies are willing to provide the large amount of initial equity to get the industry moving."
David Mills, CEO, Solar Heat and Power Pty[13]

Pacific Solar was set up in 1995 as a joint venture between the University of NSW and the state electricity company, Pacific Power, to commercialise a cost-effective solar photovoltaic technology developed in Sydney, now known as Crystalline Silicon on Glass. In June 2004, Pacific Solar sold its assets and worldwide rights to the CSG technology to a German company, CSG Solar AG, which is now undertaking commercialisation in Germany with significant government investment support.

SunTech was set up in 2001 by Chinese-Australian Dr Zhengrong Shi. Dr Shi worked in the Australian solar industry for fifteen years, at the University of NSW and Pacific Solar, but opted to found a Chinese company due to the lack of market opportunities in Australia. He is now one of the richest men in the world, and Suntech looks set to dominate the world solar market.

There are other examples of overseas commercialisation of Australian solar technology. The evacuated tube solar water heaters which now dominate the rapidly growing Chinese market were developed at Sydney University, and the high efficiency photovoltaic panels, sold under the name 'Saturn' by BP Solar, are manufactured in Spain although the technology was developed at the University of NSW.

Bioenergy

Novera Energy was founded in 1998 in Australia with the intention of developing a renewable portfolio in Australia and Europe. Their main business focus is bioenergy. However over the last ten years, while the renewable energy market in Europe has blossomed, the market in Australia has stagnated.

'Momentum in the UK renewable energy market accelerated during the year… By contrast, the Australian renewable energy market lost momentum, following unfavourable signals from the Federal Government …. Given the uncertainty, several renewable energy developers, including Novera Energy, are re-evaluating their strategy in Australia.'
Novera 2003 Annual Report, page 7

By 2004, Novera's UK revenue climbed to over $24 million, and only $0.4 million in Australia.[14] The company relocated to the UK in 2005, and was de-listed from the Australian stock exchange in 2006.

Macquarie Bank purchased Energy Power Resources, a UK bioenergy company, in 2005. They own and operate three chicken litter and one straw fuelled bioenergy power stations in the UK with combined capacity of over 100 MW.

'The activities of the company are strongly supported by [UK] Government policy.'
Energy Power Resources[15]

Unfortunately Australian energy policy does not support local bioenergy investment.

Wind

Vestas

The Vestas turbine nacelle factory at Wynyard, Tasmania, opened in November 2003 employing 73 people. Closure was announced in August 2006 owing to the lack of local market for turbines following the decision not to lift the MRET. A further 40 jobs were lost at Aus-Tech Composites, which supplied components to the factory.

ELECTRICITY GROWTH – HOW MUCH CAN AUSTRALIA AFFORD?

Electricity use is projected to rise by 2 per cent per year,[16] and peak demand by up to 3.6 per cent.[17] This represents billions of dollars wasted increasing capacity to supply unnecessary power and augment networks. Quite apart from the cost of the electricity, network investment of $2 billion per year is required to keep pace with the expansion in NSW alone.[18]

Australia will not be able to reduce greenhouse emissions without addressing this spiralling increase. Environment groups are calling for a target of zero electricity growth by 2010, followed by annual average reductions reaching 1.5 per cent by 2020.

This would require an aggressive energy efficiency program across the residential, commercial and industrial sectors. Australia would need to adopt world's best practice energy efficiency measures including: improvements to building codes, retrofitting existing buildings with insulation and shading, rolling out solar water heating, improving appliance standards and accelerating replacement, introducing rigorous standards for commercial equipment such as refrigeration and motors, and setting benchmarks for industrial and commercial energy efficiency.

Australia has considerable scope to improve energy efficiency and reduce energy consumption without compromising economic growth. We produce nearly double the greenhouse pollution per dollar of GDP compared to the European Union.[19] The European Union has just announced it plans to increase energy efficiency sufficiently to reduce energy use by 13 per cent by 2020, saving A$164 billion in the process, even though their economy is already much more energy efficient than Australia's.[20]

For this report, three scenarios have been modelled: 'electricity growth as usual', 'medium energy efficiency' and 'high energy efficiency'. Table 4 shows the electricity growth rates which have been assumed in each case, and the resulting electricity consumption in 2020. It also shows the per person electricity growth rates.

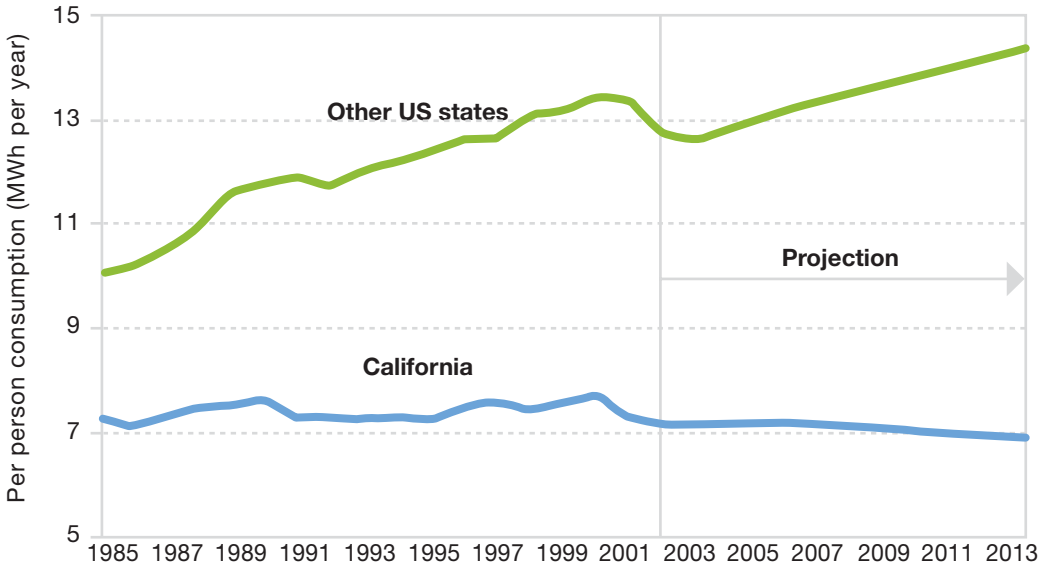
The high energy efficiency scenario is ambitious, and will need strong policy action and leadership from the Federal Government. It is possible to do this. California, with a thriving economy, is achieving aggressive energy efficiency. Electricity use per person is already flat, in contrast to the rest of the US where it is rising at 2 per cent per year. California has set a further goal to reduce electricity consumption per person by 0.5–1 per cent per year.[21]

Table 4: Assumed electricity growth and 2020 electricity consumption

	Growth rate in 2010	Growth rate in 2020	Electricity consumption in 2020	Average per person electricity growth[d]
Electricity growth as usual [22]	2.2%	1.8%	335,700 GWh	+1% per year
Medium energy efficiency	1%	0%	289,700 GWh	-0.3% per year
High energy efficiency	0%	-1.5%	244,400 GWh	-1.3 % per year

[d] This assumes the medium population growth from: Australian Bureau of Statistics (2006), 3222.0, series B - Population Projections, Australia, 2004 to 2101

Figure 3: California's electricity use per person vs other US states[23]



RENEWABLE ENERGY – A POWERFUL AND PLENTIFUL RESOURCE

Australia is missing a great opportunity, despite being blessed with abundant renewable energy resources. Our wind and solar resources are among the best in the world, and yet Australia is lagging behind countries that actively pursue clean energy.

Australia currently sources just 8 per cent of its electricity from renewable energy,[24] down from 10 per cent in 1997.[25] This because Australian electricity consumption has increased more rapidly than renewable electricity supply. The MRET will take the renewable electricity supply back to 10.5% by 2010.

Germany has 25 times more wind energy installed than Australia, even though the very best wind sites in that country are less windy than Australia's worst commercial sites. Germany has 20,622 MW installed compared to 817 MW in Australia,[26] six times more wind energy per person. Japan and Germany each have 24 times more solar electric (PV) panels installed than Australia despite significantly poorer solar resources. By the end of 2005 both countries had 1400 MW compared to Australia's 60 MW.[27]

What would 25% renewable energy mean on the ground?

There are many ways renewable energy could provide 25 per cent of Australia's electricity by 2020. This section describes the mix of technologies modelled for this report.

Figure 4 shows the electricity supply mix now and in 2020 with a legislated renewable energy target of 25 per cent by 2020. This is just one example of how renewable electricity could meet this proportion of supply.

Figure 4: Electricity now and in 2020

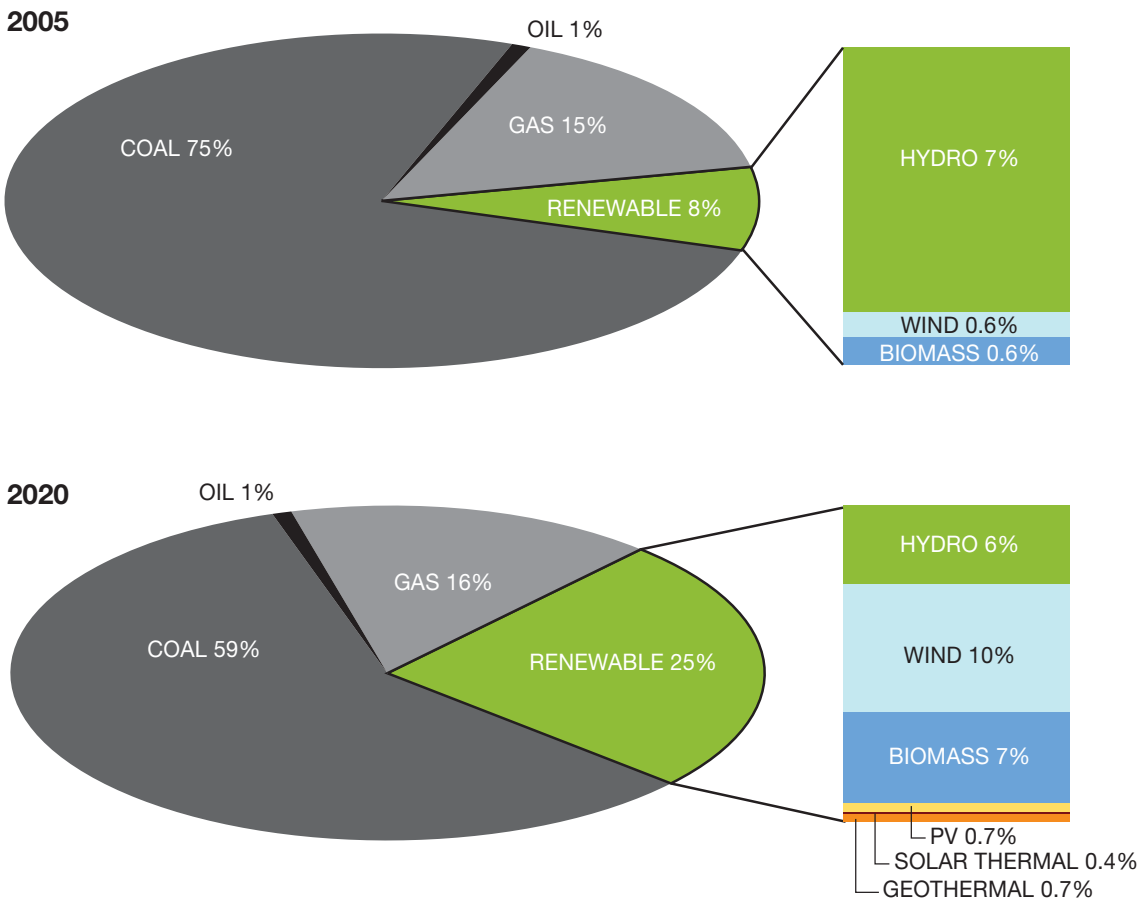
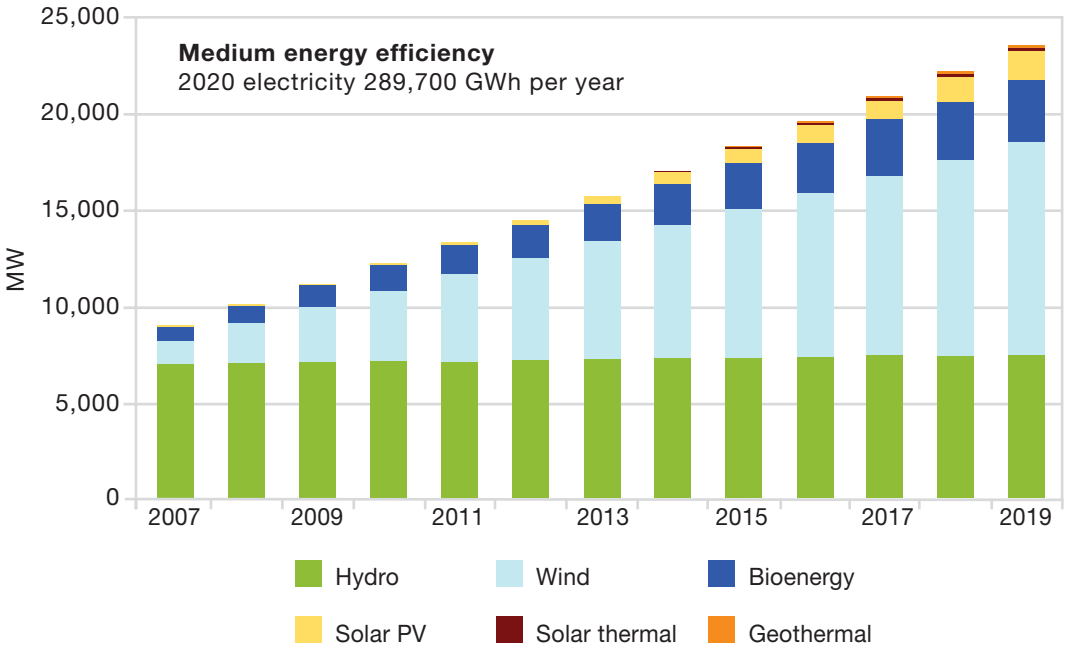


Figure 5 shows the installed capacities in each technology based on a 25 per cent renewable energy target with medium energy efficiency policies used to control electricity growth. Renewable energy for a high energy efficiency case and 'electricity growth as usual' are detailed in Appendix 1.

In the medium energy efficiency scenario, consumption is 290,000 GWh in 2020, so the 25 per cent target means 72,500 GWh would come from renewable energy. Current renewable electricity generation is 18,300 GWh, so this is an increase of 54,200 GWh from current levels. Only a quarter of this amount would be delivered by current policies (see Table 3).

The additional renewable electricity would be equivalent to the output of nine coal-fired power stations, and enough to supply every home in the country. [e]

Figure 5: Additional renewable capacity for a 25% target



Wind energy

Wind power supplies 10 per cent of Australian electricity by 2020 in this example of 25 per cent renewable electricity. Wind already supplies 9 per cent of South Australia's electricity, and is likely to supply 20 per cent in the next few years.[28] Denmark already gets 23 per cent of its electricity from wind power, and in one region of Spain wind supplies 50 per cent of electricity needs.[29]

Supplying 10 per cent of Australian electricity by 2020 would mean 11,000 MW of wind, up from just 817 MW now.[f] This would require an additional 100 medium sized wind farms with 5100 turbines.[g] In comparison, Germany is about half the size of NSW and already has more than 16,800 turbines.[30]

[e] Equivalent to nine 1000MW coal plants at 85% capacity factor.

[f] This assumes a capacity factor of 30%.

[g] This assumes 2 MW turbines and 50 turbines per wind farm.

Wind farms would occupy about 1300 square kilometres, an area equal to less than 1 per cent of the sown pastures in Australia.[h] On most of this land, existing activities go on uninterrupted – cows continue to graze and farmers plant crops.

Farmers who own land where wind farms are sited receive a much needed new income stream, making a significant difference in areas suffering the seventh year of the worst drought on record.

Bioenergy

Bioenergy is energy that comes from organic matter – material recently derived from plants and animals. Bioenergy fuels include dedicated energy crops (which could be trees or annual crops), and many different types of wastes, for example sewage, manure, straw, food waste, and woody weeds. Bioenergy fuel can be stored, so it can directly replace coal-fired power.

Bioenergy supplies 7 per cent of Australian electricity by 2020 in this example of 25 per cent renewable energy. This would see an increase to about 2800 MW,[i] up from 650 MW in Australia now. Many reports have identified the large potential for bioenergy in Australia. For example, a report by the Clean Energy Future Group estimated that bioenergy could supply 30 per cent of Australia's electricity from a combination of crop residues and woody energy crops.[31] The NSW Bioenergy Handbook identified 1535 MW of potential generation in NSW alone, excluding any materials from native forests,[32] and the Queensland sugar industry could supply an extra 1000 MW with the right policy environment.[33]

Farmers cannot plant without certainty of return on their crop. Bioenergy has an important role to play in a clean energy future, but this will not occur unless government legislates to provide the market.

If one quarter of the bioenergy came from woody energy crops, they would require about 3 per cent of Australian crop land.[j] This has the potential to provide income diversification for farmers, and dual benefits for landscape restoration and salinity control. Careful development and excellent sustainability guidelines are needed to ensure these multiple benefits are realised. The remainder could be met by a mixture of agricultural residues, landfill gas, and wet wastes (for example, sewage, animal slurry, and food waste).

Hydro

Hydro currently supplies just under 7 per cent of Australian electricity and continues to do so in this example of 25 per cent renewable energy. This report assumes an additional 500 MW of small hydro will be installed, based on the modest growth rate of 0.5 per cent per year used in ABARE projections.[34]

Solar PV

Solar PV supplies 0.7 per cent of our electricity by 2020 in this example of 25 per cent renewable energy. There are currently 60 MW of PV installed in Australia,[35] which increases by 1400 MW by 2020. This could be achieved by installing solar PV panels on just one in sixteen houses.[k] This is a very modest target for PV expansion: the PV industry roadmap suggests 6000 MW by 2020.[36]

[h] Based on 24.6 hectares per turbine, calculated by assuming a minimum spacing of seven rotor diameters.

[i] This assumes an 80% capacity factor.

[j] Assuming 30 MWh per hectare per year, the average value given in reference 31.

[k] This assumes 3 kW systems on each house.

Australia, one of the sunniest countries in the world, has less than one twentieth of the PV capacity of Germany or Japan. This is despite the fact that a PV system here will generate more than double the electricity output of the same system in Germany.

A separate policy mechanism is required to ensure development of small scale solar PV. A 'feed in tariff' is the preferred option internationally, with the level set to stimulate private investment. The tariff can be set with a 15–20 year lifetime, declining 5 per cent each year to drive down the technology price and stimulate competition.

Solar water heating has a vital role in reducing electricity demand. Rather than inclusion in targets for renewable electricity, policies should be directly targeted at guaranteeing uptake, for example by mandating minimum performance levels for water heating and through provision of rebates.

Geothermal and solar thermal

Geothermal energy for electricity generation uses underground heat to make high temperature steam, which drives a turbine just as in a conventional coal generator. Geothermal resources worldwide are usually associated with volcanic activity, but in Australia resources are associated with heat producing granites. Development work is under way in the Eromanga Basin in South Australia and Queensland, as well as in the Hunter Valley in NSW. The potential geothermal resource is estimated at 450 times Australia's total energy needs.[37] Geothermal could directly replace coal-fired power as it provides a constant power source.

Solar thermal for electricity generation uses mirrors and lenses to concentrate the sun in order to physically heat water to high temperature steam, which then drives a turbine. It is at demonstration stage (preheating water) at the Liddell coal-fired power station. The company which developed the Liddell demonstration, Solar Heat and Power, has just moved to the US because of the difficulty in getting projects going in Australia.

This study's modelling of a 25 per cent renewable target includes a small contribution from geothermal and solar thermal because these two technologies are currently at demonstration stage in Australia. Both have enormous potential if the demonstrations prove successful. The actual contribution could be much greater by 2020 in the right policy environment, which would bring down the cost of reaching the renewable energy target and/or increase the target to greater than 25 per cent of electricity.

It is important that commercialisation programs are ready to scale up successful demonstrations so that we can expand our clean energy generation to reduce emissions beyond 2020.

What would it cost Australia?

Electricity prices would remain among the cheapest in the world with a 25 per cent renewable energy target. Australia's current retail electricity prices are 38 per cent lower than the average in developed countries.[38] With a 25 per cent renewable target, Australian electricity prices would remain 32 per cent lower than average.

Figure 6: International electricity prices and Australia's, with and without a 25% renewable target [39,40]
'Average IEA countries' is for all 26 member countries of the International Energy Agency; includes all countries listed except Mexico, Korea and Chinese Taipei.

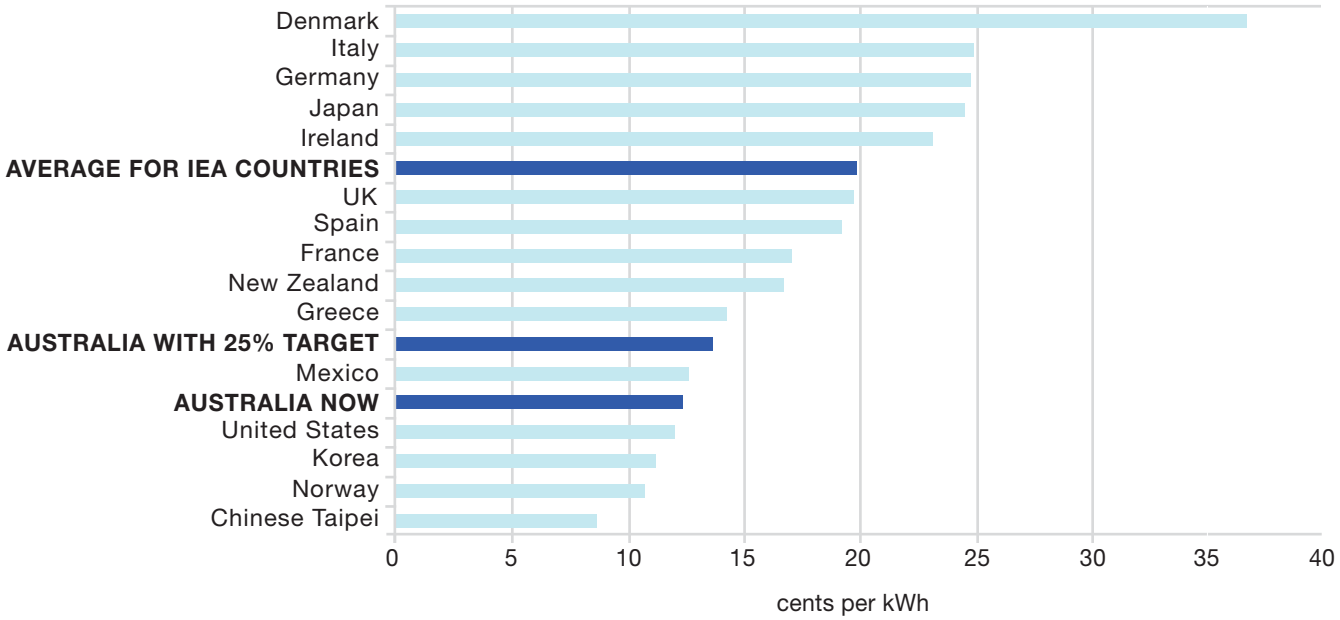
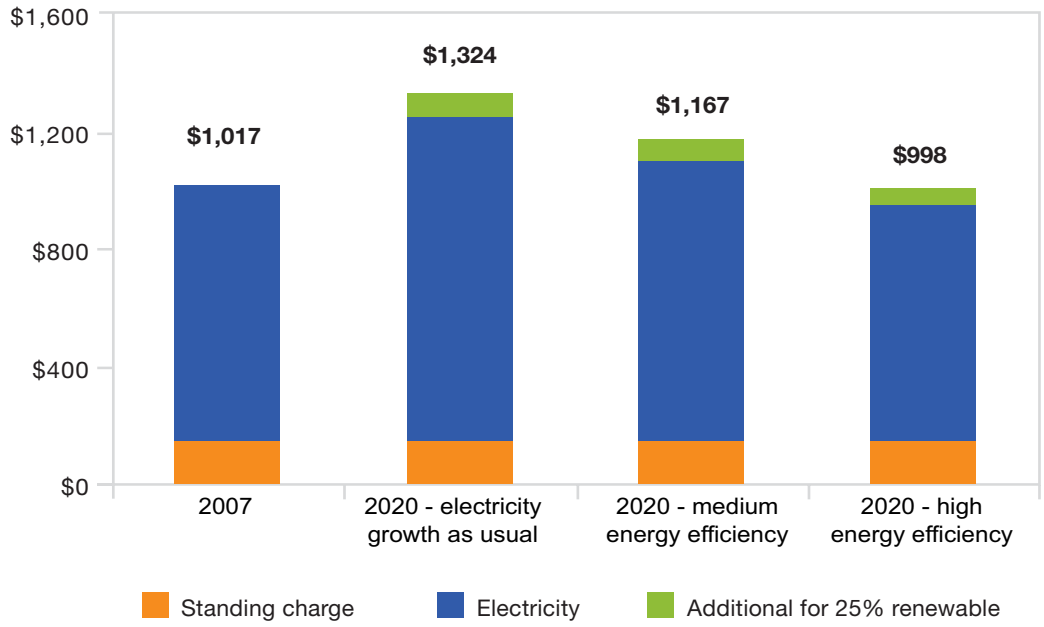


Figure 6 compares Australian residential electricity prices both with and without a 25 per cent target to other countries around the world. Getting one quarter of our electricity from renewable energy would increase prices by less than half a cent per kilowatt hour by 2020.

Figure 7 shows electricity bills for the average Australian household if electricity use keeps on growing as projected, as well as costs with medium energy efficiency, and high energy efficiency. All cases show the effect of a 25 per cent renewable energy target.

Figure 7: Average household electricity cost in 2007 and 2020
Electricity cost is based on average Australian residential consumption, NSW standing charges, and excludes taxes. All costs are 2007 dollars. All cases assume that residential consumption grows at the same rate as overall electricity consumption.



The 25 per cent renewable energy target, coupled with medium energy efficiency, adds around $64 to the average household annual electricity bill, or $1.25 per week. This is small compared to the effect of increases in electricity use, which add around $234 per year to household bills if electricity use keeps going up as currently projected (assuming that household electricity grows proportionately).

If aggressive energy efficiency policies are pursued, the saving on electricity more than compensates for the added cost of renewable electricity. The increase from today for the renewable energy target combined with medium energy efficiency is around $148 per year, a saving of approximately $84 per year compared to the projected increase from 'business as usual' electricity growth. If aggressive energy efficiency policies are adopted then the overall effect is around a $20 dollar saving compared to today, or approximately a $253 saving compared to the 'business as usual' electricity growth.

Energy efficiency measures should be targeted at low income and disadvantaged consumers and communities to ensure that their electricity bills remain the same or decrease with the introduction of a 25 per cent renewable energy target.

Costs have been calculated using the upper limit listed for wind, bioenergy, micro hydro, and geothermal in the 2006 MMA report to the Renewable Energy Generators Association.[41] PV costs are from the Australian Photovoltaic Industry Roadmap,[42] and are for residential systems. This is conservative, as much lower costs are expected from centralised, large scale solar generation. For example, the 154 MW solar power station to be built in north west Victoria is expected to be commissioned in 2013, and generate electricity at approximately half the residential PV cost.[43]

What would it bring to Australia?

A 25 per cent renewable electricity target by 2020, with medium energy efficiency measures, would conservatively deliver:[l]

- 16,600 new jobs,
- $33 billion in new investment,[m]
- 15,000 MW new renewable capacity,
- 69 million tonnes reduction in electricity sector emissions,[n] and
- enough renewable electricity to power every home in Australia.

Despite the early stage of development of the renewable energy in Australia there are already nearly 5000 people employed in the industry,[44] and an estimated 12,000 employed in solar water heating and energy efficiency.[45] Boosting renewable energy to 25 per cent would result in well over 33,000 clean energy jobs by 2020, even before counting the significant numbers of jobs that would accompany aggressive energy efficiency policies.

[l] Existing mandatory schemes (state and federal) would deliver 4600 additional jobs, 4100 MW, and $9 billion investment.

[m] Based on investment of $1.7 million per MW wind, $2 million per MW bioenergy, $1.6 million per MW hydro, and $7 million per MW PV. Australian Business Council for Sustainable Energy (2006, p. 19: all figures except PV), Clean Energy Report, Australian Business Council for Sustainable Energy, Victoria.

[n] Calculated from the reduction in electricity consumption plus the GWh renewable electricity in addition to current policies, assuming current greenhouse intensity of electricity production.

Wind: In 2004, with 700 MW installed, the Australian wind industry employed just under 1000 people.[46] Supplying one tenth of our electricity from wind by 2020 would take this to 11,000 MW and provide another 6000 jobs, mainly in construction and manufacturing.

A conservative estimate is that for each 100 MW of wind capacity added, there will be 560 people employed in construction and manufacturing for a year, and 15 jobs in operation and maintenance.[47] Getting one tenth of Australia's electricity from wind would mean approximately 800 MW new capacity per year. This is well above the 500 MW annual sales generally needed to justify local manufacturing.

Bioenergy: In 2004, there were 900 people employed in Australia's bioenergy sector.[48] Supplying 7 per cent of Australia's electricity from bioenergy would create about 3000 permanent jobs in operation and maintenance, most of these in rural areas.[49] Most of these would be farming jobs associated with harvesting, planting and transporting the bioenergy fuels.

Solar PV: Guaranteeing an outlet for a domestic solar industry secures existing jobs and would create new ones. Increasing total capacity to 1500 MW would lead to an estimated 6500 jobs.[50] The PV industry already employs 1300 people in Australia, about 30 per cent in each of design and installation, manufacturing, and distribution.[51]

THE EFFECT ON GREENHOUSE EMISSIONS

Australia needs to reduce its emissions to at least 30 per cent below 1990 levels by 2020 to play our part in avoiding dangerous climate change. Total greenhouse emissions in 1990 were 552 million tonnes, so our emissions need to fall to 386 million tonnes by 2020.

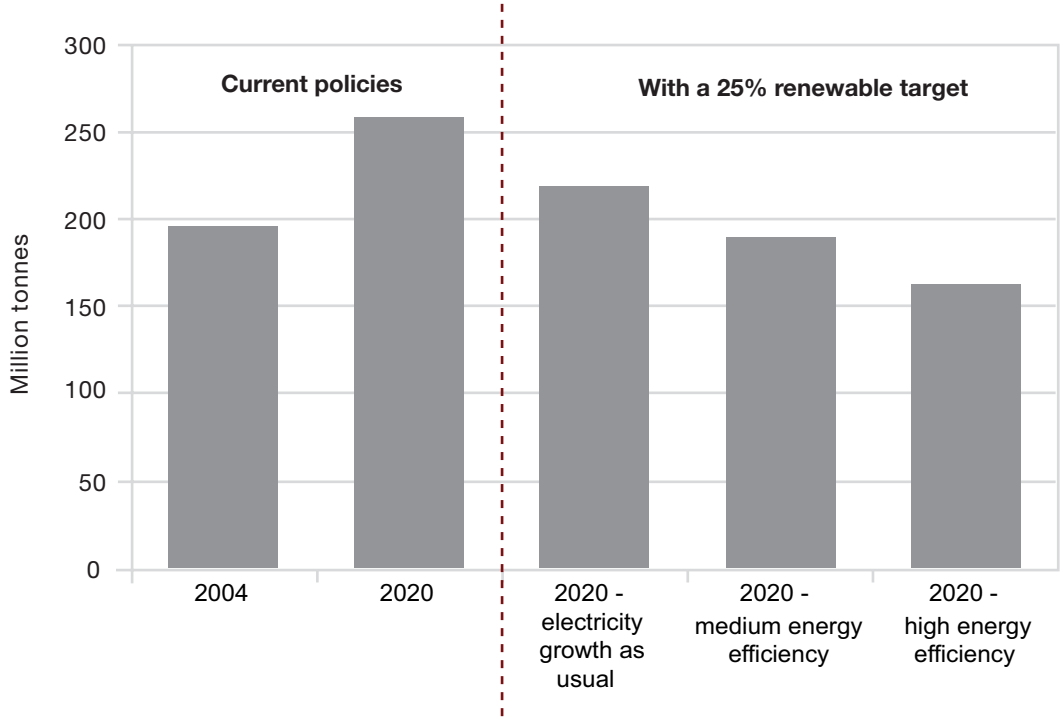
Electricity use in Australia causes 195 million tonnes of greenhouse gas emissions each year, 35 per cent of the national total of 565 million tonnes.[o] Unless electricity emissions fall from today's level, it is hard to imagine meeting the 30 per cent emissions reduction target.

With existing policies, electricity emissions will instead rise to 258 million tonnes by 2020, more than double the 1990 level of 125 million tonnes.

Electricity sector greenhouse emissions in 2020 have been modelled for four scenarios. As Figure 8 shows, these are:

- *Electricity growth as usual with current renewable policies:* emissions in 2020 would be **258 million tonnes**, more than double the 1990 level**.**
- *Electricity growth as usual with a 25 per cent renewable target:* emissions in 2020 would be **217 million tonnes**, up 68 per cent from 1990 levels, and a saving of 41 million tonnes compared to current policies.
- *Medium energy efficiency and a 25 per cent renewable target:* emissions in 2020 would be **189 million tonnes**, up 46 per cent from 1990 levels, and a saving of 69 million tonnes compared to current policies.
- *High energy efficiency and a 25 per cent renewable target:* emissions in 2020 would be **162 million tonnes**, up 25 per cent from 1990 levels, and a saving of 96 million tonnes compared to current policies.

Figure 8: Australia's electricity sector greenhouse emissions in 2020 with different policies



[o] 2004 figures from Australian Government (2006), National greenhouse gas inventory 2004, Australian Greenhouse Office, Canberra.

Only the high energy efficiency scenario with a 25 per cent renewable energy target reduces emissions significantly compared to today's levels. This presents a problem for policy makers. The high energy efficiency scenario is the most effective at reducing greenhouse emissions. However, if the renewable energy target is set assuming high energy efficiency and this is not achieved, renewable generation would fall short of 25 per cent of electricity consumption in 2020. Greenhouse emissions would be doubly increased, as electricity consumption would be higher than expected and there would be less renewable energy.

It is recommended that the 25 per cent renewable target is set based on the medium energy efficiency growth rate, and reviewed in 2010 and 2015. If the high energy efficiency policies for zero electricity growth by 2010 are on track, the renewable target could be raised to 30 per cent. This report assumes the medium energy efficiency scenario will be used to set the renewable energy target, and uses this as the basis for costs and estimates of job creation.

The additional renewable electricity to reach the 25 per cent target reduces emissions by 32 million tonnes of greenhouse gases. The combination of reducing electricity growth to zero by 2020 (the 'medium energy efficiency case') and a 25 per cent renewable energy target reduces electricity sector greenhouse gas emissions by 6 million tonnes from today's levels and 69 tonnes compared to current policies.

Adopting high energy efficiency policies in combination with a 25 per cent renewable target would mean 2020 emissions are reduced by 33 million tonnes compared to today, and by 96 million tonnes compared to current policies.

If the high energy efficiency electricity reductions are achieved and the renewable energy target has been set as recommended, renewable energy would supply 30 per cent of electricity by 2020. The combination of high energy efficiency and 30 per cent renewable electricity would reduce electricity sector greenhouse emissions to 153 million tonnes, up 18 per cent relative to 1990, a saving of 105 million tonnes compared to current policies.

Active programs to support renewable energy development are needed in order to make the transition to clean energy. A significant renewable energy target will ensure that industry development occurs early, bringing the cost reductions that follow large scale deployment. With the suggested target, and the introduction of even a modest carbon price, renewable energy is expected to be cost competitive with fossil fuel energy by 2020, the end of the target period.

This early industry development is vital if we are to meet the emissions reductions needed by 2020, and make the greater reductions required before 2050.

ACTION NEEDED ON RENEWABLE ENERGY AND ENERGY EFFICIENCY

1. **A national legislated target for 25 per cent of Australian electricity to come from renewable energy by 2020. This should stipulate:**
   - 72,500 GWh electricity to come from renewable energy in 2020, assuming that electricity consumption is no more than 290,000 GWh.
     The current MRET would need to be extended by 39,500 GWh to 49,000 GWh in 2020, assuming state targets remain. Current renewable generation is 18,300 GWh and existing state and national targets (VRET, NRET, the SA 20 per cent, and the current MRET) are expected to deliver an additional 14,700 GWh in 2020. If all the current targets are amalgamated into one mechanism, this would require an additional 54,200 GWh by 2020.
   - The target should be reviewed in 2010 and 2015 to ensure it will still meet the 25 per cent requirement, with the proviso that it can only be revised upwards.
   - Annual targets should be set from 2008 with the additional renewable energy increasing by a linear amount each year.
   - Compliance certificates should not be accepted from facilities commissioned prior to the scheme, and should include a sunset clause to ensure continuing development of new renewable energy generation.
   - Solar water heating should not contribute to this target as it is better supported directly, for example by policies mandating minimum performance standards for water heating and by rebates.
2. **A national target for zero electricity growth by 2010, followed by annual average reduction reaching at least 1.5 per cent by 2020, and the supporting measures to achieve it.**
3. **Urgent amendment of National Electricity Market regulation so network expansion costs can only be passed on to consumers if companies demonstrate that demand management or energy efficiency are not alternatives.**
4. **A fixed price for solar PV electricity going into the electricity grid (called a 'feed-in tariff'), sufficient to ensure householder investment.**

Other policies to reduce electricity sector emissions

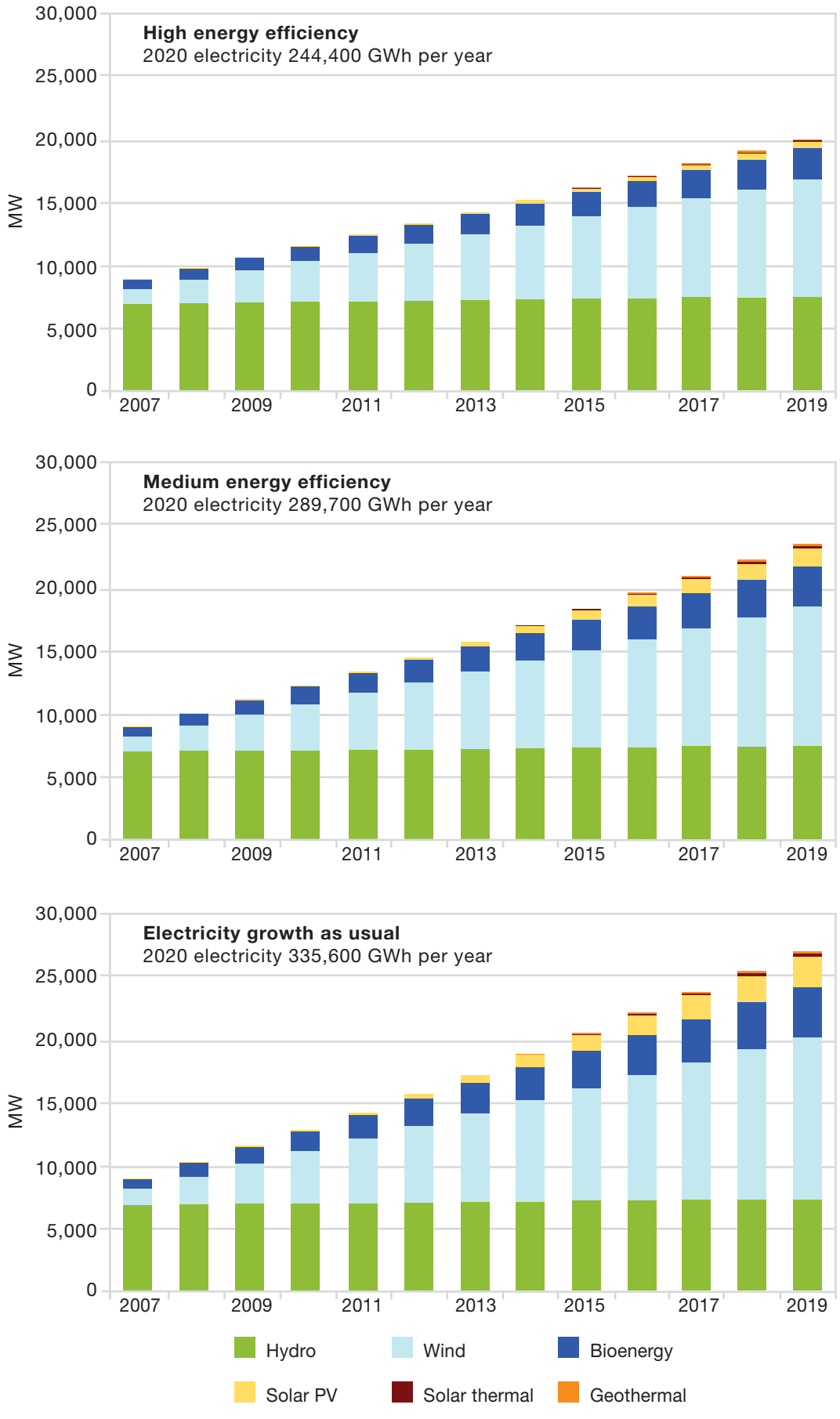
Legislating for 25 per cent renewable energy by 2020 is not enough to make the necessary reductions in electricity sector greenhouse emissions. Improving the efficiency of fossil fuel power stations, significantly increasing co-generation,[p] and fuel switching will all be necessary.

A well designed emissions trading scheme with a cap reducing greenhouse emissions to 30 per cent below 1990 levels by 2020 is an important measure alongside – and not substituting for – the renewable target.

At time of writing of this report, details of the Prime Minister's emissions trading scheme including timing of start of scheme were not yet available. The National Emissions Trading Scheme (NETS) proposed by state governments is unlikely to start until 2010. However its impact on renewable energy will be minimal until the scheme has been in operation for five to ten years, as permit prices gradually increase. Government modelling shows that by 2030 the NETS will bring total renewable energy in Australia to only 2200MW, a mere 1400 MW beyond business as usual.

[p] In cogeneration the heat produced during electricity generation is used. In conventional generation around four units of heat are wasted for each unit of electricity generated.

APPENDIX 1 RENEWABLE ENERGY CAPACITIES FOR ALL SCENARIOS



APPENDIX 2 RENEWABLE ENERGY COSTS USED FOR CALCULATIONS

	Average additional cost per MWh	Additional cost per MWh by technology [i]				
		Hydro	Wind	Bioenergy	PV	Geothermal
2007	$42	$45	$40	$45	450	$37[ii]
2020	$40	$35	$23	$37	200	$23

Costs for hydro, wind, bioenergy and geothermal from:
MMA Ltd (2006, p. 43), Renewable Energy – A Contribution to Australia's Environmental and Economic Sustainability. A report to Renewable Energy Generators Australia, REGA, Victoria.

PV costs are from:
Australian Business Council for Sustainable Energy (2004), The Australian Photovoltaic Industry Roadmap, Australian Business Council for Sustainable Energy, Victoria.

These costs are for distributed domestic systems (grid connected). Much lower costs will be associated with centralised solar generation facilities.

Notes

i A set cost of $35 per MWh for 'pool' electricity has been deducted from the MMA figures, as this table is only listing the additional cost.

ii The geothermal cost is assumed for 2014, as the technology is still at demonstration stage

Solar thermal costs have been taken as $100 per MWh in 2014, falling to $80 per MWh in 2020.

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