MINERALS COUNCIL OF AUSTRALIA

SUBMISSION TO THE REVIEW OF THE RENEWABLE ENERGY TARGET

MAY 2014

The Minerals Council of Australia represents Australia's exploration, mining and minerals processing industry, nationally and internationally, in its contribution to sustainable development and society.

Australia's minerals industry is innovative, technologically advanced, capital intensive, and environmentally and socially progressive. The industry is a major contributor to national income, investment, high-wage jobs, exports and government revenues in Australia. It operates in a global industry where competition for markets is intense, where investment opportunities abound in other resource-rich economies and where capital, people and technology are highly mobile.

In recent years, the minerals industry has accounted directly for up to 8 per cent of GDP (significantly more when account is taken of related activity), upwards of 20 per cent of business investment and around 50 per cent of national exports. Mineral commodities make up five of Australia's top 10 export earners.

MCA member companies account for more than 85 per cent of Australia's annual mineral production and 90 per cent of mineral export earnings.

The MCA represents the minerals industry with a common purpose in:

- Advocating pre-competitive or generic public policy for a socioeconomic environment conducive to growth and prosperity
- Identifying and promoting leading operation principles
- Engaging with opinion leaders and other stakeholders building a public presence that reflects the industry's contribution to the sustainable economic benefit of all Australians.

The future of the Australian minerals industry is inseparable from the global pursuit of sustainable development. The industry is committed to contributing to the sustained growth and prosperity of current and future generations through the integration of economic progress, responsible social development and effective environmental management.

The MCA advocates consistent and balanced policy settings for:

- An industry free of fatalities, injuries and diseases
- A macro-economic framework conducive to global competitiveness and sustainable economic growth, which is characterised by low inflation, low interest rates and fiscal prudence
- A skilled, productive and flexible workforce
- Efficient export infrastructure
- Reconciling energy security with managing climate change as part of a sustainable global solution
- A seamless and efficient Federation characterised by consistent regulation
- Access to competitive markets for capital, production inputs, human resources, and end products
- Access to natural resources and competitive markets for land, water and energy
- A fair and stable society where effort is encouraged and rewarded, and support is extended to those in need
- Mutually beneficial relationships with Indigenous and local communities through engagement and capacity building
- Improved environmental performance for sustainable eco-systems beyond life of mine.

Executive Summary

This submission argues that the Renewable Energy Target (RET) cannot continue in its present form for three reasons:

- The excessive cost burden it places on households and industry undermining national competitiveness
- The distortion it causes in electricity markets that may ultimately affect the stability and reliability of energy markets and lower productivity for the economy as a whole
- The costly and inefficient nature of the scheme as a climate change management measure.

First, the RET scheme creates a producer subsidy paid by electricity consumers to a specific class of technology providers via a mandated quota of production. These sources of production are more expensive than other sources of energy. This means electricity costs are higher than they would otherwise be, particularly in a time of falling demand. When demand is weaker, subsidised producers can supply at below market cost. While this in theory should mean lower prices, other factors such intermittency, network stability demands and distributed network costs mean that costs to consumers far exceed the benefits.

In other words, the RET is a transfer that involves a real resource cost to the community: the cost of investing in renewables over and above what otherwise would have been the case without the mandated quota. This over allocation of resources, the opportunity cost of the scheme, is money that might otherwise be gainfully employed in alternative productive investments. As an opportunity cost to the economy, this amounts to about $36 billion by 2020.

A significant part of this opportunity cost is the direct benefit to the providers of the favoured technologies in the form of subsidy to production. This producer subsidy equivalent is worth between $19.3 billion and $21.6 billion by 2020.

These are the additional costs paid by energy consumers – households, domestic firms and exporters such as the mining sector.

Second, the Minerals Council of Australia has long opposed the expansion of a mandatory RET, as enacted in 2009, on the grounds it is costly and a poor infant industry assistance policy. It is a questionable intervention in a functioning energy market, lasting until 2030. The MCA contends there is no market failure that justifies such intervention.

The large-scale RET scheme, LRET, in particular creates an unconditional requirement for additional renewable generation capacity. Under the structure of the east coast National Electricity Market this additional capacity is forced into the market irrespective of market conditions; that is, irrespective of whether there is an actual or potential supply shortfall, and whether the additional generation would be economic at prevailing prices. This forcing has been mandated at a time of unprecedented falling electricity demand. The combination of excess supply and low or negative price outcomes has tended to depress wholesale market prices and reduce the revenues earned by existing thermal generators. This reduction is not a function of competitive forces but of government intervention. Any wholesale price reductions observed to date are likely to be short-lived. Longer-term, a policy such as the

RET that reduces wholesale prices undermines investment in thermal capacity that is essential to maintaining reliable electricity supply.

Energy policy requires a balance between energy security and reducing emissions. This does not mean arbitrary choices of one energy source over another; rather it is recognition of the need to develop innovative ways of meeting these dual policy goals. Renewable energy is a vital part of the suite of energy sources for the minerals industry as is new technology to lower emissions from fossil fuels or techniques for safe and permanent storage of greenhouse gases. The minerals sector is both a user of renewable energy and an investor in research and development of low emissions technologies.

Third, while there has been an increase in renewable energy it has come at both a very high direct cost and high cost of carbon abatement. A mandatory renewable energy target in various forms has been in place in for more than a decade. RET schemes have changed their composition numerous times in response to ad hoc policy initiatives. Originally designed to subsidise large-scale schemes, the RET was adjusted to allow for the entry of smaller scale installations (household roof-top solar panels) and then changed again when the more generous subsidy for smaller schemes threatened to crowd out large scale development.

For the LRET, the costs of avoided emissions are projected to be in the range of $75 to $80/t $C0_2$-e even if only 60 to 70 per cent of the target is achieved. For the SRES, realistic estimates range from around $300/t $C0_2$-e to more than $640/t $C0_2$-e. These abatement cost estimates are considerably higher than the carbon price, currently set at $24.15/t $C0_2$-e.

In conclusion, the MCA has argued since 2009 that the expansion of a RET would increase electricity costs, distort the orderly operation and transition of energy markets, exacerbate concerns about the reliable and uninterrupted supply of energy and have a negative effect on jobs in the overall economy. Critically, as presumptions about national energy demand have not materialised, the scheme in its present form will force a deployment of renewable energy far greater than the 20 per cent target of overall supply presumed in the original policy. The scheme will encumber business with uncapped and high costs for subsidies, particularly for the SRES, because of poor design and a series of inchoate policy shifts.

The original policy expectation, whereby the scheme would assist the renewable sector provide most of the needed extra supply has given way to a reality where a government fiat allows a particular set of technologies to displace existing, long standing, reliable, capital intensive investments. This does not represent a market transition generated by the competitive allocation of resources.

This submission outlines these issues and includes as an attachment a detailed economic analysis from Principal Economics expanding on these themes.

We urge the RET Review Panel to recommend that Government eliminate this growing burden on Australia's competitiveness.

Minerals Council of Australia
May 2014

1. The competitiveness imperative

Australia's position as an attractive cost competitive supplier of minerals is not what it should be. Securing future economic benefits from mining requires a coherent economic reform agenda to improve Australia's productivity, cost competitiveness and structural flexibility.

Low cost, reliable energy has been a critical element of the international competitiveness of Australian industry and the living standards of households for several decades. This advantage has been lost with electricity prices now among the highest in the developed world, substantially due to ill-judged policy interventions. No other country has adopted such a unilateral assault on its comparative advantage.

High energy costs represent a substantial burden on Australian households and industry, including the mining sector which accounted for 13.5 per cent of final energy consumption in 2011-12.[1] Along with transport and labour, energy is a key cost input for Australian mining.

Australia has a comparative advantage in mining which has delivered significant benefits in the past – in the form of exports revenues, jobs, taxes and royalties and local community contributions. Exports are forecast to reach $172 billion in 2013-14, employing 254,000 people directly and supporting the employment of another 600,000 people. Social contributions from the industry are substantial, with an estimated $34 .7 billion spent on community infrastructure, local suppliers, indigenous contractors and other related activities in 2011-12 alone. And the sector continues to be the largest tax contributor, with company tax and royalties totalling more than $117 billion between 2006-7 and 2012-13. [2]

These benefits are only sustainable with the right policy settings aimed at improving international competitiveness.

The *Opportunity at Risk* report by Port Jackson Partners (PJP) released by the MCA in 2012, outlined the prize on offer from further resource development if Australian producers were simply to maintain market share through the next two decades. Based on realistic assumptions about future demand growth, mineral revenues could increase by $121 billion per annum – a 65 per cent increase on 2010 revenues for a sector that is already twice the size it was in 2006.[3]

However, the PJP report also found that more than half of Australia's existing mines across thermal coal, metallurgical coal, copper and nickel have operating costs above global averages. With respect to capital costs, Australia could build iron ore and coal projects as cheaply as our competitors a few years ago, but now iron ore projects are 30 per cent more expensive than the global average, and thermal coal projects 66 per cent more costly. Labour costs have risen faster than the national average and are amongst the highest in the world. Energy and transport costs are also much higher in Australia than in competitor countries. [4]

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[1] Bureau of Resources and Energy Economics, 2013, *Australia Energy Update*, Table 5, pg. 7.
[2] For details, see Minerals Council of Australia, *2014-15 Pre-Budget submission*, February 2014.
[3] Port Jackson Partners, *Opportunity at Risk: Regaining our competitive edge in minerals and resources*, report commissioned by the Minerals Council of Australia, September 2012, p 18.
[4] Ibid., p 10.

The urgency of the task of rebuilding industry competitiveness has only increased since the PJP analysis was released in the context of lower commodity prices, stubbornly high costs, cut backs in investment and strong supply competition from other resource-rich nations.

In October 2013, BIS Shrapnel identified rising construction and operational costs as the key risk to new mining projects.[5] In November 2013, the IEA observed that Australia has rapidly become one of the most expensive places to build a coal mine: “With increases in other operating costs and construction costs, both existing and new projects are under strain and some new projects are experiencing serious delays.” [6]

[5] BIS Schrapnel, *Mining in Australia, 2013 – 2028*, October 2013, p. xiii.
[6] International Energy Agency, *World Economic Outlook 2013*, Paris, 13 November 2013, p 152f.

2. Excessive costs

The RET represents an extra cost to users to subsidise new technologies. It is an inefficient transfer of costs onto other energy generators and then onto energy users.

There have been a range of studies, with a myriad of assumptions applied to specific electricity market models. While the size of the effect varies these studies confirm that there is a significant and growing cost transfer from users to the suppliers of renewable generation. Attached to this submission is a detailed analysis of the range of costs and the broader economic effects of the RET policy,

In 2010 the then Minister for Energy Resources and Tourism, the Hon. Martin Ferguson AO acknowledged the size of the subsidy wrought by the RET stating it represents "*a bonus to the renewable sector of the order of another $20 to $30 billion in Commonwealth Government support*".[7]

As the attached study by Principal Economics details, this estimate is consistent with a range other analyses.

The cost of the new investment required to meet the scheme's targets by 2020 is estimated at about $22.1 billion for the large scale renewable energy target, LRET, and $15.5 billion for the household, small scale scheme (mainly solar). Allowing for some offsetting of coal and natural gas fuel costs, the net opportunity costs is $36 billion. This opportunity cost does not include all the additional network and ancillary costs from the operation of the scheme.

This is mostly financed by a transfer from users to producers. Under the LRET, this producer subsidy equivalent will grow from about $323 million a year in 2010 to an estimated $2.8 billion in 2020. The SRES subsidy was about $1.7 billion in 2010 (when feed-in tariffs were larger) but will still range from at least $3.7 billion to $5.7 billion in 2020.

The cumulative total of this producer equivalent subsidy is estimated at between $19.3 billion and $21.6 billion by 2020.

For consumers, the Electricity Users' Association of Australia (EUAA) has calculated that in 2012 alone, this is equivalent to a cost of $10.50 a megawatt hour adding 25 per cent to the wholesale price or 10 per cent to the retail price of electricity.[8] End users report the prices are very volatile, undermining investment plans. The higher costs reported by the EUAA do not include the increased costs flowing from changing distribution networks to accommodate new, intermittent power sources, often remote from traditional grid corridors.

The NSW Independent Pricing and Regulatory Tribunal describes the RET as "a substantial cost to electricity retailers and their customers". The uncapped nature of the SRES means that in 2012-13 retailers will be required to surrender renewable energy certificates equivalent to 33.1 per cent of their electricity sales. The upfront deeming of the certificates from the SRES, while making the scheme easier to manage, introduces a disconnect between the timing of creating certificates and the generation of renewable energy, "with current electricity customers paying today for renewable energy deemed to be generated

[7] The Hon. Martin Ferguson AO MP, *Address to National CCS Week Conference*, November 2010.
[8] Report for Energy Users Association of Australia by CME: Carbon + Energy Markets, *Renewable Electricity in Australia: Outcomes and Prospects*, October 2011.

over the next 15 years" . These costs have been a major driver of recent increases in electricity prices through direct costs of buying certificates and additional transmission and distribution capacity.

The expensive bringing forward of RET technology (overwhelmingly wind) is coming at a time when the demand profile of Australia's east coast market, the National Electricity Market, has changed markedly. When the 20 per cent target was set in 2009, AEMO expected demand to reach 300TWh in 2020. In 2011 this forecast was estimated at 268TWh. As the chief executive of Origin Energy, Grant King, noted in May 2012, this meant at present rates the 20 per cent target would in fact reach 26 per cent by 2020.[9] Work commissioned by consultancy ACIL Tasman on behalf of energy supplier TRUenergy suggests the cost of the RET represents subsidy of $53.3 billion through to 2030, compared with $28.1 billion if a "real" 20 per cent target were deployed.[10]

The RET is therefore a policy where end users are forced to pay a second premium – paying both for today's renewable energy investment and for generation that is deemed to take place in the future.

[9] Grant King, Managing Director, Origin Energy, *Flexibility to Respond*, address to Macquarie Australia Conference, 2 May, 2012.
[10] ACIL Tasman, op.cit.

3. Market distortion and economic cost

The costs of the RET scheme are becoming apparent in the structural decline in the productivity of the electricity supply industry. This trend is a consequence of the RET scheme whereby high cost, intermittent forms of generation displace lower cost and reliable thermal technologies.

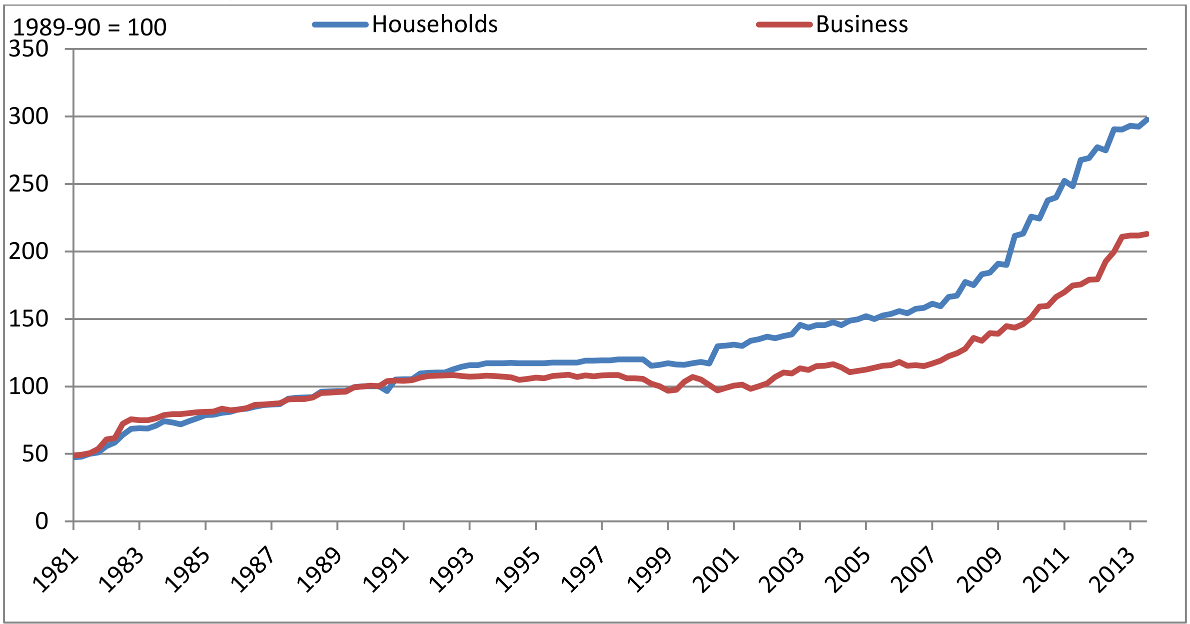
Longer-term, rising energy costs and reduced consumption will be expected to reduce economic growth.

The electricity system is moving from a simple, reliable, concentrated, generally stable supply/predictable demand system with basic regulation from government to a complex, less reliable, widely dispersed, generally stable supply with less predictable non dispatchable generation.

The growth intermittent of 'non-dispatchable' generation wind and solar PV has the potential to test grid and network balancing, particularly in the distribution network.

For many years, energy costs in Australia were low by world standards, affordable in relation to average incomes and relatively stable. However, in the last decade this has changed. Household electricity prices have increased by more than 110 per cent in the past 5 years, and are projected to increase 7 per cent annually until 2014-15.[11] In the past 5 years, electricity prices for business have increased by almost 80 per cent (Chart 1).

Chart 1: Electricity price indices for households and businesses, Australia 1981-2013



Source: ABS 2014, catalogue number 6427.0 and catalogue number 6401.0.

In recent years, wholesale prices have begun falling, and proponents of the RET have argued that this means retail prices will eventually fall. This analysis is flawed.

As the LRET mandates the aggregate amount of energy that must be generated from renewable generation sources in any one year, it creates an unconditional requirement for

[11] Australian Energy Markets Commission, *Electricity price trends: Final report*, March 2013

additional renewable generation capacity. This additional capacity is forced into the market irrespective of market conditions; that is, irrespective of whether there is an actual or potential supply shortfall, and whether (or not) the additional generation would be economic at prevailing prices. This forcing has been mandated at a time of unprecedented falling electricity demand. The combination of excess supply and low or negative price outcomes has depressed wholesale market prices in the NEM, and reduced the revenues earned by existing thermal generators. Falling wholesale prices have offset some of the cost burden of the RET on consumers, but this outcome cannot be considered a 'benefit'. Artificially depressed prices have effectively stranded a share of thermal capacity, which is progressively being withdrawn from the market. Any wholesale price reductions observed to date are therefore likely to be short-lived. Longer-term, a policy such as the RET that reduces wholesale prices undermines investment in thermal capacity that is essential to maintaining reliable electricity supply.[12]

Ultimately, retailers determine their prices by taking into account the range of prices they are likely to face across the year. Here the market cap price is important and it is arguable the high level of renewables in South Australia is driving the market price cap higher than it should be. This results in higher pool prices for all consumers in the NEM.

As the Major Energy Users group noted in a submission on the Australian Energy Market Commission's 2014 Reliability Standard and Reliability Settings Review, market price volatility has been identified as a cause of increased risk in the NEM and managing risk is a cost that is ultimately passed onto consumers. The higher the market price cap the greater the market volatility and the greater the cost to consumers.

Productivity

Policies that strengthen and build on Australia's competitive advantage by improving productivity are key to Australia's future prosperity and standard of living. In recent years, the Productivity Commission (PC) has highlighted a pronounced decline in multifactor productivity (MFP) in the Australian market sector.[13] One of the industries that has most contributed to the slowdown is the utilities sector, comprising electricity, gas, water and waste services. There are a number of reasons for the pronounced productivity decline in the electricity supply sector. Around half of the decline reflects an increase in the ratio of peak to average demand. A second important factor relates to substantial investment in network infrastructure.[14] However, an additional factor identified by the PC relates to the impact of the MRET and the RET schemes, and a corresponding shift to higher cost supply sources.

[12] See Principal Economics, *Review of the Renewable Energy Target*, May 2014, attached to this submission. Also refer: Tim Nelson, Paul Simshauser and James Nelson, 'Queensland Solar Feed-In Tariffs and the Merit-Order Effect: Economic Benefit, or Regressive Taxation and Wealth Transfers?' *Economic Analysis & Policy,* Vol. 42 No. 3, December 2012, pp. 290-98 where they argue that the RET is a subsidy that exerts downward pressure on wholesale electricity prices in the short run (owning to the low short-run marginal operating costs of wind and solar) but pushes them up in the long run (owing to the high average fixed costs of these technologies).

[13] Productivity Commission, *Productivity Update*, 2013. MFP is a measure of how well both labour and capital are combined to generate output (value added).

[14] However, given that much of the investment is in long-lived assets that would not be fully utilised until sometime in the future, the resulting impact on MFP may be considered cyclical and therefore temporary in nature.

The range of future electricity costs that would be passed on to energy users as a result of the RET scheme can be expected to increase prices and further decrease electricity consumption. It is sometimes asserted that energy constitutes only a relatively modest share of expenditure in modern economies, and that substitution and technical change can effectively 'decouple' economic growth from resources such as energy. It is therefore argued that costly energy policies can be applied without great 'harm' to the economy. However, this perspective does not take into account the key role of energy as a driver of economic growth.[15]

Energy is an essential factor of production. All production involves the transformation or movement of matter in some way, and all such transformations require energy. While use per unit of economic output (energy intensity) has declined in advanced economies, this is to a large extent due to a shift in energy use from the direct burning of fossil fuels to more efficient electricity generation.[16] When shift in the composition or quality of final energy use is accounted for, energy use and the level of economic activity are found to be tightly linked. Evidence from around the world (see attachment) suggests that that effort to reduce electricity consumption may have a negative effect on future economic (gross domestic product) rates.

Australia should avoid policy that heads down this path.

[15] David Stern, "The role of energy in economic growth", *Annals of the New York Academy of Sciences*, 1219, No.1, 2011.

[16] Energy quality is the relative economic usefulness per heat equivalent unit of different fuels and electricity. Some fuels can be used for a larger number of activities and/or for more valuable activities. For example, coal cannot be used directly to power a computer whereas electricity can.

4. Inefficient climate change policy

The RET scheme fails to allocate funds according to the long standing principle of "least cost abatement".

Minerals companies are significant users of energy. Stable, reliable energy supply is crucial to the productivity of the operation –at the excavation and extraction phase, initial processing, or smelting and refining (on-site or at other locations). The remote nature of many mining activities means the predominant fuel is gas or diesel.

The priority for minerals companies is to focus on the most efficient, least-cost options to reduce the sector's particular energy profile. This means concentrating the sector's time and resources on the energy efficiency of existing plant and equipment, the development of new technology or the use of supplementary sources of alternative energy sources where operationally appropriate. A dollar spent paying higher prices for grid electricity is money that cannot be spent on the development of improvements tailored to the business. This is inefficient and potentially counterproductive.

The volumes of greenhouse gas (GHG) emissions abated because of the RET are uncertain. Estimates of emissions abated depend on how electricity market operations are modelled and what assumptions are made about the number and quality of installations at the household level.

Notwithstanding questions about the 'real' abatement achieved by the RET, the very considerable subsidies paid to the renewables sector and households under the policy translate into a high cost of abatement. For the LRET, the cost of avoided emissions are projected to be in the range of \$75 to \$80/t $C0_2$-e even if only 60 to 70 of the target is achieved. For the SRES, realistic estimates range from around \$300/t $C0_2$-e to more than \$640/t $C0_2$-e. These abatement cost estimates are considerably higher than the carbon price, currently set at \$24.15/t $C0_2$-e.

These costs of abatement harm Australia's international competitiveness.

Review of the Renewable Energy Target

Report for the Minerals Council in Australia

May 2014

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Executive summary

Principal Economics has been asked by the Minerals Council of Australia to assess:

- the economic implications of the Renewable Energy Target (RET); and
- the RET's implications for Australia's resources sector and the Australian economy.

The Renewable Energy Target

The RET is a mandatory quota that requires electricity retailers to buy a minimum share of electricity generated from large- and small-scale renewable sources. The RET operates by awarding renewable energy certificates to large-scale generators, predominantly wind generators, and to households who install certain technologies, in particular photovoltaic (PV) systems. These certificates are sold to retailers who are required to surrender them to the regulator to meet their liability under the scheme.

The RET scheme started in a less ambitious format in 2000, but has undergone a number of reviews and changes. The original small-scale component of the scheme was substantially expanded in 2007, but terminated in 2009. The original target was significantly increased later in 2009. In 2010 the scheme design was changed into a small-scale (SRES) and large-scale (LRET) component. Subsequently further modifications were made to the SRES.

The certificates created and sold under the RET represent the direct subsidies paid to large-scale renewable generators and participating households, and are a tax on (electricity) production. The cost of these subsidies is borne by electricity consumers.

The RET also impacts on the wholesale markets in which electricity is traded in Australia. The LRET mandates the aggregate amount of energy that must be generated from renewable generation sources in any one year, and therefore creates an unconditional requirement for additional renewable generation capacity. This additional capacity is 'forced' into the market irrespective of market conditions; that is, irrespective of whether there is an actual or potential supply shortfall, and whether the additional generation would be 'economic' at prevailing prices. In the National Electricity Market (NEM) on the East Coast, and during a period of unprecedented fall in demand, the LRET has tended to depress wholesale market prices further. To an extent, lower wholesale market prices in the NEM have mitigated the price impacts of the LRET on electricity consumers; the burden of the scheme is effectively shared between existing generators and consumers. In the West Australian Wholesale Electricity Market (WEM), which is designed differently, consumers bear most of the financial burden of the RET.

Economic impacts of the RET

Achieving the RET imposes significant short- and longer-term opportunity costs on electricity consumers.

The most reliable estimate of the opportunity cost of the new large-scale investment required to meet the LRET by 2020-21 is around $22.1 billion. These expenditures are mandated in a context where both the NEM and the WEM are characterised by excess generation capacity; in the NEM 3,200 MW of thermal (coal and natural gas-fired) capacity is projected to close as a result of the LRET, almost 3,300 MW of capacity has already been mothballed or permanently retired. In these circumstances, where the market is oversupplied, electricity prices have risen significantly and consumption is continuing to fall, and where no new generation capacity is required over the foreseeable future, mandated overinvestment in renewable generation capacity simply displaces existing thermal generation capacity which is then 'stranded'.

The opportunity cost of the SRES to 2020-21 is projected to amount to around $15.5 billion. Taking into account that there may be some offsetting (coal and natural gas) fuel cost reductions because thermal generation is displaced, the combined opportunity cost of the expanded RET for the generation sector alone would amount to more than $36 billion by 2020-21. Longer-term, the opportunity costs of achieving the LRET can be expected to extend to other aspects of the electricity system. Increasing generation from intermittent wind resources will affect network flows, require costly compensating ancillary services, and will affect the efficiency of NEM operations, including inter-regional trade and investment. Ultimately, consumers will bear the burden of these outcomes.

The subsidies paid under the RET to the renewables industry and households are directly recovered from electricity consumers. RET subsidies to the renewables industry have increased from $44 million in 2001-02 to $323 million in 2010-11; subsidies paid to households increased from $11 million to $1.7 billion over the same timeframe. Forward estimates of the aggregate direct subsidies that would need to be paid by consumers to achieve the RET are in the range of $19.3 to $21.6 billion by 2020-21.

In 2012-13, the RET component of retail prices paid by electricity consumers was around $10/MWh in Queensland, Victoria and South Australia, $11/MWh in New South Wales, and $15/MWh in Western Australia. For energy-intensive mining and manufacturing businesses, these price impacts represent cost increases in the tens of thousands and even millions of dollars. Going forward, the most recent estimate of the price impact of the RET scheme is $14.4/MWh (Australia-wide) by 2020-21. This estimate is likely conservative, and does not include the opportunity cost impacts of additional system and transmission services that are likely to be required for the LRET, as well as the costs of broader market inefficiencies.

In the NEM, in the recent period of an unprecedented fall in demand, the LRET has had the effect of depressing wholesale prices and reducing the revenues and profitability of existing thermal generators. Falling wholesale prices tend to offset some of the burden of the RET on electricity consumers, but this outcome cannot be considered a 'benefit'. Artificially depressed prices have effectively stranded a share of thermal capacity, which is progressively being withdrawn from the market. Any wholesale price reductions observed to date are therefore likely to be short-lived. Longer-term, a policy that artificially reduces wholesale prices undermines investment in thermal generation that is essential to maintaining reliable electricity supply.

Exports and economic growth

Given its considerable opportunity cost, the RET can be expected to have adverse consequences on the broader Australian economy. Australian electricity consumers, including Australian industry, benefit from abundant coal supplies and the availability of low-cost, reliable electricity generated from coal. The RET acts to undermine this competitive advantage:

- At an industry level, the RET constitutes a tax on production, which raises the costs of energy inputs. Higher input costs particularly affect the competitiveness of the Australian exports and specifically the Australian mining sector, which makes a significant contribution to economic growth.

- At an economy-wide level, the RET has been identified as a cause of a structural decline in the productivity growth of the electricity sector. Falling productivity in the electricity sector has acted as a significant drag on the overall productivity growth of the market sector of the Australian economy.

More generally, costly policies such as the RET scheme raise electricity prices and consequently reduce electricity consumption. However, in modern economies, the use of high-quality forms of energy such as electricity is far more important than its share of aggregate expenditures would imply. Economy-wide growth models that account for qualitative differences between different forms of energy, and in particular the increasing importance of electricity, suggest that policies that reduce electricity consumption have a negative effect on economic growth.

Overall assessment and policy recommendations

The objectives of the RET include encouraging the additional generation of electricity from renewable sources, and reducing emissions of greenhouse gases in the electricity sector. These objectives are open-ended. The scheme target is not related to a stated emissions abatement objective, nor does it consider the trade-offs that must be made to achieve the target.

The RET has achieved its objective of increasing the share of renewable electricity generation in Australia by subsidising the renewables industry and participating households. However, this has been achieved at a very high cost to electricity consumers as a whole and the Australian economy. Furthermore, the considerable subsidies paid to the renewables sector and households under the policy translate into a high cost of abatement. For the LRET, the costs of avoided emissions are projected to be in the range of \$75 to \$80/t $C0_2$-e, although these estimates assume that only 60 to 70 per cent of the target would be achieved by 2020-21. For the SRES, estimates range from around \$300/t $C0_2$-e to more than \$640/t $C0_2$-e. These abatement cost estimates are considerably higher than the carbon price, currently set at \$24.15/t $C0_2$-

e, and the expected cost of purchased emissions under the proposed Direct Action scheme.

Going forward, the RET will rise sharply under current policy settings. While there is a policy rationale for preserving the value of past investments made as a result of the RET, there is no reason to continue to pursue a policy that is likely to strand a substantial portion of existing reliable generation capacity and impose very substantial costs on the Australian economy. The recommendation from this report is therefore:

- to rule out future increases to the LRET;
- to evaluate the costs and benefits of the LRET, and whether there is merit in reducing the LRET; and
- to bring to an end or at least rationalise on the basis of a societal net benefit calculation, any future subsidies paid under the SRES.

Abbreviations

ABS	Australian Bureau of Statistics
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ANAO	Australian National Audit Office
CCA	Climate Change Authority
CEC	Clean Energy Council
CER	Clean Energy Regulator
ERA	Economic Regulation Authority
FiT	Feed-in tariff
GWh	Gigawatt hour
LGC	Large-Scale Generation Certificate
LRET	Large-Scale Renewable Energy Target
MPC	Market price cap
MWh	Megawatt hour
NEM	National Electricity Market (East Coast)
ORER	Office of the Renewable Energy Regulator
PV	Photovoltaic
RCM	Reserve Capacity Mechanism
REC	Renewable energy certificate
RET	Renewable Energy Target
RPP	Renewable Power Percentage
STP	Small-scale Technology Percentage
SRES	Small-Scale Renewable Energy Scheme
STC	Small Scale Technology Certificate
WEM	Wholesale Electricity Market (Western Australia)

1. Introduction

The Australian Government has recently announced a Review of the Renewable Energy Target (RET). The review is to examine the operation and costs and benefits of the RET, including:

- the economic, environmental and social impacts of the RET;
- the extent to which the formal objects of the Act are being met; and
- the interaction of the RET with other Commonwealth and State policies and regulations.

1.1 Terms of reference

Principal Economics has been asked by the Minerals Council of Australia to assess:

- the economic implications of the RET; and
- the RET's implications for Australia's resources sector and the Australian economy.

1.2 Structure of this report

This report is structured as follows:

- Section 2 describes the RET, its evolution, and how it interacts with electricity wholesale markets;
- Section 3 reviews the economic effects of the RET, in terms of its opportunity costs, the subsidies paid to the renewables industry, the impacts on electricity prices, and the policies longer-term implications;
- Section 4 considers the broader economic impacts of the RET scheme on the Australian economy; and
- Section 5 concludes with an overall assessment of the RET against key policy objectives and policy recommendations going forward.

2. The Renewable Energy Target

This section describes the origins of the RET, the current policy settings for the scheme, and how it operates. While the small-scale component of the RET functions as a subsidy to households who install certain renewable technologies, the large-scale component subsidises (large-scale) renewable generation technologies who operate in organised wholesale markets and affects the operation of these markets.

2.1 Origins of the RET

The RET is a climate change related technology policy that takes the form of a mandatory quota (Productivity Commission, PC 2008). The RET requires electricity retailers and large customers to buy a minimum share of electricity generated from renewable sources.

The RET in its current form has its origins in and operates along the same lines as the Mandatory Renewable Energy Target (MRET), which commenced in April 2001. The Renewable Energy (Electricity) Act 2000 set an annual target for the amount of electricity generated from renewable energy sources that rose to 9,500 GWh by 2010, a level that was to be maintained until 2020. The policy intent behind the target was that 2 per cent of energy should be generated from renewable sources (MacGill et al. 2006).

The MRET functioned by mandating that wholesale purchasers of electricity acquire a pro-rated share of electricity purchases from renewable sources or pay a penalty charge. Accredited renewable generators could create 'renewable energy certificates' (RECs) by generating renewable electricity;[1] one REC corresponded to one megawatt hour (MWh) of eligible renewable electricity. Retailers or wholesale customers could acquit themselves of their liability by purchasing RECs from renewable energy generators, and by surrendering these to the Office of the Renewable Energy Regulator (ORER), now the Clean Energy Regulator (CER). In this way, eligible renewable generators received an income stream that was additional to any payments from the energy market. The MRET was reviewed in 2006 (the Tambling Review), but only a subset of recommendations were accepted by the Government at the time (Parliament of Australia 2006).

The small-scale component of the RET has its origins in the Photovoltaic Rebate Program, which offered subsidies of $4,000 for installations of household photovoltaic (PV) systems (Nelson et al. 2011). In 2007 the incoming Labor Government renamed the scheme the 'Solar Homes and Communities Program', increased the subsidy to $8,000, and subsequently introduced means testing to stem the flood of new applications. The program was abruptly terminated at midnight on 9 June 2009 (giving a day's notice to industry and households); by that time program costs exceeded $1

[1] The renewable electricity could come either from generators established since 1997, or from older generators above a certain baseline.

billion, compared to budgeted expenditures of $150 million over the five years from 2007-08 (Australian National Audit Office, ANAO 2010).

2.2 Expanded RET

In 2009, the Renewable Energy (Electricity) Bill 2009 replaced the MRET with the 'expanded' RET. The 2009 legislation increased the 9,500 GWh by 2010 target to 45,000 GWh by 2020, reflecting the Australian Labor Party's 2007 election commitment that 'the equivalent of at least 20 per cent of Australia's electricity supply is generated from renewable sources by 2020' (Parliament of Australia 2009). The 2009 legislation also extended the target to 2030, and introduced the 'Solar Credits' scheme. That scheme applied various 'multipliers' to determine the number of RECs that small-scale generating units, mainly PV installations, would receive.[2]

The expanded RET required significant modification within a year of the 2009 legislation when the Renewable Energy (Electricity) Amendment Bill 2010 was passed. The combination of the solar credits multipliers and the decision of many states to introduce premium feed-in tariffs (FiTs) contributed to a much higher than anticipated uptake of PV installations and an exponential increase in the number of RECs created. Most of the certificates created at that time were surplus to requirements and were 'banked', resulting in the overhang that exists today and is estimated at over 20 million (IES 2014). In response to these developments, the Government split the RET into two schemes:

- the Large-Scale Renewable Energy Target (LRET) with a revised target of 41,000 GWh by 2020; and
- the Small-Scale Renewable Energy Scheme (SRES), which is an open-ended scheme, and which provides for the creation of an indeterminate number of Small Scale Technology Certificates (STCs) as households take up eligible technologies.

The LRET requires 'liable entities' (electricity retailers and large electricity customers) to surrender 'Large-Scale Generation Certificates' (LGCs, equivalent to 1 MWh of renewable electricity) to meet their renewables obligation. Eligible renewable technologies are prescribed by legislation, as is the large-scale generation shortfall charge of $65 per MWh.[3] CER calculates an annual Renewable Power Percentage (RPP) that mandates how many LGCs retailers must surrender each year (the 2014 RPP is 9.87 per cent).

The SRES was further amended in 2011 and 2012, when the solar credits multipliers awarded under the scheme were reduced to first three and then two, and were then eliminated. CER determines the 'Small-scale Technology Percentage' (STP) to determine the number of STCs that retailers must surrender in any one year (the 2014

[2] Historically, residential PV installations were deemed upfront RECs corresponding to 15 years of generation. With the Solar Credits multiplier, five times the number of certificates were created, so that solar PV installations received certificates corresponding to 75 years of generation.

[3] Taking account of company tax treatment, the effective penalty is $93 per LGC.

STP is 10.48 per cent).[4] STCs can be sold to retailers, or through CER's STC Clearing House at a fixed price of $40 per STC, provided a buyer is found at that price.

The main difference between the SRES and the Solar Homes and Communities Program that preceded it is that, whereas the former program was funded from Commonwealth revenues, the burden of the SRES falls on electricity consumers. The subsidies paid under the LRET and its precursor the MRET have always been recovered from consumers. From a national accounting perspective, the renewable energy certificates (LGCs and STCs) that are created and surrendered under the RET are therefore considered to be taxes on production by the Australian Bureau of Statistics (ABS 2012). Taxes on production are generally passed on to purchasing industries and/or final consumers in the form of higher prices.

2.3 LRET and electricity wholesale markets

The LRET affects Australia's electricity systems and wholesale markets in which electricity is traded. As the LRET mandates the aggregate amount of energy that must be generated from renewable generation sources in any one year, it creates an unconditional requirement for additional renewable generation capacity. This additional capacity is 'forced' into the market irrespective of market conditions; that is, irrespective of whether there is an actual or potential supply shortfall, and whether the additional generation would be 'economic' at prevailing prices.

2.3.1 National Electricity Market

The National Electricity Market (NEM) operates on the East Coast of Australia and is estimated to account for 86 per cent of national electricity demand (AEMC 2011). The NEM has been characterised by excess generation capacity for some years, and this is projected to be the case beyond 2022-23 for all regions except Queensland.[5] In the NEM, the consequence of the LRET is that around 10.6 GW of additional renewable generation capacity would need to be commissioned between 2013-14 and 2020-21, of which 8.7GW would be wind generation (AEMO 2013). New renewable generation would displace existing coal- and gas-fired generation capacity and add to the current excess supply. AEMO's 2013 projections imply that, without a carbon price, 3,169 MW of existing coal- or gas-fired generation capacity would be retired by 2020-21. These projections reflect a continuation of existing trends of temporary or permanent retirements of thermal generators in recent years.[6]

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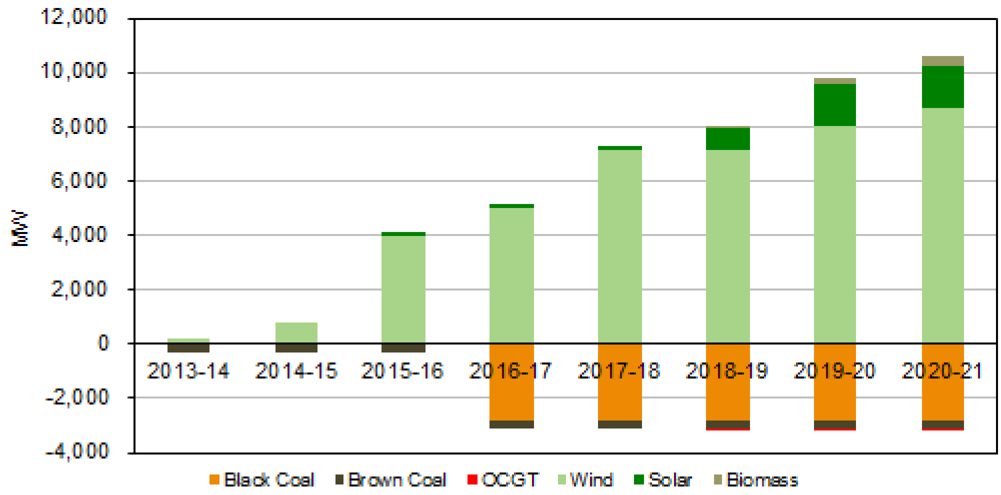
[4] STCs are also equivalent to 1 MWh of renewable electricity unless a multiplier applies.

[5] On AEMO's most recent projections (AEMO 2013), Queensland will reach its reserve deficit in 2019–20. No other regions of the NEM will reach a reserve deficit within the next 10 years.

[6] These include the closure of one unit at Yallourn (360MW, brown coal, 2012), the permanent shut-down of Swanbank B power station (500 MW, natural gas, 2012), the temporary closure of Swanbank E (385 MW, natural gas) for up to three years from 1 October 2014; the temporary closure of Wallerawang C Unit 7 (500 MW, black coal) from January 2014, on three month recall); the permanent shut-down of Munmorah power station (black coal, 600 MW, 2012); the closure of Tarong (700MW, black coal) at the end of 2012 for at least two years, and the temporary closure of Playford power station (brown coal, SA,250 MW) on 90 day recall.

Figure 2-1. Projected cumulative new entry / retirements by technology (NEM)



Notes: Zero carbon price scenario, Transmission Development Plan

Source: AEMO 2013.

There are differences in how the effects of the LRET play out in the NEM and in the West Australian Wholesale Electricity Market (WEM), reflecting differences in how these markets are designed. The NEM is a 'gross' pool: all electricity that is generated from power stations above a certain size (including from renewable generators) must be traded and settled in the market. The NEM is also an 'energy only' market that does not incorporate payments for generator capacity or availability. In general, thermal (coal and natural gas-fired) generators must recover their fixed and variable costs from market clearing prices or from (financial) contract payments (which are in turn linked to market prices). The broader philosophy behind this market design is that wholesale market prices have a central signalling function: as the demand-supply balance tightens over time, prices begin to rise, and incentivise new generation investment (and vice versa).

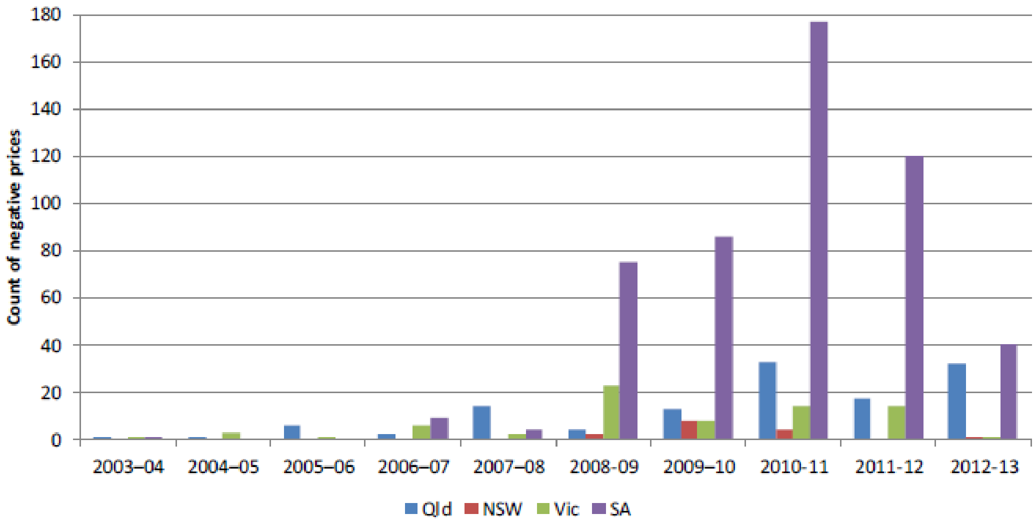
Given the design of the NEM and the types of renewable generation technologies commissioned under the scheme, the LRET has had a material effect on wholesale prices, as well as on the revenues of existing (thermal) generators. First, prices are artificially reduced since the LRET increases the supply of (renewable) generation capacity far beyond what would be economic at prevailing spot prices. The second effect arises because to date the LRET has overwhelmingly been met from wind generation. Wind farms do not incur fuel costs and are therefore positioned at the bottom of the 'merit order'. Wind generators may therefore offer their output at zero or, given the additional revenues they receive for LGCs, at negative prices. In circumstances where negative offers from wind farms set the market clearing price, thermal generators 'pay' to generate their output.[7]

The combination of excess supply and low or negative price outcomes has tended to depress wholesale market prices in the NEM, and reduced the revenues earned by

[7] This effect typically occurs in the NEM and in the WEM overnight or when demand is low, but when wind farms are operating at high levels of output. In these circumstances, coal-fired power stations that cannot turn on or off at short notice are forced to keep operating at 'minimum stable generation'.

existing thermal generators. The number of negative price outcomes has increased, and has been particularly pronounced in NEM regions where the relative penetration of wind to date is highest (South Australia, Figure 2-2).

Figure 2-2. Number of spot prices below zero for mainland regions



Source: AER (2013).

Overall, therefore, and broadly speaking, the effect of the LRET in the NEM has been to depress wholesale prices and therefore to reduce the revenues of all existing thermal generators (reflecting the gross pool design). To an extent, lower wholesale market prices have mitigated the price impacts of the LRET on electricity consumers; the burden of the scheme is effectively shared between thermal generators and consumers.

2.3.2 Western Australian Electricity Market

Electricity is also traded in the Western Australian Electricity Market (WEM), which encompasses the South West Interconnected System (SWIS), and is estimated to account for around 6 per cent of Australian electricity demand (AEMC 2011). The WEM is also characterised by excess generation capacity until at least 2018-19, or until 2020-21 if Kwinana Stage C remains in service (IMO 2013).

The WEM is organised differently than the NEM and the effects of the LRET differ. The WEM is a 'net' pool, and it incorporates a capacity payment. 80 to 85 per cent of electricity is bought and sold through confidential long-term bilateral contracts between retailers or large customers and generators; only net amounts are settled in the energy market (Economic Regulation Authority, ERA 2013, 2013a). The WEM itself consists of a capacity market (the 'Reserve Capacity Mechanism', RCM), and two short-term markets in which differences between bilateral contract positions are traded. The purpose of the RCM is to ensure that there is sufficient generation capacity to maintain reliability. Certified power stations earn 'capacity credits' through this mechanism; retailers and large customers are required to purchase credits equivalent to their forecast contribution to peak demand.

Given this market design, the main impact of the LRET on the WEM is via the RCM. As in the NEM, significant amounts of wind generation have entered a market characterised by excess supply. However, unlike in the NEM, in the WEM this additional capacity does not affect a single energy market clearing price. Instead, the renewable capacity is awarded credits under the RCM, the cost of which is passed through to consumers.[8] The number of negative price events in two short-term (day-ahead) and real-time balancing markets in the WEM has also increased, reflecting similar factors as in the NEM. However, lesser volumes of energy – short-term variations from contract positions – are traded in these markets, so that the effects on generator revenues are likely to be more limited. Overall, the burden of the LRET in the WEM therefore largely falls on consumers.

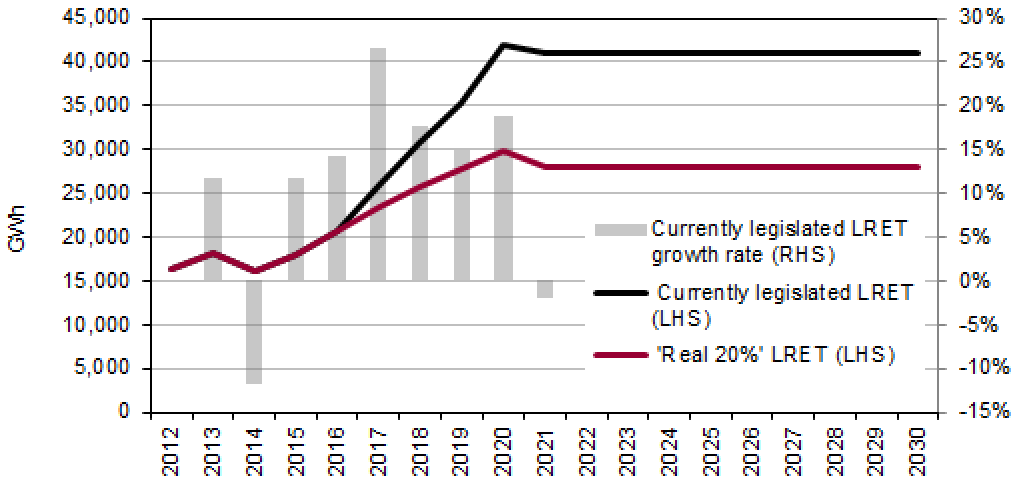
2.4 LRET going forward

A key reason for the surplus in generating capacity in the NEM and in the WEM relates to a fall in electricity consumption in recent years. In the NEM, estimated consumption in 2012-13 was 4 per cent lower than in 2009-10 when the 41,000 GWh target for the LRET was determined. Falling demand trends appear set to continue in 2013-14; the Australian Energy Market Operator's (AEMO's) most recent supply-demand update indicates that as of January of this year (AEMO 2014), consumption was additionally 2.3 per cent lower than over the same period in 2012–13, and that the closure of large industrial loads could be expected to reduce consumption further (AEMO 2014).

The effect of reduction in electricity consumption is that the 41,000 GWh LRET is far higher than the 20 per cent target that was originally envisaged. Figure 2-3 below shows that an updated 20 per cent target would amount to a LRET target of around 28,100 GWh by 2020, less than 69 per cent of the current 41,000 GWh target. Given that demand projections that underpin the estimate in Figure 2-3 have been further revised downwards, a 'real' 20 per cent target is likely to be even lower.

[8] That cost has been reduced because of a rule change, which reduced the capacity value of intermittent forms of generation such as wind in line with reliability attributes.

Figure 2-3. 'Real 20%' target for the LRET versus the 41,000 GWh target (Australia)



Notes: Targets for 2012 to 2016 are left unchanged.

Figures for the currently legislated LRET correspond to the original 41,1000 GWh target, which was based on anticipated Australian electricity consumption by 2020 of 300,000 GWh. The 'real 20%' LRET of 28,079 GWh reflects recent electricity consumption projections by 2020 of around 250,000 GWh (net of around 16,600 GWh of existing baseline renewable energy, and a 4,000 GWh allowance for the SRES).

Source: Acil Tasman (2012).

2.5 Summary

The RET is a mandatory quota that requires electricity retailers to buy a minimum share of electricity generated from small-scale and large-scale renewable sources. This policy is operationalised by awarding STCs to households who install renewable energy technologies and LGCs to large-scale (wind) generators. These certificates are sold to retailers who are required to surrender them to the regulator to meet their liability under the scheme.

The RET has existed in a less ambitious format since 2000, but has undergone a number of important changes. Its design was first reviewed (but left largely unchanged) in 2006. The original small-scale component of the scheme was substantially expanded in 2007, but terminated in 2009. The overall scheme target was significantly increased later in 2009, but the scheme design subsequently had to be revised in 2010 into a small-scale (SRES) and large-scale (LRET) component. Further modifications were made to the SRES after that.

The certificates created and sold under the RET correspond to the subsidies paid to participating households and large-scale renewable generators, and represent a tax on (electricity) production. The cost of these subsidies is ultimately passed on to consumers, but the scheme also affects the wholesale markets in which electricity is traded in Australia. In the NEM, in the recent period of an unprecedented fall in demand, the LRET has tended to depress wholesale market prices, which has mitigated some of the retail price impacts of the scheme on consumers. In the smaller West Australian WEM, consumers bear most of the financial burden of the RET.

3. Economic impacts of the RET

This section considers the short- and longer term economic implications of the RET. Different estimates of the opportunity costs and the subsidies paid under the scheme have been developed over the years. A review of recent studies suggests that the short- and longer-term opportunity costs and subsidies associated with the scheme are substantial. Ultimately, these costs will be reflected in the electricity prices paid by electricity consumers.

3.1 Modelling approaches and terminology

This section provides some background about how the impacts of the RET are typically modelled, the terminology used in this report, and the reported modelling results.

3.1.1 Electricity market models

The detailed cost and other implications of the RET discussed in the following were derived using proprietary electricity market models. These models are simplified representations of a particular power system and how trading takes place in the corresponding market (such as the NEM or the WEM). They combine supply side assumptions (numbers and types of power stations, as well as technology costs and operating characteristics), assumptions about demand, and physical constraints, including the transmission grid. In essence, electricity market models attempt to 'mimic' how power stations are 'dispatched' (operate) to meet demand, what the corresponding price outcomes would be, and what new generation investment or retirements can be expected going forward.

Electricity market models are inherently complex, not necessarily transparent, and incorporate many detailed assumptions or inputs that can influence the results. There are some specific aspects of the corresponding model results that are relevant to the discussion in this section:

- *How new investment and/or reliability are modelled*: In electricity modelling studies, supply is constrained to meet demand, either through generation from existing power stations or as a result of new investment. Similarly, in the case of the LRET, models may incorporate a constraint that requires the target to be met through new investment in renewable capacity. However, projections of future reliability outcomes and generation investment may be misleading if wholesale prices are not high enough for investment to be commercially viable.
- *How generator bidding behaviour is modelled*: In wholesale power markets, generators 'offer' their output at a price of their choosing. When competition is intense, generators may offer their output at marginal (fuel) cost, but there are many circumstances when generators submit (far) higher offers. These generator bidding patterns are generally modelled as repeated 'games'. The

difficulty then arises is that, first, price and despatch outcomes depend on what type of game is being modelled, and, second, that there may be multiple solutions to such games. Hence models are often 'calibrated' in order to mimic historically observed price outcomes. As a result, the predictive value of such models, in terms of their ability to forecast market prices, is very limited when market circumstances and bidding patterns change (Baldick 2002, 2007).

- *How renewable technologies are modelled:* Electricity market models project outcomes for many years into the future. For studies that investigate the LRET, assumptions need to be made about the capital costs of new technologies, particularly wind, and how these costs will evolve going forward. If these costs are underestimated, the aggregate costs of meeting the target will also be underestimated.

3.1.2 Opportunity costs, subsidies and prices

A broader assessment of the effects of the RET is complicated by the use of different terminologies. This report distinguishes between opportunity costs, the subsidy equivalent, and consumer price impacts.

Opportunity costs refer to the costs of what society has to give up in order to achieve the RET, and therefore the trade-offs that have to be made. Opportunity costs are defined with reference to the 'next best' alternative. For instance, a key component of the opportunity costs of the LRET is the cost of the large-scale renewable generation that must be installed. In 'normal' circumstances where electricity demand is growing, the opportunity cost of the additional renewable generation capacity that must be commissioned to meet the LRET (say, $20 billion) would be assessed relative to the most efficient thermal generation alternative (say, $5 billion). In these circumstances, the opportunity cost of the generation component of the LRET would be $15 billion. However, in circumstances where the market is significantly oversupplied, consumption is falling, and no new generation capacity is required for many years, the next best alternative is not to invest (doing nothing). In this case, the opportunity cost of the LRET is the full investment cost ($20 billion in this example).

In addition to the generation cost component, the opportunity costs of achieving the RET extend beyond the cost of the additional renewable generation capacity that must be commissioned to include the costs of connecting that capacity to the grid, any transmission impacts and additional system support services that must be procured, as well as potentially impacts on reliability and the longer-term consequences of market interventions on the efficient operation of wholesale markets.

The subsidy equivalent refers to the share of the RET's opportunity costs that is recovered via the sale of certificates, and which is directly passed on to electricity consumers (PC 2011). The subsidy equivalent constitutes a tax on production and is the most 'visible' aspect of the costs of the RET, but it only accounts for a portion of the scheme's overall opportunity cost. For instance, the subsidy equivalent does not include transmission and other cost impacts.

Given that retailers will pass the expenditures they incur to acquire certificates (i.e. the subsidy equivalent) through to consumers, electricity prices and bills will increase.

As noted in Section 2.3, however, in the NEM the price impacts on final consumers are complicated by the LRET's impacts on wholesale market prices.

3.1.3 Carbon price

As described above, the results of modelling exercises of the RET can differ for many reasons, including the assumptions that are made and how models formulate and solve for generator bidding strategies. However, a key assumption that affects the results, in particular estimates of the subsidy equivalent, is whether or not a carbon price is in place. The link between LGCs and wholesale market prices arises because under the LRET, wind generators earn a ‘bundled’ revenue stream (NERA 2013):[9]

$$Bundled\ revenue = Spot\ price\ revenue + LGC\ revenue$$

Renewable generators such as wind farms, which account for the overwhelming majority of capacity commissioned as a result of the LRET, are not viable on the basis of spot market payments alone. Under the LRET these generators receive an additional payment in the form of LGCs when they produce output. Studies in which the RET is modelled typically assume that the bundled price required by wind farms need only be sufficient for a wind farm to recover its costs, which are largely fixed. The implication is that LGC prices are inversely related to spot market prices, so that LGC prices decline as spot market prices increase and vice versa. All things equal, therefore, LGC prices decrease as a result of the carbon price. Given that the current Government has announced its intention to remove the carbon price, the model results summarised in the following and reviewed in more detail in Appendix A therefore generally cover scenarios without a carbon price.

3.2 The LRET

3.2.1 Opportunity costs

Figure 2-3 above shows that the LRET, as currently defined, will increase steeply in the coming years, with year-on-year increases of 4,600 GWh from 2017 and an increase of around 6,600 GWh in 2020. The requirement to source additional generation on that scale is projected to impose substantial costs on all aspects of the electricity system and ultimately on electricity consumers.

Opportunity costs - Generation

The opportunity cost of the LRET as it relates to the generation sector consists of the capital cost of the additional renewable generation that must be commissioned to meet the target, the associated operation and maintenance (O&M) costs, net of any

[9] In the WEM, renewable generators may also earn a capacity credit that is based on an average generation for the preceding years.

reduction in fuel and O&M costs of thermal generation that is displaced as a result of the scheme.

Estimates of the generation cost of the LRET have been derived in a number of modelling studies. The most impartial and transparent estimate of these costs can be derived from AEMO's projections for the National Transmission Network Development Plan (NTDP), shown in Figure 2-1 (AEMO 2013). NTNDP modelling outcomes under the zero carbon price scenario indicate that, given that the NEM is characterised by significant excess generation capacity, the LRET will be the sole driver of generation investment in the NEM: all new generation until 2020-21 is renewable generation that is solely required to meet the LRET. AEMO's modelling shows that:

- The capital costs of building the renewable plant to meet the LRET would amount to $20.7 billion between 2013-14 and 2020-21.
- $1.4 billion in connection costs would additionally need to be incurred to connect new renewable plant to the grid.
- The combined total investment cost of meeting the LRET would be around $22.1 billion.

The NTDP figures do not include additional O&M costs for renewable generation, but they also do not account for offsetting thermal generation cost reductions. CCA (2012) estimates suggest that these cost reductions may be in the order of $1.5 billion, so that the (net) generation cost of meeting the LRET would be at least $20.6 billion. This figure can be contrasted with the $12 billion estimated to have been invested in the NEM since the beginning of the market in 1998 (Pierce 2012).

There are other studies that estimate the generation costs of the LRET without a carbon price, but the results are often not fully reported and cover different timeframes, as shown in Table 3-1.

Table 3-1. LRET - Opportunity costs of renewable generation (Australia-wide)

Modeller	Costs of large-scale renewable generation ($millions)	Cost of avoided emissions * ($/t C02-e)
ROAM (2014) +	appr. $14,800 (2014-15 to 2020-21)	n/a
SKM MMA (2012) ++	$13,255 (2012-13 to 2020-21)	n/a
NERA/OG (2011) +++	n/a	(LRET not met) $80/t $C0_2$-e in 2011-12 $75/t $C0_2$-e in 2019-20

Notes: * Calculated as the incremental capital and O&M costs, divided by the change in emissions compared to no LRET. + Capital costs only. ++ $2012-13 prices; capital and O&M costs; estimate refers to the 'zero carbon price' scenario. +++ $2010-11 prices.

Source: NERA/OG (2011), SKM MMA (2012), AEMC (2011), ROAM (2014).

The following comments can be made about the LRET generation cost estimates shown in Table 3-1:

- NERA/Oakley Greenwood (NERA/OG 2011) modelled the LRET on behalf of the Australian Energy Market Commission (AEMC 2011). They assumed that only generation projects that would be commercially viable given wholesale market and LGC prices would enter the market. NERA/OG found that if this profitability condition is applied, the LRET would not be met. The shortfall would be 30 to 40 per cent of the target, and increase to more than 50 per cent in the low demand scenario. These result suggest that the opportunity cost of achieving only 60 to 70 per cent of the LRET would still amount to $75 to $80 on a per tonne of emissions abated basis.

- SKM MMA (2012) modelled the LRET on behalf of the Climate Change Authority (CCA 2012). They concluded that the LRET could be met, but also assumed that new investment would be commissioned to meet reliability criteria, irrespective of whether it would be commercially viable or not. There are other reasons to think that SKM MMA's estimate of the opportunity cost of meeting the LRET ($13.3 billion) is an underestimate. SKM MMA (Appendix A):

    - included a number of renewable generation projects that are partly financed by additional government subsidies amounting to at least $3.8 billion;

    - assumed that the capital costs of additional renewable generation, in particular solar and geothermal technologies, would fall steeply;[10] and

    - assumed that high rates of 'learning by doing' would lead to significant cost reductions for the Australian components of renewable technologies.

- ROAM Consulting (ROAM 2014) modelled the LRET on behalf of the Clean Energy Council (CEC). They provide very little detail on how the investment cost estimate of $14.8 billion was derived.

In summary, the most credible estimates of the opportunity cost of the LRET as it relates to the generation sector in the NEM indicate a (net) opportunity cost of at least $20.6 billion. Even modelling studies undertaken on behalf of advocates for the RET show that the opportunity costs of the LRET as it relates to the generation sector are substantial ($13.3 to $14.8 billion). The cost of emissions abatement is estimated at $75-80/t $C0_2$-e if only 60 to 70 per cent of the target is met.

[10] In contrast, the AEMC (2011) and IES (2011) identify a lack of cost effective renewable energy projects, reflecting increasing land use planning concerns about wind farms, and the failure of geothermal technologies to develop as projected. Although anecdotal, ROAM's (2014) sample of recent power purchase agreements (PPAs) for wind farm developments also suggests that the cost of new developments has increased, from $75/MWh in 2007 to $186/MWh in 2013 (Appendix A).

Opportunity cost - Transmission

The opportunity costs of the LRET extend beyond the generation sector to the high voltage transmission grid. The grid on the East Coast of Australia (and in the SWIS) is configured to reliably accommodate power transfers from existing thermal generators to major load centres in the capital cities. The anticipated rapid build-up of renewable generation capacity as a result of the LRET would change these historical power flow patterns. These trends may either require additional investment in transmission or lead to more network 'congestion', whereby flows on particular transmission paths must be curtailed.

A recent analysis by AEMO identified the following opportunity costs relating to the transmission network from the advent of around 8.9GW of additional wind capacity in the NEM by 2020 (AEMO 2013a):

- Significant new wind generation could reduce existing interconnector transfer limits, particularly when wind generation forms a large percentage of the generation mix.
- Up to 5,750 GWh and 1,260 GWh of the maximum potential wind energy in Victoria and South Australia, respectively, could be curtailed due to network limitations.

These impacts have not been costed. However, they point to significant opportunity costs that may arise in the NEM in future:

- The implication of interconnector limitations is that inter-regional trade is curtailed, and that generation can no longer be dispatched in order of least cost. Such outcomes indicate productive and pricing inefficiencies.
- The fact that wind output may need to be curtailed means that, without significant network investment, around 7 GWh of energy generated from wind would never reach electricity consumers (and therefore have no value).

Opportunity cost - Ancillary services

The LRET would additionally increase the costs of managing the power system. One of the key characteristics of generation from renewables, particularly from wind, is that it is intermittent and its output unpredictable. Wind generation therefore creates a number of operational challenges and associated costs for a power system. These challenges relate to rapid swings in output, wide variations in output from one day to the next, and the consequent difficulties of controlling output to balance supply and demand at all times.

When intermittent generation is a small share of total generation capacity, existing thermal generating units can generally compensate for output variations.[11] However,

[11] The above discussion predominantly relates to wind, but effects of this type are also relevant for solar technologies (ERA 2011).

beyond a certain point, additional 'ancillary' (regulation or load following) services are required to compensate for variations over very short timeframes. In addition, wind generation typically does not offer a number of other power system services that are needed to keep the system in a secure operating state, meaning that key parameters, such as voltage and frequency remain within certain technical limits, and that the system can withstand sudden interruptions and faults without collapsing. These services can typically only be supplied by thermal generating plant.

Some of these effects were investigated by ROAM (2011) on behalf of the AEMC (2011). ROAM concluded that significant additional regulation and voltage support services would be needed in the NEM if the LRET is met, estimated at $200 million per annum and $24 million per annum by 2019-20, respectively.

More recently, AEMO identified a number of operational challenges arising from the projected ramp-up of wind generation (AEMO 2013a):

- the displacement of conventional thermal generation by wind generation could reduce the inherent ability of the power system to withstand contingency events;
- power system frequency in Tasmania and South Australia may breach technical limits; and
- increasing levels of wind generation will reduce power system fault levels at some locations, which may lead to further limitations on the operation of wind generation and high voltage direct current (HVDC) interconnectors.

The issues identified by AEMO (2013a) have a number of possible consequences.[12] AEMO concluded that the identified challenges could be addressed within the existing NEM Rules framework by limiting wind generation or, as a last resort, intervening in the market and issuing directions to thermal generators. Alternatively, new ancillary services requirements could be developed or network operators could invest in additional equipment. However, irrespective of how these impacts are managed, they entail an opportunity cost, either in the form of additional services or investment, or by reducing the overall efficiency of market operations that would not be incurred in the absence of the LRET.

3.2.2 Subsidy equivalent

Only a portion of the opportunity costs of the LRET described in the previous section is *directly* recovered from consumers in the form of a surcharge on electricity prices. This share corresponds to the expenditures incurred by retailers in purchasing LGCs (the subsidy equivalent).

Table 3-2 shows different estimates for the subsidy equivalent; the year which they refer to is shown in brackets. The ABS estimated that actual subsidies paid to

[12] Less is known about these impacts on the West Australian WEM. However, the ERA (2010) noted that there was the potential for significant issues as a result of the RET, including in relation to the efficient dispatch of scheduled generators, ancillary services costs and network connections.

renewable energy producers via LGCs amounted to $323 million in 2010-11 (ABS 2012).

Forward projections of annual LRET subsidy equivalent have increased over time, from $283-$459 million in 2010 (PC 2011) to $1,063 in 2012-13 (SKM MMA 2012), and similarly for the long-term estimates. The only aggregate estimate (SKM MMA 2012), suggests that the total subsidy equivalent of the LRET would amount to $15.9 billion by 2020-21. SKM MMA's aggregate figure is difficult to interpret; it is *higher* than their estimate of the aggregate renewable generation cost of the LRET over the same timeframe ($13,255 million, Table 3-1), but *lower* than AEMO's estimate of the aggregate cost of the new renewable generation capacity that would be required under the LRET ($22.1 billion).

Table 3-2. Estimates of the LRET subsidy equivalent (Australia-wide)

	Subsidy equivalent, by year ($millions)	
	Near-term	**Long-term**
ABS (2012)	$323 (2010-11, actual)	
PC (2011)	$283 - $459 (2010)	n/a
Grattan Institute (2011)	$264 - $616 (2011-12)	$897 - $2,093 (2020-21)
NERA/OG (2011)	$812 (2012-13)	$2,240 (2020-21)
SKM MMA (2012) *	$1,063 (2012-13)	$2,825 (2020-21)
	$15,884 (2012-13 to 2020-21)	

Notes: ABS (2012) figures refer to actuals. PC (2011) and Grattan Institute (2011) estimates are based on prevailing LGC prices. NERA/OG (2011) and SKM MMA (2012) estimates are based on modelled LGC prices. * Estimate refers to 'zero carbon price' scenario.

Source: ABS (2012). PC (2011), Daley et al. (2011), NERA/OG (2011), SKM MMA (2012).

3.3 The SRES

The SRES subsidises the installation of solar water heaters and small-scale generation units (overwhelmingly PV) at residential dwellings.

3.3.1 Opportunity costs

The opportunity cost of the SRES include the capital, installation and maintenance costs of the relevant technologies, net of the cost of any energy that may be displaced as a result of these installations.

Table 3-3 summarises estimates of the opportunity cost of the SRES. These costs are substantial, particularly relative to the volume of emissions abated. The aggregate cost of the SRES projected by SKM MMA (2012) amount to around $15.5 billion by 2020-21; given some of the cost assumptions used (Section 3.2.1), these estimates may be on the low side.

Table 3-3. SRES - Opportunity cost of renewable generation (Australia-wide)

	Aggregate costs * ($millions)	Cost of avoided emissions ($/t CO_2-e)
SKM MMA (2012) +	$15,489 (2012-13 to 2020-21)	n/a
ERA (2011)	N/a	$257 - $301/t CO_2-e (2008, 30-year PV life) $640/t CO_2-e (2010, NSW)
NERA/OG (2011) ++	N/a	$500/t CO_2-e (2011-12) $300/t CO_2-e (2019-20)
ANAO (2010) +++	N/a	$447/t CO_2-e (2008)

Notes: * Calculated as the economic resource cost of PV installations divided by the abatement achieved by these installations. + $2010-11 prices. ++ Assuming a life of PV installations of 30 years. ++ 2012-13 prices. +++ Estimates refer to the Solar Homes and Communities Plan.

Source: NERA/OG (2011), SKM MMA (2012). ERA (2011). Australian National Audit Office (2011.

3.3.2 Subsidy equivalent

The SRES mandates electricity consumers as a whole to subsidise the installation of energy saving activities by a subset of customers. These installations confer a significant private benefit on the owners of these installations (ERA 2011). The ABS estimates that households received $1.7 billion in subsidies under the SRES in 2010-11 (ABS 2012). This figure is higher than all of the near-term estimates shown in Table 3-4. Aggregate estimates of the subsidy equivalent for the SRES vary from around $3.4 billion to $5.7 billion until 2020.

Table 3-4. SRES - Subsidy equivalent (Australia-wide)

	Subsidy equivalent ($millions)		
	Near-term	Long-term	Aggregate
ABS (2012)	$1,700 (2010-11, actual)		
NERA/OG (2012)	$989 (2011-12)	$381 (2020-21)	$4,400 (2011-12 to 2020-21)
AcilTasman (2012)	1,469 (2012)	554 (2021)	$5,726 (2012 to 2020)
SKM MMA (2012)	$617 (2012-13)	$292 (2020-21)	$3,441 (2012-13 to 2020-21)

Notes: PC (2011) and Grattan Institute (2011) estimates are based on prevailing LGC prices. NERA/OG (2011) and SKM MMA (2012) estimates are based on modelled LGC prices. * Estimate refers to 'zero carbon price' scenario.

Source: PC (2011), Daley et al. (2011), NERA/OG (2011), SKM MMA (2012).

3.4 Price impacts of the RET

The above discussion has focused on the opportunity costs and corresponding subsidies implied by the RET. As is set out in this section, these effects translate into price impacts for energy users, although in ways that are not necessarily straightforward to determine:

- The subsidy equivalents of the LRET and the SRES are the expenditures that retailers and large customers incur to acquire renewable energy certificates. These expenditures represent taxes on production, which are directly recovered from electricity consumers and increase retail electricity prices.
- The subsidy equivalents are a component of the overall opportunity costs of the RET. Large-scale electricity producers receive the LRET subsidy equivalent, but also payments in the wholesale market for any electricity they generate. The cost of wholesale electricity is in turn reflected in retail electricity prices paid by consumers. In addition, the opportunity costs of the RET also include network, ancillary services and other costs, and which are all (eventually) borne by energy users. However, the price effects reported below only refer to the impacts from the subsidy equivalent of the RET.
- In the NEM, the retail price impacts of the RET have, to date, been mitigated by the fact that the LRET has tended to depress wholesale electricity prices (Section 2.3). Overall retail price rises have therefore been lower than they otherwise would have been. Looking forward, however, wholesale electricity prices in the NEM are likely to increase if thermal generation plant that become unprofitable as a result of the LRET are temporarily or permanently closed. If this occurs, retail prices can be expected to increase.

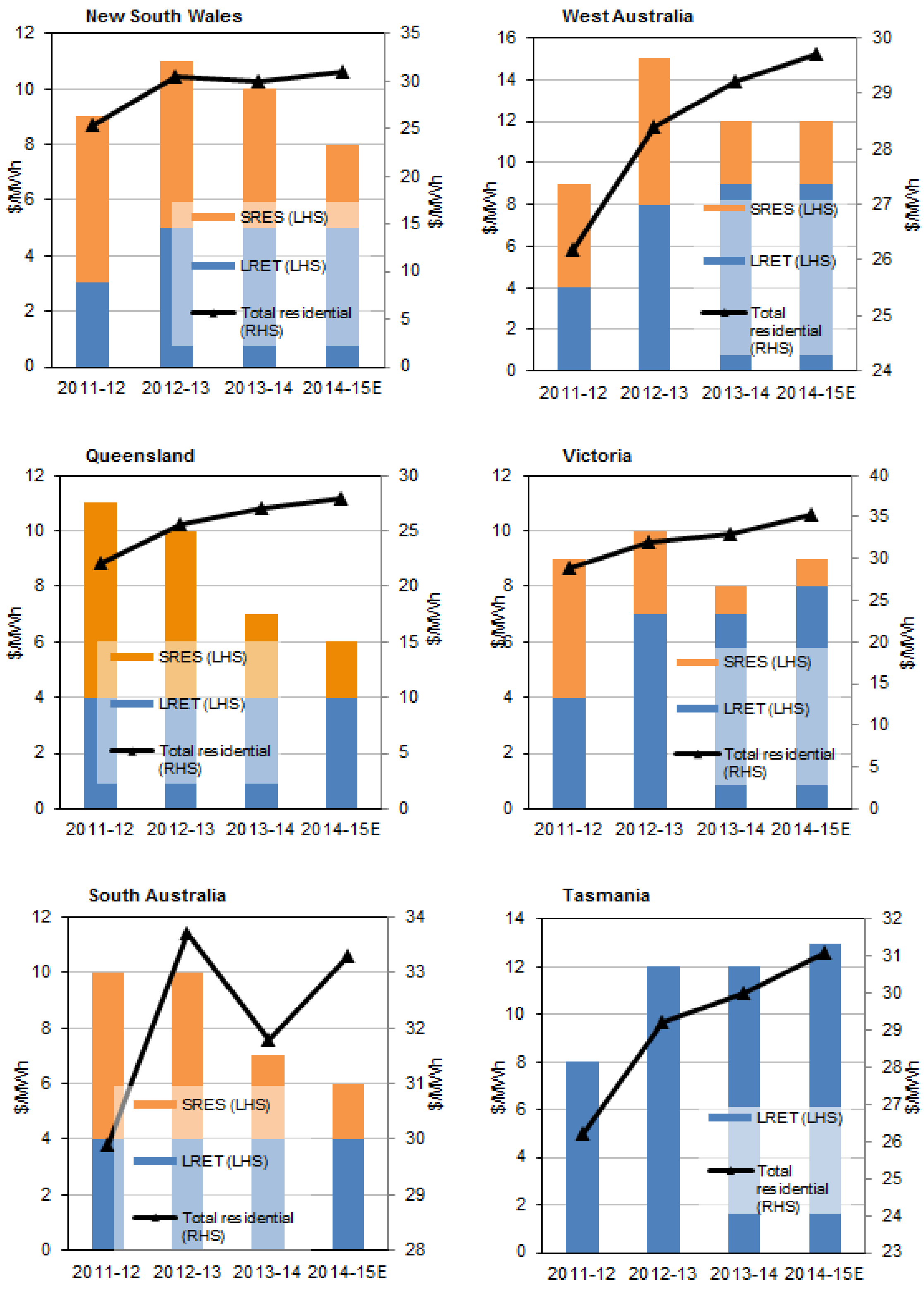
3.4.1 Electricity prices and bills

The effects of the LRET on electricity prices and bills depend on a number of factors, including consumers' consumption, and the share of energy costs in their bills.

Residential

Figure 3-1 shows estimated short-term trends in the RET component of electricity prices for residential consumers. In 2013-14, the combined impact of the LRET and the SRES on prices ranged from $12/MWh in Western Australia and Tasmania, to $7/MWh in South Australia and Queensland. Price impacts of the SRES are projected to moderate after 2013/14 with the phase-out of the solar credits multiplier. IPART estimate that in 2012-13 and 2013-14, the impact of the RET on a typical small consumer's bill would amount to $102 and $107, respectively.

Figure 3-1. LRET and SRES components of residential electricity prices



Notes: Total retail prices include the LRET and SRES components, the cost of jurisdictional 'green' schemes, retail margins, FiTs, distribution costs, transmission costs, carbon costs and whole sale electricity costs.

For Tasmania, the price impact of the SRES is zero.

Source: AEMC 2013. IPART 2011, 2013.

Business customers

SKM MMA (2012) forecast the subsidy equivalents of the LRET and the SRES on a per MWh basis (Australia-wide). They project that the prices would increase from $9.3/MWh in 2012-13 to $14.4/MWh in 2020-21.[13] Applying these figures to average electricity consumption profiles for different mining and manufacturing businesses of different sizes gives an indication of the additional impost faced by businesses who are not exempted from the RET (Table 3-5).

Table 3-5. Estimated bill impact of the RET on businesses, assuming no long-term wholesale price reductions (Australia)

	Average electricity consumption 2011-12 (MWh per year)	Per unit price impact ($/MWh)		Annual bill increase ($ per year)	
		2012-13	2020-21	2012-13	2020-21
			Mining		
0- 19 employees	635	$9.31	$14.45	$5,909	$9,167
20- 199 employees	5,479	$9.31	$14.45	$51,018	$79,147
200 + employees	11,0346	$9.31	$14.45	$1,027,521	$1,594,041
			Manufacturing		
0- 19 employees	156	$9.31	$14.45	$1,455	$2,258
20- 199 employees	1,222	$9.31	$14.45	$11,376	$17,647
200 + employees	111,526	$9.31	$14.45	$1,038,516	$1,611,098

Source: SKM MMA (2012); ABS 46600DO002_201112 Energy Use, Electricity Generation and Environmental Management, Australia, 2011-12.

The figures in Table 3-5 do not take account of future wholesale price reductions that have been projected as a result of the LRET, for the following reasons:

- As discussed in Section 3.1 above, predictions of future wholesale electricity prices can be problematic if they assume that generators' bidding patterns do not change over time. One of the criticisms of SKM MMA's (2012) modelling on behalf of the CCA was therefore that the results overstated the extent to which wholesale prices would fall as a result of the LRET, since generators would attempt to change their bidding strategy in order to raise wholesale prices and increase their profitability.

[13] However, as discussed in Section 3.2, these estimates are likely to be on the low side given that SKM MMA's (2012) assumptions of reliability-driven thermal generation investment, as well as rapid cost reductions for renewable technologies.

- A second issue, set out in Section 3.4.2 below, is that generators will temporarily or permanently withdraw capacity if wholesale prices remain low for extended periods of time, which will in turn raise wholesale prices. How future capacity withdrawals are modelled therefore crucially affects future price predictions. In this context it should be noted that SKM MMA (2012) predicted that 420MW of thermal capacity would be withdrawn in the NEM between 2012-13 and 2020-21; this contrasts with 1,060MW of capacity whose closure had already been announced, but was included in SKM MMA's modelling (Yallourn, Tarong), and 885MW of capacity closed in 2014 (Swanbank E, Wallerawang C). AEMO's projections in the NTDP assume significant additional generator retirements (Figure 2-1).

Going forward, and as discussed in the following, given that a number of NEM participants have reported losses in their wholesale market operations, NEM generators can be expected to adjust their operating capacity, so that offsetting wholesale price impacts of the LRET would also fall away.

The results summarised above contrast with statements by the Clean Energy Council (CEC), that 'future power prices will be lower' with the RET than without the scheme, albeit not until 2018-19 (CEC 2014). However, a review of the modelling study on which this statement is based (ROAM 2014) shows that this finding reflects very low forecast wholesale price trends going forward. These low future wholesale market prices in turn appear to be based on the assumption that all currently mothballed (thermal) generation plant are brought back online and that no further generation capacity is retired; that is, the NEM would remain permanently oversupplied. This would not seem to be a credible basis for forecasting long-term price outcomes.

3.4.2 Wholesale prices

It is generally acknowledged that the LRET has, to date, in the recent period of unprecedented fall in demand, depressed electricity wholesale prices in the NEM. Many modelling studies have accordingly projected similar price reductions into the distant future. For instance, NERA/OG (2011) forecast that the LRET would reduce wholesale prices in the NEM by around $3/MWh in 2013-14 and by around $13/MWh by 2020-21. Other modellers such as ROAM (2014) forecast significantly greater price differentials.

Artificially reduced wholesale market spot prices imply that some share of existing thermal generators' assets is effectively stranded, and at least in part account for the generator retirements that have already been observed and are expected in the NEM going forward (Section 2.3). Some commentators have argued that these wholesale price reductions constitute a 'benefit' for electricity consumers, but this interpretation is short-sighted. A policy that has the effect of artificially depressing wholesale prices and causing thermal generators to exit the market, and which furthermore does not support new coal- or natural gas-fired generation investment that is essential to maintain reliable electricity supply, is not sustainable, nor is it in the longer-term interests of electricity consumers.

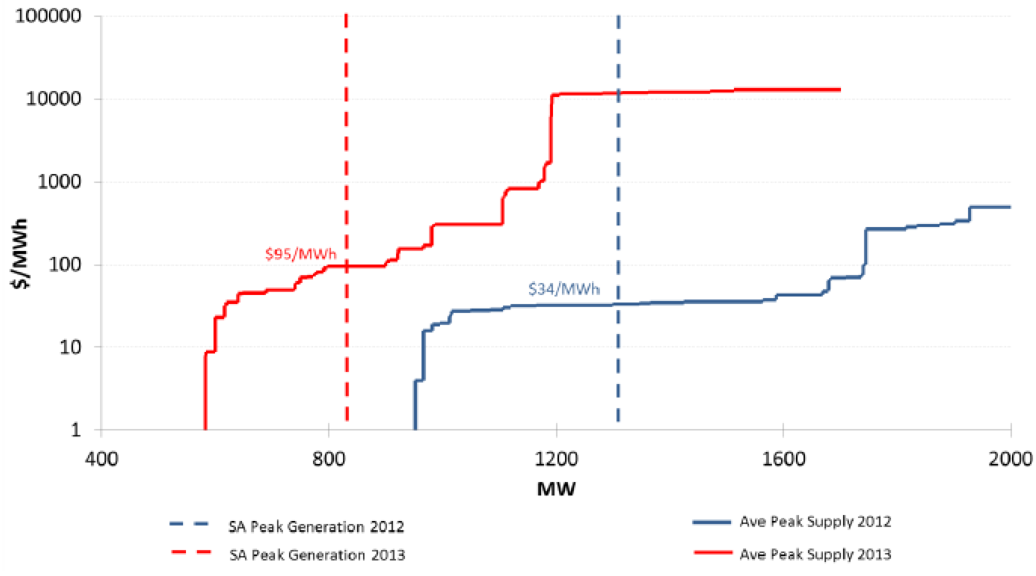
Perhaps more importantly, there are also good reasons for thinking that currently observed lower wholesale prices would not be maintained as the electricity sector adjusts to new circumstances. As discussed in Section 3.1, projections of future spot market prices, such as those reported above, rely crucially on what assumptions are made about generation investment and retirement decisions, and how bidding behaviour by generators is modelled. There is no reason to assume that past bidding patterns will hold in future, particularly if, as expected, a greater share of thermal generation capacity exits the market.

The Australian Energy Regulator's (AER's) 'Special Report' on market outcomes in South Australia in 2013 illustrates these effects (AER 2013). The AER identified very high spot prices, price fluctuations that had not been forecast, and numerous low reserve events where the system came very close to blackout in 2013. These events occurred in April, May and June – 'shoulder' periods when spot prices would normally be expected to be low. During April and May, South Australia experienced 212 events where spot prices were greater than $200/MWh, of which 19 involved spot prices greater than $1,500/MWh. Overall, volume weighted average prices in South Australia were $29/MWh and $60/MWh higher than in Victoria in April and May, respectively.[14]

The AER (2013) identified a number of factors that contributed to these outcomes:

- Thermal generators took unprofitable capacity offline. This resulted in a marked reduction in reliable baseload and peak generating capacity (Figure 3-2).

Figure 3-2. Average supply curves and output level (excluding wind) in South Australia during peak periods in April, May : 2013 versus 2012 (log scale)



Source: AER (2013)

[14] AEMO issued 'lack of reserves' (LOR) 1 notices (insufficient supply to meet demand in the event of the loss of the two largest generating units) on 34 days, LOR2 notices (insufficient reserves to manage the loss of the largest generating unit) on 7 days, and one LOR3 notice (insufficient generation to meet demand).

- Output from wind generators was exceptionally low, corresponding to only 27 per cent of installed capacity during peak times, and falling to less than 11 per cent of available capacity when spot prices were greater than $1,500/MWh.
- Generators changed their bidding strategies, including Torrens Island power station, the region's most flexible power station, which is normally best able to accommodate intermittent patterns of wind generation.

The AER concluded that (AER 2013, P.4):

> *..these types of market outcomes may become more frequent as conventional merchant generators react to challenging wholesale market conditions associated with flattening demand, input costs and increased levels of installed renewable energy capacity.*

3.5 Longer-term investment and security of supply issues

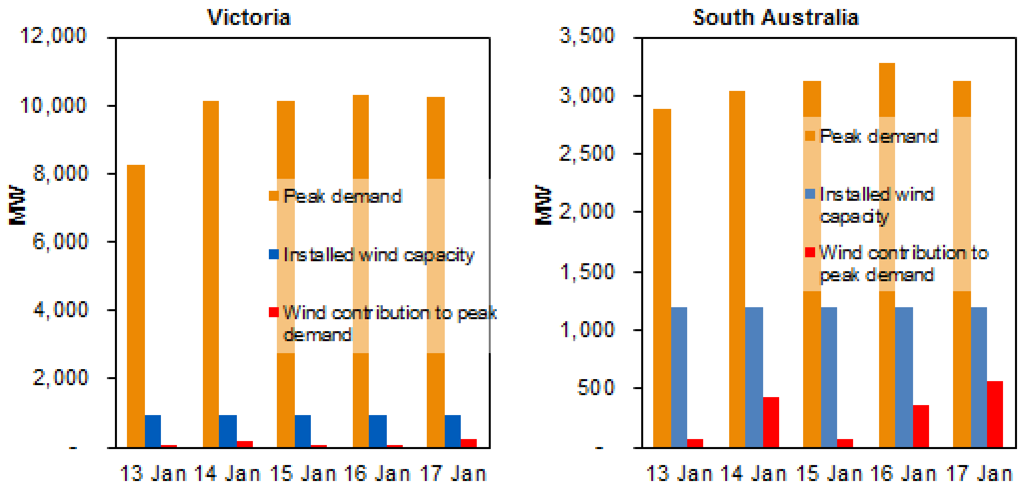
The above sections have focused on the cost, subsidy and price impacts of the RET. This section is concerned with a number of longer-term effects that have received little attention to date, in part because they are difficult to model:

- the potential for 'unserved energy' events, where supply to at least a subset of loads must be curtailed;
- the longer-term impacts of wind generation on key market design parameters; and, relatedly,
- the distribution of trading risks and retailers' ability to hedge against spot price volatility.

3.5.1 Potential for unserved energy events

The evidence in the NEM and in the WEM to date (and in other countries, such as the United States (Joskow 2011) is that wind generation contributes little to meeting peak demand when the electricity system approaches the limits of its capability and generation is most valuable. Figure 3-3 shows the results of a recent analysis by AEMO that highlights the contribution of wind generation in South Australia and Victoria to meeting demand during the heat wave of 13 through 17 January 2014. Minimum reserve levels were breached in both regions so that the failure of any single major generator, interconnector, or transmission asset would have potentially resulted in load shedding. The contribution of wind generation to meeting demand was extremely low in both Victoria (62 MW) and South Australia (71 MW) on 15 January when reserves were at their lowest.

Figure 3-3. Contribution to peak demand by wind generation (January 13 -17 2014)



Source: AEMO 2014a.

The inherent unpredictability of wind generation output means that an increasing share of wind in the generation mix must be compensated by a corresponding increase in the amount of flexible thermal generation capacity. However, while the output from flexible generation plant is vital to maintaining the stability and reliability of the system, these plant may not operate for a sufficient number of hours to be viable as the share of wind output increases (AEMC 2011). In its assessment of the impact of the LRET on electricity wholesale markets, the AEMC therefore concluded that, irrespective of whether or not a carbon price is in place, unserved energy in excess of the reliability standard would become a problem from around 2015-16 onwards in the NEM.

3.5.2 Market price cap and trading risks

Whether or not thermal generating plant that are essential for maintaining system security are commercially viable as wind penetration increases may affect the risks to which NEM retailers are exposed. This effect arises because a ‘market price cap' (MPC) is applied in the NEM to limit spot price outcomes (currently set at $13,100/MWh). The MPC is intended to balance price risks for retailers, on the one hand, and the need to incentivise investment in peak generation capacity that is required when demand is very high, on the other.

Modelling undertaken by ROAM (2013) on behalf of the Reliability Panel to reassess the MPC going forward showed that South Australia requires an MPC that is (significantly) higher than in other regions. While this result in part reflects the particular ‘peaky’ demand profile in South Australia, it is exacerbated by the high wind output in that region. Specifically, the rapid growth of wind capacity in South Australia has reduced the load factors of thermal generating plant (a measure of the proportion of time that these plant operate), as well as the revenues earned by these plant. Hence very high occasional price spikes are required in order for a peaking generator to recover its cost.

Higher MPCs may be required in the NEM as the share of wind output increases across all regions, but would potentially have broader adverse consequences for market participants and market outcomes. In particular, higher price caps would potentially (Frontier Economics 2010):

- require higher NEM prudential requirements to cover against the financial default of market participants, which would in turn raise barriers to entry, particularly for new retailers;
- increase the incentives of generators to exercise market power since the 'payoffs' from withholding capacity would also increase, which would raise wholesale prices; and
- further increase the risks of inter-regional trading in the NEM, which may reduce competition and lead to (inefficient) investment in high-cost regions.

All of the above effects ultimately translate into higher wholesale market prices, higher risk premia, and/or reduced competition, the costs of which will ultimately be borne by consumers.

3.6 Summary

Achieving the RET imposes significant opportunity costs on electricity consumers. The most reliable estimates of these opportunity costs are in the order of at least $20.6 billion to achieve the LRET, and around $15.5 billion for the SRES by 2020-21. Longer-term, the opportunity costs of achieving the LRET can be expected to extend to other aspects of the electricity system. Increasing generation from intermittent wind resources will affect network flows, require compensating ancillary services, and may affect the efficiency of NEM operations, including inter-regional trade and investment. Ultimately, consumers will bear the burden of these outcomes.

A share of the opportunity costs of the RET is currently directly recovered from electricity consumers in the form of higher electricity prices. The subsidy equivalent corresponds to the expenditures that retailers incur to acquire and surrender renewable energy certificates. In 2010-11 that subsidy equivalent amounted to around $300 million and $1.7 billion for the LRET and the SRES, respectively. Going forward, the subsidy equivalent for the LRET is projected to increase rapidly to well in excess of $2 billion per year to reach an estimated total of around $15.9 billion by 2020-21. Aggregate estimates for the subsidy equivalent of the SRES range from $3.4 to $5.7 billion by 2020-21.

In the NEM, the LRET has had the effect of depressing wholesale prices and reducing the revenues of existing thermal generators. Falling wholesale prices tend to offset some of the cost burden of the RET on consumers, but this outcome cannot be considered a 'benefit'. Artificially depressed prices have effectively stranded a share of thermal capacity, which is progressively being withdrawn from the market. Any wholesale price reductions observed to date are therefore likely to be short-lived. Longer-term, a policy such as the RET that reduces wholesale prices undermines investment in thermal capacity that is essential to maintaining reliable electricity supply.

In 2013-14, the RET component of retail electricity bills ranged from around $7/MWh in Queensland and South Australia to $12/MWh in Western Australia and Tasmania. For energy-intensive mining and manufacturing businesses, these impacts represent cost increases in the tens of thousands and even millions of dollars. Going forward, the most recent estimate of the price impact of the RET is $14.4/MWh (Australia-wide) by 2020-21, although this figure is likely to be conservative. This estimate also does not include the opportunity cost impacts of additional system and transmission services that are likely to be required, as well as of broader market inefficiencies.

4. Exports and economic growth

Section 0 focused on the opportunity costs of the RET and the price impacts on consumers who shoulder the burden of the subsidies paid to large-scale producers of renewable energy and households benefiting from the SRES. This section considers the broader implications of this policy on trade-exposed industries, in particular the mining sector, as well as its implications for productivity and economic growth.

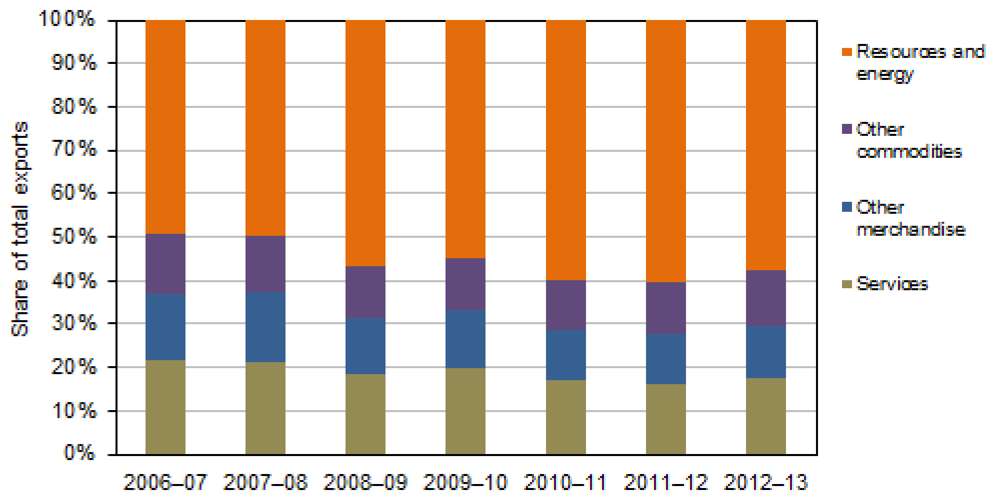
4.1 Competitive context

Australia has a competitive advantage in the form of low-cost, reliable coal supplies. The short-run generating costs (SRMC) of coal-fired plant in the NEM vary depending on age, location and other factors, but most of the larger units have an SRMC in the \$10 – \$15/MWh range, and a significant number have an SRMC well below \$5/MWh.

Under current policy settings for the RET, the share of generation from coal-fired plant across Australia would fall from 71 per cent in 2012-13 to 63 per cent by 2020-21, and from 76 per cent to 68 per cent in the NEM across the same timeframe (SKM MMA 2012). That transformation would be achieved by effectively writing down the value of a substantial share of Australia's existing thermal generation asset base, and replacing it with high-cost and unreliable renewable alternatives.

The high cost of achieving the RET would fall on all energy users, but would particularly affect the competitiveness of Australian exports. At more than \$170 billion in 2012-13, the Australian mining sector accounted for almost 60 per cent of Australian goods and services exports (Figure 4-1).

Figure 4-1. Australian goods and services exports



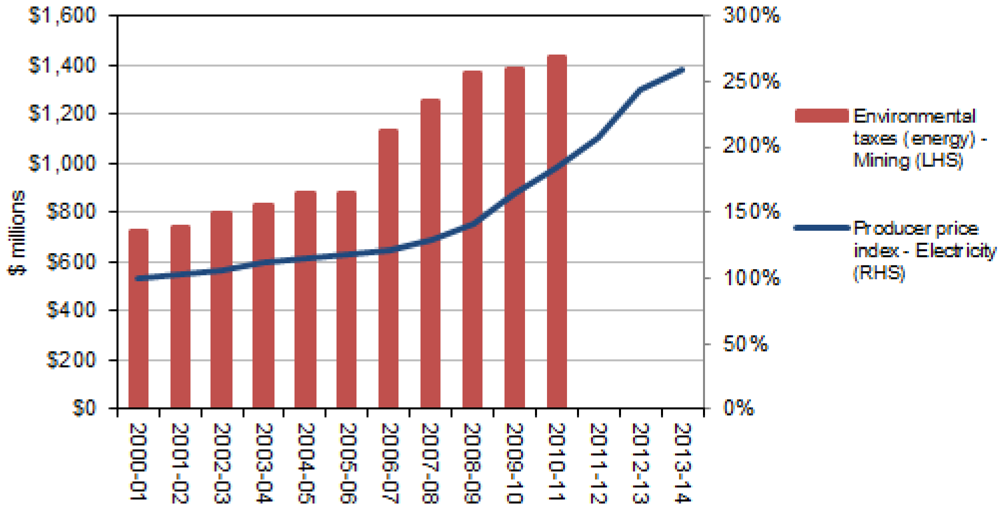
Notes: Resources and energy include coal, coke and briquettes; other fuels; metalliferous ores and other minerals; gold; other metals.

Source: BREE, 2014. Resources and Energy Quarterly Statistical data, March.

The mining sector is also a major contributor to economic growth, with growth in gross value added consistently outstripping aggregate GDP growth in Australia in recent years. In recent years, the sector has made a significant direct contribution to economic activity in Australia and the incomes of Australian residents through the creation of high quality and well-paid jobs, increased demand for domestic services, tax and royalty payments, and after-tax profits paid to Australian residents (RBA 2011).

Australian producers of resources and energy commodities compete to sell their output in intensely competitive and transparent global markets, in which they are price takers. Forecasts of rapidly growing minerals exports (and the prosperity that these exports bring to Australia) presuppose that Australian production remains competitive in the global marketplace. Irrespective of these commercial imperatives, the expenditures incurred by the mining sector, both for electricity and for environmental energy taxes (mainly renewable energy certificates) have increased sharply in recent years (Figure 4-2). Producer electricity prices have more than doubled, while energy taxes on production have increased from $723 million in 2000-01 to more than $1.4 billion in 2010-11. Going forward, these input costs can be expected to rise sharply, given that the RET will rapidly increase.

Figure 4-2. Electricity price and environmental energy tax impacts on the mining sector



Notes: Environmental taxes on energy are: excise on petroleum products; import duties ozone protection and synthetic GHG levies; renewable energy certificates. Environmental taxes do not include the carbon price.

Source: ABS 2012. ABS, 2014. 6427.0 Producer Price Indexes, Australia.

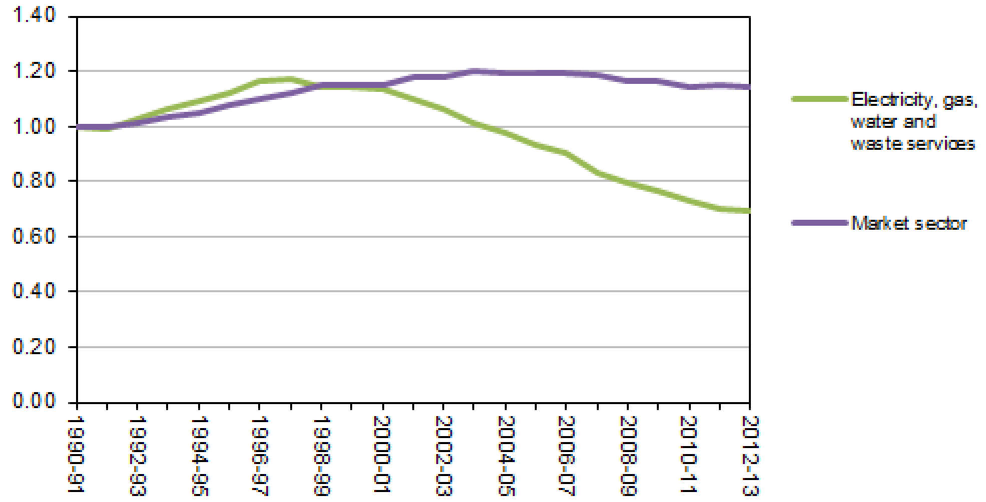
4.2 Impact on productivity

Policies that strengthen and build on Australia's competitive advantage by improving productivity are key to Australia's future prosperity and standard of living. In recent years, the PC has highlighted a pronounced decline in multifactor productivity (MFP) in the Australian market sector (PC 2013).[15] One of the industries that has most

[15] MFP is a measure of how well both labour and capital are combined to generate output (value added).

contributed to the slowdown is the utilities sector, comprising electricity, gas, water and waste services (Figure 4-3). The electricity supply division was an important contributor to this productivity slowdown with MFP falling by, on average, -2.7 per cent per annum between 1997-98 and 2009-10; this productivity decline was a major constraint on long-term productivity growth in the Australian economy (Topp and Kulys 2012).

Figure 4-3. MFP productivity indexes - market sector versus utilities



Notes: 1990-91=100. MFP is the ratio of output (value added) to the combined inputs of labour and capital, measured in volume terms. The market sector consists of ANZSIC06 Divisions A to K, R.

Source: ABS 2013, 5260.0.55.002 Estimates of Industry Multifactor Productivity, Quality adjusted hours worked basis.

There are a number of reasons for the pronounced productivity fall in the electricity supply sector. Around half of the decline reflects an increase in the ratio of peak to average demand. A second important factor relates to substantial investment in network infrastructure.[16] However, an additional factor identified by the PC relates to the impact of the MRET and the RET, and a corresponding shift to higher cost electricity supply sources. The PC noted that from the late 1990s onwards Australia began to move away from coal as the primary source of new baseload and intermediate generation capacity, first to natural gas, and then to renewable fuel sources.

The decline in productivity associated with the RET (and its precursor, the MRET) is the result of a structural trend, and reflects permanent increases in the cost of inputs required to produce each unit of output in the electricity supply sector. Given the timeframe analysed by the PC (1997-98 to 2009-10, Topp and Kulys 2012), the size of the negative effect on measured MFP due to LRET is likely to have been relatively small. However, as noted by the PC, productivity in the electricity supply sector will continue to decline as more renewables (particularly wind power) are brought into the system as a result of the RET.

[16] However, given that much of the investment is in long-lived assets that would not be fully utilised until sometime in the future, the resulting impact on MFP may be considered cyclical and therefore temporary in nature.

4.3 Electricity and economic growth

The opportunity costs of achieving the RET will increase electricity prices and will further decrease electricity consumption in Australia. It is sometimes asserted that electricity constitutes only a relatively modest share of expenditures in modern economies, and that substitution and technical change can effectively ‘decouple’ economic growth from energy consumption. It is therefore argued that costly energy policies such as the RET would not cause great ‘harm’ to an economy. However, this perspective does not take into account the key role of electricity consumption as a driver of economic growth (Stern 2004, 2011).

The recent research on the role of electricity in a modern economy is relevant to how a policy such as the RET can be assessed from a broader, economy-wide perspective. On the face of it, energy used per unit of economic output has declined in advanced economies. However, to a large extent, this trend reflects shifts between different types of fuel consumption. Different energy carriers vary in their relative economic usefulness or ‘quality’ (for instance, in terms of their flexibility and the value of activities they can be used for), and electricity is generally considered to be the highest quality form of energy. When the shift towards electricity use is accounted for by adjusting for the quality of energy inputs, energy use and the level of economic activity are found to be tightly linked. A factor of production such as electricity, which accounts for a relatively small share of aggregate expenditures, is then found to be far more productive than its share of aggregate inputs would imply (Ayres and Warr 2005).

Quantifying the link between energy consumption and economic growth is complicated by the statistical properties of the underlying time series data. However, recent research using advances in statistical techniques has found that either quality-adjusted measures of energy or of energy measured in terms of ‘useful work’ – both of which give greater weight to electricity use – ‘cause’ GDP growth. These results apply to a number of countries, including the United States, Korea and Canada (Stern 2011, Warr and Ayres 2010).

4.4 Summary

The RET can be expected to have wider adverse consequences that extend beyond its short- and longer-term costs for Australian electricity consumers.

Australian electricity consumers, including Australian industries, benefit from abundant coal supplies and the availability of low-cost, reliable electricity generated from coal. The RET acts to undermine this competitive advantage. At an industry level, the RET constitutes a tax on production, which raises the costs of energy inputs. Higher input costs particularly affect the competitiveness of the Australian exports and specifically the Australian mining sector, which makes a significant contribution to economic growth. At an aggregate level, the RET has been identified as a source of a structural decline in productivity growth in the electricity sector, which acts as a significant drag on the productivity growth of the market sector of the Australian economy.

Costly policies such as the RET raise electricity prices and consequently tend to reduce electricity consumption. However, in modern economies, the use of high-quality forms of energy such as electricity is far more important than its share of aggregate expenditures would imply. Economy-wide growth models that account for qualitative differences between different forms of energy, and in particular the increasing importance of electricity, suggest that energy use is a driver of economic growth. Policies that reduce electricity consumption therefore have a negative effect on future economic growth.

5. Assessment and policy recommendations

This section considers the overall economic trade-offs implied by the RET, in terms of what the RET is likely to achieve and its opportunity costs. The RET can be assessed on the basis of the policy objectives set out in the legislation, but also from a broader economic welfare perspective. While subsidies paid under the RET have supported the growth of the renewable industry, emissions reductions achieved by the scheme have come at a high cost. The recommendation in this report is therefore not to increase the target beyond current levels.

5.1 Achievements and costs of the RET

The objects of the Renewable Energy (Electricity) Act 2000 are:

(a) to encourage the additional generation of electricity from renewable sources; and

(b) to reduce emissions of greenhouse gases; and

(c) to ensure that renewable energy sources are ecologically sustainable.

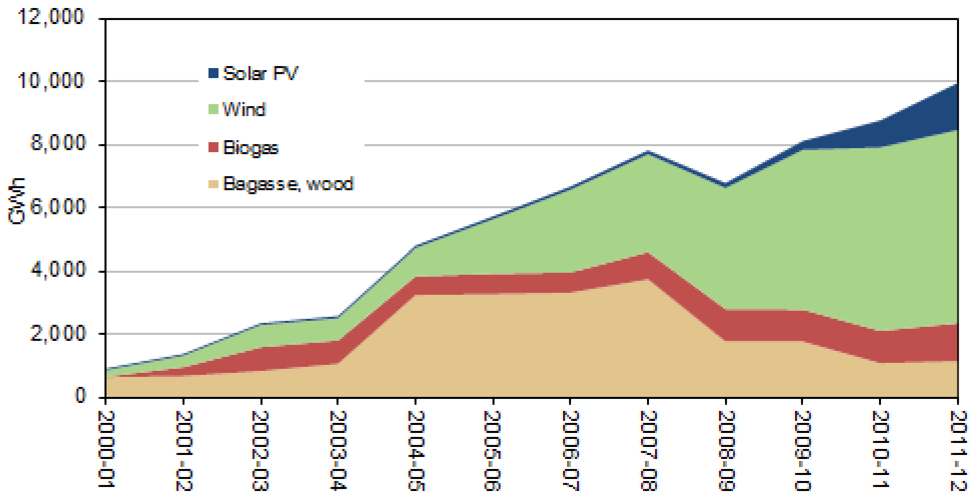
The interpretation of (c) is unclear and is not discussed in the following.

5.1.1 Additional generation from renewable sources

The objectives of the RET include a commitment to increase the share of electricity generated from renewable sources in Australia. This objective has been achieved via the considerable subsidies transferred to the renewable energy industry and household beneficiaries via higher prices paid by electricity consumers as a whole.

Since 2001, 400 power stations (overwhelmingly wind) have been accredited under the LRET; installed wind generation capacity has increased from around 100 MW in 2001 to over 3,800 MW in 2013 (Commonwealth of Australia 2014). Generation from renewable energy has increased almost ten-fold since 2000-01 (Figure 5-1). Over that time, the role of biogas, bagasse and similar fuels has diminished, while wind output increased from 210 GWh in 2000-01 to around 5,800 GWh in 2011-12. The dominant role of wind generation in meeting the RET is consistent with predictions made by the PC in 2008: mandatory volume quotas such as the RET encourage the development of the cheapest and already mature (renewable) technologies, and do not facilitate technology development and innovation.

Figure 5-1. Generation from renewable sources (2000-01 to 2011-12)

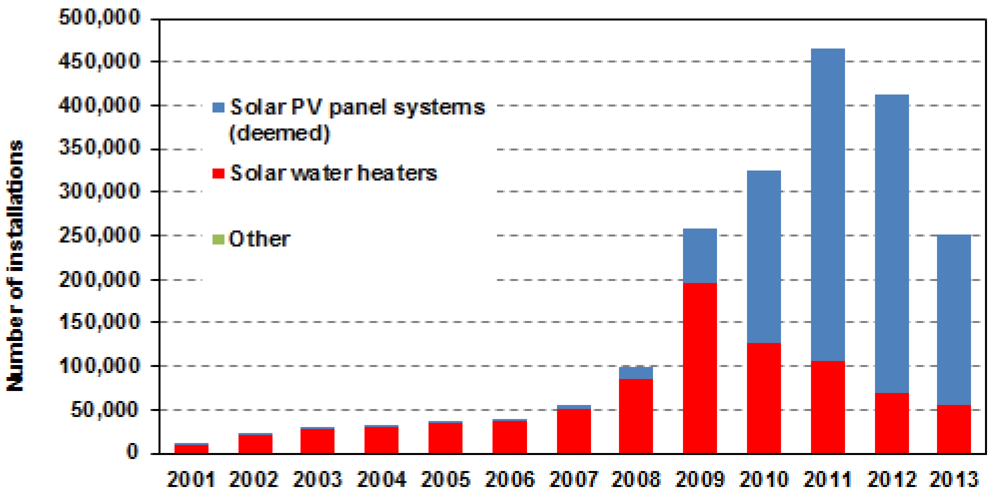


Notes: Excludes generation from hydroelectric sources.

Source: BREE 2013, 2013 Australian energy statistics, BREE, Canberra, July.

In addition, more than two million small-scale renewable energy systems have been installed under the RET, including around 1.2 million solar PV systems and 850,000 solar water heaters (Figure 5-2).

Figure 5-2. Small-scale installations by installation year



Source: Clean Energy Regulator 2014.

The tremendous expansion of renewable energy generation has unambiguously benefited the Australian renewables industry, overseas exporters of PV and wind generation equipment, as well as participating households who gain from lower electricity bills. However, the support of renewable energy has come at a high cost. Subsidies paid to renewable energy producers have increased from $44 million in 2001-02 to $323 million in 2010-11 (ABS 2012). Subsidies paid to households increased from $11 million to $1.7 billion over the same timeframe. These direct subsidies are recovered from all electricity consumers in the form of a tax on electricity production.

Going forward, the extent of sectoral subsidies and the wider cost impacts on the electricity sector are projected to increase substantially. As set out in Section 0, if the RET is indeed achieved, the small- and large-scale generation costs alone could surpass $36billion by 2020-21.

5.1.2 Emissions abatement

The CCA (2012) cites analysis undertaken by SKM MMA (2012a) on behalf of the CEC, which estimated the abatement achieved by the RET at around 20 Mt $C0_2$-e between 2001 and 2012.

Scope of abatement

The volumes of greenhouse gas (GHG) emissions abated because of the RET are uncertain. Estimates of emissions abated depend on how electricity market operations are modelled and what assumptions are made about the number and quality of installations at the household level.

The real extent of emissions abatement as a result of the LRET is difficult to gauge, because certain aspects of the electricity system are difficult to model. For instance, thermal power stations that are required to compensate for short-term variations in wind output may need to be kept on idle or otherwise operating at less efficient output levels (i.e. at minimum stable generation). Power stations that operate in this way consume more fuel and generate more emissions than would otherwise be the case. Capturing these effects requires detailed modelling of generator operating patterns and changing heat rates.

Any emissions abatement attributed to the SRES would be particularly uncertain. The emissions abatement attributed to small-scale installations is not measured directly, but is 'deemed' on the basis of a simplified, *ex ante* calculation undertaken by CER. As noted by ANAO (2010), only a very small proportion of these installations are ever inspected by the regulator.[17] Deeming calculations are furthermore difficult and contentious, given the importance of numerous assumptions about the equipment in question, including how efficiently it operates, and its useful life. For instance, CER's deeming calculation for solar PV units takes into account the rated power output and post code of the installation, and assumes that these units operate for up to 15 years. This calculation does not factor in site-specific factors such as the positioning of the units, the extent of direct sunlight, the location of the inverter, or whether the system is being monitored, cleaned, and maintained. In other contexts, for instance, in estimating the amount of energy saved by energy efficient light bulbs, deeming calculations have been found to be questionable.[18]

[17] For instance, CER (2013) reports that approximately 32.5 million small-scale technology certificates were validated in 2012-13, but only 3,349 inspections of small-scale installations were undertaken.

[18] For instance, significant divergences have been found in the estimation of deemed savings for a 15W compact fluorescent lamp (CFL) in the United States. A 15W CFL installed in Vermont was deemed to save 332 kWh over its

Abatement costs

Notwithstanding questions about the 'real' abatement achieved by the RET, the very considerable subsidies paid to the renewables sector and households under the policy translate into a high cost of abatement. For the LRET, the costs of avoided emissions are projected to be in the range of \$75 to \$80/t $C0_2$-e even if only 60 to 70 per cent of the target is achieved. For the SRES, realistic estimates range from around \$300/t $C0_2$-e to more than \$640/t $C0_2$-e. These abatement cost estimates are considerably higher than the carbon price, currently set at \$24.15/t $C0_2$-e.

High abatement costs are a reflection of the scheme's design. At the large-scale level, the LRET effectively prioritises the financial support of the renewable industry over direct abatement activities. For instance, a policy such as the carbon price directly reduces carbon emissions because it changes the relative costs of all generators in the market. The output of emissions-intensive generators becomes more costly and these generators operate less, and vice versa. In contrast, the LRET mandates that a specified (minimum) quantity of electricity must be generated from renewable (typically wind) generators. The effect of this policy is to displace the output of higher cost thermal generators, irrespective of their emissions intensity. In practice, the LRET has then tended not to displace high emissions generators (AEMC 2011, P. vii):

> *The modelling by our consultants forecasts that under both the LRET and SRES, renewable generation will often not displace the highest emitting plant in the NEM (coal fired generation, and particular brown coal generation), but will instead often displace gas fired generation. The effect is particularly pronounced for residential solar PV, which generates during the daytime hours, so will often displace mid-merit gas fired plant. Baseload coal plant would continue to generate including during the night when solar PV does not generate.*

The very high abatement costs at the small-scale level in turn reflect the very high cost of PV installations subsidised by the SRES. Estimates of the long run marginal cost (LRMC) for a typical 1.5kW system in Sydney range from \$422/MWh for a 25-year economic life to \$785/MWh for a 7 year economic life (Nelson et al. 2011). Electricity produced in this way is therefore vastly more costly than electricity from thermal or even renewable, utility-scale energy technologies.

5.1.3 Additional employment

Advocates of the RET such as the CEC have argued that the RET will be an important source of job creation. The CEC (2014) states that the policy will generate approximately 18,400 new jobs by 2020.

The CEC's estimates are based on a study prepared by ROAM (2014). ROAM's estimate is predicated on a fixed 'multiplier' of 15 jobs/MW of capacity installed (provided by the CEC), and refers to the 'peak' number of jobs created. If this estimate were accepted at face value, and taking ROAM's forecast that the current RET would

lifetime, 149 kWh in Connecticut, 119 kWh in California, and 450 kWh by the US Environmental Protection Agency (Loper et al. 2010).

underwrite $14.8 billion of new investment, the cost to society per 'new' job created would amount to around $800,000.

In reality, however, the figures cited by the CEC almost certainly overestimate the employment impacts of the RET. ROAM's estimates:

- presuppose that there is an existing pool of skilled but unemployed workers (for instance, qualified tradespeople or engineers), who would move from unemployed status to a full-time position in the renewable sector; and
- fail to consider any corresponding negative impacts on employment in other sectors of the electricity supply industry, in particular workers in coal-fired generating plant who are mothballed or retired.

Employment estimates of the type advanced by the CEC obscure the broader negative implications for economic welfare because they fail to account for off-setting impacts (Frondel et al. 2010). The most immediate effects that arise from subsidising the renewable sector are job losses that result because cheaper forms of conventional energy are crowded out, which in turn impacts upstream (resources) industries. Additional job losses can be expected to arise from the drain on economic activity as a result of higher electricity prices.

5.2 Consistency of the RET with Government policy

The recently released White Paper (Commonwealth of Australia 2014) describes the Government's climate change policy framework and the key initiatives that the Government intends to pursue. The centrepiece of this policy is the Emissions Reduction Fund (ERF), which would purchase emissions reductions from a broad range of sources through an auction process beginning in 2014. The policies set out in the White Paper are intended to support economic growth and boost productivity. A key principle that therefore underpins the design of the ERF is that of achieving emissions reductions at lowest cost.

The RET is not consistent with Government policies to raise productivity and support economic growth, and does not support least-cost abatement. As set out in this report:

- the cost of achieving emissions reductions via the RET is many multiples of the current carbon price, which the Government has committed to removing in order to lower costs for Australian businesses, particularly trade-exposed industries, and to ease cost of living pressures for households;
- the focus of the policy on the renewable sector results in a high cost to the Australian economy and a structural decline in the productivity of the electricity sector; and
- the resulting pressures on electricity prices harm the competitiveness of Australian export sectors and their contribution to economic growth, as well as increasing the burden on households and domestic industries from rising electricity bills.

5.3 Policy recommendations

To date, the RET has achieved a significant increase in electricity generated from renewable technologies. The CCA estimated that renewable electricity generation accounted for around ten per cent of total electricity generation in in 2012 (CCA 2012). Given the high opportunity costs of the policy, however, and in particularly its near-term trajectory and the considerable cost increases this entails, further increases in the share of renewable energy in the generation mix and the corresponding support of the renewables and household sector should not be supported.

5.3.1 Policy confidence and predictability

In its recent review of the RET, the CCA (2012) argued against material changes to the scheme, citing the need to maintain policy confidence and predictability so as to ensure ongoing investment in renewable forms of electricity generation. The CCA concluded that any adjustments to the LRET would reduce investor confidence and increase risk premiums for planned renewable energy projects. The CCA similarly argued that leaving the SRES largely unchanged would provide a degree of confidence and predictability for the small-scale installers, small businesses, and households and community groups participating in the scheme. The CCA did not, however, have similar concerns about the impacts on investor confidence arising from the RET itself and its effects on existing thermal generators who have unambiguously been financially damaged by the policy.

As a general principle, government policies should be consistent and predictable over time. Changes in government policies that retrospectively diminish the value of investments that were made on that basis reduce investor confidence and increase perceptions of risk. In the longer term, interventions of this type harm investment and economic growth.

However, while concerns about the longer-term impacts of a policy on the value of assets that are effectively sunk may be valid, the same argument cannot be made in relation to investment that has yet to take place. A decision not to increase the RET from current levels would not affect past large-scale investments made by the renewables industry or materially reduce the value of certificates held by industry participants.[19] Households who have installed renewable installations would also not be affected if the policy is modified or ended, given that households are deemed advance certificates for any energy produced. More generally, permitting further increases in the RET in line with current policy settings in the interests of policy certainty would imply perpetuating an inefficient industry support policy that comes at a considerable cost to consumers and the broader economy. Overall, a decision not to halt further increases in the target would imply that the interests of a narrow set of beneficiaries of the RET – the renewables industry - outweigh the public interest in an efficient energy policy.

[19] The PPAs that underpin wind farm investments are typically structured so that the purchaser of the energy bears the majority of the risk associated with regulatory change. If the RET is held constant or reduced, LGCs would need to be held for longer, hence there would be a carrying cost.

It is also difficult to argue that changes to the RET going forward would either be without precedent or unexpected. As described in Section 0, the RET and its precursors, the MRET and the Solar Homes and Communities Program have been changed over time, and have been subject to a number of reviews, most recently in 2012 by the CCA. In the course of these revisions, major changes were enacted to both the small- and the large-scale components of the scheme, including the substantial expansion of the target, changes in the number of eligible technologies, and the introduction and subsequent termination of the solar credits multiplier (Section 0). It is also well-known that as the wider cost implications of the target have become apparent, concerns about the current trajectory of the RET have intensified, and that this is reflected in the current prices of certificates.[20]

5.3.2 RET going forward

Considerable investment in renewable energy sources has been underwritten on the basis of the RET to date. These investments will continue to represent a burden on electricity consumers going forward, including because of the substantial overhang of banked certificates that were created as a result of past government policies.

Notwithstanding these future burdens, it can be considered that Australia would suffer reputational damage if past investments undertaken on the basis of the RET were stranded, and if the value of renewable energy certificates held by participants were materially reduced. The policy recommendation is therefore:

- not to support any further increases of the LRET beyond current levels as a means of bringing to an end the rapid growth in industry support and subsidies for the renewables industry;
- to assess the overall costs and benefits, as well as the financial implications on existing owners of renewable assets, including certificates, of alternative paths to winding down the LRET over time; and
- given the exceptionally high cost of the small-scale component of the RET and its questionable value towards achieving an emissions abatement objective, to bring to an end or, at a minimum, rationalise on the basis of a societal net benefit calculation, any future subsidies paid for small-scale renewable installations under the SRES.

[20] For instance, the consulting firm IES Advisory Services concluded that (IES 2014): *LGC forward prices, estimated by various broking firms, match rather closely with the price trajectory of the 20% LRET scenario, signalling that the market is taking the view that a revision of the LRET to 20% of electricity demand will be the most likely outcome from the 2014 RET review.*

5.4 Summary

The RET has achieved its objective of increasing the share of renewable electricity generation in Australia, but at a very high cost to electricity consumers and the Australian economy. The design of this policy effectively prioritises support for the renewable energy sector and participating households over objectives that would promote economic growth and wellbeing in Australia. Claims that subsidies to the renewable sector are a source of additional employment are overstated, and fail to consider the corresponding trade-offs.

Going forward, the RET will rise sharply under current policy settings. While there is a policy rationale for preserving the value of past investments made because of this policy, there is no corresponding reason for continuing a policy that is likely to impose costs in the order of tens of billions of dollars on the Australian economy, with all the negative flow-on effects that such a policy would entail. The recommendation from this report is therefore to rule out future increases to the LRET, and to bring to a close future subsidy payments under the SRES.

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Appendix A. RET modelling studies

This appendix summarises studies that have assessed the cost and price impacts of the RET. With the exception of SKM MMA's analysis for the Climate Change Authority (CCA, SKM MMA 2012), the results reported here relate to the impact of the RET without a carbon price.

A.1 Productivity Commission (2011)

The PC (2011) estimated the subsidy equivalent of the RET in 2010.[21] For the LRET, the subsidy equivalent was estimated as the difference between the long run marginal cost (LRMC) of generating electricity using wind farms (assumed to be $110/MWh), and the average wholesale electricity price (assumed to be $50/MWh). The subsidy equivalent for the SRES was calculated using the average spot price of $37.03 for the 21 million STCs issued in 2010. Upfront STCs received were converted into an annualised value (assuming an economic life of 20 years), and adjusted for the solar multiplier.

Table 5-1. RET implicit abatement subsidy (2010, Australia-wide)

	Subsidy equivalent	Abatement estimates			Abatement subsidy
		Low	Central	High	
	$million		Mt CO_2		$/t CO_2
			LRET		
Lower bound, LGC price = $37.03	283	4	7	8	37 - 69
Upper bound, LGC price = $60	459	4	7	8	60 - 111
LRET range	283 - 459		4.3 - 8.0		37 - 111
			SRES		
7% discount rate	73	0.2	0.3	0.3	230 - 425
3% discount rate	52	0.2	0.3	0.3	152 - 281
11% discount rate	98	0.2	0.3	0.3	283 - 525

[21] As noted by the PC, 2010 was unusual for two reasons: the large number of RECs created as a result of the Solar Credits scheme, and the composition of RECs, the majority of which were sourced from small generation units and solar water heaters.

	Subsidy equivalent	Abatement estimates			Abatement subsidy
		Low	Central	High	
	$million		Mt CO_2		$/t CO_2
SRES range	52 - 98		0.2 - 0.3		152 - 525
RET total	335 - 556		4.3 - 8.0		42 - 129

Source: Productivity Commission 2011.

A.2 AEMC (2011)

A.2.1 NERA/Oakley Greenwood (2011)

NERA/OG (2011) estimated the cost and price impacts of the RET on behalf of the AEMC (as reported in AEMC 2011). Subsequent to the publication of the AEMC's interim report, additional modelling was undertaken to assess the implications of a reduced demand forecast (NERA/Oakley Greenwood 2011a, AEMC 2011a).

NERA/OG used a market optimisation model to assess generation entry and determine the least cost dispatch of generation plants. No carbon price was assumed in the reference case. Unless stated otherwise, all prices are in $2010-11. NERA/OG's modelling approach required new generation plant to be economically viable at prevailing wholesale market prices.

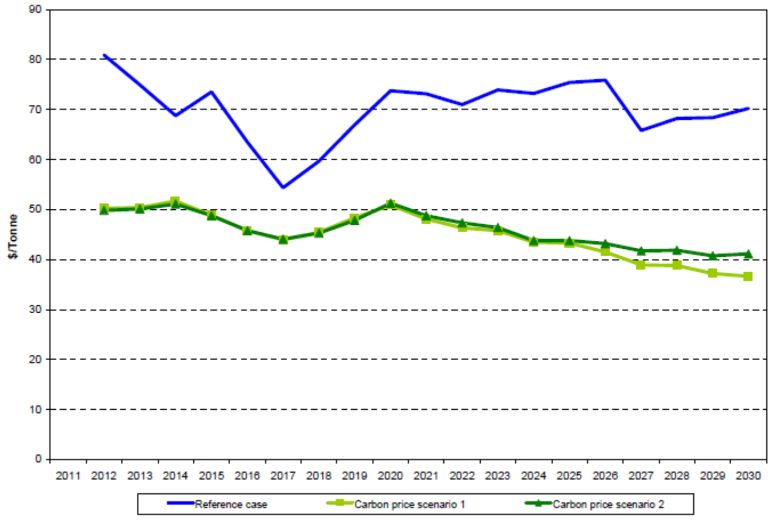
Opportunity cost

NERA/OG (2011) do not report the aggregate opportunity cost of the LRET for the generation sector (referred to as 'abatement cost'), instead reporting the cost of the scheme per unit of emissions avoided.

Abatement costs were estimated as the incremental operating and capital costs associated with the RET, divided by the change in emissions (Figure 5-3):

- LRET abatement costs were projected to fall from just over $80/t CO_2-e to around $55/t CO_2-e by 2015-16 before increasing to around $75/t CO_2-e in 2019-20, and remaining at around $70 - $75/t CO_2-e thereafter;
- SRES abatement costs range from around $500/t CO_2-e in 2010-11 to around $300/t CO_2-e in 2019-20;
- under the low demand scenario, the cost of LRET abatement ranges from around $55/t CO_2-e to around $70/t CO_2-e between 2012-13 to 2030-31;
- for the overall enhanced RET, the average abatement cost was estimated at $185/t $C0_2$-e by 2020 (2010-11 dollars).

Figure 5-3. Abatement costs



Notes: Years refer to financial years. The reference case assumes the LRET is in place but no carbon price.

Source: NERA/Oakley Greenwood (2011)

Subsidy equivalent

The LRET subsidy equivalent (referred to by the AEMC as 'compliance cost') was estimated with reference to retailers' costs of purchasing LGCs or, alternatively, the cost of the penalty price:

- The subsidy equivalent associated with the LRET for Australia overall was forecast to increase from around $812 million in 2011-12 to around $2.24 billion in 2020-21.
- From 2020-21 onwards the subsidy equivalent was forecast to fall to around $1.7 billion in 2030-31.
- Under the low demand scenario, the subsidy equivalent would peak at $2.45 billion in 2020-21, declining thereafter to $1.76 billion in 2030-31.
- 92 per cent of the subsidy equivalent associated with the LRET would be incurred by NEM participants.

The SRES subsidy equivalent was estimated using a fixed price of $40 per STC. The subsidy equivalent of the SRES was expected to fall from around $989 million in 2011-12 to around $381 million in 2019-20 (nominal). The cumulative costs of the SRES was estimated at $4.4 billion by 2020 across Australia.

The total subsidy equivalent of the enhanced RET was forecast to increase from $1.78 billion in 2011-12 to $2.20 billion in 2019-20 ($2010-11).

Wholesale prices

In the NEM, the LRET will dampen wholesale electricity prices:

- with the LRET, NEM wholesale prices were forecast to be around $50/MWh by 2020-21;
- with the LRET, and in the low demand scenario, NEM wholesale prices were forecast to be around $40/MWh by 2020-21;
- without the LRET, wholesale prices were forecast to be around $10/MWh to $15/MWh higher by 2020-21 at around $60/MWh to $65/MWh.

The LRET was not projected to have a significant impact on wholesale prices in the SWIS. With or without the LRET, wholesale prices were forecast to increase from around $67/MWh in 2011-12 to $79/MWh by 2020. The LRET is similarly not expected to impact wholesale prices in the Darwin-Katherine Integrated System.

Retail prices

The overall retail price impact of the RET on residential customers in the NEM was forecast to increase by 37 per cent in nominal terms from 0.97c/kWh in 2011-12 to 1.33 c/kWh in 2019-20. For most of the outlook period, the LRET was projected to account for around 74 per cent of total RET costs.

A.2.2 ROAM Consulting (2011)

ROAM Consulting (ROAM, 2011) assessed the potential impacts of the LRET on the cost of maintaining security of supply on behalf of the AEMC (2011). ROAM forecast that (Table 5-2):

- the requirement for regulation Frequency Control Ancillary Services (FCAS) in the NEM would increase significantly from current levels;[22]
- the increase in Network Support and Control Ancillary Services (NSCAS) costs specifically due to the LRET would be small;[23] and
- potential transmission impacts would also be small.

[22] FCAS involve adjusting supply and demand to ensure that they match at all times, and the system frequency remains stable. They consist of regulation (load following) services – the service of adjusting supply minute by minute to match the variations in load or in intermittent generation, and contingency (spinning reserve / load rejection) – the service of adjusting supply in the event of a generator or load trip.

[23] NSCAS consist of (localised) reactive power ancillary service (voltage control) to control the voltage at different points of the network to within the prescribed standards, and network loading control ancillary service to control the power flow on interconnectors to within short term physical limits.

Table 5-2: Additional FCAS and NCAS costs associated with the LRET ($2011)

	FCAS ($millions)		NSCAS ($millions)	
	2009-10 *	2019-20	2012-13	2019-20
NEM	10	199	17 **	41
SWIS	18	0	0	0

Notes: * Current costs. ** 2012-13 additional costs.

Source: AEMC (2011)

A.3 Grattan Institute (2011)

The Grattan Institute (Daley et al. 2011) estimated the abatement cost of the RET on the basis of past REC prices and using 2010 emissions reductions projections from the Department of Climate Change and Energy Efficiency (Table 5-3). Daley et al. (2011) note that REC costs have varied from around $30-40 to $70 and calculate a range on that basis. The aggregate subsidy equivalent has been derived using these figures.

Table 5-3. RET subsidy equivalent (2010 and 2020, Australia-wide)

	Annual emissions reduction (Mt)	Abatement subsidy ($/t CO_2-e)	Subsidy equivalent ($millions)
2010	8.8	30 - 70	264 - 616
2020	29.9	30 - 70	897 - 2,093

Source: Daley et al. 2011.

A.4 AcilTasman (2012)

ACIL Tasman (2012) modelled the impact of the RET and a ‘real 20%’ RET variant on behalf of TRUenergy. While the LRET estimates incorporate a carbon price and are therefore not strictly comparable, Acil Tasman also estimated the subsidy equivalent of the SRES (which is less sensitive to carbon price assumptions).

SRES subsidy equivalents were derived using PV installation projections prepared by AEMO (National Electricity Forecasting Report, 2012) under their medium planning scenario. Projections for solar water heaters were developed through a stock replacement model. Acil Tasman report an aggregate (nominal) subsidy equivalent for the SRES over the period from calendar year (CY) 2012 to CY 2030 of around $10.1 billion.

A.5 SKM MMA (2012)

SKM MMA (2012) undertook electricity market modelling of RET outcomes on behalf of the CCA for the Authority’s review of the scheme (CCA 2012). With the exception of one scenario, all scenarios modelled by SKM MMA incorporate a carbon price. Selected results relating to a subset of the scenarios considered are reviewed here:

- the 'reference case', which models the impacts of the RET as it stands, using medium demand forecasts, and assuming a carbon price of \$21.75/t $C0_2$-e until June 2015 and a (gradually increasing) carbon price of \$10.72/t $C0_2$-energy thereafter;
- a 'no RET' case, which mirrors the reference case (including a carbon price) but assumes that the RET is removed;
- an 'updated 20%' case, which also mirrors the reference case, but assumes that the current RET target is reduced to 26,400 MWh by 2020;
- a 'zero carbon price' case, which incorporates the RET but assumes that the carbon price is removed; and
- a 'low demand' case, which reflects the reference case, but assumes a low demand forecast.

Opportunity costs

The opportunity cost of the RET for the generation sector are the sum of:

- the fuel costs of existing and new plant;
- the operations and maintenance (O&M) cost of existing and new plant; and
- the annualised capital cost of new plant.

Table 5-4 shows the aggregate cost estimates for the various scenarios, as derived from SKM MMA's output spreadsheet.

Table 5-4. Costs of the generation sector (2012-3 to 2020-21, \$June 2012, Australia-wide)

	Scenarios				
	Reference case *	No RET *	Updated 20% *	Zero Carbon Price	Low demand *
LRET (\$m)	13,110	3,224	8,136	13,255	13,040
SRES (\$m)	15,489	14,832	15,489	15,489	15,489
Thermal (\$m)	81,238	83,647	82,142	81,126	78,663
Total (\$m)	109,838	101,703	105,768	109,870	107,192

Notes: * Incorporates a carbon price. In the 'No RET' case it is assumed the RET will cease on 1st January 2013. A zero target has been assumed from 2013. All committed renewable energy projects are assumed to proceed as planned.

Source: SKM MMA modelling results.

SKM MMA's (2012) modelling appears to target the NEM reliability criterion, so that new generation would be commissioned irrespective of profitability if there is a potential supply shortfall.[24]

In addition, it appears that SKM MMA (2012) may underestimate the (opportunity) cost of renewable technologies. SKM MMA's modelling of new renewable generation capacity is based on a proprietary database of 'known and prospective' projects, a number of which would be funded, at least in part, via additional government subsidies. Hence SKM MMA (2012) assume that:

- Projects subsidised by the Australian Renewable Energy Regulator (ARENA) will proceed: the 250 MW solar thermal Solar Dawn project in Queensland, AGL's 159 MW solar PV project in Broken Hill and Nyngan), and CS Energy's Kogan Creek Solar Boost project (44 MW).
- An additional $3.75 billion funding would be available from the Clean Energy Finance Corporation, including $1.9 billion for network extensions and storage technologies, and the remainder for 'novel' technologies.

A failure to consider the full opportunity cost of renewable technologies would mean that the cost estimates in Table 5-4 are underestimates. This may also account for why, even in the zero carbon price scenario, SKM MMA project that 558 GWh would be generated from geothermal technologies and 1,288 GWh from large scale solar/PV technologies by 2016-17; both are very costly technologies, as well as being untried at scale in Australia.

There are other reasons why SKM MMA's (2012) cost and generation expansion projections may be thought to be optimistic:

- SKM MMA assume that the capital costs of renewable technologies, in particular solar and geothermal technologies, will fall steeply by 2020. In contrast, other modellers assume that the future costs of developing renewable (wind) generation projects will increase. IES (2011), for instance, note that the better sites located near major urban areas will be developed first, with subsequent sites either located near urban areas with higher capital costs or sites with good wind resources but remotely located, albeit with increased costs of connecting to the shared transmission network.[25] Although anecdotal, ROAM's (2014) sample of recent power purchase agreements (PPAs) for wind farm developments also suggests that the cost of new developments has increased, from $75/MWh in 2007 to $186/MWh in 2013 (Appendix A).
- SKM MMA (2012) assume high rates of 'learning-by-doing': the costs of installations in Australia or Australian equipment are projected to reduce by

[24] For instance, SKM MMA (2012) say (P. 104): "After selecting new entry to meet AEMO's minimum reserve criteria, SKM MMA's pool market solution indicates whether prices would support additional new entry under typical market conditions and these are included in the market expansion if required."

[25] IES (2011) note that the increase in cost is a consequence of the need for higher towers, wind turbines tailored to make efficient use of lower wind speeds, and more stringent generation licensing requirements.

20 per cent for every doubling of capacity. McLennan Magasanik Associates' (as SKM MMA were known at the time) learning-by-doing assumptions have previously been assessed by the Productivity Commission (PC, 2008). The PC concluded that these assumptions were 'very optimistic' since they pertained to global learning rates, and the learning rates ascribed all cost reductions to learning-by-doing.

Abatement costs

The CCA/SKM MMA only report incremental abatement costs relative to the reference case, which assumes a carbon price. It is unclear what the abatement cost under the reference case is, hence only incremental abatement costs are reported below (Table 5-5). A positive number illustrating greater emissions for the case shown. Figure 61 further illustrates the relationship between resource cost and GHG emissions under the various RET cases.

Table 5-5. Incremental abatement costs relative to the reference case (2012-13 to 2030-31)

	No RET *	Updated 20% *	Zero Carbon Price	Low demand *
NPV change in resource costs ($m)	-8,645	-4,457	2,035	-5,938
Change in emissions (Mt)	217	119	137	-349
Incremental abatement costs ($/t C02-e)	-40	-38	15	17

Notes: A negative value means the parameter is lower relative to the reference case.

Incremental abatement costs are calculated as the discounted cumulative net resource cost, divided by the cumulative additional abatement.

Source: SKM MMA 2012, Table 3.

Subsidy equivalent

The RET subsidy equivalent (referred to by the CCA/SKM MMA as 'certificate cost') was estimated by:

- for the LRET, multiplying the forecast LGC price in any one year with the change in renewable generation over that year; and
- for the SRES, multiplying the forecast STC price with the volume of SRES expected in the year.

Table 5-6 shows the estimated subsidy equivalents for the various scenarios described above, as derived from SKM MMA's output spreadsheet.

Table 5-6. RET subsidy equivalents (2012-13 to 2020-21, $June 2012, Australia-wide)

	Scenarios				
	Reference case *	No RET *	Updated 20% *	Zero Carbon Price	Low demand *
LRET ($m)	12,767	0	7,741	15,884	13,676
SRES ($m)	3,441	0	3,441	3,441	3,441
Total ($m)	16,208	0	11,182	19,325	17,117

Notes: * Incorporates a carbon price.

Source: SKM MMA modelling results.

Wholesale prices

Table 5-7 shows average wholesale prices for the various scenarios, as derived from SKM MMA's output spreadsheet.

Table 5-7. Average wholesale prices under various RET scenarios ($/MWh, $June 2012)

	Scenarios				
	Reference case *	No RET *	Updated 20% *	Zero Carbon Price	Low demand *
			NEM		
2012-13 to 2014-15	$50	$51	$50	$50	$49
2015-16 to 2020-21	$47	$56	$50	$32	$39
			SWIS		
2012-13 to 2014-15	$66	$74	$68	$59	$62
2015-16 to 2020-21	$64	$73	$66	$54	$58

Notes: * Incorporates a carbon price.

Source: SKM MMA modelling results.

Residential and commercial retail prices

Table 5-8 shows average retail prices for residential and commercial customers under the various scenarios, as derived from SKM MMA's output spreadsheet. Commercial prices were derived assuming lower network costs and retail margins.

Table 5-8. Average residential and commercial retail prices under various RET scenarios ($/MWh, $June 2012, Australia-wide)

	Scenarios				
	Reference case *	No RET *	Updated 20% *	Zero Carbon Price	Low demand *
	Retail prices - residential				
2012-13 to 2014-15	$218	$211	$217	$218	$215
2015-16 to 2020-21	$233	$234	$233	$219	$225
	Retail prices - commercial				
2012-13 to 2014-15	$178	$171	$177	$178	$176
2015-16 to 2020-21	$188	$189	$189	$175	$181

Notes: * Incorporates a carbon price.
Residential consumption is assumed to be 7 MWh per year. Commercial consumption is assumed to be 140 MWh per year.

Source: SKM MMA modelling results.

A.6 ROAM (2014)

ROAM (2014) was commissioned by the Clean Energy Council to model the RET, including the LRET and SRES. The following scenarios were modelled:

- BAU: the currently legislated trajectory of the RET;
- No RET: a repeal scenario, where no new projects are eligible after 2015, but existing and committed projects continue to produce and sell LGCs; and
- Extended RET: a 30 per cent by 2030 scenario.

The modelling assumed that the carbon price would be repealed from 1 July 2014. ROAM provide relatively few numerical results.

Opportunity costs

ROAM (2014) only report renewable investment for the various scenarios. It is assumed that under the ‘no RET' scenario, a small number of renewable projects would still be built, including currently committed projects and some wind generation in Queensland beyond 2020.

Table 5-9. Investment in large-scale renewable generation (2014-15 to 2020-21)

	Nominal ($billions)
BAU	14.8
No RET	3.8
Extended RET	As per BAU + $1 billion per annum 2020-2030

Source: ROAM (2014)

Retail bills

Table 5-10. Comparison of residential bills under the BAU and the 'no RET' scenario (real $2013, Australia-wide)

Bill component	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
			RET (current policy settings)			
Wholesale cost	$333	$330	$371	$386	$418	$408
Network	$949	$949	$949	$949	$949	$949
FiT	$28	$27	$18	$18	$17	$18
LRET	$47	$56	$70	$78	$85	$96
SRES	$20	$15	$16	$17	$18	$19
Other	$349	$349	$349	$349	$349	$349
Total bill	$1,726	$1,726	$1,773	$1,797	$1,836	$1,839
			No RET			
Wholesale cost	$337	$345	$409	$443	$535	$558
Network	$949	$949	$949	$949	$949	$949
FiT	$27	$27	$16	$15	$13	$12
LRET	$32	$34	$33	$30	$24	$22
SRES	$20	$0	$0	$0	$0	$0
Other	$349	$349	$349	$349	$349	$349
Total bill	$1,716	$1,705	$1,757	$1,786	$1,871	$1,891
			Difference RET (BAU) - No RET			

Bill component	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Wholesale cost	-$4	-$15	-$38	-$57	-$117	-$150
Network	$0	$0	$0	$0	$0	$0
FiT	$1	$0	$2	$3	$4	$6
LRET	$15	$22	$37	$48	$61	$74
SRES	$0	$15	$16	$17	$18	$19
Other	$0	$0	$0	$0	$0	$0
Total bill	$10	$21	$16	$11	-$35	-$52

Source: ROAM (2014)

FTEs

ROAM provide an estimate of the number of jobs created in each scenario, based on a survey of published estimates of the number of jobs associated with existing and planned wind farms in Australia. It was assumed that job numbers would be for full-time equivalent (FTE) roles for the duration of a project. For the SRES, ROAM assumed that in any one year, there were 15 jobs/MW of capacity installed in that year, based on a multiplier provided by the Clean Energy Council.

ROAM estimated the number of 'positions' created by 2019-20 and by 2029-30, which they assume to be equal to the *peak* number of jobs (Table 5-11).

Table 5-11. Positions created in the renewable industry in Australia

	BAU	No RET	Extended RET
By 2019-20	18,400	6,600	18,400
by 2029-30	20,300	9,000	21,000

Source: ROAM (2014)

Cost of new wind farm developments

ROAM (2014) provide an overview of PPAs signed for new wind farm developments.

Table 5-12. Summary of PPA prices

Project	Off-taker(s)	Details	Date of PPA announcement	Starting PPA price ($/MWh)
Snowtown	Sun Retail/ Origin Energy	90% of electricity and LGCs to	Pre-June 2007	75

Project	Off-taker(s)	Details	Date of PPA announcement	Starting PPA price ($/MWh)
		December 2018		
Hallett 2	AGL Energy	All electricity and LGC revenue	August 2008	104
Hallett 4	AGL Energy	All electricity and LGC revenue	October 2009	$120
Oaklands Hill	AGL Energy	All electricity and LGC revenue	June 2011	$99
Royalla	FRV	Feed-in tariff (including LGCs)	Sep 2012	$186
Canberra 2	Zhenfa	Feed-in tariff (including LGCs)	August 2013	$178
Canberra 3	Elementus Energy	Feed-in tariff (including LGCs)	August 2013	$186

Source: ROAM (2014)