Centre for Energy and
Environmental Markets

Submission on the RET Review Issues Paper

by

Assoc. Prof Iain MacGill, Dr Jenny Riesz, Dr Peerapat Vithayasrichareon

Centre for Energy and Environmental Markets
University of NSW

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About CEEM and this Submission

The UNSW Centre for Energy and Environmental Markets (CEEM) undertakes interdisciplinary research in the design, analysis and performance monitoring of energy and environmental markets and their associated policy frameworks. CEEM brings together UNSW researchers from the Australian School of Business, the Faculty of Engineering, the Institute of Environmental Studies, and the Faculty of Arts and Social Sciences and the Faculty of Law, working alongside a growing number of international partners. Its research areas include the design of spot, ancillary and forward electricity markets, market-based environmental regulation, the integration of stochastic renewable energy technologies into the electricity network, and the broader policy context in which all these markets operate.

The Federal Government is currently reviewing the Renewable Energy Target. CEEM welcomes the opportunity to contribute to this important and potentially far-reaching process through this submission. CEEM has been researching the Federal Australian Government's Renewable Energy Target for the past decade. Indeed, some CEEM researchers made a submission to the first MRET review in 2003.

Our submission draws on a range of work by researchers associated with the Centre on possible low-carbon electricity industry options for Australia, renewable energy policy design, and facilitating renewable energy integration within the Australian National Electricity Market (NEM). This work is undertaken through projects that are funded by partners including CSIRO and the Australian Renewable Energy Agency. Relevant papers and presentations, and more details of the Centre can be found at the CEEM website – www.ceem.unsw.edu.au.

This is an area of ongoing work for CEEM and we are actively seeking feedback and comments on this submission, and on related work from both the RET Review Panel and other stakeholders with an interest in these important and challenging issues. The corresponding author for this paper is:

Assoc. Professor Iain MacGill
i.macgill@unsw.edu.au
+61 2 9385 4920
Centre for Energy and Environmental Markets (CEEM)
The University of New South Wales
SYDNEY 2052 AUSTRALIA
www.ceem.unsw.edu.au

Executive Summary

The RET is an extremely important policy mechanism that is successfully supporting the renewable energy industry in Australia. Reduction or removal of the RET would almost certainly be detrimental to our efforts to address Australia's growing energy and climate challenges, increasing electricity costs for consumers, exacerbating perceptions of regulatory risk and increasing the cost of future investment in renewables in Australia, and potentially causing the collapse of the vibrant renewable energy industry that has been developed by this mechanism to date.

This Review provides a valuable opportunity to implement a number of adjustments and improvements to the RET, including the following:

- ***Shortfall charge*** – Should the current fixed carbon price be removed, the shortfall charge needs to be significantly increased to ensure sufficient incentive to invest in renewable projects. The shortfall charge should also be indexed at CPI.
- ***Extend the scheme to 2040 or 2050*** – To obtain financing, renewable projects need PPAs extending at least 10, and preferably 15 years. Given the end of the RET in 2030, and the current lack of a credible carbon pricing policy that is likely to elevate the electricity price to the required levels ($80 to $100/MWh) in 2030, in the near future projects likely to struggle to convince investors that they can make a sufficient return. This could stall investment. Extending the scheme to 2040 or 2050 would alleviate this issue. If the RET is extended to 2040 or 2050 it will be important to implement a sunset clause, such that projects do not continue to receive LGC revenue beyond a period of 15-20 years. Continuing to create LGCs beyond the first 15-20 years of the project creates the potential for significant windfall gains, at the expense of consumers and potential new renewable projects.
- ***Increase the 2030 target*** – CEEM's modelling indicates that a renewable penetration level of 60-75% by 2030 is lowest cost and lowest risk for Australia. Increasing the RET target to this level by 2030 would provide the simplest mechanism for achieving this. Changes to the RET target should not be made lightly, and it is important that there is a high degree of confidence that targets can be met. CEEM's preliminary analysis does suggest that achieving targets at these levels is feasible, and worthy of further consideration during the RET Review process.
- ***Increase the 2020 target*** – In order to achieve a level of 60-75% renewable energy by 2030, increasing the 2020 target to at least 35% renewable energy would provide the smoothest transition from the present 15% level.
- ***Market Power*** – Issues related to market power in Australian retail electricity markets have already proven problematic. Given weak and mixed incentives to sign PPAs with smaller renewable developers, it appears that the three major gentailers may have been able to exert some level of market power. Mechanisms to avoid potential market power problems adversely impacting on the success of the RET need to be considered.
- ***RET Review process*** – The governance processes for the NEM may highlight some possible approaches to managing the trade-off between fixing problems as they arise, but meanwhile maintaining the high levels of certainty required to drive investment. For example, it could be specified that rule change proposals are possible at any time (allowing rapid response to

issues as they arise) but that all potential changes to the RET are assessed against the overall objective of the scheme, via a highly transparent and consultative decision processes.

- ***Revise EITE exemptions*** – CEEM's analysis indicates that the current exemption arrangements are not appropriate. Our findings highlight likely significant redistributive transfers between different energy user classes under current RET arrangements. In particular, some energy-intensive industries are benefiting from lower wholesale electricity prices whilst being largely exempted from contributing to the costs of the scheme. By contrast, many households are paying significant RET pass through costs whilst not necessarily benefiting from lower wholesale prices. A more equitable distribution of RET costs and benefits could be achieved by reviewing the scope and extent of industry exemptions and ensuring that methodologies to estimate wholesale price components in regulated electricity tariffs reflect more closely actual market conditions.

CEEM welcomes the opportunity to contribute to this Review, and is happy to provide further information on any of the points raised, or any other questions the Panel may be exploring.

Contents

General Comments

The Federal Government's bipartisan support for the Renewable Energy Target (RET) when in opposition was commendable. The RET has played, and can continue to play, a vital role in driving renewable energy deployment and assisting in reducing Australian emissions over the past decade. The RET was, after all, introduced by the Howard Government which also committed to its expansion in 2007, an expansion that was then delivered by the subsequent Labor Government.

Such deployment oriented policy measures play a critical role in renewable energy technology innovation between R&D and demonstration of promising but still emerging technologies, through to potential widespread commercial uptake. Elsewhere in the world, market 'pull' measures to drive renewables uptake have also been very widely deployed as a key element of climate and energy policy frameworks, and have proven highly effective.

Appropriate policies have been delivering cost-effective emissions reductions, building an increasingly global renewable energy industry that continues to deliver considerable technical progress and cost reductions, and expanding the institutional capacity of the wider energy industry in managing the transition to more sustainable energy systems. All three outcomes will be key in achieving the longer-term major emissions reductions that the IPCC has highlighted are almost certainly required to avoid dangerous climate change.

By comparison with renewables, other low-carbon electricity generation options including carbon capture and storage (CCS) have achieved far less progress over the past decade despite considerable government support. Given growing climate change concerns, as evident in the recent IPCC Fifth Assessment Report [1], and the considerable success of renewable energy globally and in Australia over the past decade, it is therefore surprising that the Federal Government would now seem to be questioning the key objective of the expanded RET - that renewables contribute at least 20% of Australian electricity supply in 2020.

While there are likely challenges with the current RET arrangements and opportunities to enhance its effectiveness, efficiency and equity, its success to date in delivering its stated objective stands in stark contrast to some other Government policy measures that were also intended to drive low-emission energy technology deployment over the past decade. Examples of such failures include the former Federal Government Greenhouse Gas Abatement Program (GGAP) [2].

The Federal Government's proposed Emission Reduction Fund (ERF) is now intended to be a key driver of emission reductions to 2020. However the design of the scheme is still to be finalised and its likelihood of effective performance is questionable given the mixed performance of similar 'direct action' schemes to date and the apparent budgetary constraints that it may face [3].

Some of the policy discussion regarding the future of the RET appears to be missing the vital role that a renewable deployment policy such as the RET can play in the present, highly uncertain, policy context. The RET provides relatively affordable and assured emissions reductions that also support the longer-term transition to decarbonised energy systems.

A key aspect of the climate policy challenge is that of robustness. Given ongoing uncertainties in the climate science, it is possible that the necessary scale and speed of emission reductions to avoid dangerous warming may be revised. Similarly, there is little clarity on what international consensus on mitigation may emerge over the next few years. Finally, there are inevitable uncertainties associated with particular policy measures themselves. Even the best designed policies may fail to achieve their desired ends. This is a particular issue with newly introduced policy measures where government policy makers and key stakeholders haven't had the opportunity to build up experience in operation of the scheme. It is also a particular issue with incentive based approaches that seek to change private sector decision making through financial carrots or sticks. It is inherently uncertain how these participants may choose to respond. The proposed ERF faces both such hurdles.

As such, Australia's climate and energy policy framework will need to be robust against surprises – good or bad – on both the scale of the emission reduction challenge and the best means of addressing it. Key elements of robust policy include the use of a portfolio of policies such that if one fails, others can continue to drive progress. Removal of the carbon price and associated institutional frameworks reduces the options available to the Government to drive action should circumstances change, or preferred approaches prove more challenging than expected.

The RET should therefore be seen as a relatively proven deployment policy for proven emission reduction technologies that also provides policy insurance against the possible shortcomings of other elements of the climate and energy policy framework. This policy 'insurance' perspective is relevant to all of the design questions raised in the RET Issues paper. While there are certainly opportunities to improve the performance of the RET, there are also significant risks in making major changes without careful, thoughtful and deliberative policy assessment.

More generally, the recent Emission Reduction Fund Exposure Draft Legislation Paper does not provide great confidence in the ability of the Federal Government to deliver effective and efficient additional major abatement, in the short to medium term at least. In this context, policy 'insurance' such as that provided by the RET, has a critical role to play. Indeed, there are opportunities to expand the scheme beyond 2020 in order to enhance its value as Australia undertakes the necessary but challenging transition to a highly carbon constrained future.

Summary Responses to the Review Terms of Reference

We provide very brief responses to the Review Terms of Reference here, before addressing the specific questions of the Issues paper in the following Section.

In particular the Review was asked to examine the operation, costs and benefits of the RET including:

1. *the economic, environmental and social impacts of the RET scheme, in particular the impacts on electricity prices, energy markets, the renewable energy sector, the manufacturing sector and Australian households;*

The RET is currently providing significant economic, environmental and social benefits to the Australian community. These benefits are, however, not captured appropriately, or equitably distributed, within current energy market arrangements. This has adversely impacted assessments of the scheme's efficiency and equity implications.

For example, the value of the emission reductions driven by the RET is only partially captured by the present carbon price for emissions within the electricity sector. The fixed carbon price falls significantly below Australian and global estimates of the social cost of carbon emissions, that is, the damage being caused by climate change [4]. Removal of this carbon price would further 'devalue' this benefit. Unpriced externalities reduce market efficiency as commercial decisions fail to appropriately account for the broader social costs and benefits they cause. By effectively 'pricing' the value of emissions reductions, the RET is actually increasing market efficiency. As such, the RET has also enhanced market competition in facilitating new clean energy participants and new technologies to enter and compete in both the wholesale and retail markets.

Another benefit, which will largely be seen in future prices within a carbon constrained electricity industry, has been the role of the RET in expanding the capabilities of the Australian renewable energy industry and reducing renewable technology costs. This will facilitate achieving major emission reductions at a lower cost.

Furthermore, the RET provides benefits in reducing future cost risk related to uncertainty over future fuel prices (such as gas prices) and the future cost of carbon. CEEM's modelling on this topic is discussed later in this submission.

The increase in electricity prices through the RET obligation placed on retailers and hence imposed on customers is relatively modest for most, certainly by comparison with other drivers of price increases over the decade. However, significant exemptions given to large so-called Energy Intensive Trade Exposed (EITE) industry from having to contribute to the scheme places a greater cost burden on households and other businesses. Furthermore, small energy users have not necessarily been receiving the benefit of falls in wholesale prices due to the RET given current retail market arrangements [5]. There are opportunities to improve the performance of the RET in these regards as discussed later in this submission.

2. *the extent to which the formal objects of the Act are being met;*

The formal objects of the Act – additional renewable energy generation, emissions reductions and ensuring that this renewable generation is ecologically sustainable are largely being met. As seemingly inevitable with policy development, however, better choices in the design of the original MRET and then expanded RET could have improved outcomes.

3. *the interaction of the RET scheme with other Commonwealth and State/Territory policies and regulations, including the Commonwealth Government's commitment to reduce business costs and cost of living pressures and cut red and green tape, and the Direct Action policies under development.*

Policy interactions in the energy and climate domain certainly need very careful consideration. A wide range of policies will be required to comprehensively and coherently address climate change, and transform the diverse sectors of Australia's economy towards low carbon alternatives. As existing policies are removed, and others are added it will be necessary to re-assess the remaining policy suite and ensure coherent and comprehensive coverage. The proposed removal of the carbon pricing mechanism in Australia is certainly problematic in this regard, and CEEM's analysis suggests that in the absence of the carbon price, the RET will need to be strengthened in order to still achieve its legislated objectives. The RET and the carbon price were designed to work in partnership, with the price of Large-scale Generation Certificates (LGCs) rising and falling as necessary to hedge against movements in the wholesale electricity price (affected by the carbon price). With the removal of the carbon price, the wholesale electricity price can be expected to fall. This means that the LGC price will likely need to rise significantly to support continued investment in renewable generation.

It is difficult to assess the potential interactions of the RET with general Government commitments that have not yet been translated into actual policy proposals and legislation. It seems very unlikely that the proposed ERF will support additional renewable generation, so overlap between it and the RET may not be large.

The Review is also to provide advice on:

4. *whether the objective of the RET scheme, to deliver 41,000 gigawatt hours (GWh) and small scale solar generation by 2020, is still appropriate;*

The current target to 2020 certainly still appears achievable, although this may require some relatively modest changes to the Scheme such as the level of the shortfall charge. Given growing climate concerns and hence the need for Australia to achieve major, rapid and sustained emission reductions over the coming decades, expansion of the Target and extension of the mechanism beyond 2020 is almost certainly required. Analysis highlights the critical role that a higher RET target and extension of the scheme post 2020 could play in achieving effective and efficient emission reductions of the scale and speed that the current climate science highlights is required.

5. *the extent of the RET's impact on electricity prices, and the range of options available to reduce any impact while managing sovereign risk;*

Experience to date with the RET has highlighted its complex yet relatively modest impact on electricity prices by comparison with other price drivers over the past decade, while modelling has highlighted the potential role that the scheme can play in moderating future wholesale prices. There are opportunities to improve the equity of the scheme by removing the present partial scheme exemptions for some favoured energy intensive industry stakeholders, and ensuring that reductions in wholesale market prices are transferred to small energy users.

6. *the operation of the small-scale and large-scale components of the RET and their interaction;*

Utility scale renewable energy projects and small-scale distributed renewable energy systems (notably PV) have such different drivers and commercial contexts that their incorporation into a single scheme as implemented in the original MRET was always likely to prove non-ideal. Separation into the small and large components has assisted in managing these different characteristics. In the longer term, small-scale renewables need to be facilitated through more effective and efficient retail market arrangements that better value and price their energy and environmental benefits and costs. However, such large-scale retail market transformation has proven difficult to implement and current developments driven by recent success with residential PV may well worsen arrangements in this regard. As such, there is still a key role for explicit small-scale renewable system support and the SRES provides a well established and demonstrated framework for this.

7. *implications of projected electricity demand for the 41,000 (GWh) target; and*

Given that the RET's intent was to "ensure that the equivalent of *at least* 20 per cent of Australia's electricity comes from renewable sources by 2020," the relatively recent trend of falling demand in Australia has been of considerable benefit in providing greater certainty that this goal can and will be achieved. Should demand begin to climb significantly (via, for example, the onset of rapid electric vehicle uptake) then the current 41,000 LRET GWh target for 2020 might need to be revisited and raised in order to ensure the 2020 target. More importantly, falling demand opens up the opportunity to increase the 2020 target to a level more in keeping with the evident need to rapidly achieve major emissions reductions from the Australian electricity industry.

8. *implementation arrangements for any proposed reforms to the RET, including how to manage transition issues, risks and any adjustment costs that may arise from policy changes to the RET*.

Policy transition is a critical yet often neglected aspect of policy making. It is particularly important where policy measures are intended to drive longer-term investment decisions, such as the RET. While there are certainly opportunities to improve the effectiveness, efficiency and particularly equity of the current scheme, the scheme has performed reasonably well to date and there are significant risks in making changes, particularly major changes.

Responses to Specific Review Questions

How has the RET performed against the objectives in the Renewable Energy (Electricity) Act 2000?

The objects of the RET were:

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 original scheme design was highly innovative as the world's first mandatory national Renewable Energy Target based on the use of tradeable certificates. The target for the scheme was significantly expanded after a decade of operation and the underlying design has undergone only relatively modest changes since then.

The RET appears to be meeting its original objectives with an evident:

- increase in new renewable generation in Australia which has almost entirely been driven by the RET for large-scale projects, and significantly driven by the RET for small-scale deployment
- reduction in electricity related greenhouse emissions and, critically, electricity industry emissions intensity with the RET clearly playing a major although not lone role (gas and old hydro are also contributing here)
- focus of the scheme on deploying renewable generation types that pose very low risks of adverse ecological impacts (notably PV and wind).

This has been achieved at relatively modest direct costs to energy consumers, and delivering considerable net benefits –economic, environmental and social - to the Australian energy sector.

Are there more efficient and effective approaches to achieving these objectives?

All policy implementation processes involve compromises that will often reduce the effectiveness, efficiency and particularly equity of scheme outcomes. The Australian Mandatory Renewable Energy Target (MRET) was one of the world's first national Tradeable Green Certificate (TGC) schemes, and therefore a highly innovative policy measure. Such schemes have been adopted by a number of other countries and have considerable theoretical advantages over other approaches including feed-in tariffs and capital subsidies. They offer technology-neutral support to a wide range of potential renewable energy sources, create competitive pressures to reduce costs, are compatible with restructured electricity industries and may support high levels of renewable energy integration by ensuring project developers and operators are exposed to energy market price signals.

The RET appears to have performed reasonably well to date in effectively achieving its target at low policy support costs by international standards. Note, however, that such Quota or Tradeable Green Certificate (TGC) Schemes were widely considered to have been a failure in Europe in comparison with feed-in tariffs during their initial implementation. There, TGC schemes demonstrated low effectiveness in achieving significant deployment of key technologies such as wind power, while simultaneously achieving low efficiency because the publicly funded policy support costs proved considerably higher than estimated project costs [6]. Suggested reasons for this poor performance included the novelty of the schemes, but also:

- Developer demands for a higher internal rate of return (IRR) given the greater investor insecurity than seen with other approaches;
- A 'single' price for different situations and technologies that can lead to windfall profits; and
- The susceptibility of the scheme design process to being captured by incumbents who lobby for regulations that they know they can satisfy but that small non-incumbent competitors will not be able to manage.

The original MRET and now RET appear to have avoided these failings to date in meeting their annual targets through driving major investment, and achieving this at reasonable additional costs. However, some initial design choices were poorly made (for example, the baselines for old hydro plant, insufficient market disclosure requirements and the inclusion of solar hot water in a renewable electricity scheme) [7].

While the expanded RET established a far more appropriate target, some other design changes implemented at that time likely worsened scheme performance (for example, partial exemption for some favoured large energy users and the introduction of the solar multiplier for small-scale systems). The separation of the scheme into large-scale and small-scale components was a necessary response to some of these design failings.

Still, the scheme has performed well by international standards and with regard to its legislated objectives. While its future performance cannot be absolutely assured (the emergence and growing market power of three major 'gentailers' in the Australian NEM is certainly problematic in this regard [7]) it seems likely to be able to achieve its 2020 target with reasonable efficiency. There are also some relatively modest changes that could improve its performance, and assurance that it can continue to deliver greater renewable energy targets for 2020 and beyond, as outlined below.

Do the objectives of the Act remain appropriate, in light of falling electricity demand and the Government's target and policies for reducing greenhouse gas emissions?

The case for the original objectives of the original Act in 2000 has significantly strengthened over the past thirteen years given the extraordinary progress of some key renewable energy technologies over that time [8] , and the growing urgency of achieving emissions reductions [1].

While the RET can play a key role in delivering the Federal Government's current 2020 target of 5% reduction in Australian greenhouse emissions on 2000 levels, an effective global and hence Australian response to our climate challenges would require a much more significant 2020 target, and progressively greater targets for 2020 and beyond. The Climate Change Authority Targets review suggests an appropriate target is 19% reductions for 2020 and 40-60% reductions for 2030 [4]. Given the Federal Government's commitment to achieving this through local abatement, the RET therefore has a critical role to play.

How has the RET influenced the development of the renewable energy industry?

The development of the Australian renewable energy industry over the past decade has been one of the great successes of the RET. The industry has successfully deployed over 3GW of wind and 3GW of PV and the knowledge and skills that it has developed have greatly contributed to the improving technical performance and falling costs of key renewable technologies.

More generally, the RET has expanded the institutional capacity of the wider energy industry in managing the integration of novel renewable energy technologies, and hence in facilitating the transition to more sustainable energy systems. This is, perhaps, one of the Scheme's most significant accomplishments. A wide range of electricity industry stakeholders including the regulators, owners of conventional generation assets, network service providers and retailers now have a far better understanding of, and capability to appropriately manage, novel renewable energy technologies.

Should the LRET be abolished, reduced or increased? If retained, what level should it be? What would the impact of such changes be?

Given the RET's performance to date and our daunting energy challenges, abolishing the LRET is, or certainly should be, unthinkable.

In contrast, CEEM analysis indicates that there may be merit in considering an increase of the target for 2020, given the costs and risks of relying on other forms of generation technology, as outlined in Appendices 1 and 2 to this submission. This modelling suggests that the optimal strategy for minimising costs, minimising cost risk and reducing GHG emission levels in the NEM involves minimising energy sourced from gas by increasing renewable generation towards levels around 60-75% of energy by 2030 and 80-100% by 2050. A linear trajectory towards these levels in 2030 implies achieving a renewable penetration of at least 35% by 2020. Given lower than anticipated demand, this could be achieved by increasing the present LRET from 41,000 GWh to around 51,000 GWh (based upon AEMO's 2013 central projections of demand and rooftop photovoltaic generation) [5].

The uncertainty over the future of the RET over the past few years has adversely impacted investment, which may lead some to question the feasibility of achieving a higher target such as 35% by 2020. This extremely important question that will require careful consideration before increasing the target, since a failure to meet an expanded target is not in anyone's interests. However, preliminary analysis indicates that this target may be achievable, and is certainly worthy of further consideration in the process of this Review.

To achieve the levels of renewables that CEEM's modelling indicates is optimal for minimising costs and cost risk in 2030, a linear trajectory would require an installed level in 2020 of 8 GW of photovoltaics and 10 GW of wind. Taking into account the presently installed levels of 3 GW of wind and 3 GW of photovoltaics, this suggests a new build of 5 GW of photovoltaics and 7 GW of wind by 2020. Reaching this would require adding the equivalent of 0.8GW of photovoltaics each year, and 1.1GW of wind each year to 2030.

With regards to PV, 1.3 GW of rooftop photovoltaics were installed in the NEM in the one year from 2011-12 to 2012-13, *almost double the amount required to meet this requirement*, from rooftop photovolaics alone [6]. This suggests that the Australian PV industry is already capable of adding far in excess of the PV capacity required, even without further growth in the industry, or any contribution from utility scale projects. AEMO predicts that under present policy settings rooftop photovoltaic installations alone are likely to reach 5 GW by 2020 (in the central projection), and may be has high as 8 GW [6]. Although rooftop photovoltaics are included under the SRES (rather than the LRET), achieving STC production at these levels would allow a reduction in the above described LGC target, to meet the 35% renewable energy level by 2020.

Utility scale investment such as AGL's 102 MW photovoltaic solar farm in Nyngan and 52 MW photovoltaic solar farm in Broken Hill, Fotowatio Renewable Ventures' 20 MW Royalla Solar Farm, Zhenfa's 13 MW Mugga Lane Solar Park and the Elementus Energy 7 MW OneSun Capital Solar Farm currently under construction would be additional to this investment. The Solar Flagships and ACT Solar Auction processes attracted significant interest, with a very large number of proposals received (with each proposal representing a project already in the development pipeline). For example, the ACT Solar Auction, although small, attracted 49 proposals by 27 proponents.

With regards to wind generation, there is already 16 GW of announced wind generation projects proposed for development in the NEM, with 834 MW committed for imminent development, despite the prevailing policy uncertainty [7]. Further projects are likely to be in the development pipeline, but not yet formally announced to AEMO. This means that announced wind projects are already *more than double* the 7 GW of new wind estimated to be required by 2020 to meet the increased target (with the corresponding photovoltaic investment outlined above; lower levels of PV investment would require higher levels of wind investment to meet the same renewable target).

This suggests that there are already more projects in the development pipeline than required to meet the expanded target. Although this analysis is preliminary, it does appear worthy of further consideration during the RET Review process. On the basis of this analysis, CEEM recommends that the Review Panel commission a detailed study of the feasibility of expanding the RET target to 35-45% by 2020 and 60-75% by 2030.

Of course, some key scheme design changes and associated broader energy market reforms, as outlined throughout this submission (and summarised in the Conclusion), will be necessary for achieving these targets in an effective, efficient and equitable manner.

Do small-scale renewable energy systems still require support through the SRES? If so, for what period will support be required for?

Small-scale renewable generation has seen extraordinary cost reductions over the life of the RET. On paper, small-scale renewables, such as PV, have reached grid parity and no longer require additional policy support. However, in reality there remain significant non-price barriers to their continued deployment and until these are eliminated, appropriate market values are placed on the environmental value that renewables provide, and market arrangements appropriately facilitate and reward their potential contribution to other valuable industry services such as peak demand reductions, voltage management and ancillary services, the SRES market should be retained.

Should the LRET and SRES schemes be recombined?

The very different characteristics of these markets necessitated the split of the LRET and SRES schemes, and remains good justification for them to remain separate. The split of these two markets prevents issues in one market from flowing to the other (such as the oversupply of certificates due to the solar multiplier, generous feed in tariffs and unforseen global developments in PV costs, preventing investment in large-scale wind generation).

What impact is the RET having on electricity markets and energy markets more broadly? How might this change over time?

Growing renewable energy penetrations in the Australian electricity industry are certainly now impacting on wholesale and retail electricity markets. This is expected – markets and market prices should change as the context does and new participants and technologies arise. One issue receiving growing attention is the so-called 'merit order effect' of wind generation in wholesale electricity markets. Wind has very low operating costs and therefore tends to displace higher cost conventional generation from market dispatch, reducing both wholesale prices and conventional plant outputs. CEEM's analysis[1] [8] has extended the current literature on this effect through an empirical study employing a range of econometric techniques to quantify the impacts of growing wind penetrations in the NEM. The results suggest that wind is having a marked impact on spot market prices, as illustrated in Figure 1. Furthermore, while wind is primarily offsetting higher operating cost gas generation, it is now also significantly reducing dispatch of emissions intensive brown coal generation [8]. Over time, as renewable penetrations grow, the merit order effect may become even more marked, however, the RETs overall market implications will also be impacted by other supply and demand developments, and the response of market participants.

More generally, the RET provides a "proxy" for under-priced and unpriced externalities in the electricity market. Greenhouse emissions are only one of a number of adverse environmental impacts arising from electricity industry operation that aren't currently properly priced into industry decision making. The present fixed carbon price at present remains far lower than key Australian and global estimates of the "social cost" of carbon [4], and the RET assists in correcting this market distortion. The US Environmental Protection Agency's most recent estimate has a social carbon price of over A$75/tCO2e in 2020 given a 2.5% societal discount rate. The abatement cost of the RET is significantly less than this.

The RET also acts as a proxy to help correct some of the other unpriced externalities of conventional generation such as the regional air pollution associated with coal-fired plant. Ideally it would be preferable to directly price these externalities in the market as causer pays penalties, but in the absence of a significant carbon price and other schemes to effectively implement this, the RET is an existing scheme that successfully contributes in this role. As such, it improves electricity market efficiency.

Perhaps the most significant impact of the RET on Australia's electricity markets has been to increase competition and participation in them. The scheme has bought new technologies and participants into the market – both wholesale and retail. Conventional fossil-fuel plant has effectively been subsidised against clean energy alternatives by the absence of appropriate environmental regulation

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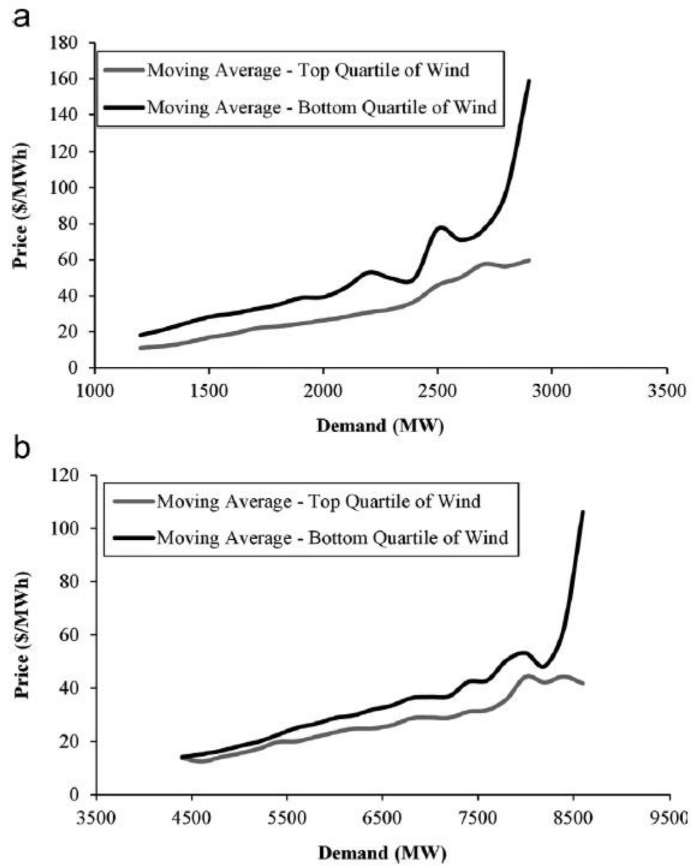
[1] Available at http://dx.doi.org.wwwproxy0.library.unsw.edu.au/10.1016/j.enpol.2013.02.026

or externality pricing. The RET goes some way to levelling the competitive playing field. It is hardly surprising that some incumbents oppose such competition given the threat it potentially poses. Policy makers must, of course, place the overall societal benefits of increased competition before such concerns.

Figure 1 – Average regional prices under top and bottom wind quartiles. (a) SA and (b) VIC



Are the current exemption arrangements appropriate?

CEEM's analysis indicates that the current exemption arrangements are not appropriate. Using time-series regression, we have shown that the increasing amount of wind energy in the NEM has placed considerable downward pressure on wholesale electricity prices through the so-called merit order effect. On the other hand, RET costs are passed on to consumers in the form of retail electricity price premiums. Our findings highlight likely significant redistributive transfers between different energy user classes under current RET arrangements. In particular, some energy-intensive industries are benefiting from lower wholesale electricity prices whilst being largely exempted from contributing to the costs of the scheme. By contrast, many households are paying significant RET pass through costs whilst not necessarily benefiting from lower wholesale prices. A more equitable distribution of RET costs and benefits could be achieved by reviewing the scope and extent of industry exemptions and ensuring that methodologies to estimate wholesale price components in regulated electricity tariffs reflect more closely actual market conditions. We refer the RET Panel to our detailed analysis on this topic[2] [9].

[2] Available at SSRN: http://ssrn.com/abstract=2359205 or http://dx.doi.org/10.2139/ssrn.2359205

How should reforms to the RET be implemented? What transitional issues could arise and how might they be addressed?

Any reforms to the RET being considered should be implemented with great care. There is the potential to create a perception of significant regulatory risk in the Australian market, which would inhibit future investment of any kind by increasing the cost of capital. Since renewable technologies are capital intensive, their cost is particularly sensitive to the cost of capital and these effects. This effect could be nuanced; for example, a strong bipartisan commitment to increase renewable generation, demonstrated by strengthening and extending of the RET would signal a low regulatory risk for renewable technologies, lowering the cost of capital for those technologies. Meanwhile, the cost of capital for emissions intensive fossil fuel technologies may increase, given the apparent lack of political support for these technologies. This effect could work in reverse if the Government appears to support fossil fuels and incumbents above renewables, increasing the future cost of investment in low carbon technologies.

Expanding and extending the RET might require little in the way of transitional arrangements except for agreement on the definition of the targets, via a percentage or a fixed amount. In the past, the electricity industry has preferred a fixed GWh target because it provided more certainty. Some ther changes would also be required to assure the effectiveness of the scheme and its efficiency as outlined in some of the following Sections.

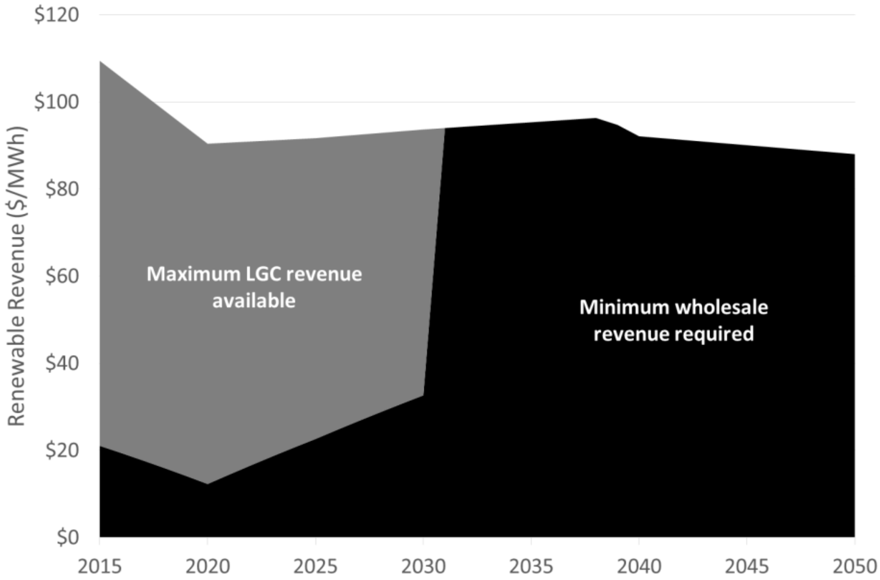
Of course, other market arrangements, as proposed above, should be introduced in stages between now and 2020. The RET scheme itself should be kept as straightforward as possible, with additional market signals, such as time or location stamps being provided via price signals through the wholesale market for large-scale generation and through cost-reflective tariffs at the retail level. It will of course be important for investors in renewable projects to know what the minimum price will be over a minimum period (such as 15 years).

How does the RET interact with other government policies that have, or will have, an impact on the operation of the RET, or that impact on renewable energy or energy markets more generally? What can be done to improve the efficiency and effectiveness of these interactions in delivering intended policy objectives?

CEEM's analysis suggests that in the absence of the carbon price, the Renewable Energy Target (RET) will need to be strengthened in order to still achieve its legislated objectives [10]. The RET and the carbon price were designed to work in partnership, with the price of Large-scale Generation Certificates (LGCs) rising and falling as necessary to hedge against movements in the wholesale electricity price (affected by the carbon price). With the removal of the carbon price, the wholesale electricity price can be expected to fall. This means that the LGC price will likely need to rise significantly to support continued investment in renewable generation.

The shortfall charge for the RET was set at a level that is appropriate in the presence of a meaningful carbon price. However, in the absence of a carbon price, it seems likely that the shortfall charge is too low to ensure continued investment in renewable generation. Figure 2 illustrates an estimate of the minimum wholesale electricity revenue required to promote continued renewable investment, based upon projected technology costs and the legislated shortfall charge. Based upon this analysis, with removal of the carbon price the RET shortfall charge will need to be increased significantly to ensure continued renewable investment. We would also recommend that the shortfall charge is indexed at CPI to prevent decline in real terms. If the shortfall charge is not increased, retailers may prefer to pay the penalty fee rather than invest in renewable generation, causing increased costs to consumers without the positive outcomes of decarbonising the electricity sector, promoting rural development, and supporting the growth of the renewable energy industry.

Figure 2 - Minimum wholesale electricity revenue required to promote continued renewable investment



Source: Total renewable revenue required determined from levelised cost of least cost renewable technology in each year (wind and PV), sourced from Bureau of Resources and Energy Economics (BREE) Australian Energy Technology Assessment (AETA) 2012.

Furthermore, the RET ceases in 2030, which is already within the technical lifetime of renewable projects installed today. Retailers may well be reluctant to sign long term PPAs beyond the end of the RET unless there is confidence of electricity prices exceeding $90/MWh. Given the intention of the present Government to repeal the carbon price this confidence is not likely to be forthcoming. In the absence of sufficiently long term PPAs (or confidence of sufficiently high LGC prices and electricity pool prices), renewable projects are likely to struggle to obtain financing.

One way to address this issue would be to extend the RET beyond 2030, subject to a number of changes to the scheme including project sunsets, in addition to providing long term certainty on the scheme details, and an increase in the shortfall charge.

If the RET is extended to 2040 or 2050 it will be important to implement a sunset clause, such that projects do not continue to receive LGC revenue beyond a reasonable period of 15-20 years. Continuing to create LGCs beyond the first 15-20 years of the project creates the potential for significant windfall gains, at the expense of consumers and potential new renewable projects. The Victorian Government's State RET scheme design (which was eventually rolled into the National RET) incorporated a sunset clause of this nature which provides a basis for its implementation here [7].

Another issue that requires further consideration is the potential for market power in the retail market. This is problematic for the electricity industry in many ways, so it would be worth considering general measures to reduce the potential for market power in the retail sector. However, it is specifically pertinent to the success of the RET. Issues related to market power in the retail market have already proven problematic. Given weak and mixed incentives to sign PPAs with smaller renewable developers, it appears that the three major gentailers may have been able to exert some level of market power. There have certainly been some experiences in other RET certificate-based schemes in Europe where large market participants may have exerted market power in both target shortfalls and green certificate pricing to increase their returns from the schemes [6] [15].

Can the administrative arrangements of the RET be simplified? If so, how can they be simplified and what would be the risks of doing so?

There is inevitably complexity in the design of any new market scheme. Market participants will always have an incentive to seek a competitive advantage by stretching the rules or seeking loopholes, rather than competing within the intended market design. Thus, adjustments to an existing scheme that has been functioning for more than a decade should be made with caution. While admirable in intention, simplification may lead to new potential for market participants to stretch the rules in ways that are not aligned with the intention of the scheme.

As discussed elsewhere in this submission, CEEM proposes that solar hot water be removed from the SRES. As a demand side technology, solar hot water would be more appropriately supported by a tailored demand side measure (or suite of measures), rather than via the SRES. This could assist in reducing the complexity of arrangements under the SRES, related to the inclusion of this technology.

The suggestion of including non-renewable technologies would appear to be a retrograde step with regards to scheme simplicity. Adding non-renewable technologies will invariably add complexity, particularly relating to any measures that attempt to quantify and accurately reward the relative environmental benefits of different technologies under the scheme.

Should any other energy sources be included in the LRET? Should any non-renewable (but low emissions) energy sources be included?

The RET is, and should remain, a renewable energy target, not a low emission target. Other low emission energy sources are certainly worthy of policy support given current market failings to adequately support clean energy and price the environmental damage of current fossil-fuel generation options. However, there are good reasons to keep this separate from the existing RET.

One reason is the administrative complexity and inevitable scheme uncertainty that would arise from attempting to include different generation technologies with low but non-zero emissions. CEEM has some experience with policy measures that attempt to equate the clean energy contribution of very different generation technologies including the NSW Greenhouse Gas Abatement Scheme. The scheme has had widely reported additionality and other performance challenges.

Gas-fired generation should not be supported through the LRET, or through any other subsidy or Government mechanism. CEEM's analysis suggests that baseload gas generation presents high cost and high risk for the NEM, as outlined in Appendix 2 of this submission. Peaking gas generation (such as OCGT generation) could be supported if necessary, but this should not be done through the RET (which rewards energy production rather than capacity provision), but rather through electricity market adjustments to ensure resource adequacy, if the present market mechanisms prove inadequate. This is an area of active research for CEEM, including investigating the ongoing viability of the energy-only market design with very high renewable penetrations, and the possible necessity and effectiveness of introducing alternative market designs, such as a capacity market[3] [11].

Should any new small-scale generation technologies be eligible under the SRES?

Any ecologically sustainable small-scale renewable electricity generation should be eligible under the SRES.

Should any new displacement technologies be eligible under the SRES?

Demand side displacement technologies are an extremely important part of reducing GHG emissions from the electricity sector. There are many excellent technologies in many contexts which are worthy of policy support given current energy market failings. However, such support should be through better tailored, demand-side oriented measures. Supporting these technologies through the SRES is suboptimal, and solar hot water systems should be removed from the SRES, and transitioned to support via alternative mechanisms. More generally, there is an urgent need for more ambitious, comprehensive and coherent demand-side policy efforts, particularly with regard to energy efficiency.

What should be the frequency of statutory reviews of the RET?

In setting the frequency of statutory reviews of the RET it is important to manage the trade-off between fixing problems as they arise, but meanwhile maintaining the high levels of certainty required to drive investment. The governance processes for the NEM highlight some possible approaches. For example, it could be specified that rule change proposals are possible at any time (allowing rapid response to issues as they arise) but that all potential changes to the RET are assessed against the overall objective of the scheme, via a highly transparent and consultative decision processes. This could provide sufficient certainty and confidence to investors that there is support for the delivery of their projects, while allowing any emerging issues to be addressed in a timely manner.

What administrative and regulatory arrangements should be put in place to ensure that the reinstatement of native forest wood waste is consistent with the sustainable management of native forests?

Given the risks associated with such a move, native forest wood waste should not be reinstated within the scheme.

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Appendix 1 – Mitigating price uncertainty with renewables

Introduction

In this time of high and ongoing uncertainty for the electricity sector, it will become increasingly important to understand not only the central projections of cost relating to a policy decision, but also to understand the potential risks associated with that decision. Uncertainty in the Australian electricity sector is particularly pronounced in three key areas: the domestic gas market, energy and climate policies and future electricity demand growth. Renewable generation options have the potential to reduce the risk of electricity generation portfolios by effectively mitigating the potential for extreme electricity prices caused by high and uncertain gas and carbon prices. This study aimed to examine and quantify this effect.

Method

UNSW's recent modelling study[4] examines different possible future generation portfolios in the NEM by considering different renewable energy penetration scenarios in 2030. The modelling assesses a wide range of generation portfolio mixes for different renewable energy penetration scenarios in 2030 under highly uncertain future gas price, carbon pricing policy and electricity demand. Outcomes were modelled for 396 possible generating portfolios, each with 10,000 simulations of possible fuel prices, carbon prices and electricity demands where the cost risk is measured as the standard deviation in cost over these 10,000 simulations.

Results

A renewable penetration of around 75% was found to be the most optimal in 2030, both on the basis of lower expected wholesale generation cost (given widely accepted central projections for gas and carbon prices), and on the basis of lower cost risk.

Results of the modelling, as shown in Figure 3, show that the generation portfolio with the lowest expected cost in 2030 was found to include 60% renewable energy. However, increasing the renewable proportion to 75% only very slightly increased expected generation cost (by $0.2/MWh), but decreased the standard deviation of cost (representing the cost risk) by 40%.

This is also illustrated in Figure 4, which shows the probability distribution for the lowest cost generation portfolio at each renewable penetration level considered. Moving from 60% to 75% renewable energy significantly reduces the width of the probability distribution with only minimal change in the expected cost of the portfolio (indicated by the solid markers). This is likely to be attractive option for decision makers since a very small increase in expected costs results in a large increase in certainty around expected cost.

Increasing the renewable proportion from the present 15% to 75% renewable energy by 2030 is found to decrease expected wholesale electricity costs by $17/MWh. This equates to a cost saving of $126 per annum for each typical Australian household.

Furthermore, renewable generation is found to effectively mitigate cost risk associated with gas and carbon price uncertainty, with each addition of 10% renewable energy reducing the cost risk by an average of 20%. This is found to be robust to a wide range of carbon pricing assumptions.

[4] This modelling employs Monte Carlo simulation and portfolio techniques to assess the expected generation costs, cost risk and greenhouse emissions of a wide range of generation portfolios, given conditions of highly uncertain future gas prices, carbon pricing policy and electricity demand. Input assumptions were based upon widely accepted future technology cost estimates, electricity demand, fuel costs, carbon prices and their associated uncertainties as well as hourly wind and photovoltaic generation.

This quantity of renewables is far in excess of the level in the present NEM, suggesting that policies to promote a managed increase in renewable generation towards the level of 75% by 2030 could be warranted on a cost and risk minimisation basis for consumers.

Figure 3 - Installed generation capacity, expected costs, standard deviation (SD) of generation costs (cost risk) and CO2 emissions of the least cost generation portfolio in each renewable penetration scenario

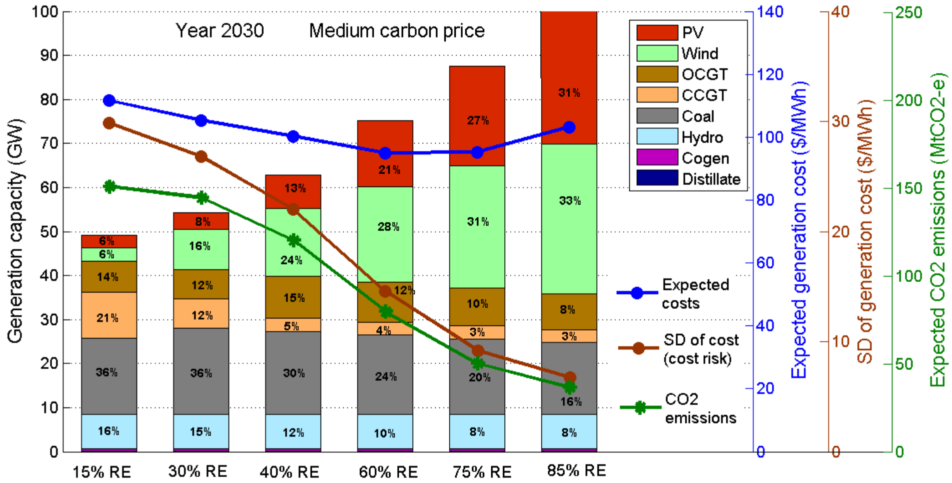
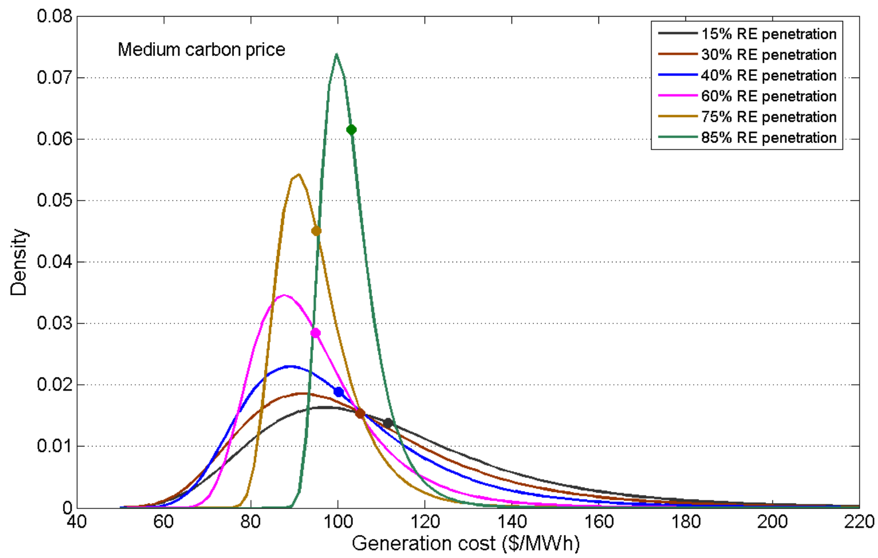


Figure 4 - Probability distribution of the generation cost for the least cost generation portfolio for each level of renewable penetration considered.



Significant investment in renewable generation not only leads to reductions in the overall system cost and emissions, but also reduces exposure to risks which can arise from significant uncertainty in future gas prices and carbon pricing policies. Future generation portfolios with a large share of gas-fired generation, particularly CCGT, and consequently far less renewables are likely to be exposed to considerable cost risk. Therefore, the additional cost of investing in renewable generation at present can be accurately framed as an "insurance" or hedge against future extreme prices, in addition to a cost minimisation measure.

CCGT plants are exposed to high and uncertainty gas prices, and therefore play a very small role in the lowest cost portfolios, in terms of both capacity and annual generation, even when carbon pricing is not applied. Continued reliance upon the present fleet of coal-fired and gas-fired generation in Australia carries significant risks related to the uncertainty of future gas and carbon prices. However, these existing plants can continue to play an important role in all of the least cost power systems in 2030. By moving into a peaking role, coal and gas-fired plant can effectively complement variable renewables, providing firm capacity without contributing significant greenhouse emissions.

Conclusions

This modelling suggests that policy mechanisms to promote a managed increase in renewable generation towards a level of 75% by 2030 would minimise costs to consumers, and effectively mitigate the risk of extreme electricity prices due to uncertain gas and carbon prices. Based upon the last decade of investment, the existing RET scheme appears to be an effective mechanism for gradually increasing the proportion of renewable generation in Australia. An expanded target of 75% renewable energy by 2030 may be a suitable policy response, given the results of this modelling.

Next Steps

A draft of this working paper has been provided with this submission**. We request that this working draft remain confidential (not publicly released with this submission)**. A final version of the working paper will be released by CEEM in the coming weeks, when it is finalised.

Appendix 2 – Exploring the "Gas Transition"

Introduction

Some stakeholders have proposed that Australia pursue a low carbon transition pathway via predominantly gas-fired electricity [12]. This proposal typically rests on the idea that gas-fired generation is operationally similar to conventional coal-fired generation, so a transition via gas would allow greenhouse emissions to be reduced more rapidly, easily and cost effectively than via renewable technologies. CEEM recently completed detailed modelling to explore this concept of a "Gas Transition" to low carbon electricity.

Approach

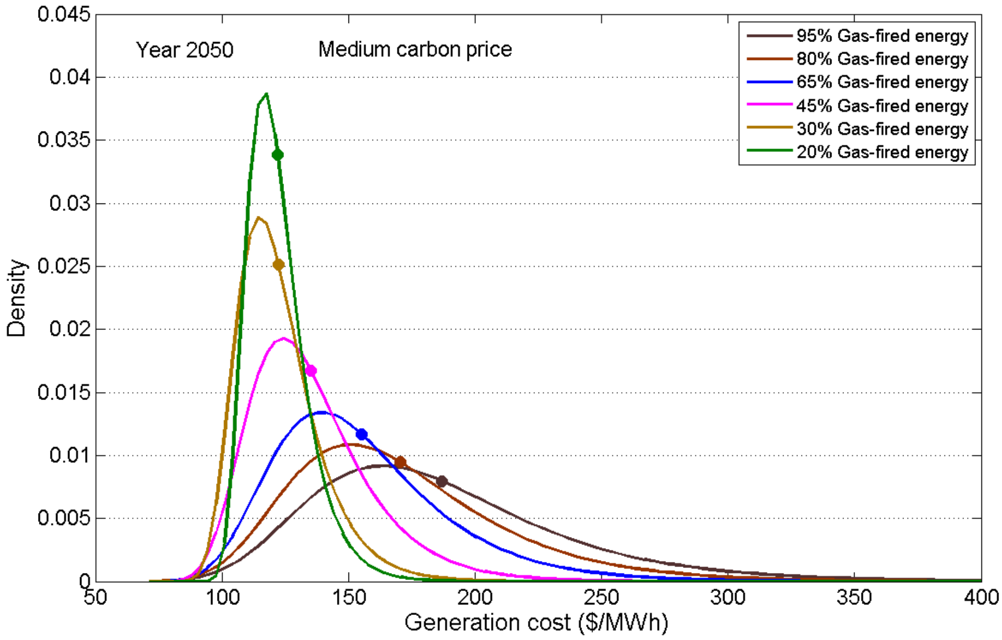
A large number of possible generation portfolios for the Australian National Electricity Market (NEM) composed of varying quantities of gas-fired and renewable generation were compared on the basis of expected costs, cost risk and greenhouse gas emissions. A Monte-Carlo based generation portfolio modelling tool was applied to take into account the effects of highly uncertain future gas prices, uncertainty around future carbon pricing policy and uncertainty around future electricity demand. Input assumptions were based upon widely accepted future technology cost estimates, electricity demand, fuel costs, carbon prices and their associated uncertainties [13] [14]. Hourly wind and photovoltaic generation profiles were used to account for generation variability. Outcomes were modelled for 396 possible generating portfolios in 2030 and 66 possible generating portfolios in 2050, each with 10,000 simulations of possible fuel prices, carbon prices and electricity demands.

Results

The modelling found that the most important factor that changed the cost and cost risk of future portfolios was the ratio of energy supplied by gas versus renewables. Figure 5 illustrates the generation cost profiles calculated for the portfolios that exhibited the lowest cost, at each ratio of gas to renewable generation. It is clear that portfolios sourcing significant quantities of energy from gas-fired generation are significantly higher cost, as indicated by the position of the "dot" on each curve (showing the "expected cost" of the distribution).

Portfolios sourcing energy predominantly from gas are also significantly higher risk, as exhibited by the wide shape of the cost distributions. Predominately gas-fired portfolios exhibit a much higher standard deviation in cost, which indicates a much higher level of cost risk (or, correspondingly, a much lower certainty around cost).

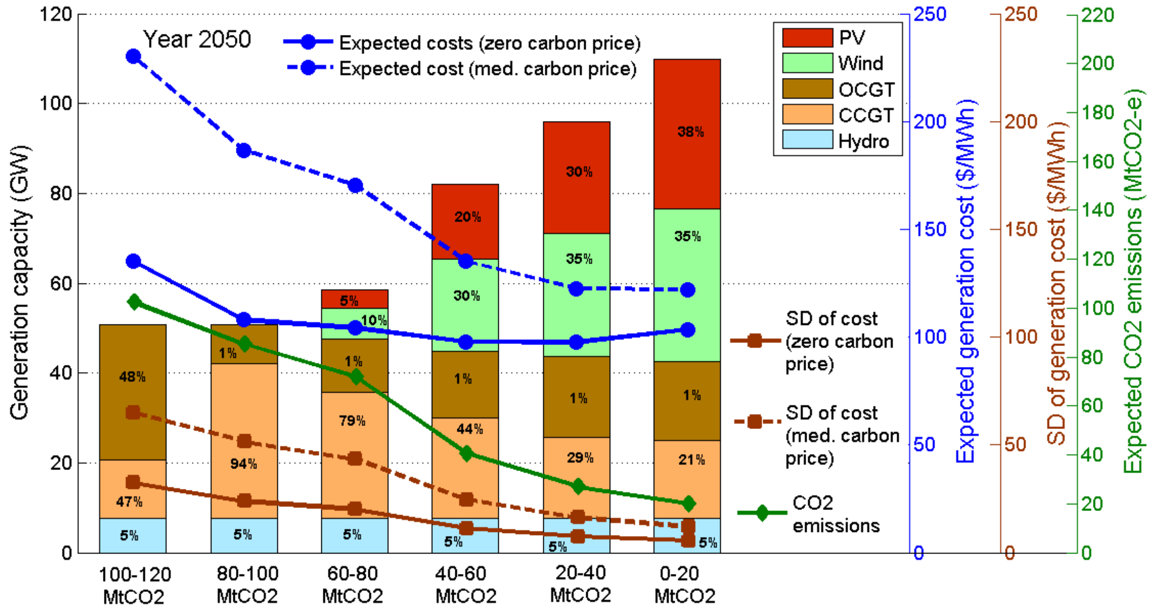
Figure 5 - Probability density distribution of the generation cost for the lowest cost portfolio for each level of gas-fired generation considered. The markers on each curve show the expected (average) cost for the distribution. Since lognormal distributions have been applied for the various input assumptions, the expected cost lies to the right of the peak density.



For example, as illustrated in Figure 5, portfolios that source 95% of energy from gas-fired generation in 2050 experience expected generation costs that are $65/MWh (40%) higher than portfolios that source only 20% of energy from gas-fired generation (with the remaining 80% of energy sourced from renewables). The high gas portfolio also exhibits a cost risk (standard deviation in cost) that is three times higher. The lowest cost portfolios in 2050 source less than 20% of energy from gas, and source the remaining 80% of energy from renewables.

Even in the absence of any probability of a carbon price (which is not representative of the reality that there is some probability of a future carbon price), the lowest cost portfolios achieve GHG emissions levels in the range 20-40 MtCO_2-e (around 10-20% of present levels), and source 70% of energy from renewables, as illustrated in Figure 6. This is due to the high and uncertain price of gas.

Figure 6 - Installed capacity, expected costs, SD of generation costs (cost risk) and CO2 emissions of the least cost generation portfolios for each emission range for 2050 in the case without a carbon price. Dotted lines indicate the costs and cost risk for these portfolios if the carbon price distribution is applied.

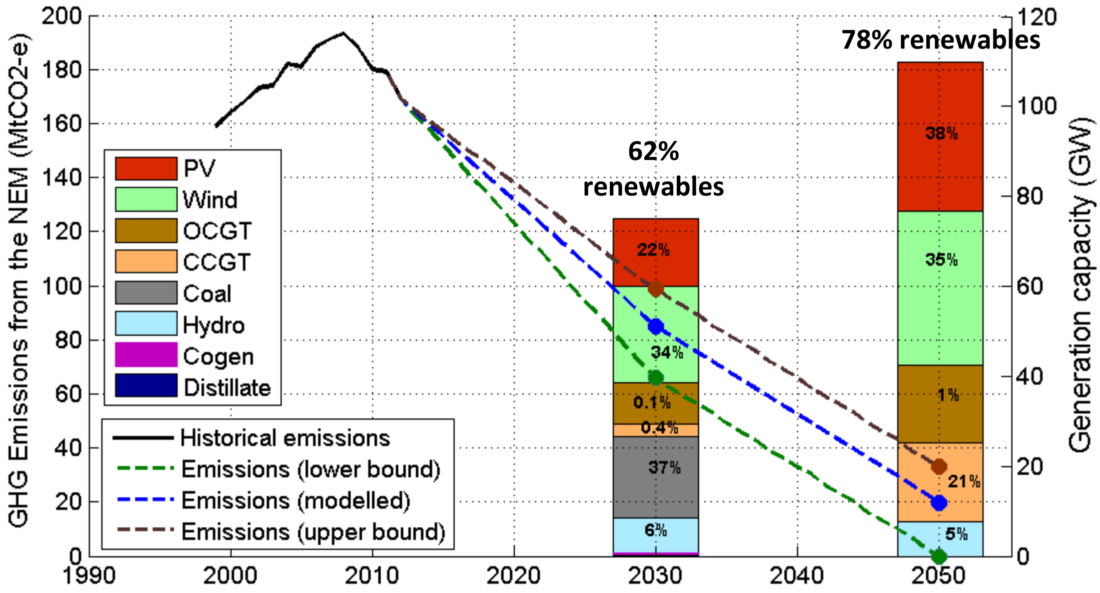


Results also indicate that portfolios composed primarily of gas-fired generation cannot achieve the greenhouse gas (GHG) emissions reductions levels required. Figure 6 illustrates the lowest cost portfolios at each level of GHG emissions. Entirely gas-fired portfolios can only achieve emissions as low as 80 $MtCO_2$-e, which is approximately 50% of present NEM emissions (and most entirely gas-fired portfolios exhibit emissions higher than this level). However, the legislated target for Australia is an 80% reduction in emissions by 2050. This implies that significant renewable investment by 2050 (36 years from present) is necessary.

Figure 7 illustrates the historical GHG emissions levels from the NEM, with a range of trajectories for the future based upon legislated targets, and the recommendations by the Australian Government Climate Change Authority [15]. They recommend a GHG budget for the period to 2050, such that higher emissions earlier would necessitate lower emissions later. Therefore, neither of the dotted lines indicates a trajectory that would be followed to meet the Climate Change Authority recommendations. However, they do indicate the range in which emissions would realistically need to fall in order to meet the required budget.

Two possible portfolios have been selected from the hundreds modelled, as illustrated in Figure 7. These are the lowest cost portfolios that meet the required emissions reduction ranges. They are also the lowest cost and lowest cost risk portfolios, if the cost and cost risk associated with carbon pricing is taken into account. The emissions associated with these portfolios are indicated by the blue dotted line. This analysis suggests that by 2030, in order to minimise costs and cost risk, the NEM should continue to operate a selection of existing coal-fired plant with reduced capacity factors (in a peaking role), supporting the operation of a significant quantity of renewable energy (supplying in excess of 60% of energy). This portfolio includes very minimal investment in CCGT gas-fired plant. By 2050, assuming all existing coal-fired generating capacity will be retired, maximising the proportion of energy sourced from renewable technologies (and therefore minimising the proportion of energy sourced from gas-fired generation) minimises costs and cost risks, and is also important for achieving the required emissions reductions.

Figure 7 – The lowest cost portfolios for the NEM in 2030 and 2050 (including the probability of a carbon price or equivalent). The emissions of these portfolios are shown in blue, compared with the GHG emissions trajectories for the Australian NEM in the proportions of national targets recommended for Australia by the Climate Change Authority. Percentages indicate the % of energy supplied by each technology.



The year 2020 was not directly modelled in this study. However, to achieve the level of renewables found to be optimal in 2030, a linear trajectory would require adding 0.8 to 1.4 GW of photovoltaics each year, and 1.1 to 1.6 GW of wind each year to 2030. Based upon AEMO's latest projections of demand [5], this would mean that renewables would be providing 35% to 45% of energy in 2020. Therefore, this modelling suggests that an increase of the RET to 35% to 45% of anticipated demand in 2020 (73,000 to 93,000 GWh pa) would be in Australia's interests to minimise electricity costs and cost risk.

Conclusions

This modelling suggests that the optimal strategy for minimising costs, minimising cost risk and reducing GHG emission levels in the NEM involves minimising energy sourced from gas by increasing renewable generation towards levels around 60-75% of energy by 2030 and 80-100% by 2050. A linear trajectory towards these levels in 2030 implies achieving a renewable penetration around 35% to 45% by 2020.

In the lowest cost and lowest risk portfolios, firm capacity is provided primarily by the transition of existing coal-fired plant into a peaking role, and later by further investment in peaking open cycle gas turbine plant. Baseload gas generation does not play a role in any of the lowest cost and lowest risk portfolios.

Next Steps

CEEM is currently finalising the presentation of this analysis, and will soon be publishing a full working paper on the CEEM website.

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