



**14 September 2012**

Climate Change Authority  
GPO Box 1944  
Melbourne VIC 3001

**By email: [submissions@climatechangeauthority.gov.au](mailto:submissions@climatechangeauthority.gov.au)**

Dear Sir/Madam,

**AGL Energy Response to the Climate Change Authority's Renewable Energy Target Review Issues Paper**

AGL Energy (**AGL**) welcomes the opportunity to comment on the Renewable Energy Target (**RET**) Review Issues Paper (**Issues Paper**) issued by the Climate Change Authority.

As a leading investor in renewable energy and one of the largest energy retailers in Australia, AGL is well placed to comment on the Issues Paper. AGL operates across the supply chain and has investments in coal-fired, gas-fired, renewable and embedded electricity generation. AGL is Australia's largest private owner, operator and developer of renewable generation in Australia. AGL is also a significant retailer of energy with over 3 million electricity and gas customers. The diversity of this portfolio has allowed AGL to develop a detailed understanding of the risks and opportunities presented by climate change-related policy.

AGL is a strong supporter of retaining the RET in its current form. AGL's overarching view is that the RET scheme should be the primary mechanism for supporting renewable energy and it should not be adjusted. AGL does not believe that reviews of the RET, conducted as regularly as required by legislation, are necessary for the effective and efficient operation of the RET. Such reviews in fact have the potential to adversely impact the renewable energy industry by introducing a level of policy uncertainty and hence negatively impacting on investor confidence. However, while biennial reviews remain a legislative requirement, these reviews should be governed by the principle that changes to the policy are only required where there is a degree of market failure (e.g. penalty is being paid rather than new generation is being constructed and operated).

Attached to this submission is AGL Applied Economic and Policy Research Working Paper No.35: "*An analysis of Australia's Large Scale Renewable Energy Target: restoring market confidence*". This paper quantifies the significant financial cost associated with both reform to, and a repeal of, the RET policy. Responses to some of the questions raised in the Issues Paper are also provided in this submission. Should you have any questions in relation to this submission, please contact me on (02) 9921 2516 or [tanelson@agl.com.au](mailto:tanelson@agl.com.au) or Anita George at [ageorge@agl.com.au](mailto:ageorge@agl.com.au) or on (03) 8633 7212.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tim Nelson', is written over a light blue horizontal line.

Tim Nelson  
Head of Economic Policy and Sustainability

## **AGL responses to the issues set out in Issues Paper**

### ***Large-scale Renewable Energy Target***

#### ***Current targets should be maintained***

AGL supports the current LRET 2020 target and the interim annual targets. Maintaining an environment of policy certainty is of primary importance in determining the appropriate strategy to adopt in relation to the future of the RET. Investments made pursuant to the RET policy result in projects with operating lives of around 20 – 30 years. A stable framework established for the long term, as the RET is, is critical to the achievement of economic efficiency throughout the industry.

Nelson, Nelson, Ariyaratnam and Camroux (2012)<sup>1</sup> (**attached**) show that policy uncertainty, measured by a material amendment to the LRET, would result in financing 'premium penalties' being applied to both renewable and thermal generation projects. That is to say, perceptions of ongoing policy uncertainty (driven by experience related to changes to the LRET after only two years of operation) would lead to additional costs being applied by financiers of power generation. The end result would be a further widening of actual pricing from efficient levels. These costs would likely manifest themselves as higher costs to consumers – up to \$119 million (NPV) in the event of a significant amendment to the RET (eg. a reduction in the target), and \$51 million (NPV) in the event of a repeal of the RET. These costs are over and above any savings resulting from lower LGC liabilities as a result of changes to the LRET targets.

Accordingly, changing the RET targets only two years into the operation of the LRET policy would be counterproductive to the intention and rationale behind the RET: it would actually serve as a disincentive to the very investment in renewable energy that is required in order for the targets to be achieved. It is important to note that amending the RET to alleviate electricity price increases of recent years would actually be counter-productive and increase costs to consumers.

AGL is strongly in favour of targets continuing to be expressed in fixed gigawatt hours rather than as a percentage of demand. The targets should be unaffected by changing demand forecasts. AGL points to the recommendations expressed in the Tambling Review in this regard. As experience has shown, demand is very difficult to predict and subject to frequent change. Therefore targets expressed as a proportion of demand would be prone to constant fluctuation which would introduce an additional element of uncertainty into the market with no counterbalancing benefit to justify it. Furthermore, if targets are expressed as a percentage of demand, it is unclear how variable renewable sources (such as hydro) would be treated given that output from these sources has varied by up to 7 TWh year to year in the past.

AGL does not consider it necessary to consider increasing the existing targets beyond 2020 at this stage. There have been significant reforms to climate change and renewable energy policies in the recent past, most notably the introduction of the national carbon price, changes to State feed-in tariffs schemes, and discussion about the introduction of a National Energy Savings Initiative. All of these initiatives, along with the RET, would be expected to have significant impacts on levels of investment in renewable energy, costs of technology, and certificate prices. AGL sees merit in allowing time for these initiatives to take effect, and for progress on meeting existing targets to be known, before mandating increased targets to apply some time into the future.

#### ***Investment in renewable energy***

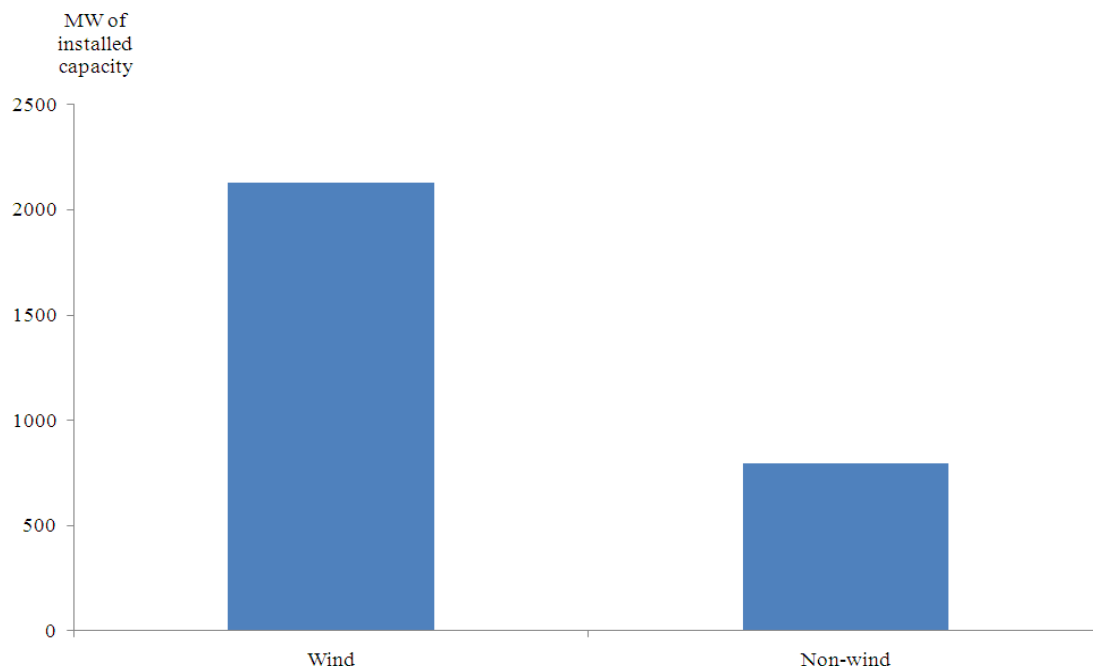
The existence and development of the RET in its various forms has led to a large growth in investment in various forms of renewable energy, as evidenced by Figure 1 below. While wind has experienced greater growth than other technologies, there are a wide variety of non-wind projects that have been developed since the introduction of MRET in 2001. The

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<sup>1</sup> Nelson, T, Nelson, J, Ariyaratnam, J, Camroux, S, (2012) 'An analysis of Australia's Large Scale Renewable Energy Target: restoring market confidence', AGL Applied Economic & Policy Research Working Paper No. 35, Sydney. Available at [www.aqlblog.com.au](http://www.aqlblog.com.au)

policy has been effective at driving the uptake of a range of technologies including landfill gas, biogas, agricultural waste, wind and solar. Accordingly, there is little need to change the policy as it has been effective at driving investment in new renewable energy.

Figure 1



Policy certainty is the most important consideration in ensuring that an economic environment exists in which sufficient investment occurs to meet the 2020 target. Making any material changes to the operation of the RET would run counter to this objective as it would increase the risks and lower the returns on investments in renewable energy made on the basis of the existing law. In turn, this would discourage the further investment which is necessary in order to ensure that future targets are met.

***Treatment of projects funded by the Clean Energy Finance Corporation ("CEFC")***

AGL does not believe that LRET targets should be adjusted to take account of projects financed by the CEFC. Such an increase would introduce policy uncertainty to the operation of the RET which as explained above would serve to discourage future investment in renewable energy generation. Further, it would be very difficult to calculate the amount of any possible increase in the target with any level of accuracy, given that the number and type of projects that will receive CEFC funding, and the impact this will have on investment in and financing of other generation projects, is unknown at present.

AGL sees no reason, at this stage, for CEFC-financed projects to be treated any differently from any other generation projects for the purposes of the RET. This would particularly be the case where the CEFC is a price taker in the market for large-scale generation certificates and the market continues to operate with competitive neutrality.

However, AGL believes that the CCA has a role to play in advising the Commonwealth Government on the potential negative impacts the CEFC could have on renewable energy investment as a result of the CEFC's involvement 'crowding out' other renewable projects (specifically, if funding provided by the CEFC is provided on preferential terms relative to other market participants). It would be appropriate for the CEFC in consultation with the Government to devise strategies to resolve this, for example, through the voluntary surrender of the certificates generated by CEFC-funded projects. However AGL sees no reason to make changes to the RET scheme at this stage which are predicated on the assumption that CEFC funding will have sub economic or inefficient impacts on other investment the market.

### **Eligible renewable sources**

The current list of renewable energy sources provided for in the *Renewable Energy (Electricity) Act 2000 ("REE Act")* is appropriate and does not require broadening. Changing the list of eligible renewable sources, either to extend or limit it, would arbitrarily impact the supply and price of large-scale generation certificates and would therefore adversely impact upon investor certainty. AGL is also unaware of large scale technologies not listed which are at the commercial deployment stage of their development.

### **Small-scale Renewable Energy Scheme**

#### **Separate LRET and SRES schemes**

AGL strongly supports the current and continued separation of the RET scheme into the LRET and SRES. As experience has shown, the economic drivers of, customers for, and nature of, investments in large and small renewable energy generation technologies are fundamentally different and separating the scheme on this basis allows appropriate policies to be devised which address these differences without adversely impacting each other.

Prior to the separation of the scheme in 2010, a number of significant overlapping policies with respect to small scale technologies were introduced by a number of jurisdictions such as solar credits and premium feed-in tariffs. As a result, the market for renewable energy certificates faced distortions due to a much higher than anticipated take up of small scale renewable generation which was not supported by the equivalent volume of renewable energy generation (i.e. via the certificate multiplier). This placed into jeopardy the objectives of the RET scheme, and led to a sharp decline in the price of renewable energy certificates and a stalling of new investment in large scale renewable electricity generation to satisfy the 20% target.

The separation of the RET scheme was vital to addressing this situation and to creating conditions conducive to investment in large scale renewable generation. If this separation was removed, the market for large scale renewable certificates could again face distortion, jeopardising the 20% target and stymieing large scale renewable electricity generation in Australia (particularly if any new State-based policies emerged). Further, the change in RET policy, particularly to an initiative that has only recently been introduced, would undermine policy certainty and investor confidence. There have been no fundamental changes to the market dynamics which made necessary the division of the RET scheme in 2010. Accordingly there is no rationale upon which to remove this separation now.

#### **Use of multipliers in the RET**

The solar credits multiplier introduced in 2009 was very successful at encouraging widespread domestic support for and uptake of solar PV systems, a corresponding increase in investment in solar PV technology, and a resultant decrease in technology costs. However, overuse of multipliers, or their use in the absence of economic justification, leads to the oversupply of STC's, which has a distortionary impact on the price of and market for these certificates. AGL fully supports the phasing out of solar credit multipliers and does not see a need for the introduction of any other form of multiplier in the RET scheme.

#### **Operation of STC Clearing House and appropriateness of \$40 cap for STCs**

AGL does not support changing the operation of the STC Clearing House, or amending the existing framework which allows the Minister to alter the fixed price under certain conditions. This would have a damaging impact on future investment in small-scale renewable energy generation and on the viability of current small-scale renewable energy generation businesses which would face asset devaluation resulting from a reduction in the STC price cap (other than for reasons already articulated in the legislation).

AGL notes the power of the Minister under the *REE Act* to reduce the clearing house price of STC's from \$40 (section 30LA), and the ability for changes to be made to the value of the solar credit multiplier from the levels specified in the *REE Act* under Ministerial authority. Given the availability of these mechanisms to make adjustments to the price of STC's in the future should the need arise, AGL sees no rationale for making these changes via amending the RET scheme at this stage.

### ***Diversity of renewable energy***

The design of the RET scheme should not be changed to promote any further diversity of renewable energy sources. We point to Figure 1 above to indicate the growth in investment in renewable energy generation that has occurred since 2001 which can be attributed to the introduction of the RET scheme in its various forms. AGL considers that it is preferable to address the issue of increasing the diversity of renewable energy sources, if this is considered necessary, through the decisions of, and financing by, the Australian Renewable Energy Agency and the CEFC.

### ***Frequency of review of RET scheme***

AGL points to the arguments made by Nelson, Nelson, Ariyaratnam and Camroux (2012) in the attached Working Paper that reveal that investors in power generation require stable policy frameworks. Amendment to a policy which is designed to underpin infrastructure investment for the next 20 years will not be welcomed by most investors.

The research referenced in the Working Paper shows that constant review is not reform. The LRET should remain in place without amendment if confidence in the policy is to be restored and additional costs are not to be imposed on consumers.

It is AGL's view that the policy should **not** be reviewed every two years – to do so is destructive to the efficient operation of the market. Rather than conducting a review every two years, market effectiveness would be better facilitated if the review only commenced once relevant threshold criteria were met. Such criteria would involve some type of LRET market failure which necessitated intervention. An example of such a situation would be where the penalty is being paid rather than new generation being constructed.

# AGL Applied Economic & Policy Research

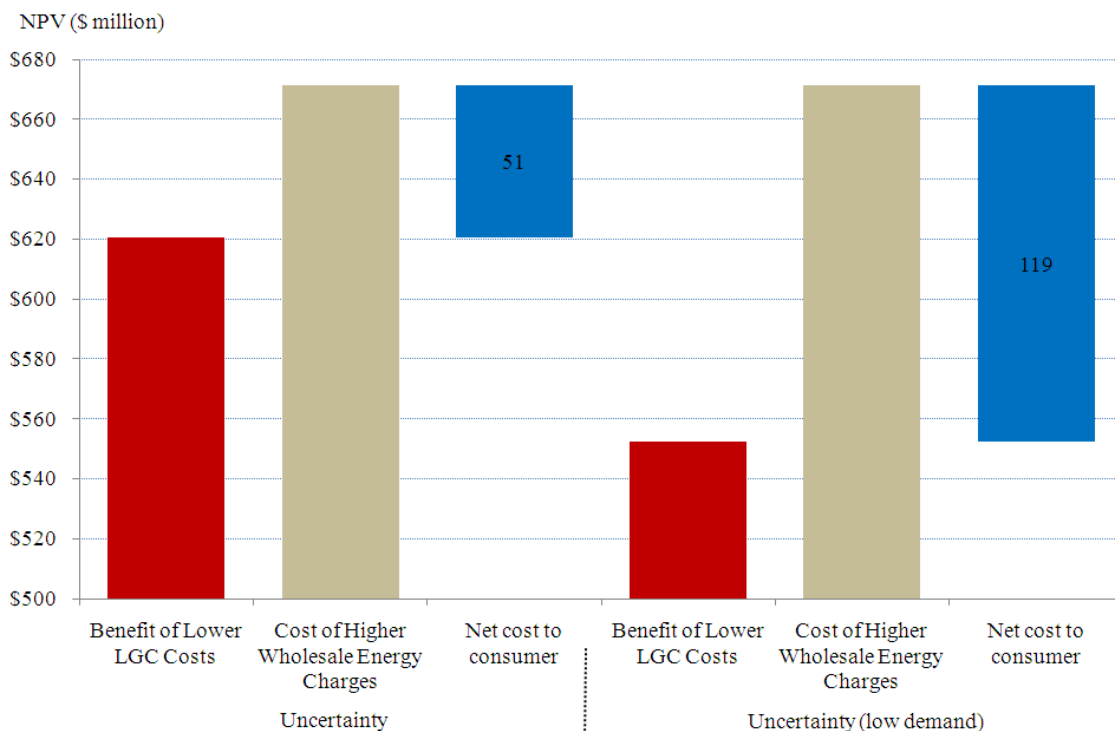
## Working Paper No.35

An analysis of Australia's Large Scale Renewable  
Energy Target: restoring market confidence



Tim Nelson, James Nelson, Jude Ariyaratnam and Simon Camroux

- This article considers approaches to renewable energy public policy development in Australia, applying the same methodology utilised by Simshauser and Nelson (2012) to assess the capital market efficiency losses (higher risk premiums) associated with uncertainty in relation to the Large-scale Renewable Energy Target (LRET).
- A survey of project financiers demonstrated that policy uncertainty (measured by material amendment to the LRET) would result in financing 'premium penalties' being applied to both new renewable and new gas-fired generation projects. The mean of respondents was 0.75 percentage points or 75 basis points (bps) above the reasonable cost of debt.
- Analysing the risk, and rates, applied by project financiers in relation to the Renewable Energy Target (RET), the researchers find that:
  - o The net cost to electricity consumers of repealing the RET is \$51 million (the result of the difference between higher generation costs and the removal of the need to purchase Large-scale generation certificates (LGCs)); and
  - o The net cost to electricity consumers of a significant amendment (a reduction of the target) of the RET is \$119 million (the result of the difference between higher generation costs and the removal of the need to purchase LGCs).





Policy conclusions and recommendations:

- Investors in power generation capacity and associated infrastructure require stable policy frameworks and any amendment to a policy which is designed to underpin infrastructure investment for the next 20 years will not be welcomed by most investors.
- Amendment of the RET policy framework that is aimed at alleviating electricity pricing pressures would be a more expensive option for electricity consumers and society than leaving the current policy in place.
- The policy conclusion from this research is that 'constant review is not reform'. The LRET should remain in place without amendment if confidence in the policy is to be restored and additional costs are not to be imposed on consumers.
- The policy should not be reviewed every two years as this compounds investor uncertainty.

## **An analysis of Australia’s Large Scale Renewable Energy Target: restoring market confidence**

Tim Nelson, James Nelson, Jude Ariyaratnam and Simon Camroux\*  
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September 2012

*In 2001, Australia introduced legislation requiring investment in new renewable electricity generating capacity. The legislation was significantly expanded in 2009 to give effect to a 20% Renewable Energy Target (RET). Importantly, the policy was introduced with bipartisan support and is consistent with global policy trends. At the time of writing, a statutory review of the policy is being conducted by the Climate Change Authority. In this article, we examine the history of the policy and establish that the ‘stop/start’ nature of renewable policy development has resulted in investors withholding new capital until greater certainty is provided. We utilise the methodology from Simshauser and Nelson (2012) to examine whether capital market efficiency losses would occur under certain policy scenarios. The results show that electricity costs would increase by between \$51 million and \$119 million if the large-scale RET is abandoned even after accounting for avoided renewable costs. Our conclusions are clear: we find that policymakers should be guided by a high level public policy principle in relation to large-scale renewable energy policy: constant review is not reform.*

*Keywords: policy uncertainty; renewable energy; electricity policy.  
JEL Codes: H23, D22, D62, D81, Q20*

### **1. Introduction**

Australia has significant reserves of low-cost black coal, brown coal and natural gas. This energy providence has sustained Australian economic growth for much of the last century. However, as Jarvinen, Orton and Nelson (2011, p.63) observed, Australian policy derivation is often ‘policy taking’ rather than ‘policy making’ due to the relatively small size of Australia in terms of population, technology origination and global influence. To that end, Australia has been one of 96 countries that have embraced government policies designed to facilitate greater investment in renewable energy technologies (BNEF, 2012) despite the advantage of abundant low-cost fossil fuel energy reserves. Globally, concerns about energy security have motivated policymakers to introduce mechanisms designed to deploy renewable energy. Within Australia, it would be reasonable to state that the public policy objectives being pursued in relation to renewable energy relate to reducing greenhouse gas emissions and diversifying Australia’s electricity supplies. This is in addition to market failures associated with sub-optimal, inter-temporal, investment allocation given the long-lived nature of electricity infrastructure, and a bipartisan agreement to reduce greenhouse gas emissions over the long-term.

The vast majority of Australia’s roughly 230 TWh of electricity production is the result of the combustion of coal and gas. In 2011, approximately 90% of all electricity generated in Australia was fuelled by either coal or gas. The remaining 10% was sourced from renewables with hydro-electric generation producing around 7% and wind contributing around 3% (esaa, 2012). This result is different when compared to ten years ago. In 2000, coal and gas collectively powered

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92% of all electricity generation in Australia with hydro-electricity comprising the remaining 8% (esaa, 2000). Wind was almost non-existent as a deployed technology within the Australian electricity market. The critical difference between the years 2000 and 2011 was the operation of the Mandatory Renewable Energy Target (MRET).

The MRET was introduced in 2001 by the Commonwealth Government with a public policy objective of increasing Australia's renewable electricity generation by an 'additional 2%'. It became known as the '2% MRET' policy and was successful in achieving its public policy objective. One only needs to examine the evidence presented in the preceding paragraph whereby the proportion of renewable energy in Australia's electricity system increased from 8% to 10% over the ten years to 2011 while load growth over the same period was a very substantial 20% in aggregate. In addition to the deployment of large scale renewable energy such as wind farms, the policy was also very successful at incentivising small-scale embedded technologies such as residential solar PV systems and solar hot water systems.

However, there have been several policy development 'junctures' where investor confidence has been damaged due to ongoing reviews and amendment of this policy. It remains a mystery as to why energy market policy, designed to underpin investments and investment confidence in long-dated infrastructure, is thought to be something which requires continuous review and continuous adjustment. Since the passage of the legislation underpinning the original MRET policy, there have been two major amendments and five points of 'review' by policymakers. While one of these amendments could be thought of as being unambiguously material – the expansion of the policy from 2% to 20% – the remaining reviews contributed little towards providing a stable platform for investors to make long-term decisions regarding renewable energy infrastructure.

An added complication for investors has been the overlapping nature of federal and state government policies. While this is always an issue in Federalist systems of government, the negative consequences associated with renewable energy policy have been particularly acute. When the MRET was expanded in 2009 to provide for a 20% Renewable Energy Target (RET), a last minute amendment was made providing small scale solar PV systems with a 'multiplier' for their output. At the same time, most state governments in Australia introduced premium feed-in tariffs. Individually, either policy mechanism may have made sense. But when combined, they distorted the RET significantly and led to investors in large-scale renewable energy effectively being 'crowded out' of the very policy designed to underpin new investments in the first place. As a consequence, the RET legislation was amended within 12 months of the significant 2009 reforms. The amendment resulted in the RET being split into two markets: a large-scale renewable energy target (LRET); and a small-scale renewable energy scheme (SRES).

In addition to consistent uncertainty in relation to Australian renewable energy policy, there has been the added uncertainty created by the intense debate around climate change policy within Australia. On 1 July 2012, the Commonwealth Government introduced a fixed carbon price or carbon tax of \$23 per tonne of carbon dioxide equivalent (CO<sub>2</sub>e) which will apply to all industrial facilities with emissions greater than 25,000 tonnes of CO<sub>2</sub>e. It is intended that the fixed price (which increases each year) will apply for three years with an emissions trading scheme to commence operation from 2015. This policy mechanism is designed to deliver on the Government's policy objective - reducing Australia's 2020 greenhouse gas emissions by 5% relative to 2000 levels. However, while the objective is shared by the opposition (Liberal/National Coalition), the mechanism by which to achieve the target is not. The opposition has committed to repealing the carbon price legislation if elected to form Government and will then implement a 'direct action' framework. Accordingly, policy uncertainty exists in relation to the longevity of carbon pricing in Australia.

The impact of carbon policy uncertainty has been quantified in two aspects by Australian economists (a) suboptimal investment decisions, and (b) suboptimal investment costs relative to a counterfactual scenario. Nelson, Kelley, Orton and Simshauser (2010) examined the costs associated with the sub-optimal capital investment caused by carbon policy uncertainty. They found that the costs could be as high as \$2 billion per annum in unnecessarily high electricity prices. This research was tested by other economic modeling firms and while the thesis was found to be correct, cost estimates varied. Nelson, Simshauser, Orton and Kelley (2011) provide a summary of these studies so we do not intend to replicate such analysis here. On suboptimal investment costs, Simshauser and Nelson (2012) estimated the capital market efficiency losses associated with carbon policy uncertainty. Their project finance market survey established that providers of debt finance would impose higher risk premiums as a result of ongoing policy uncertainty in relation to carbon pricing. The higher risk premiums would result in capital market efficiency losses of up to \$4.5 billion over the period between 2015 and 2020.

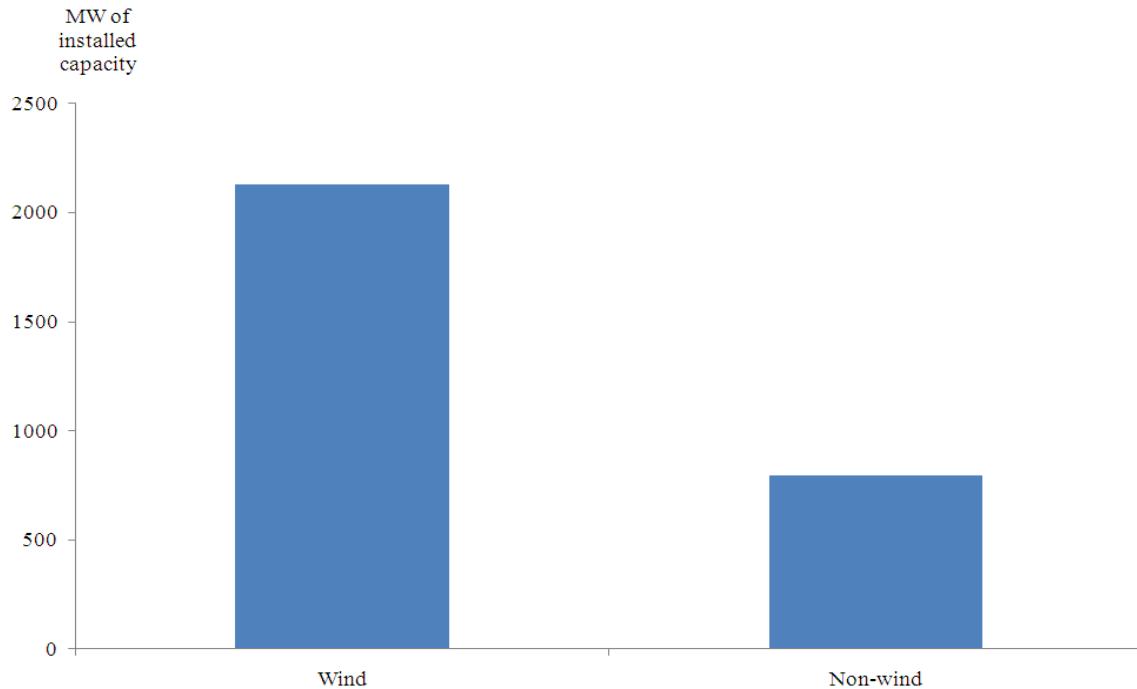
It is in this context that this article considers approaches to renewable energy public policy development in Australia, applying the same methodology utilised by Simshauser and Nelson (2012) to assess the capital market efficiency losses associated with uncertainty in relation to the LRET. It is important to note that this article is not intended to discuss the merits or otherwise of renewable energy policy. This has been debated at length in the Australian and international context (for example, see SKM-MMA, 2012). Rather, our analysis takes as given a renewable energy policy in place for 11 years with legislated targets for the following 18 years. As employees of one of Australia's largest diversified energy companies, we have conducted this analysis to inform the public policy debate around the merits of amending the LRET through the current statutory review being undertaken by the Climate Change Authority (CCA).

This article is structured as follows: Section 2 reviews the evolution of large scale renewable energy policy in Australia and associated global market developments; the supply and demand for Large Scale Generation Certificates (LGCs) is presented in Section 3; the results of a survey of renewable electricity market participant views in relation to policy and pricing are documented in Section 4; Section 5 analyses the capital market efficiency losses associated with higher risk premiums being applied to new developments; partial equilibrium analysis of electricity price impacts related to ongoing policy uncertainty is presented in Section 6; our policy recommendations are presented in Section 7 with concluding remarks provided subsequently.

## **2. The evolution of large-scale renewable energy policy in Australia**

The Mandatory Renewable Energy Target (MRET) was introduced in Australia in 2001. The legislation underpinning the policy was passed in 2000. The *Renewable Energy (Electricity) Act 2000* and *Renewable Energy (Electricity) Regulations 2001* required electricity retailers to purchase Renewable Energy Certificates (RECs) to avoid paying a shortfall penalty of \$40 per megawatt hour (MWh) of renewable energy not acquired. Under MRET, new renewable electricity generators constructed after 1997, and incumbent renewable generators who generated power above their historical baseline, were eligible to create RECs with one REC equivalent to the generation of one MWh of renewable energy. The legislation required retailers to progressively increase their purchases of RECs so that by the year 2010, an additional 9,500 MWh of new renewable generation would be produced. It was forecast that the policy would add renewable generation output equivalent to around two percent of electricity demand by 2010. It could be argued that the policy was effective in achieving its objectives over its first few years of existence as significant new investments in renewable energy capacity were made in biomass, landfill gas and wind farms. Figure 1 shows the new installed renewable capacity (wind and non-wind) since 2001. This is in addition to the roughly 1.5 GW of small scale solar PV installed between 2001 and 2011.

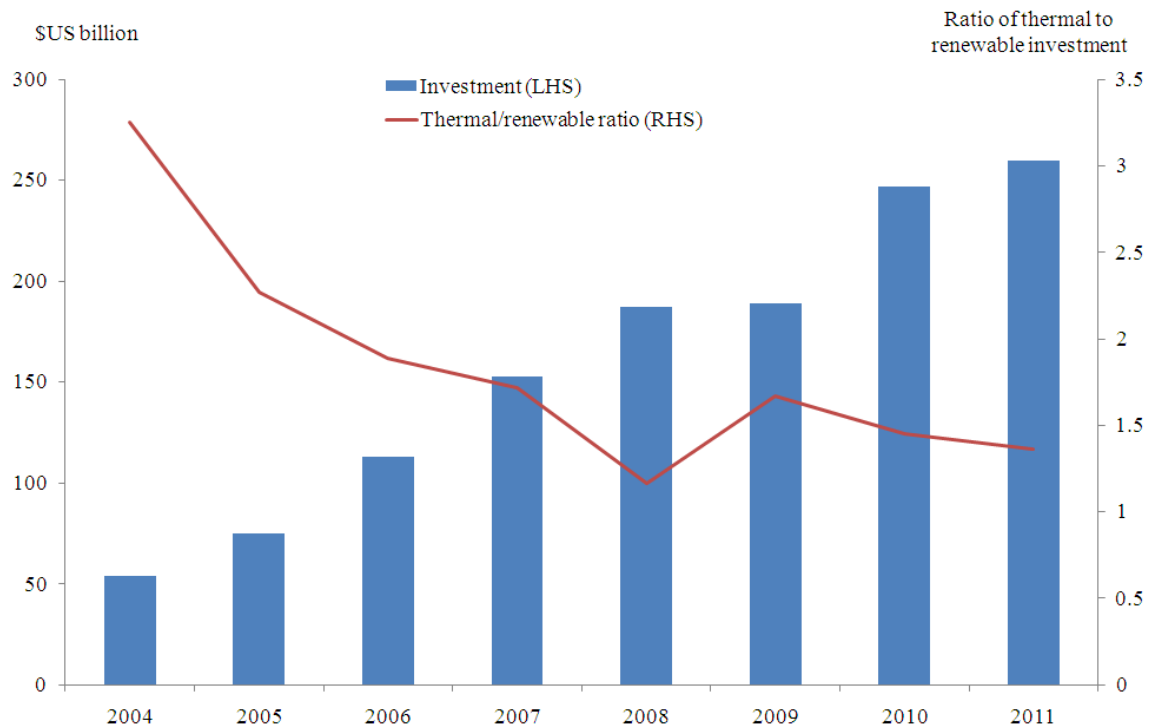
**Figure 1: Investment in large-scale renewable capacity 2001-2012**



Source: esaa, 2012

In 2003, a review of the MRET legislation was initiated by the Howard Government and conducted by a panel chaired by former Northern Territory Senator Grant Tambling. The review came to be known as the ‘Tambling Review’ and heard from interested stakeholders about the operation of the MRET since its inception in 2001. Recommendations from the review included: the MRET measure to continue to operate; MRET targets to continue to be expressed in GWh and not as a percentage of overall electricity demand; MRET targets to increase beyond 2010 and to stabilise at 20,000 GWh in 2020; and the end date of the measure to be extended beyond 2020 so that renewable energy projects receive RECs for a full 15 year period presumably because such a tenor would align more closely to project financings (Australian Greenhouse Office, 2004).

The Tambling Review provided its report to the Minister for the Environment and Heritage in late 2003 and was tabled in Parliament in early 2004. The Commonwealth Government made a number of minor changes to the policy as a result of the Tambling Review but the significant recommendations outlined above were largely ignored (Australian Greenhouse Office, 2004). When considered in the context of global renewable energy policy, this is not surprising. Renewable energy investment at the time was relatively small by comparison to investment in thermal coal-fired and gas-fired power generation. This is shown in Figure 2. Global renewable energy investment (LHS) and the ratio of global thermal to renewable investment (RHS) are plotted for the years 2004 through 2011. In 2004, when the Commonwealth Government largely rejected many of the recommendations of the Tambling Review, investment in new thermal electricity generation was around 3.5 times greater than investment in new renewable electricity capacity.

**Figure 2: Global investment in renewable energy**

Source: Adapted from Bloomberg New Energy Finance (2012)

Figure 2 shows that between 2004 and 2007, there was a rapid run-up in global renewable energy investment, and a significant decline in the ratio of thermal to renewable investment. This coincides with a rising number of countries around the globe introducing renewable energy targets. While the Commonwealth Government had ruled out increasing the MRET, various state governments initiated their own policy frameworks designed to support the uptake of renewable energy. In 2006, the Victorian Government legislated the Victorian Renewable Energy Target (VRET) and the New South Wales Government developed (but did not legislate) the New South Wales Renewable Energy Target (NRET). Both policies were effectively duplicates of the MRET policy with higher targets, whereby a liability was placed on retailers incentivising the development of new renewable energy through tradable certification.

It was obvious to industry participants, at least, that this situation of duplicate policy development was adding unnecessary transaction costs and was therefore unsustainable. Consequently, the 2007 Commonwealth election saw both major political parties put ambitious clean energy policies to the electorate. The incumbent Howard Government outlined an expansion of the MRET to achieve 15% ‘clean’ energy production by 2020. In addition to expanding the targets under the MRET, the eligibility criteria was to be amended to allow ‘effectively zero emission’ technologies such as coal and gas generation with carbon capture and storage. The Rudd Opposition proposed an expansion of the MRET targets to achieve 20% renewable energy production by 2020. Regardless, both the incumbent Government and the Opposition pledged to introduce emissions trading and expand renewable energy policies. However, a key point that was noted by all market participants was the broad based bipartisan agreement related to anthropogenic climate change and renewable energy policies.

Policy certainty did not occur immediately. The Rudd Government took almost two years to legislate a relatively simple set of amendments required to give effect to the expanded 20%

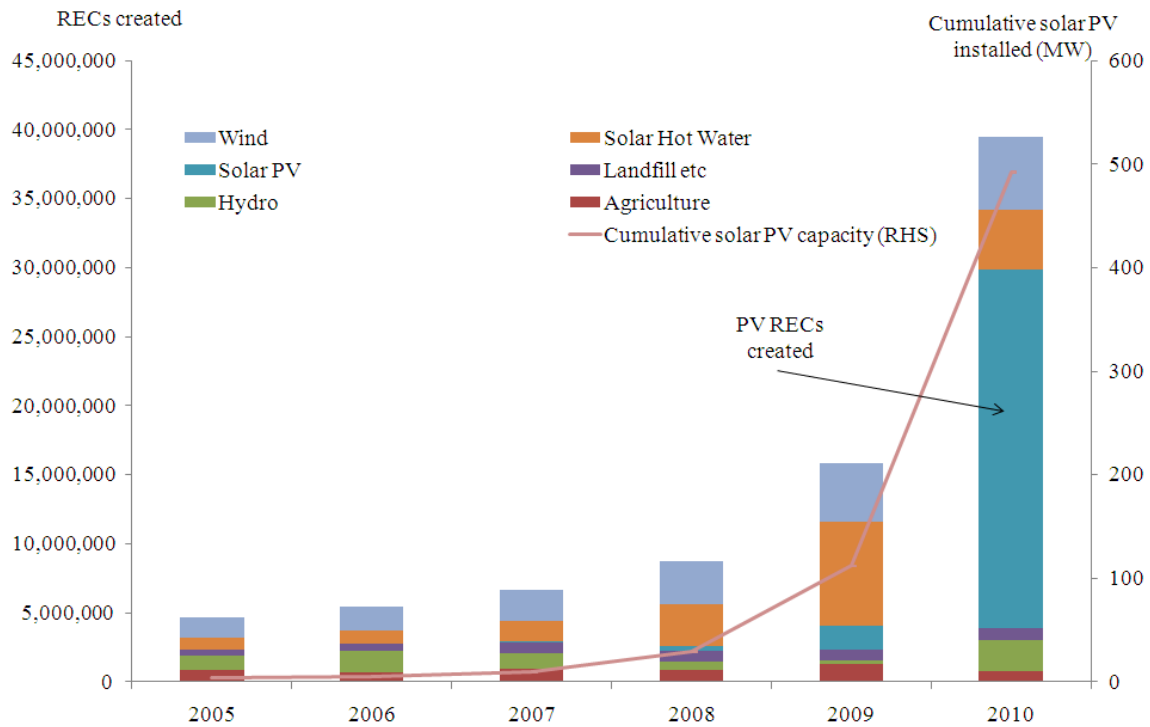
Renewable Energy Target.<sup>1</sup> However, the legislation passed in August 2009 also contained a number of material changes to the design of the original MRET legislation. The most notable of these was the Solar Credits Multiplier. While small-scale solar PV generation (residential solar) had historically been able to create RECs for fifteen years of generation upfront (known as ‘deeming’), the Solar Credits Multiplier allowed installers of small scale solar PV to create five times the number of these certificates. In effect, residential solar PV was receiving 75 years worth of certificates immediately while all other generation types (e.g. large-scale biomass, solar, landfill gas and wind) only created RECs as the actual energy was generated.

**Table 1: Premium Feed-in Tariff policies in place during 2010**

State	Max size	Rate \$/MWh	Duration	Approximate pay-back period
Vic	5kW	\$600 (net)	15 years	6.5 years
SA	30kW	\$540 (net)	20 years	7.5 years
NSW	10kW	\$600 (gross)	7 years	2 years
QLD	30kW	\$440 (net)	20 years	9 years
ACT	30kW	\$450 (gross)	20 years	2.5 years

Source: Nelson, Simshauser and Nelson (2012)

**Figure 3: Renewable Energy Certificates (RECs) created and cumulative solar PV installed**



Source: REC Registry; Nelson, Simshauser and Nelson (2012)

At the same time, premium feed-in tariffs for small scale solar PV units were being introduced by most Australian state governments. Table 1 outlines the premium feed-in tariff policies that were in place in 2010 in each jurisdiction. With the introduction of the Solar Credits Multiplier and the various premium feed-in tariff policies, the payback for installing small scale solar PV was between 2 and 9 years. With such attractive investment returns, it was obvious that installation of small-scale solar PV systems would significantly increase. The result of these distortions was an

<sup>1</sup> Following passage of the amendments giving effect to the expansion of the MRET, the policy became known as the Renewable Energy Target (RET).

effective ‘crowding out’ of other renewable energy technology options within the RET and an associated slump in prices due to the material oversupply of RECs.

Figure 3 shows the annual creation of RECs by generation type since 2005 (LHS). Note in 2010 that the actual target under the MRET policy had a demand of 9.5 million certificates but about 40 million were actually created/supplied, primarily through the distortionary effects of the Solar Credits Multiplier, or ‘phantom RECs’ as they became known. The combination of the Solar Credits Multiplier and state-based premium feed-in tariff policies resulted in approximately 500 MW of new installed residential solar PV capacity over the same period (RHS). The RET policy framework was not incentivising new renewable energy development other than residential solar PV, but the annual production of renewable energy was only 1/75 of the certificates created because, as noted earlier, the 15-year output from such units is deemed up-front, and was then multiplied five times over. Unsurprisingly, REC prices plunged from around \$50 in April 2009 to just \$28 per REC in late-2009 as Figure 4 later reveals. With wholesale electricity prices in the various National Electricity Market (NEM) regions in 2009 between \$33/MWh and \$55/MWh, combined revenue from wholesale and REC pricing was well short of the roughly \$120/MWh required to bank a new wind farm project at that time.

In late-2009 and early-2010, there were a number of vocal critics of the newly designed RET. The significant disquiet from large-scale renewable energy producers about the unintended consequences of the Solar Credits Multiplier and complementary premium feed-in tariff policies resulted in the Government (with Opposition support) announcing fundamental changes to the operation of the policy. In February 2010, the Commonwealth Government announced that the RET would be split into two new policies: the Large-Scale Renewable Energy Target (LRET) and the Small-Scale Renewable Energy Scheme (SRES). The LRET would operate in the same way that the RET and its predecessor MRET had operated – fixed GWh targets applied to liable entities with Large-Scale Generation Certificates (LGCs) replacing RECs as the certificate eligible to be traded. However, only large-scale generation would be eligible to create LGCs for the 41,000 GWh target in 2020. The SRES would allow installers of small-scale renewable generation (i.e. solar PV units) to create fixed price \$40/MWh certificates for their deemed abatement with liable entities (electricity retailers) required to purchase them at rates prescribed by the independent regulator.

These changes were legislated in June 2010. One of the amendments negotiated during the legislative review process related to ongoing ‘statutory review’ of the policy. Section 162 of the *Renewable Energy (Electricity) Act 2000* (the legislation underpinning the LRET and SRES) requires an independent statutory review to be conducted every two years and presented to Parliament. The first of these reviews is to be conducted by the newly established Climate Change Authority and is to be completed by 31 December 2012. Perhaps unsurprisingly, and indeed ironically, 12 months prior to the current review, the market essentially closed down for business due to the heightened uncertainty that prevailed due to the review itself. The consequences for market pricing of renewable energy are highlighted in Figure 4.

**Figure 4: LGC (formerly REC) price and total renewable revenue**

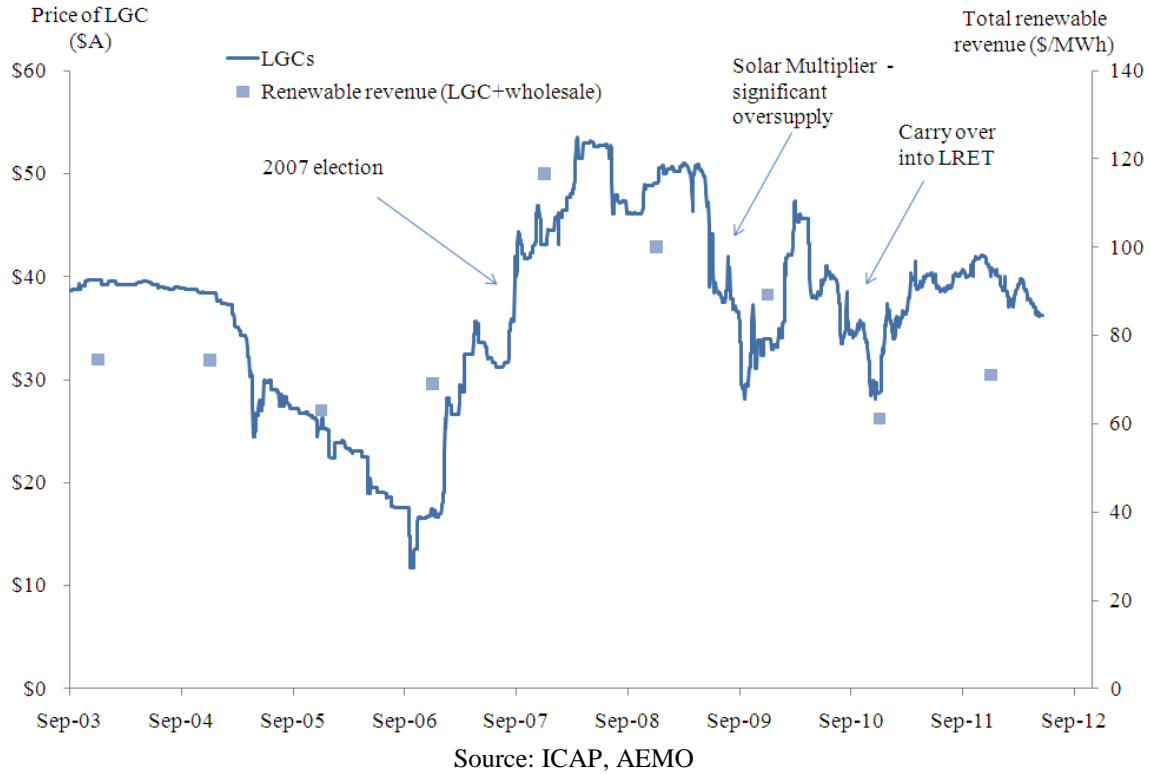


Figure 4 shows the prices of LGCs (formerly RECs) from 2003 to 2012 (LHS). Also shown is the average revenue that would have been earned by a large scale renewable energy generator from LGCs and the average wholesale energy price in South Australia in that year. It should be noted that the long-run marginal cost (LRMC) of the most economic renewable technology (wind) is currently about \$90-\$100 per MWh. Two things are clear from this graph. First, the market for LGCs responds significantly to movements in government policy. Three examples are highlighted: (a) the rapid run up in LGC prices in 2007 as a result of an election in which political parties were effectively seeking to ‘out-bid’ each other in relation to support for renewable energy policy; (b) the significant fall in prices in 2009 as the combination of the Solar Credits Multiplier and premium feed-in tariffs resulted in significant oversupply of certificates; and (c) the fall in prices in 2010 associated with emerging knowledge of the extent of the oversupply of RECs that would be carried into the LGC market. And second, relative policy certainty is required for the combined LGC and wholesale market revenue to equal or exceed the LRMC of developing renewable energy.

This review of history highlights the particularly volatile nature of large-scale renewable energy policy development since 2001 within Australia. One could be forgiven for suggesting that investment has flowed into the industry in spite of policy rather than because of it. Specifically, the original MRET legislation has been materially amended twice in ten years and reviewed publicly by policymakers on at least four occasions. The logical question that follows is whether investor and market participant perceptions of the market have been skewed towards expecting further legislative or regulatory change.

### 3. Supply and demand for large scale generation certificates

Economic theory dictates that the price of an LGC today should reflect the difference between the wholesale electricity price and the long-run marginal cost of the most economic renewable energy project at the point of time where new renewable generation is required due to supply falling short of demand (discounted to current prices). Accordingly, we have constructed a simple model of LGC supply and demand to test whether the price today reflects the underlying fundamentals of the market. The demand and supply for LGCs in our model in any year (y) is calculated using equation 3.1 (demand) and equation 3.2 (supply):

$$D_{LGC} = D_{RET} + D_{GP} + D_V \text{ where:} \quad (\text{Equation 3.1})$$

$D_{RET}$  is equal to legislated targets under the *Renewable Energy (Electricity) Act* in year (y);

$D_{GP}$  is equal to yearly demand for Green Power (projected forward unchanged)<sup>2</sup>; and

$D_V$  is equal to yearly demand for other renewable energy (e.g. known large contracts)<sup>3</sup>.

$$S_{LGC} = S_{CS} + S_W + S_H + S_O + S_{NW} \text{ where:} \quad (\text{Equation 3.2})^4$$

$S_{CS}$  is equal to the cumulative surplus of LGCs carried forward from y-1;

$S_W$  is equal to the annual supply produced by existing wind turbines;

$S_H$  is equal to the annual supply produced by existing hydro generators;

$S_O$  is equal to the annual supply produced by other existing renewable generators; and

$S_{NW}$  is equal to the annual supply produced by wind turbines under construction today.

Balancing equations 3.1 and 3.2 in each year (y) produces either a surplus of LGCs carried forward to y+1 as cumulative surplus or a deficit carried forward as new supply required. At the beginning of the modeling period (2012), we have assumed a cumulative surplus of 32 million LGCs. This is based upon the surplus of certificates available at the end of the 2011 compliance period. The results of our model are shown in Figure 5.

<sup>2</sup> Data sourced from reports available at: [www.greenpower.gov.au](http://www.greenpower.gov.au)

<sup>3</sup> Data based upon knowledge of voluntary industry contract purchases of new renewable energy

<sup>4</sup> Data for existing generators sourced from REC registry – [www.rec-registry.gov.au](http://www.rec-registry.gov.au). Data for new generation sourced from ESAA (2012)



**Figure 5: Modeled supply and demand of LGCs from 2012 to 2020**

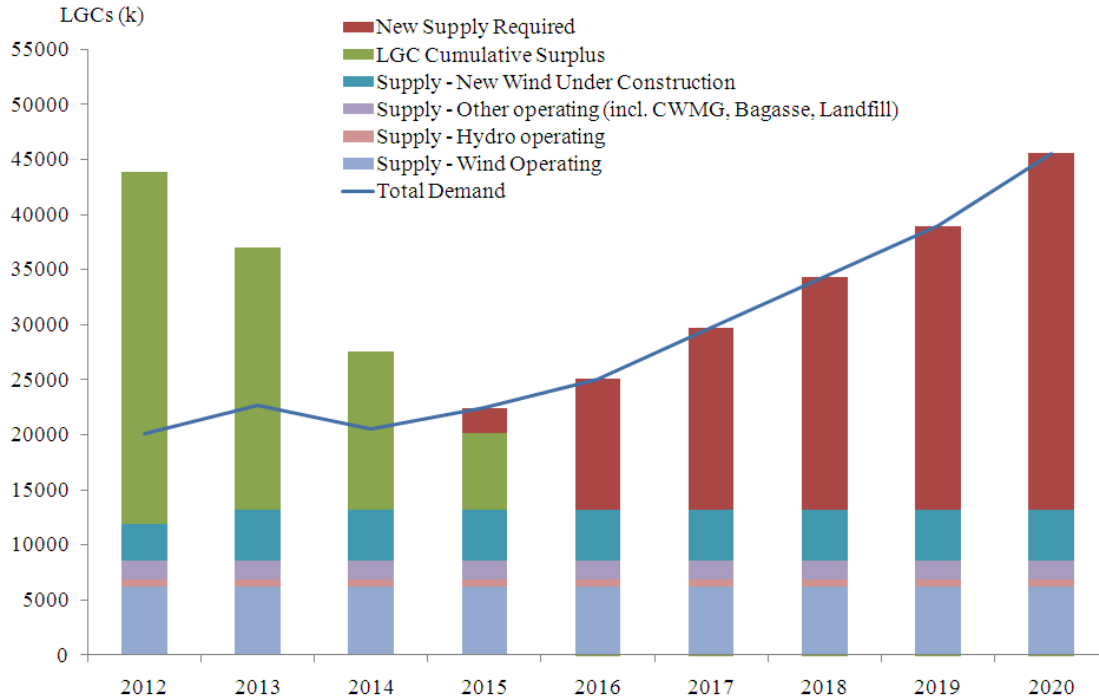


Figure 5 shows the results of our modeling of the supply and demand of LGCs from 2012 to 2020. The significant existing surplus of LGCs in 2012 is gradually absorbed by increasing demand and a small amount of new supply through commissioning of projects currently under construction. However, new supply (from new projects not yet under construction) is not required until 2015. Beyond 2015, the significant increase in legislated targets under LRET results in rapidly increasing new build requirements. By 2020, an additional 32 million certificates are required to be produced each year to ensure compliance with the scheme. This is the equivalent of approximately 9,000 MW of new renewable energy capacity (assuming 35-40% capacity factors and median output from existing fleet of renewable plant). Over the 6 years between 2015 and 2020 (inclusive), implied annual new investment is therefore around 1,500 MW or \$3.3 billion (assuming an ‘all-in’ overnight capital cost of \$2,200/kW for new wind).

Our modeling has shown that new renewable generation is required in 2015. Based upon this observation, we are now able to calculate the implied LGC price today. As outlined earlier, the price of an LGC certificate today should reflect the difference between the wholesale electricity price and the LRMC of the most economic renewable energy project in 2015 (discounted). Based upon a wind LRMC of \$99/MWh<sup>5</sup> (inflated by 2.5% to account for inflation and expressed in 2015 dollars)<sup>6</sup> and a 2015 forward electricity contract price ( $P_E$ ) of \$55/MWh<sup>7</sup>, we can use equation 3.3 to solve the efficient LGC price today.

$$LRMC = P_{LGC} + P_E \quad (\text{Equation 3.3})$$

$$\$107/\text{MWh} = P_{LGC} + \$55/\text{MWh}$$

<sup>5</sup> We have based our estimate of the LRMC of wind utilising project financing results from a subsequent section within this article. The estimate would be at the low conservative end of a spread of low, medium and high estimates.

<sup>6</sup> It is reasonable to utilise current capital costs for wind given that a two year construction timeframe would require financial close for new projects to be completed in 2013 (less than a year from the time of writing) to ensure that the shortfall of LGCs in 2015 is met. Wind is currently the most economic large scale renewable energy opportunity in Australia.

<sup>7</sup> Obtained from d-cyphatrade on 18 June 2012 – 2015 base future for NSW.

$P_{LGC} = \$52$  per certificate (2015 dollars).

Discounting this price using a 7% discount rate for the ‘cost of carry’ for the three years between 2015 and 2012 implies that the efficient price of LGC certificates in 2012 is \$42. This can be contrasted with the price of LGC certificates being \$36 at the time of this calculation. Based upon this analysis, it would appear that LGC market participants either: disagree with the fundamentals presented in this paper; or they believe the market structure is likely to be changed through further legislative or regulatory change, thereby diminishing LGC value. In our view prices are well below those implied by market fundamentals. The efficient price (based upon market fundamentals and assuming perfect information) is 17% higher than the actual market price. Given this disparity, it is necessary to consider why market participants are not acting on this clear arbitrage opportunity and increasing demand for LGCs to reflect the economic disparity between actual and our estimate of efficient pricing. As Section 4 later reveals, it would seem our peers agree quite fundamentally with this substantive finding. Our hypothesis is that the continuing review and change to the large-scale renewable energy policy outlined in Section 2 has led to a belief among market participants that, in aggregate, ongoing policy changes will occur and thus any apparent arbitrage opportunity may well be nothing more than ‘*a mirage*’. Accordingly, prices have and will continue to trade at a discount to the ‘efficient’ price because investors must, based on historical experience, wait to see what the outcomes of the legislative review by the Climate Change Authority will be before they commit scarce debt and equity capital to meet the underlying policy objective function.

#### **4. Market participant views on the LGC market**

To suggest that a genuine price arbitrage exists, is well known but is not being cleared by a market of buyers and sellers requires more than a casual observation to be credible. To that end, we conducted a survey of LGC market participants in mid-2012 to confirm whether the existence of an arbitrage exists, and if so, to test whether ‘policy uncertainty’ is the key issue preventing the arbitrage from being cleared by the market efficiently. Two sets of market participants were invited to participate in the survey: (1) large-scale renewable energy developers and the buyers of the certificates (i.e. energy retailers); and (2) project financing professionals. The survey responses for the first group of respondents were facilitated by the Energy Retailers Association of Australia (ERAA) and the Clean Energy Council (CEC) to remove any bias associated with knowledge of the authors. 11 firms responded and given the relatively small number of materially substantive participants in the sector, we believe this sample size is in fact quite robust because we understand that the most significant participants (by market share) have been included in the sample. That said, we acknowledge that such a small size requires further validation of results which we provide in the following analysis. The second group of respondents was contacted directly. The survey size for project financing professionals was 14 banks and 10 responses were received representing a response rate of 71%. The results of the survey of large-scale renewable energy developers and electricity retailers are presented in Table 2.

**Table 2: Survey response (large scale renewable energy developers/retailers)**

Survey Question	Response
When do you think the market will require new renewable generation?	$\mu = 2015$ (Var=0.98 years)
Does the current LGC price represent simple market oversupply or other factors	5 participants stated simple oversupply, 6 participants stated other factors
Based upon market fundamentals, what do you believe the market price of LGCs should be in 2012?	$\mu = \$45$ - $\$50$ (Var= $\$1.19$ )
What do you believe is the reason for why the current LGC price is not in the range you provided in the previous question? <sup>8</sup>	4 participants stated uncertainty about both LRET and carbon pricing, 2 participants stated uncertainty about LRET, remaining participants gave other reasons including lack of spot trading due to prevalence of non-market PPAs
Do you believe the LRET should be amended through the upcoming Climate Change Authority review?	10 participants stated no amendments should be made, 1 participant said amendments should be made (related to reducing the target)

The results contained in Table 2 confirm that ongoing policy uncertainty is impeding the efficient clearing and indeed, functioning of the LGC market. The mean of responses indicates that market participants expect that new generation will be required to be operational by 2015 to ensure that demand is met. These views of market participants align with our modeling presented in Section 3, which is important given our earlier comments on the existence of market arbitrage. The mean of responses provided in relation to the ‘efficient’ market price was the price band \$45-\$50 per certificate, significantly above the current market price of \$36 per certificate. Again, this aligns closely with our modeling in Section 3 which produced an ‘efficient’ market price of \$42 per certificate. It is likely that our lower estimate of the ‘efficient’ market price relative to the views of those surveyed is a function of our estimate of the LRMC of wind being at the conservative (low) end of the full spectrum of estimates of wind LRMC within the industry (perhaps due to locational or intermittency discounts).

While we would not suggest such results could be relied upon as conclusive, they are, in our opinion, persuasive in relation to our hypothesis being robust. Importantly, the majority of market participants were of the view that the disparity of pricing between implied efficient prices based on market fundamentals and actual prices is the result of ongoing policy uncertainty – specifically carbon pricing and the LRET. When asked whether the LRET should be amended through the legislative review process to be undertaken by the Climate Change Authority, 10 out of the 11 participants surveyed stated that it should *not* be amended. Importantly, the results of our analysis of this relatively small sample (by number of participants) are supported by others including ROAM (2012) and environmental market brokers such as Nextgen (2012) who noted that, “*given the history of regulatory change that has occurred over the last five years in particular, having confidence in the long term appearance of the LRET is no easy thing.*” Importantly, our results are not specific to LRET market participants. Project financing professionals provided similar responses as Table 3 demonstrates.

<sup>8</sup> Four options were provided: uncertainty about carbon pricing; uncertainty about the LRET policy; uncertainty about both carbon pricing and LRET; and other.

**Table 3: Survey response (project financing professionals)**

Survey Question	Response
When do you think the market will require new renewable generation?	$\mu = 2015$ (Var=0.54 years)
Does the current LGC price represent simple market oversupply or other factors	4 participants stated simple oversupply, 6 participants stated other factors
Based upon market fundamentals, what do you believe the market price of LGCs should be in 2012?	$\mu = \$45$ -\$50 per certificate (Var=\$11.14)
What do you believe is the reason for why the current LGC price is not in the range you provided in the previous question? <sup>9</sup>	6 participants stated uncertainty about both LRET and carbon pricing, remaining participants gave other reasons including combination of oversupply and policy uncertainty
Do you believe the LRET should be amended through the upcoming Climate Change Authority review?	7 participants stated no amendments should be made, remaining participants stated amendments extending the scheme beyond 2030 should be made

Table 3 shows that electricity generation project financing professionals have similar views on the LGC market to LGC market participants – bearing in mind that project financiers have an especially acute understanding of market conditions given their debt facilities are illiquid and particularly long-dated. Project financiers must closely analyse wholesale electricity and environmental markets to assess the business case for providing funding to any new or existing piece of energy infrastructure. Project financing professionals expect that new generation will be required from 2015 and that the price of LGCs should be between \$45 and \$50 per certificate at the time of writing (albeit with a significantly greater variance of pricing expectations than LGC market participants). Based upon the mean, these results mirror those of the market participants. In relation to the reasoning behind the misalignment between market fundamentals and pricing, the majority of respondents stated that uncertainty about the legislative review of LRET and the longevity of carbon pricing policy are key factors. It is unsurprising given the similarity of views on these issues that the majority of project financiers do not support further changes to LRET through the Climate Change Authority legislative review.

## 5. Capital market efficiency losses and policy uncertainty

Policy uncertainty is evidently present within the large-scale renewable energy industry. There is a rich and detailed existing economic literature related to the costs of policy uncertainty in Australia's electricity markets (see for example Nelson et al, 2010; Frontier Economics, 2010; Sinclair Knight Merz, 2011a; Deloitte, 2011; Nelson et al, 2012a; and Simshauser and Nelson, 2012). Two basic implications of ongoing public policy uncertainty on the electricity industry have been explored. Firstly, the impact of sub-optimal investment in new generation capacity has been examined. As electricity generation is highly capital intensive, it is necessary to take a long-term view of market fundamentals and regulatory and legislative stability to ensure that capital is not stranded. Secondly, the impacts of capital market efficiency losses have been examined.

It is the second form of uncertainty related to capital market efficiency losses that we address in this article. Given the results presented in Section 4 indicate that the market is concerned that further changes to the LRET policy may be made as a result of the Climate Change Authority's legislative review, it is appropriate to ask whether *actual* material amendment of the policy in 2013 would result in additional risk premiums being applied to large-scale renewable energy

<sup>9</sup> Four options were provided: uncertainty about carbon pricing; uncertainty about the LRET policy; uncertainty about both carbon pricing and LRET; and other.

investments. The framework applied by Simshauser and Nelson (2012) is useful for answering such a question. We have adopted this framework in the current section to determine whether further amendment of the LRET will result in capital market efficiency losses.

Simshauser and Nelson (2012) surveyed project financing professionals to determine pricing, tenors and participation in the market for funding large scale generation in the NEM. Simshauser (2010) found that the NEM has more than 20,000MW of privately owned (i.e. pre-existing and new entrant) generating plant and around 17,000MW (85%) of this is project financed. With such a heavy reliance upon project financing, spreads on syndicated project debt provide a specific and relevant insight into market participant expectations about the risks associated with investment in electricity generation infrastructure. This is important for two reasons. First, historically much of the plant introduced since the creation of the NEM in the late 1990s has been project financed. Second, and looking forward, while it may well be true that the large retailer/developers (i.e. AGL Energy, Origin Energy, TRUenergy) may be theoretically able to raise on-balance sheet finance from debt capital markets to avoid the use of project finance, such an outcome may lead to a substantial concentration of renewable plant ownership. This would seem incompatible with the objectives of the policy. Besides which, in a well functioning market for new plant, a material proportion of the large investment required under LRET should be project financed and undertaken by Independent Power Producers if for no other reason than predictable balance sheet and investment concentration constraints of those large retailer/developers – hence our interest in broader bank debt spreads.

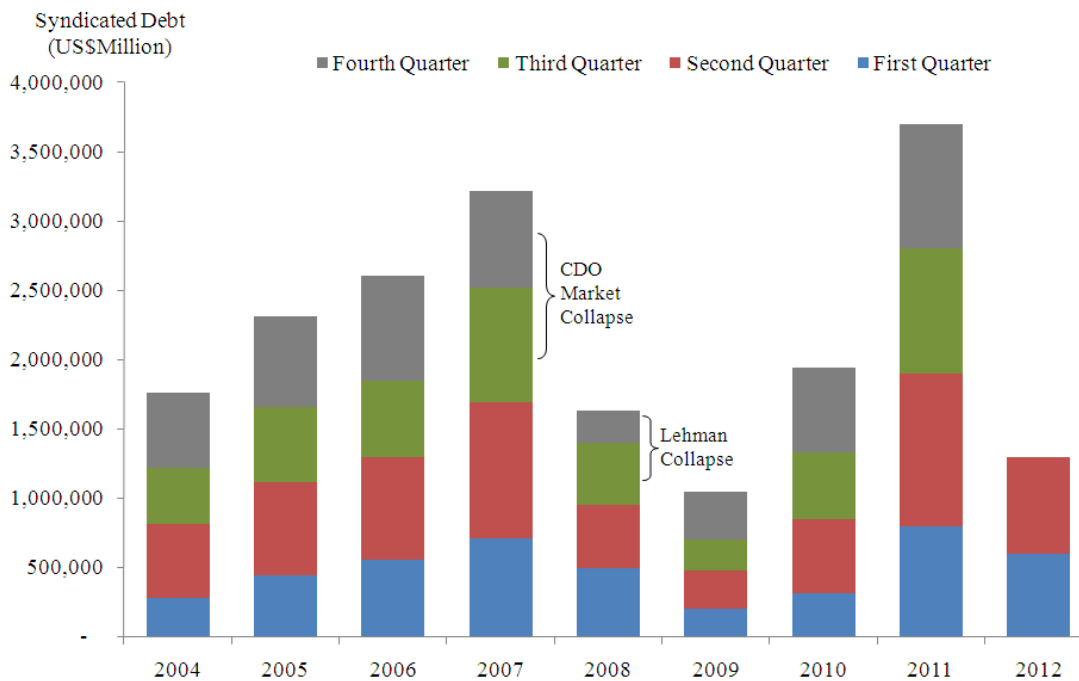
The results of the Simshauser and Nelson (2012) survey are presented in Table 4. Note the significant increase in Project Finance (PF) spreads from 2008 to 2011 relative to those of BBB bonds (down only 11% compared to 33%). BBB bonds were used as a comparator. While corporate bonds are not necessarily good substitutes for PF, the relative change in pricing of both debt instruments is of course entirely relevant. They found that the most logical explanation of the elevated spreads relative to local and global comparators was the ongoing policy uncertainty on greenhouse gas emissions. The conclusion of the study was that the higher spreads arising from carbon pricing uncertainty would result in increased electricity prices for consumers.

**Table 4: Survey results on perceptions of PF facilities in 2006, 2008 and 2011**

	2006	2008	2011
PF Spreads	100-120bps	400-450bps	350-400bps
<i>Spread Movement</i>	<i>Stable</i>	<i>Up 3.8×</i>	<i>Down 11%</i>
Max tenor	12 years	3 years	7 years
Max gearing	65%+	Approx 55%	Approx 60%
MLA Banks	3 or less	7-8 banks	7-8 banks
Syndication Banks	3 or less	Club deal	4-8 banks
Active Banks	29	11	14
Spread on BBB Bonds	85bps	360bps	240bps
<i>Spread Movement</i>	<i>Stable</i>	<i>Up 4.2×</i>	<i>Down 33%</i>

Source: Simshauser and Nelson (2012)

The 2012 study noted that volumes in syndicated debt markets retreated significantly during the ‘great recession’ of 2008 and 2009. While markets have rebounded, the most recent observations point to further potential retreats due to ongoing concerns about economic conditions in Europe and the fragility of some banking industries. Figure 6 shows total syndicated debt transactions broken down by quarter and year since 2004. While 2011 saw a significant turnaround post the ‘great recession’, quarter on quarter trends for 2012 reveal a subsequent retreat in syndicated debt.

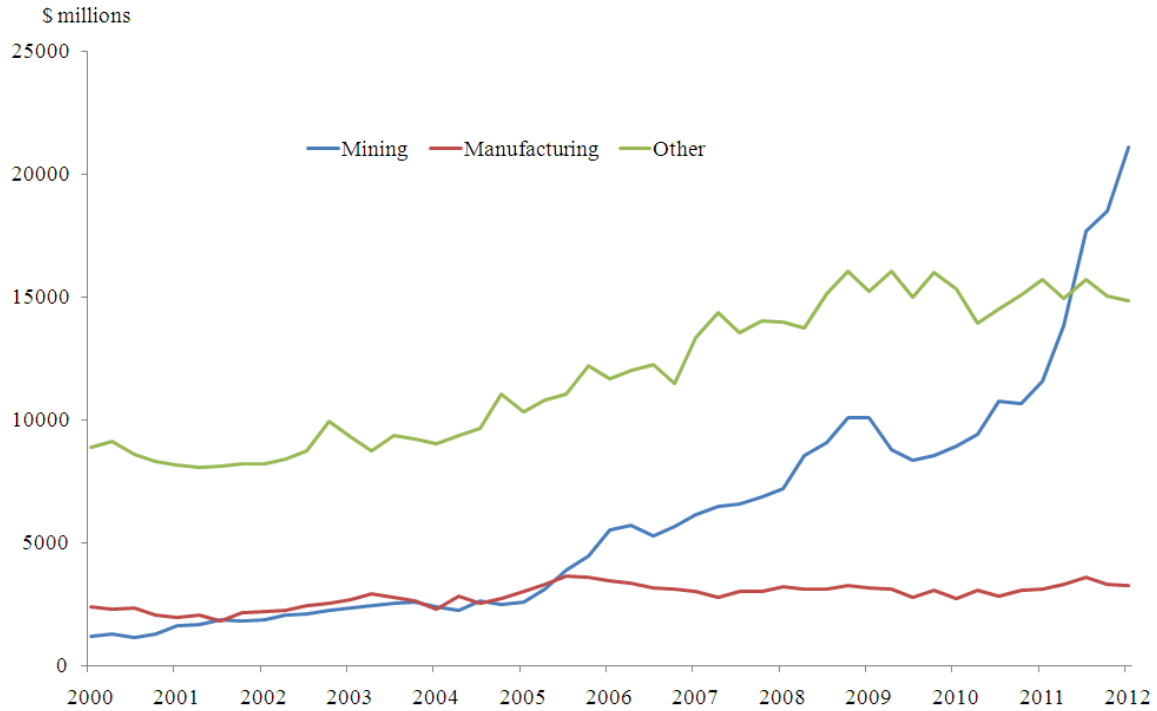
**Figure 6: Global syndicated bank debt by Calendar Year – 2004 to 2012**

Source: Bloomberg (2012)

This has non-trivial implications for Australian energy markets given around half of Australian investment funding (debt and equity) is sourced internationally as Simshauser and Catt (2012) noted. Simshauser and Catt (2012) estimate that between 2010 and 2015, \$85.9 billion in capital will be required within the electricity supply system. Capital investment on new network infrastructure and upgrades to existing equipment was forecast to hit \$43 billion. Fully \$33.6 billion was projected for refinancing of existing network infrastructure while \$9.4 billion was forecast to be used to refinance existing power stations. In addition, incremental capital between 2012 and 2020 related to the LRET is likely to be between \$20 billion and \$30 billion.

This vast capital inflow requirement within Australia needs to be assessed within a domestic capital market which is increasingly skewed towards energy and resources. Figure 7 shows private capital investment in mining, manufacturing and other industries since 2000. Figure 7 illustrates that capital expenditure on mining has risen by around 100% since 2009. It is therefore critical that consideration be given to the importance of capital inflows for financing resource and energy projects – a thematic identified in Simshauser (2010b). As a consequence of credit concentration limits, domestic banks are simply incapable of funding all new capital expenditure in the sector. Given the vast capital financing requirements of the electricity sector between now and 2020 and potential constraints in global syndicated debt activity as a result of global economic conditions (and indeed Basel III reforms), it is paramount that energy policymakers consider the impacts of policy uncertainty on the attractiveness of Australia (and the Australian energy sector in particular) as a destination. Intense competition for capital both domestically (between sectors) and internationally (between countries) underscores the importance of maintaining policy stability for investors in electricity infrastructure with long-lived asset lives.

**Figure 7: Private new capital expenditure by industry**



Source: ABS (2012)

To test whether policy uncertainty in relation to large-scale renewable energy would result in distortions related to pricing of infrastructure by these capital markets, we conducted a survey of project financing professionals as noted in Section 4. The results of this survey are presented in Table 5.

**Table 5: Survey response (project financing professionals)**

Survey Question	Response
What would you expect the ‘reasonable’ credit margins over BBSW for a large-scale renewable project in 2012?	$\mu = 250-300$ bps
If the LRET is materially amended in 2012/13, what additional credit margin would be applied to reflect risks associated with ongoing regulatory change	Renewable: $\mu = 51-100$ bps Gas: $\mu = 51-100$ bps

The results of the survey presented in Table 5 are consistent with the thematic identified in Simshauser and Nelson (2012). Respondents indicated that policy uncertainty (measured by material amendment to the LRET) would result in financing ‘premium penalties’ being applied to both new renewable and new gas-fired generation projects, which is to be expected. The mean response was the band 51-100 bps, providing an effective mean of 75 bps above the reasonable credit margin over BBSW in 2012 of 275 bps.

We have applied these survey results to the PF Model utilised in Simshauser and Nelson (2012) and documented in Nelson and Simshauser (2012) to examine how changes in financing parameters impact on the underlying cost structures of baseload/intermediate combined cycle gas turbine plant (CCGT), renewable projects (wind) and peaking open cycle gas turbines (OCGT). We have used the same range of assumptions published in Table 7 of Simshauser and Nelson (2012) and so we do not intend to reproduce them here. One key variation is a lower capital

turbine cost for wind at \$2,200/kW, compared to \$2,500/kW in the 2012 study<sup>10</sup>. Three scenarios have been modeled:

1. Certainty Scenario: In this scenario, we assume that that the Climate Change Authority recommends no substantive changes to the operation of the LRET, and critically, bi-partisan support for the policy in its current form continues. Spreads on project financed power generation facilities reflect uncertainty in relation to carbon pricing but not uncertainty in relation to renewable policy. This results in credit margins of 275bps over BBSW and enables firms to secure longer facility tenors. Gas input pricing for CCGT is assumed to be steady at \$4.50/GJ.
2. Uncertainty Scenario: Key assumptions in this scenario relate to the Climate Change Authority recommending “material changes” to the operation of the LRET. Bi-partisan support for the policy in its current form evaporates, resulting in genuine policy uncertainty for investors. Spreads on project facilities reflect both uncertainty in relation to carbon pricing, and uncertainty in relation to development of large-scale renewables. Credit margins increase by 75 bps to 350 bps over BBSW, and facility tenors are reduced which heightens refinancing risks and reduces achievable debt levels within the capital structure of projects. Gas input pricing for CCGT remains unchanged and steady at \$4.50/GJ.
3. High Gas Scenario: Primary assumptions in this scenario are that as in the certainty scenario, the Climate Change Authority recommends no material changes to the operation of the LRET and bi-partisan support for the policy in its current form continues. Spreads on project financed power generation facilities reflect uncertainty in relation to carbon pricing but not uncertainty in relation to renewable policy. This results in credit margins of 275bps over BBSW. However, gas input pricing for CCGT significantly increases from \$4.50/GJ to \$10.00/GJ reflecting high global demand for natural gas and the linkage of previously isolated Australian east-coast domestic gas markets with LNG pricing (see Simshauser, Nelson and Doan, 2011a for further information on structural gas pricing shocks in Australia). Carbon pricing of \$15/tonne of carbon dioxide equivalent is also included in fuel costs. This scenario has been included to reflect consideration of issues related to gas pricing raised by Riesz and Tourneboeuf (2012), which as our partial equilibrium analysis subsequently reveals, is critically important for policymakers to consider.

The PF Model results for these three scenarios are presented in Figure 8. Gearing is applied relatively consistently at between 60% and 63%. This represents the main variation in application from Simshauser and Nelson (2012) and explains the higher returns to equity and lower interest payments in each of the results for the 200 MW wind project. Financing is provided using 5, 7, 10 and 12 year tenors depending upon the scenario and technology.

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<sup>10</sup> Most recent observations for wind capital costs indicate prices are even lower (see Trustpower (2012) which indicates pricing at \$1,630/kW). However, we are uncertain as to whether such pricing includes the full cost of construction, and specifically, items such as interest during construction, owners project development costs, grid connection and so on. Accordingly, we have opted to use estimates based on information provided in BREE (2012).



**Figure 8: Project financing model results for CCGT and wind**

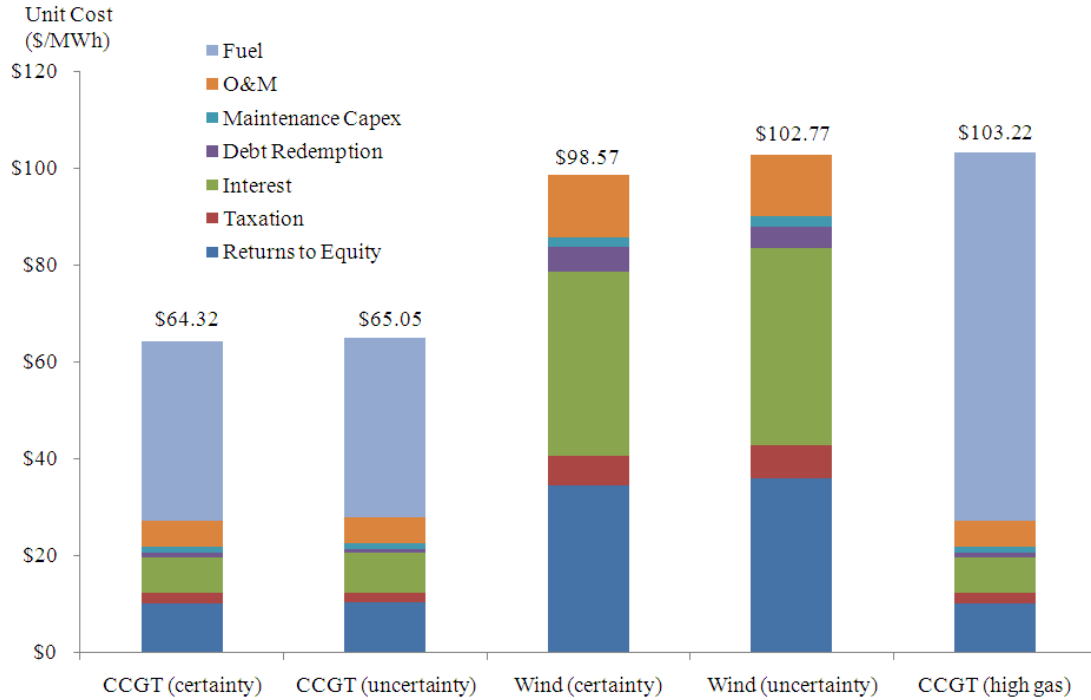
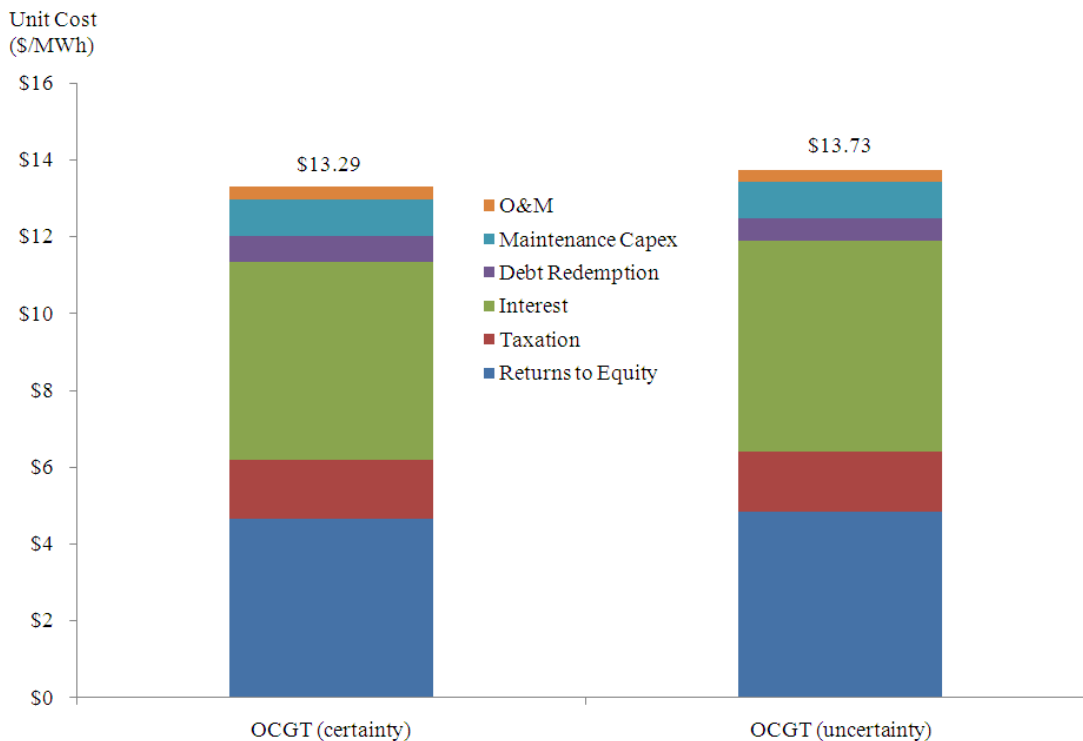


Figure 8 shows that, unsurprisingly, the unit cost of a 200 MW wind project increases by \$4.20/MWh (4.3%) from \$98.57/MWh to \$102.77/MWh with the introduction of policy uncertainty. Importantly, the unit cost of a 1 x 400 MW CCGT project also increases by \$0.73/MWh (1.1%) from \$64.32/MWh to \$65.05/MWh under the same conditions. The most material change in unit cost occurs with the significant increase in gas pricing where CCGT costs increase to \$103.22/MWh (i.e. above the cost of wind).

**Figure 9: Project financing results for OCGT**



Due to the different operating duties of an OCGT (peaking) plant, Figure 9 presents the ‘carrying cost’ or ‘total fixed costs’ (including a normal return on funds invested) for a 525 MW plant comprising three units. This can be thought of as the fair value of a \$300/MWh call option written by new entrant peaking plant. The incremental cost of an OCGT in moving from the certainty to uncertainty scenario 1 to scenario 2 is \$0.44/MWh.

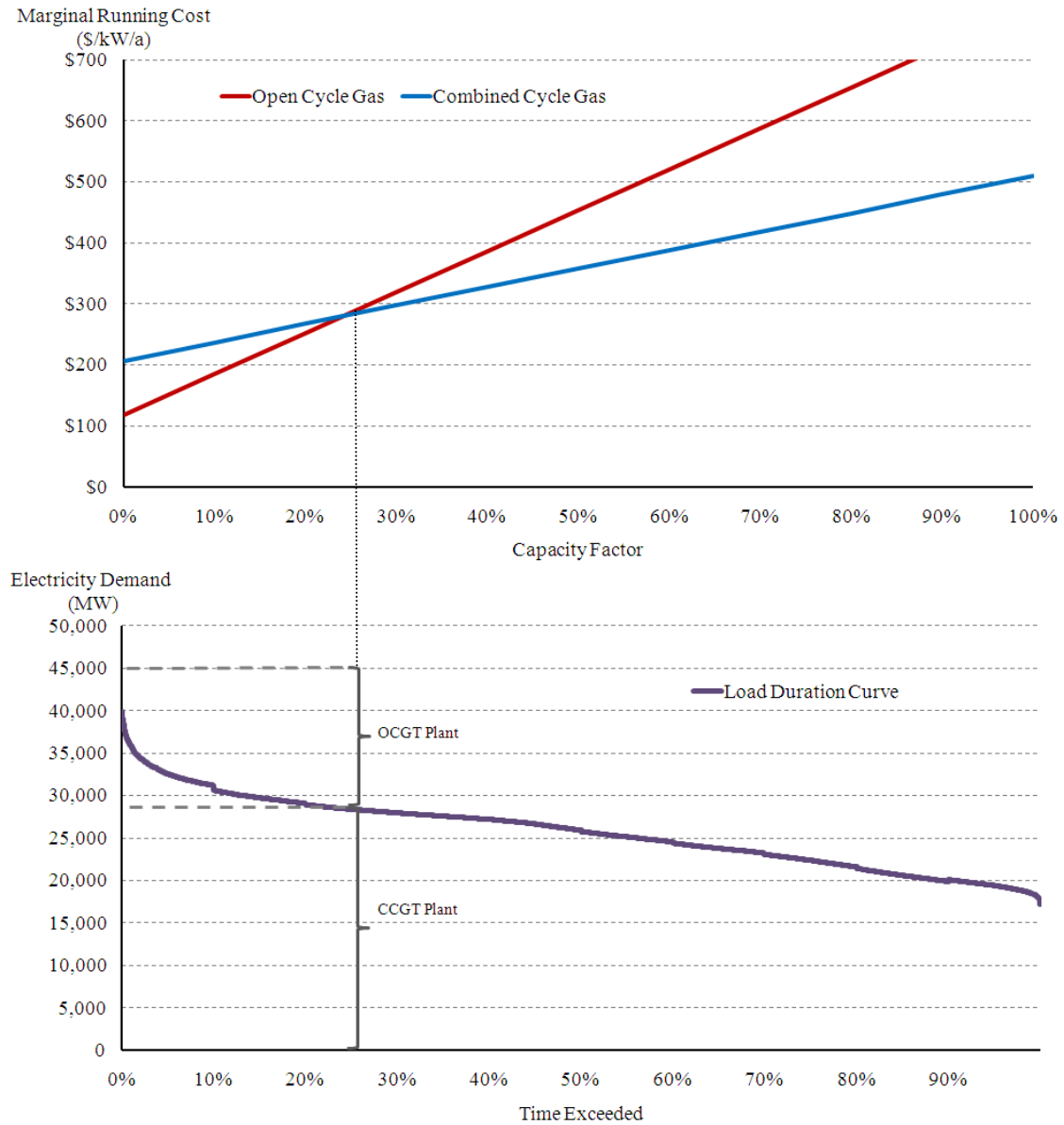
## **6. Partial equilibrium analysis – policy uncertainty and electricity prices**

A higher LRMC for new gas and renewable plants have obvious long-run impacts on consumer electricity prices. As the NEM operates under a uniform, first-price, energy-only gross pool auction design, the value of spot and forward prices must ultimately rise to the cost of entry prior to new plant being built. To assess the economic impact of our different scenarios on electricity prices, we assume financing costs calculated in previous sections begin to bind immediately from the date at which legislative change in response to the Climate Change Authority review is proposed (i.e. 31 December 2012). For simplicity, we have assumed that any legislative change would be announced in late 2013 and implemented in 2014. Higher LRMC costs associated with policy change would be revealed in the market from 2017 onwards as new plant is commissioned (and in practice, as existing plant is refinanced). CCGT forms the dominant base and intermediate load technology while OCGT undertakes peaking duties.

We utilise the Optimal Plant Mix Model (OPM Model) from Simshauser and Wild (2009) to undertake the analysis. This partial equilibrium electricity system model simulates half-hour resolution and assumes perfect competition and essentially free entry to install any combination of capacity that satisfies differentiable conditions. As this model has been documented in Simshauser and Wild (2009), we do not intend to reproduce the details here. A static graphical representation of the half-hourly modelling results is presented in Figure 10.

Demand has been projected utilising the latest forecasts from the Australian Energy Market Operator (AEMO, 2012). These forecasts account for the recent declines in energy demand associated with adoption of embedded solar PV, energy efficiency schemes and responsiveness to higher retail prices driven by increased network costs. Average growth in annual energy for the ten year period out to 2022 is now forecast to be 1.7%, down from the previous forecast of 2.3% in 2011. We utilise the methodology outlined in Nelson, Kelley, Orton and Simshauser (2010) to distribute the average annual growth of 1.7% across deciles of actual 2011 NEM demand ranked by time.

**Figure 10: Graphical representation of partial equilibrium analytical framework**



The three scenarios outlined in the previous section have each been modeled using the partial equilibrium framework discussed above. One additional scenario has also been modeled based upon material adjustment of the LRET targets to reflect recent commentary related to electricity demand being softer than anticipated when the LRET was first legislated. Origin Energy (2012) made the salient point that with softening electricity demand, the *Renewable Energy (Electricity) Act* would result in more than 20% of Australia’s electricity being sourced from renewable sources, at least given most recent forecast information.

**Table 6: NEM system average cost between 2017 and 2021 (2012\$)**

	Certainty \$/MWh	Uncertainty \$/MWh	High gas \$/MWh
Underlying energy costs	69.17	69.86	103.05

The power generation system cost results for each scenario are presented in Table 6. The certainty scenario results in a system average cost of \$69.17/MWh between 2017 and 2021. The introduction of policy uncertainty results in average system costs increasing by \$0.69/MWh (1.00%) to \$69.86/MWh. If the high gas scenario were to materialise, average system costs would increase by \$33.88/MWh (49%) to \$103.05/MWh. It should be noted that renewable generation is included in this analysis. Additional costs of operating higher LRMC renewable plant are revealed in LGC costs which our subsequent analysis examines.

Table 6 notes that uncertainty results in higher costs associated with servicing projected future demand. However, this ignores any potential savings associated with reductions in LGC costs incurred by retailers passed through to customers as reductions in prices. These cost savings are significant. We have utilised an LRMC methodology represented graphically in Figure 11.

**Figure 11: Breakdown of revenues for wind under certainty and uncertainty scenarios<sup>11</sup>**

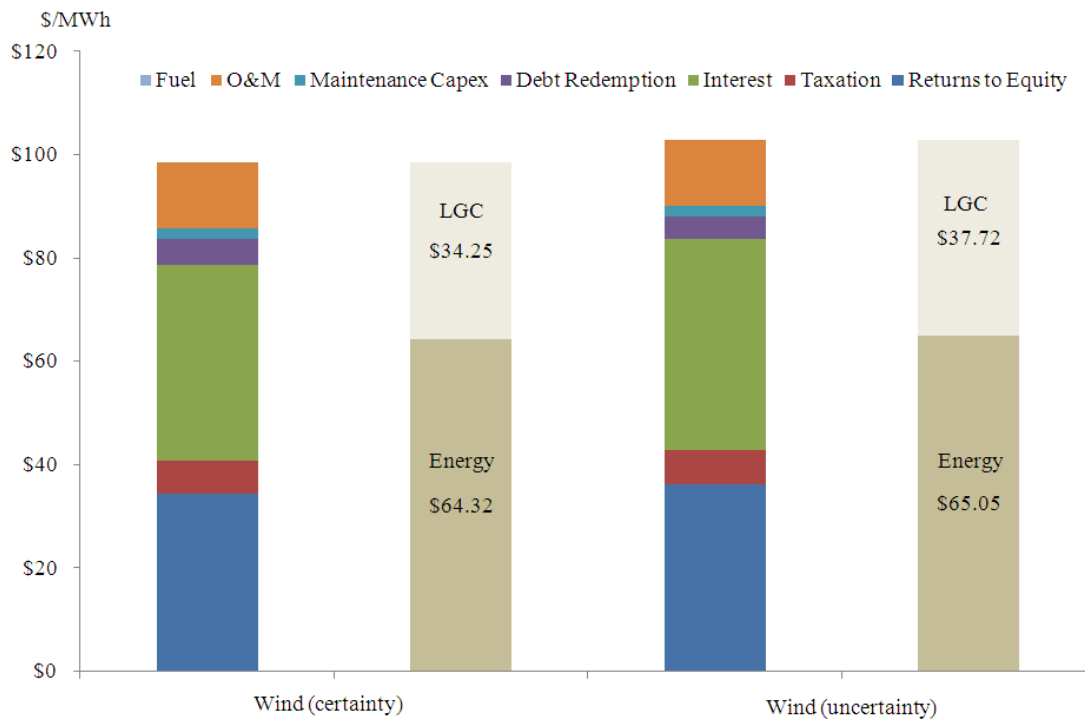


Figure 11 shows the revenues that a wind turbine would earn, on average. Note that these revenues come from two sources: (1) from the wholesale energy market and (2) from the sale of LGCs. These two income streams can be thought of as the components that comprise an appropriately priced Power Purchase Agreement (PPA). We have assumed away any penalty applied to wind in wholesale energy markets related to the intermittency of output. We consider this to be a reasonable assumption given the relatively modest penalties identified by Simshauser (2011) in relation to intermittent wind generation, and the fact that most other plants will face equivalent intermittency issues in any event. To calculate the net costs to society of uncertainty created by material amendment to the LRET, we have contrasted reduced LGC costs to 2021 with higher wholesale energy costs associated with the results of our partial equilibrium analysis. Effectively, we have created two scenarios:

<sup>11</sup> The lower implied LGC pricing (relative to Section 3) is a function of higher wholesale pricing in 2017 (\$64.32/MWh compared to \$55/MWh for 2015 energy futures contracts available at the time of writing). For our modeling, we have used the actual yearly estimates produced through our partial equilibrium analysis (rather than the cost of a CCGT or average wholesale prices).

- Uncertainty:** In the uncertainty scenario, we have assumed that LRET targets beyond 2016 are not increased at all. Effectively, this scenario simulates a situation where the LRET policy is repealed. However, it presumes that existing investments are grandfathered (including projects committed through to 2014). Higher wholesale energy costs (outlined in Table 6 previously) are incurred due to investor perceptions of regulatory risk as a result of the material amendment of the policy. However, these higher costs are somewhat offset by the reduced LGC liability between 2017 and 2021 as a result of repeal of the LRET legislation<sup>12</sup>.
- Uncertainty (low demand):** For the uncertainty (low demand) scenario, we have assumed that LRET targets are reduced in 2014 to reflect softening projections of electricity demand in 2020 and a desire to achieve no more than 20% renewable electricity by 2020 given lower demand forecasts. Using the logic in Origin (2012), we have reduced the targets between 2016 and 2020 to ensure a linear approach to 27 TWh in 2020, down from 41 TWh. Higher wholesale energy costs (outlined in Table 6 previously) are incurred due to investor perceptions of regulatory risk as a result of the material amendment of the policy. However, these higher costs are somewhat offset by the reduced LGC liability between 2017 and 2021 as a result of lower LRET targets relative to current legislation<sup>13</sup>.

Our results for the two scenarios identified above are presented in Figure 12.

**Figure 12: NPV of net cost to consumer of uncertainty and uncertainty scenarios**

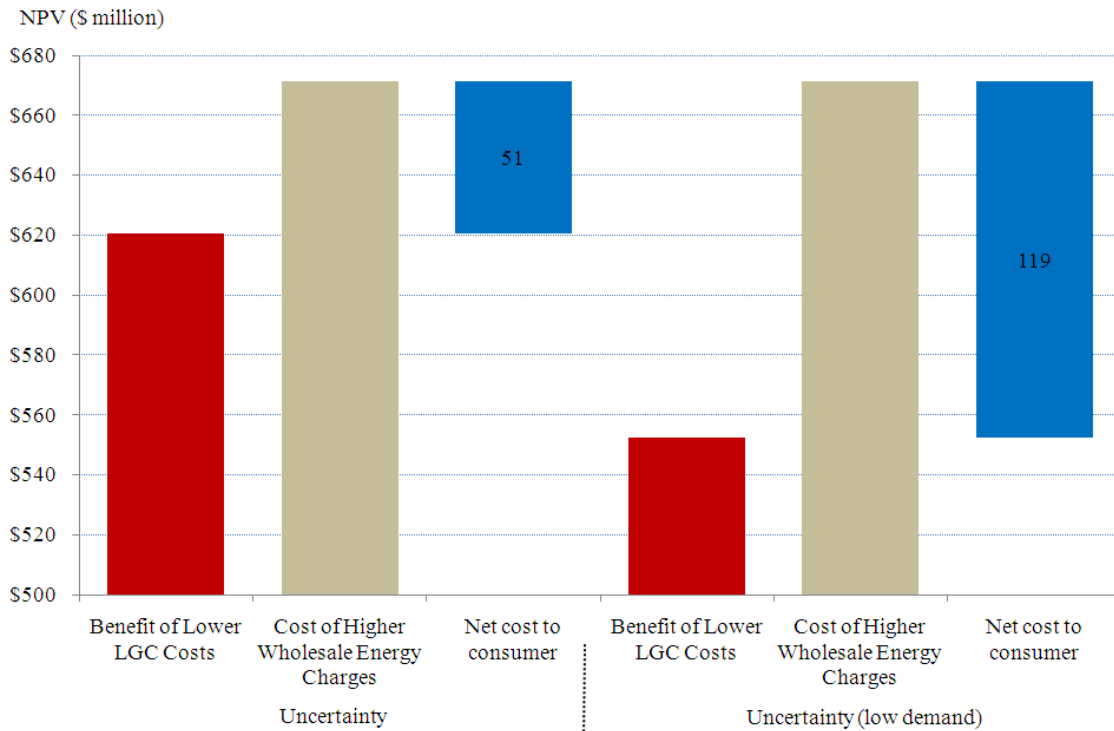


Figure 12 shows the costs and benefits associated with significantly amending the LRET. While lower LGC costs are incurred in both scenarios, the higher wholesale energy costs, as identified in Table 6, are greater. The end result is a net cost to the consumer of \$51 million (NPV 2012\$) if

<sup>12</sup> As our analysis is for the NEM, we have reduced the LGC liability in our modeling by 10% to reflect that the Western Australian and Northern Territory LGC liabilities are not relevant (around 10% of national electricity demand).

<sup>13</sup> As per footnote 12.

the LRET is effectively repealed. Of course, the costs associated with this scenario would ultimately dissipate, while the benefits would more than likely be sustained. And so over the very long run, these results might reverse, although this is dependent upon Australia's policy of repealing the LRET being consistent with global trends (which based upon evidence presented in Section 2 appears somewhat unlikely). But over the period of our examination, that is, from 2012 to 2021, there would be a net cost to consumers from repealing the policy, even with a grandfathering of existing projects. If the LRET target was reduced to change with fluctuating demand, the net cost to consumers was found to be \$119 million (NPV 2012\$) over the period 2012-2021. While these results appear counter-intuitive, they are a simple function of the fact that there are real costs associated with policy uncertainty.

## 7. Policy recommendations

The Climate Change Authority is tasked with completing a review of the operation of the LRET by 31 December 2012. A key finding of this article is that the best outcome of the review would be no amendments. Material amendments to the policy would result in heightened uncertainty in relation to energy policy with resultant costs being applied by financiers of power generation, and a further widening of the theoretical to actual prices. These costs would manifest themselves as higher costs to consumers – up to \$119 million (NPV 2012\$) between 2017 and 2021, and sharper run-up in LRET prices when shortages inevitably occur.<sup>14</sup> We have not considered the merits of first principle public policy objectives in relation to large-scale renewable energy policy. Instead, we have looked at the market as it exists today and found that amendment of the policy framework designed to alleviate pricing pressures would be a more expensive option for electricity consumers and society than leaving the current policy in place. This should not be considered contentious. Investors in power generation require stable policy frameworks and amendment to a policy which is designed to underpin infrastructure investment for the next 20 years will not be welcomed by most investors. International Power (reported in Maher, 2012) drew the obvious conclusion:

*“Over \$6 billion of investment has to date been made in renewable generation and investors (both Australian and international) have relied on the RET legislation remaining in full force and effect. Stable legislation (and regulation) is required for large scale capital intensive infrastructure whether this is renewable generation and/or fossil-fired generation. If legislation is changed, then it sets a worrying precedent that the legislative/regulatory goalposts will be moved again and again over the next 20 to 30 years.”*

A key additional conclusion based upon this thematic is that the ongoing biennial statutory review of the LRET is unnecessary. The LRET is effectively a ‘sunk’ policy in the sense that it has been in place for a long period of time and investments in industrial capacity have been made on the basis that it will continue to exist until its legislative end date (i.e. 2030). Rather than conducting a review every two years, market effectiveness would be better facilitated if the review only commenced once relevant threshold criteria were met. Such criteria would involve some type of LRET market failure which necessitated intervention. An example of such a situation would be where the penalty is being paid rather than new generation being constructed.

In addition to our broad conclusions in relation to policy certainty, we believe the dynamic discussed by Riesz and Tourneboeuf (2012) in relation to uncertainties about gas pricing requires greater consideration. Policymakers should have regard to all of the factors which may result in wholesale energy price pressures when considering the merits of renewable energy. The nature of the NEM with its uniform, first-price, energy-only gross pool auction design means that plant

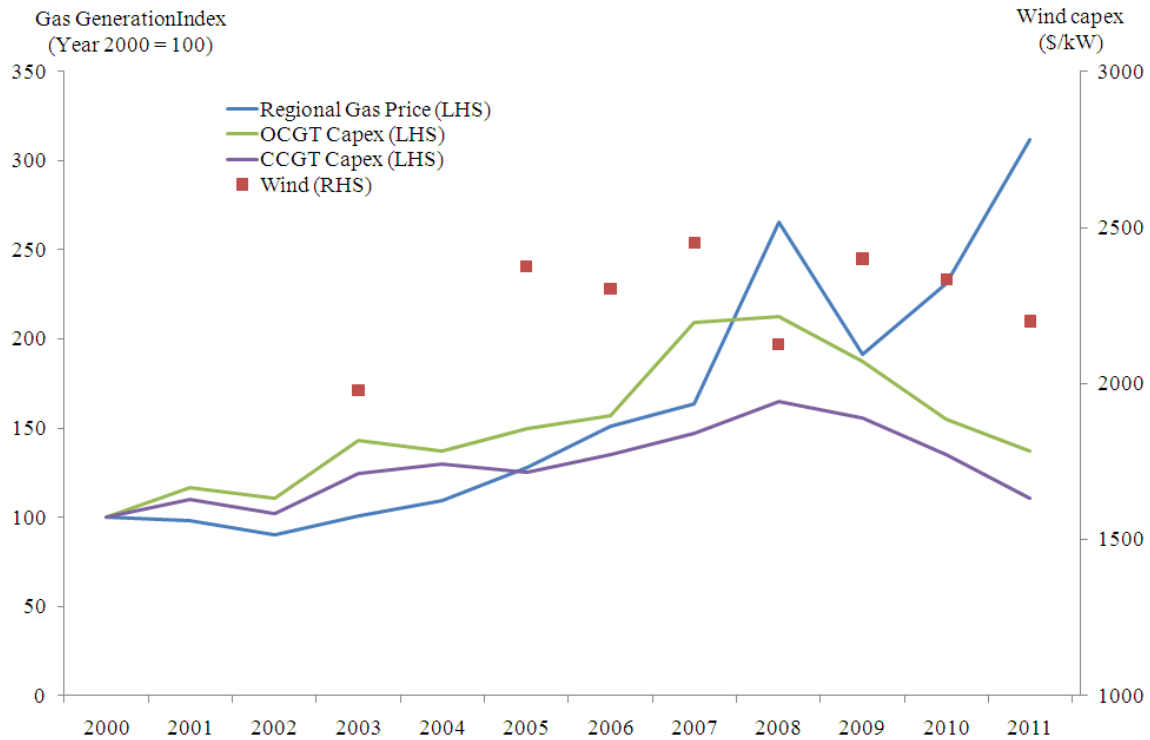
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<sup>14</sup> We acknowledge the somewhat arbitrary nature of modeling between 2017 and 2021. However, we expect that analysis beyond 2021 would not be relevant given that higher costs applied by project financiers would eventually abate.

with very low short-run marginal costs (such as wind farms) have little or even negative impacts on pool prices. Conversely, the cost structure of a gas-fired plant is a direct function of the gas price. Our research has shown that a significant increase in gas prices could result in gas-fired plant becoming more expensive than wind. We do not make conclusions about the likelihood of this occurring, only that renewable energy with no fuel cost should be contrasted with gas in this environment.

Figure 13 shows indices for gas prices and capital expenditure for wind, OCGT and CCGT for the period 2000 to 2011. There are several conclusions that can be drawn by policy makers in relation to future pricing. Firstly, wind turbine prices are trending down while gas prices are trending up. Secondly, capital expenditure trends for OCGT, CCGT and wind are relatively similar. It is reasonable to state that the most recent pricing for turbines is likely to be temporary given the somewhat unusually high \$A driven by international investor appetite for Australian denominated sovereign debt.<sup>15</sup> The trends in Figure 13 appear consistent with those presented by US researchers (see Bolinger and Wiser, 2011). In this context, and given the net cost to society of amending the LRET policy, it would appear prudent to maintain existing policy commitments.

**Figure 13: Wind and gas capex and fuel prices**



Source: Compiled from Simshauser, Nelson and Doan (2011a); BREE (2012); SKM (2011b); BP (2012)

**8. Conclusion**

This article has found that ongoing uncertainty in relation to the future of large-scale renewable energy policy in Australia is preventing the LGC market from operating efficiently. Our survey of market participants confirms that buyers and sellers of LGCs are concerned about the potential for further legislative change and this concern is manifesting itself in poor pricing and capital allocation decision making. Arbitrage opportunities clearly exist but no party is willing to clear the arbitrage based on battle-hardened historical experience. Our conclusion is clear – material amendments to the LRET through the biennial Climate Change Authority review would result in

<sup>15</sup> The issue here is that, at the time of writing, Australia’s terms of trade had been falling while the Australian dollar had concurrently remained unusually strong.

net costs to consumers of between \$51 million and \$119 million (2012\$). As such, the policy recommendations from this research are somewhat obvious – ‘constant review is not reform’. The LRET should remain in place and without amendment if confidence in the policy is to be restored. It is important to note that bipartisan support for the policy continues as indicated by recent statements by political leaders such as, ‘*There’s a review coming but we remain committed to the Renewable Energy Target*’ (Hunt, 2012).<sup>16</sup>

Importantly, many of the conclusions made as a result of our survey of market participants appear consistent with previous and similar studies. In our view, ROAM Consulting expressed the requirement for consistency as well as any:

*“a good outcome from the biennial review would be to leave the LRET to function in its current form. Uncertainty about the future of the scheme is a significant issue, and there was consensus that investor confidence will return only if the legislation goes through the review with no changes. Furthermore, the review should be done as quickly as possible and released as quickly as possible once complete.”* (ROAM, 2012, p. 56)

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<sup>16</sup> Such a policy recommendation is consistent with community attitudes in relation to renewable energy. For example, community support for wind farms is high: 83% of people support wind farms; while only 14% oppose them; and 3% don’t know. Over 7 in 10 people support wind farms being built nearby (to their residence) and over 8 in 10 agree that “wind farms are an important part of our clean energy future” (Pacific Hydro, 2012).



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## **10. Declaration of the authors**

The authors of this working paper are employed by AGL Energy Ltd. While the working paper represents the views of the authors, the research was completed to form part of AGL's public policy response to the Climate Change Authority statutory review of the Renewable Energy Target (RET) legislation. In this context, it should be noted that AGL's public policy position in relation to the RET is for no changes to be made to the scheme. This is influenced by AGL's core business activities which include developing, owning, and operating renewable energy capacity; writing Power Purchase Agreements to underwrite new entrant renewable energy capacity; owning and operating brown coal and gas-fired generation capacity; developing and producing coal-seam gas; and retailing electricity and gas to more than 3.5 million customers in Australia.

Earlier drafts of the paper were reviewed by the AGL Applied Economic and Policy Research Council and comments made by Council members were gratefully received by the authors. The role of the Council is not to endorse working papers but provide constructive review. In this context, all opinions, statements, errors and omissions are those of the authors and should not in any way be attributed to the Council and its members. Members of the Council are Elizabeth Nosworthy, Prof. Christine Smith, Prof. Stephen Gray, Prof. Mahinda Siriwardana, Keith Orchison, Tony Brinker and Carlo Botto.