Report to

Office of the Renewable Energy Regulator

Review of REC Markets

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McLennan Magasanik Associates

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EXECUTIVE SUMMARY

The Office of the Renewable Energy Regulator (ORER) has invited McLennan Magasanik (MMA) to undertake a project to forecast the price path of Renewable Energy Certificates (RECs), based on a forecast range of technology/fuel response scenarios to meet the 9,500 GWh target by 2010 as legislated by the Federal Government.

This document provides the assumptions used in the analysis and a discussion of the resulting REC price forecasts. The risk factors affecting the REC price on the spot market were defined through sensitivity analysis using a short term risk model. Forecasts are underpinned by the costs for renewable generation. The analysis is based on assumptions and policy environment as at late May 2007. Some recent announcements in regards to emissions trading and clean energy targets by the Federal Government may change the outlook contained in this report.

The three different price scenarios (high, medium and low) are presented in Table 1 and Figure 1.

In the high price scenario, the target can be met by additional solar water heaters until 2008. From 2009 onwards, new renewable generation plants may be needed to fulfil the obligation, although the time left for the scheme prevents new generation coming in at a price under the penalty price. The downwards slope to the end of the scheme is underpinned by the penalty price in real terms. Solar water heaters contribute around 3,000 GWh as a yearly average to the renewable energy market. The increase in the REC price in 2008 reflects the need for additional solar water heaters sales and new renewable generation.

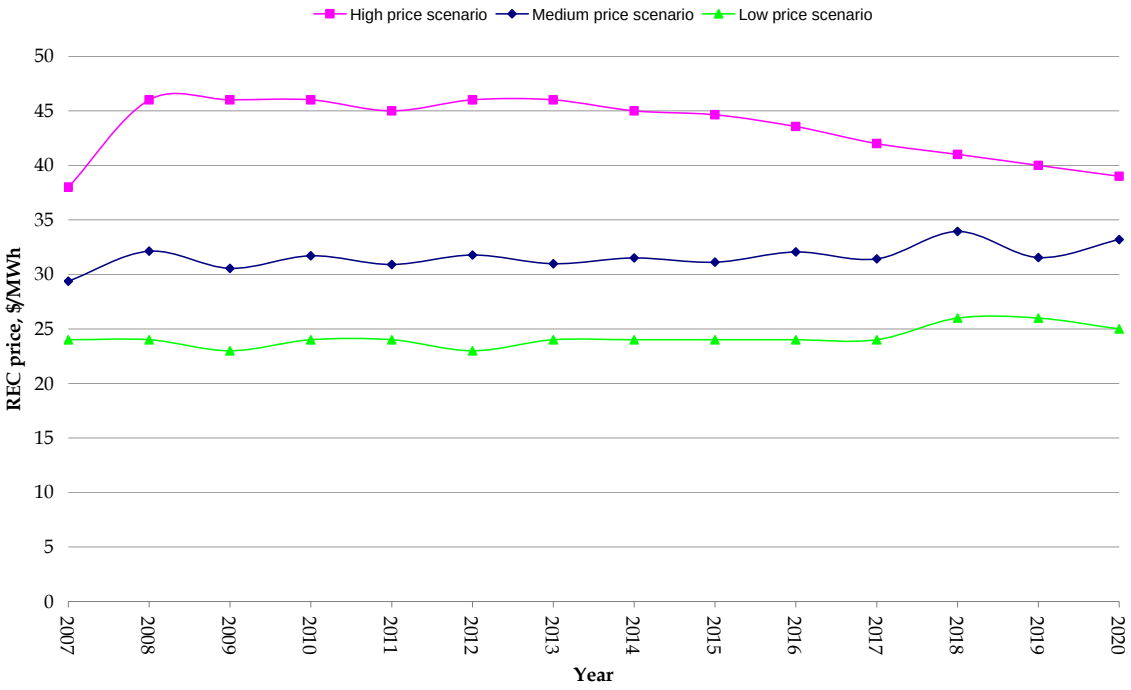
The prices in the medium price scenario are largely underpinned by the need for additional solar water heaters to meet the targets under the Mandatory Renewable Energy Target scheme. There is an average demand of around 1,400 GWh per year of solar water heaters. Hydro generation is contributing around 950 GWh as a yearly average. No new renewable generation is needed beyond those currently under construction.

The prices in the low price scenario are mainly set by the short-run marginal cost of existing plant or the cost of RECs required covering expenditure on additional sales of solar water heaters. The target can be met by existing or committed renewable power plants and no RECs from additional solar water heaters (above the current contribution of solar water heaters) are needed. Generation is sufficient from existing plant and plant under construction so that no new plant is required. Prices fall as a result of competition amongst uncontracted renewable generators (mainly RECs created from solar water heater sales and above baseline generation from older hydro-electric generators) to supply uncontracted liabilities.

Table 1: Forecast REC price – medium, high and low price scenario, $/MWh

Year	Low	Medium	High
2007	24	29	36
2008	24	32	46
2009	24	31	46
2010	25	32	46
2011	24	31	46
2012	24	32	46
2013	23	31	46
2014	23	32	46
2015	24	31	45
2016	24	32	44
2017	23	31	42
2018	26	34	41
2019	25	32	40
2020	25	33	39

Figure 1: Range of forecast REC prices



As the scheme draws to a close, the range narrows due to the penalty which sets the price in the high price scenario from 2014 onwards.

The REC price forecasts are highly sensitive to small changes in the key underlying assumptions, regarding the contribution of solar water heaters and cost for renewable generation. Small variations to these assumptions may change the price forecasts significantly. This sensitivity arises because only a small increment of new renewable capacity is required under our high price scenario assumptions. The REC price rises from current levels to allow this new capacity to enter the market. However, a higher level of

RECs created from solar water heaters than assumed in our analysis would mean this new capacity would not be required and that REC prices would be lower than forecast.

Another uncertainty is the level of generation from large scale hydro-electric plant, as climate change may lead to a lower level of water inflows into their storage facilities. If the low rainfall patterns continue, the REC prices will increase rapidly.

Renewable generators currently under construction to meet the Mandatory Renewable Energy Target may elect to participate in the new state-based renewable energy targets. This may also put upward pressure on REC prices. On the other hand, implementation of an emission trading scheme as proposed, which was not considered in the analysis in this report, could increase electricity prices and reduce the price of RECs.

1 INTRODUCTION

The Office of the Renewable Energy Regulator (ORER) has invited McLennan Magasanik (MMA) to undertake a project to forecast the price path of Renewable Energy Certificates (RECs), based on a forecast range of technology/fuel response scenarios to meet the 9,500 GWh target in 2010 as legislated by the Federal Government.

This document provides the assumptions used in the analysis and discussion of the resulting REC price forecasts. The forecasts are based on information available to MMA as at late May 2007. All monetary values in this report are in mid 2006 dollar terms, unless otherwise stated.

2 BACKGROUND

2.1 Renewable energy schemes

There are currently three schemes aimed at promoting additional renewable energy generation in Australia: the Commonwealth Government's Mandatory Renewable Energy Target (MRET) scheme, the Victorian State Government's Renewable Energy Target (VRET) scheme and the NSW State Government's Renewable Energy Target (NRET) scheme. The NRET scheme is expected to be legislated by the NSW State Government in early 2008. We have included it in our modelling as we believe it will be passed by the legislator. The Western Australian, Queensland and South Australian state governments are also expected to introduce measures to support renewable energy in the near future.

2.1.1 The Mandatory Renewable Energy Target scheme

The Commonwealth Government has enacted legislation to mandate the supply of an additional 9,500 GWh of renewable energy by 2010 as part of Australia's commitment to reducing our greenhouse gas emissions and to develop a renewable energy industry. The MRET scheme has been set up as an obligation on electricity retailers and large consumers to purchase a portion of their power from renewable sources. To facilitate this aim, tradable Renewable Energy Certificates (RECs) are being allocated to generators for every MWh of electricity generation qualifying as renewable under the terms of the scheme.

The main aims of the MRET scheme are:

- to accelerate the uptake of renewable energy, in order to reduce greenhouse gas emissions;
- to stimulate renewable electricity generation and provide an ongoing base for the development of commercially competitive renewable energy; and
- to contribute to the development of internationally competitive renewable energy industries.

The design of the measure is intended to minimise the cost to the national economy. The tradable RECs are a component of the scheme that enables the renewable energy targets to be met at least cost.

The MRET scheme has been implemented with a high penalty for non-performance of $40/MWh. This penalty is not indexed to CPI. In addition, the penalty is not tax deductible, meaning that under current company tax rates, a liable party would be indifferent between paying the penalty or purchasing certificates at a price of around $57/MWh.

This penalty would effectively provide a cap on the premium available for renewable energy.

Whilst a ramp-up target schedule has been developed for each calendar year by the government as shown in Table 2-1, a credits banking regime will stimulate earlier development of such projects.

Table 2-1: Renewable energy targets

Calendar year	Target (GWh)
2002	1,100
2003	1,800
2004	2,600
2005	3,400
2006	4,500
2007	5,600
2008	6,800
2009	8,100
2010 and later years	9,500

2.1.2 Changes to MRET regulations

The first set of changes to the Renewable Energy (Electricity) Act 2000 included:

- Changing the deeming provisions applying to solar water heaters (SWH) to cover all models. MMA analysis indicates this, in combination with recent changes to state-based planning laws mandating the use of SWHs, could increase the level of RECs created by the SWH sector, which may put some downward pressure on REC prices.
- Providing a longer period and a larger capacity threshold for deemed RECs from photovoltaic generators to increase the rate of adoption of these technologies. The threshold for PV units has been increased to 100 kW and PV units installed after 31 July 2005 will have an option to create 15 years worth of RECs in a single up-front transaction.
- Removing the primary purpose test applying to energy crops.

The second package of amendments, the Renewable Energy (Electricity) Amendment Act 2006 was passed by Parliament in June 2006, with the legislation commencing in September 2006. This package redefined plantation biomass as an energy crop, thus removing a large amount of uncertainty regarding the use of this resource as a fuel source. It also had the purpose of enhancing market transparency and improving business certainty, providing increased opportunities for solar and bioenergy technologies, and improving the operational effectiveness and efficiency of the measure.

The second set of changes to the Renewable Energy (Electricity) Amendment Act 2000 include:

- Allowing for recent reforms in the National Electricity Market (NEM) and potential new market operators.
- Putting limits on the timing of creation of certificates. In the original legislation there was no time limit on when the certificates had to be created after renewable generation had occurred. Renewable generators could produce fewer RECs than their level of

sent out energy would suggest in any particular year. This shortfall would then be held over until a more opportune time for the generator (for example, when REC prices are higher) before the generator creates the RECs. Thus, in any particular year, the number of RECs created need not correspond with the electrical energy generated. The uncertainty over the number of RECs available is believed to have made the market less transparent. Enforcing a time limit on creation would put some downward pressure on certificate prices but remove a source of uncertainty for renewable energy project proponents. With this amendment, the certificate has to be created by the end of the year following the year of generation. Certificates not created from generation prior to the end of 2005 will need to be created by the end of 2007.

- Providing for provisional accreditation of proposed generation projects, establishing timeframes for determining the eligibility of proposed projects by the Renewable Energy Regulator and clarifying the components of a power station.
- Allowing for the publication of additional data on baselines and renewable electricity generation.
- Clarifying the provisions and definitions in the Act for Eligible Renewable Energy Sources and providing increased opportunities for bioenergy.
- Clarifying the provisions with respect to the claiming of RECs associated with SWH and small generation units.
- Clarifying the provisions in relation to the eligibility of SWH and expediting the process by which certificates can be claimed for new SWH models, as they become commercially available.
- Clarifying the provisions in relation to a relevant acquisition of electricity to ensure that only one entity is made liable in relation to the purchase of a particular quantum of electricity.
- Providing the Renewable Energy Regulator with the power to vary a number of assessments and determinations under the Act, including varying the energy acquisition statement, renewable energy shortfall statement and the 1997 eligible renewable energy baselines for accredited power stations.
- Providing the Renewable Energy Regulator with information gathering powers to enable the effective monitoring and compliance with the provisions of the legislation.
- Allowing for the suspension of an accredited power station under a number of circumstances including where gaming is suspected. That is, whereby power station outputs are manipulated to increase the number of renewable energy certificates that can be created without increasing renewable energy generation.
- Removing a statutory requirement to expose new or amended regulations to a 30-day public consultation process.

2.1.3 VRET scheme

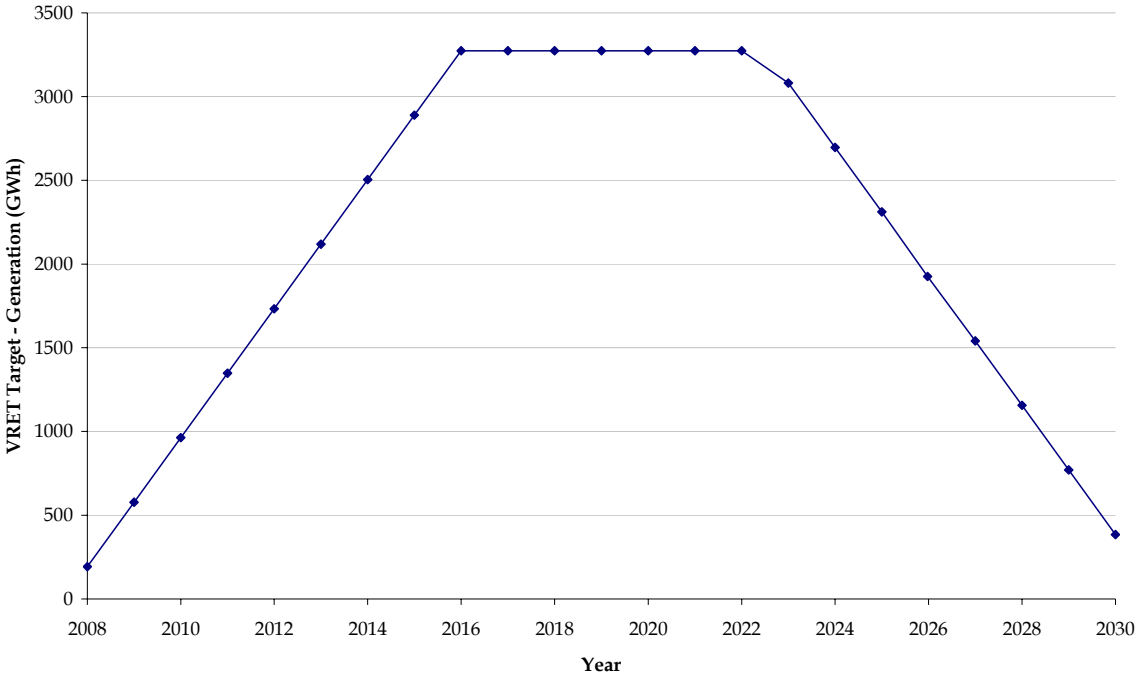
The Victorian State Government's Victorian Renewable Energy Target (VRET) requires electricity retailers to purchase 10% of their electricity consumption from renewable energy sources by 2016. Eligible renewable energy sources include hydro, wind, biomass, geothermal and solar (excluding SWH), and must be located in Victoria. The VRET scheme is implemented through a 3,274 GWh additional renewable energy target with a high penalty for non-performance of $43/MWh (in 2007 dollars). Unlike the MRET scheme, this penalty is indexed to CPI. The penalty is not tax deductible and is therefore equivalent to an after tax value of $61.40/MWh, which will act as a cap on the price of Victorian renewable certificates.

VRET will continue until 2030, and a target schedule has been developed for each calendar year as shown in Table 2-2. Banking of certificates is allowed. However, generators are only eligible to create Victorian renewable certificates for 15 years, so incentives to enter the market early will be diminished. The target ramps down after 2022 to reflect the fact that renewable energy projects developed to meet the initial target will no longer be eligible to create certificates after that period.

Table 2-2: Required GWh from Victorian renewable energy sources

Calendar year	Target (GWh)
2008	193
2009	578
2010	963
2011	1,348
2012	1,733
2013	2,118
2014	2,504
2015	2,889
2016	3,274
2017	3,274
2018	3,274
2019	3,274
2020	3,274
2021	3,274
2022	3,274
2023	3,081
2024	2,696
2025	2,311
2025	1,926
2027	1,541
2028	1,156
2029	770
2030	385

Figure 2-1: VRET target



2.1.4 NRET scheme

The New South Wales State Government's Renewable Energy Target (NRET) scheme requires retailers to source 10% of their energy consumption from renewable energy sources by 2010 and 15% by 2020. Eligible renewable energy sources include hydro-electric, wind, biomass, geothermal and solar, and can be located in any of the eastern states as long as the generator is connected to the National Electricity Market. The penalty price for non-compliance of the scheme is as yet unknown, but it will be indexed to CPI. For modelling purposes, we have aligned the penalty price with the VRET scheme. This is reasonable, since the NSW Government has explicitly stated that it is seeking to align NRET with VRET.

The NRET scheme is scheduled to take effect from 2008 and will end in 2030. The scheme's 10% target by 2010 means that 1,317 GWh of additional renewable energy generation needs to be sourced in that timeframe. Similarly, 7,250 GWh of additional renewable generation is required by 2020. The 7,250 GWh target will be held constant from 2020 until 2030, when the scheme ends. The target schedule is shown in Table 2-3.

Table 2-3: Required additional GWh from renewable sources to meet NRET target

Calendar year	Target (GWh)
2008	439
2009	878
2010	1,317
2011	1,878
2012	2,439
2013	3,000
2014	3,600
2015	4,200
2016	4,800
2017	5,400
2018	6,000
2019	6,625
2020	7,250
2021	7,250
2022	7,250
2023	7,250
2024	7,250
2025	7,250
2025	7,250
2027	7,250
2028	7250
2029	7,250
2030	7,250

Figure 2-2 shows the proposed NRET target. The NRET target is much higher than the VRET target, as can be observed in Figure 2-3.

Figure 2-2: NRET target

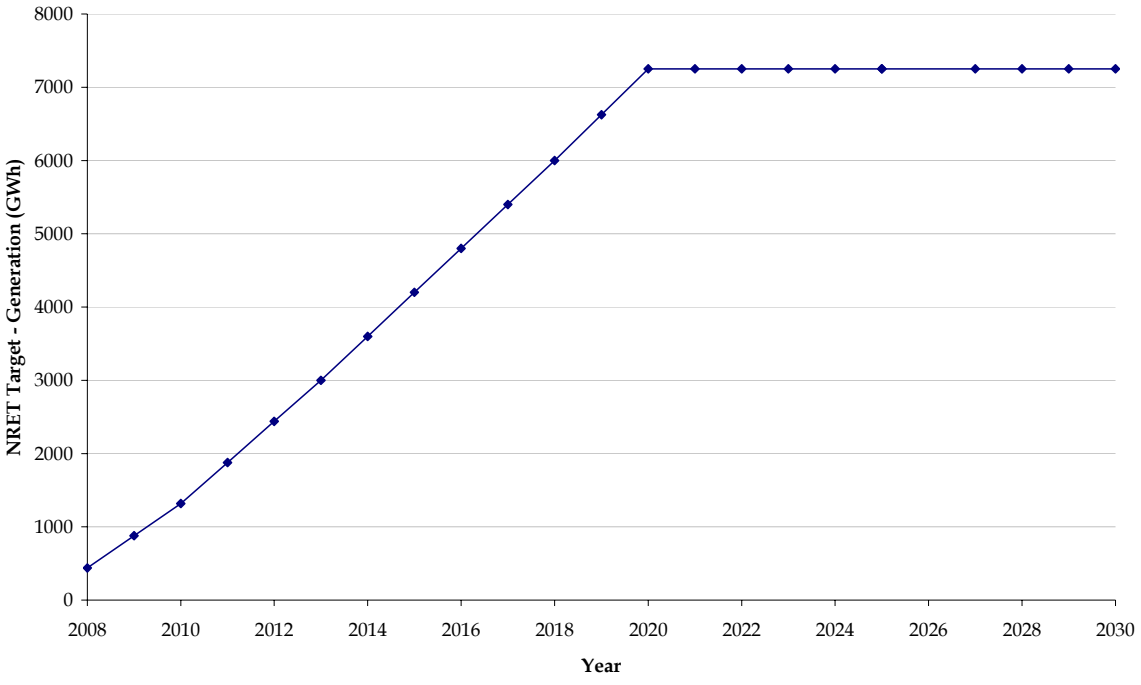
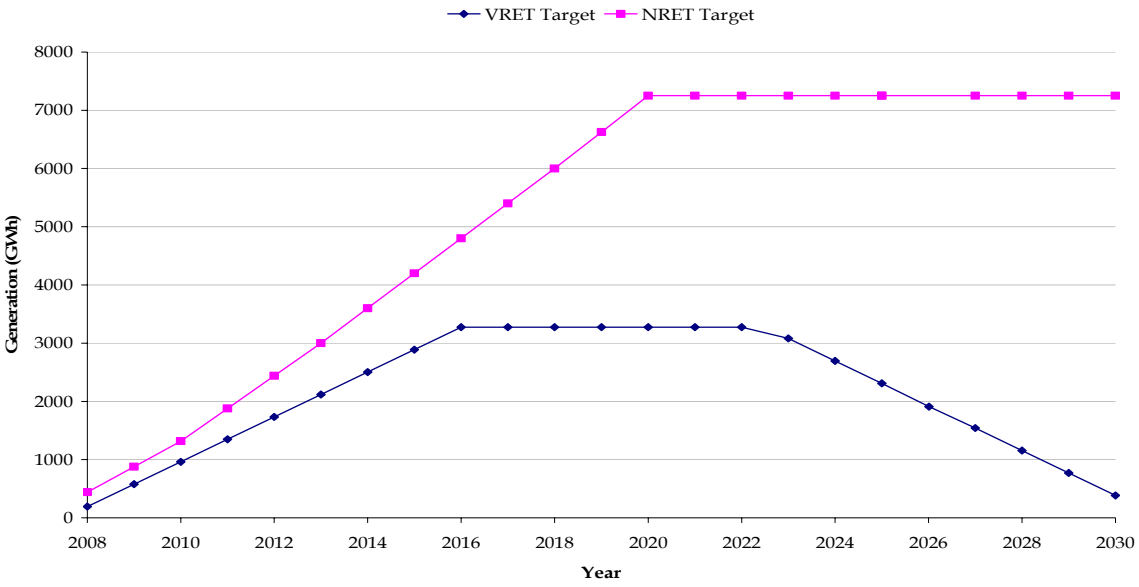
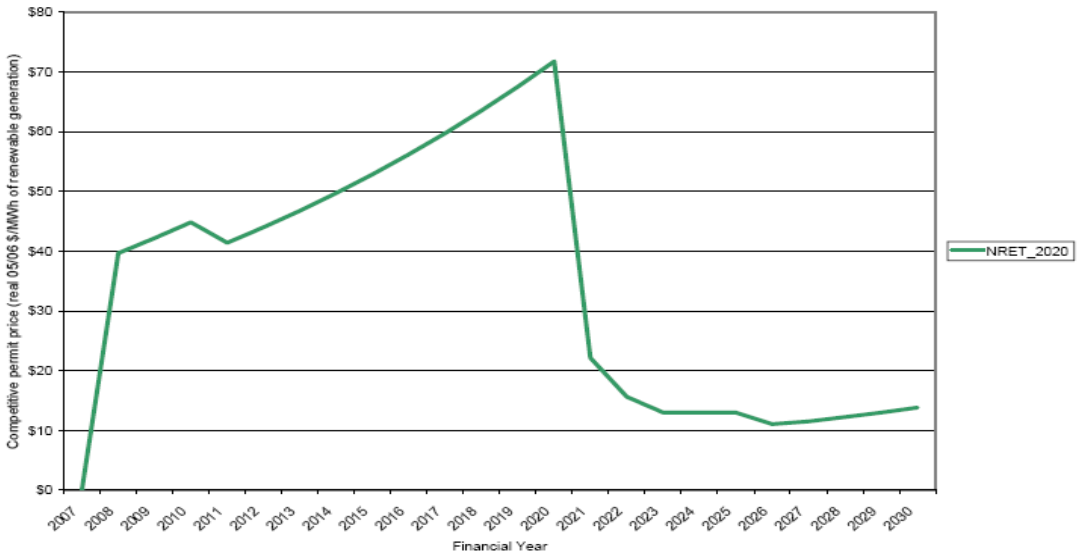


Figure 2-3: Comparison of VRET and proposed NRET targets



The NSW Department of Energy, Utilities and Sustainability (DEUS) and Frontier Economics undertook modelling to evaluate the economic costs of introducing the NRET scheme. From their analysis, they have determined the competitive certificate price. The analysis indicates that the competitive permit price is expected to rise to $45/MWh in 2010 and then rise to about $70/MWh by 2020 and fall from 2020 onwards as MRET ends (see Figure 2-4). When the MRET scheme terminates, renewable energy generation that was earning RECs will be able to earn certificates under the NRET and hence cause prices to fall. The forecast permit price of $70/MWh in 2020 is higher than the effective price cap under the MRET Scheme (predicted to be around $39/MWh in mid 2006 dollar terms assuming an inflation rate of 2.5% per annum), and higher than the effective price cap under VRET of around $61/MWh.

Figure 2-4: NRET competitive permit price



Source: NSW Government, NSW *Renewable Energy target – Explanatory paper*, November 2006.

2.1.5 Potential developments in South Australia

South Australia has recently enacted legislation to achieve a reduction in greenhouse gas emissions by 60% of 1990 levels by 2050.

South Australia's Greenhouse Gas Strategic Plan targets national leadership in wind, solar and geothermal and aims to have renewable electricity account for 15% of electricity consumption by 2014. The potential areas of reference for strategy development are emissions trading, climate change planning, industry development, market reform and geosequestration. The renewable energy technologies highlighted as potential areas for development are biomass energy, wind, solar, geothermal and hydrogen.

Currently, there is no publicly available information detailing how the targets for renewable electricity will be met and the interaction with existing renewable energy strategies. Newly announced policies such as a Feed-In Tariff[1], which will allow households with solar panels to earn double the amount of revenue for selling power back to the grid will assist South Australia to meet their renewable energy target. The government has also recently announced their plan to source 20% of their energy needs from 2008 onwards from Green Power.

As the specific nature of mechanisms that will be used to achieve the South Australian targets have not been provided, it is too early to perform a detailed quantitative analysis of potential impacts on the REC market.

2.1.6 Potential developments in Western Australia

The Western Australian Government is considering establishing targets for low emission generation in the South West Interconnected System. It has stated publicly a target of 6% by 2010 (which will largely be met with existing renewable generation), but is investigating increasing this proportion to 20% by 2025. Feasibility studies are under way to determine the appropriate target.

The Western Australian scheme could impact on prices for RECs under MRET if it diverts new generation away from MRET.

2.2 Green Power

Green Power is a product developed by electricity retailers comprising electricity sourced from accredited renewable generation. The high cost of renewable generation relative to conventional generation results in Green Power being sold at a premium of a few cents per kilowatt hour.

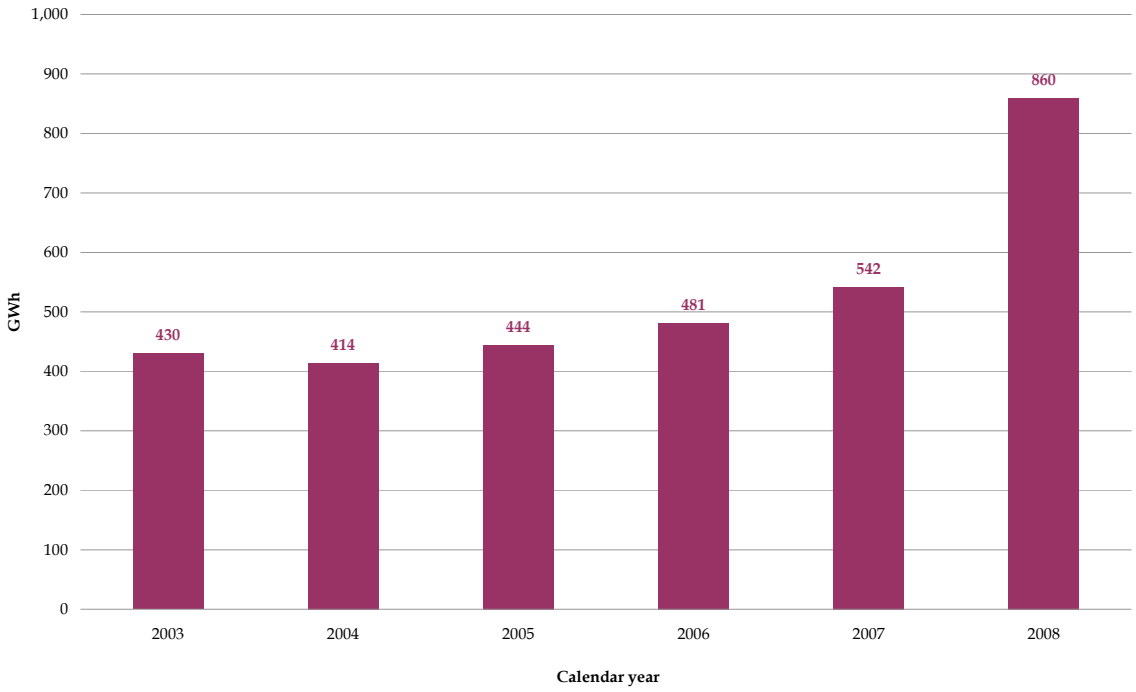
1 Feed-in tariffs provide a financial incentive for investment in renewable energy generation. A set price is paid by liable parties (typically retailers or network owners) to generators for renewable energy exported to the grid. These prices can apply over an extended period of time. The set prices are set at a level to cover the cost of renewable generation. Differential tariffs can be set for each type of RE technology.

Green Power schemes can be either of the following two types[2]:

- Consumption based schemes, in which a premium is charged on the price paid by consumers on some or all of the electricity consumed. An example is Energy Australia's Pure Energy scheme, which allows consumers to nominate a percentage of their electricity (25%, 50%, 75% or 100%) to come from renewable sources.
- Contribution based schemes, in which consumers contribute to a fund administered by a retailer to support renewable energy generation.

By the end of 2006, there were over 381,789 customers who had opted for Green Power from their retailers.[3] Figure 2-5 shows that Green Power energy was 860 GWh in 2006 and Green Power sales increased by more than 60% in this year. Green Power has had an impact on encouraging development in renewable energy and in 2006 it contributed to around 18% additional renewable energy sales above the MRET target. Green Power is an ongoing program.

Figure 2-5: Green Power sales[4]



Green Power schemes originated in New South Wales through the Sustainable Energy Development Authority (SEDA). SEDA took on the role of accrediting Green Power generators and auditing retailers to ensure that all Green Power sold is actually generated

2 C. L. Sonneborn, S. Russell amd C. Crawford Smith (1999), *Green Power in Australia*, Australian CRC for Renewable Energy Occasional Paper, Perth, February.

3 *Quarterly Reports 2001-2006.* Source: http://www.greenpower.gov.au

4 *Quarterly Reports 2001-2006* . Source: http://www.greenpower.gov.au

by an accredited generator. The functions of SEDA are now undertaken by the NSW Department of Energy and Water (DEW).

The introduction of the MRET scheme has complicated the Green Power scheme and there was considerable uncertainty as to whether generation could be accredited for both and therefore gain two additional revenue streams. This confusion has been resolved through new Green Power accreditation rules that essentially mean that renewable generation may be either used for the RECs or sold as Green Power, but not both.

The decision a generator must make therefore is whether there is more value in the RECs or from Green Power sales.

3 MARKET FOR RENEWABLE ENERGY CERTIFICATES

3.1 Consultations with market participants

Consultations with a range of market participants were undertaken to provide an insight into the operation of the spot and contract markets for RECs. Discussions were held with market traders, third party traders, selected retailers and eligible generators.

The objective of the consultations was to obtain information on:

- The key factors driving market prices, with specific emphasis on the most recent period.
- The reasons for historical trends in prices, in particular the fall in prices over 2005 and 2006.
- The issues that could impact on the effective operation of the market in the future particularly the key market and regulatory issues.
- Liquidity of the spot and forward market and whether prices in these markets are representative of prices for the bulk of trades in the market. Indicative estimates of the volumes being traded on the spot market compared with contract positions were also sought.

Section 3.2 and 3.4 provides a summary of the views obtained from the participants.

3.2 Price movements and contract positions

The REC market commenced in 2001, with the liable parties focusing on entering into bilateral arrangements with the accredited generators to secure forward contracts to meet their MRET obligations. Demand for RECs by the liable parties led to an increase in supply, by commissioning new renewable energy generation to meet future RECs targets.

New renewable energy projects were accelerated in the lead up to the Tambling review in 2003, and in anticipation of an increase in the target. The decision by the Federal Government not to increase the target created an oversupply of RECs in the market.

It is believed that in early 2005, one of the accredited hydro generators oversold RECs on the OTC market for four to five years whilst liable parties had long contract positions, causing a decline in the REC spot market price.

Other factors also helped to subdue the price:

- The offer of 640,000 RECs created by SWH for a four year term starting in 2005 added to the oversupply of RECs in the market. The price offered was below $30 per REC, which was another key driver of REC prices moving downwards.

- As REC prices moved further below $30, market participants were buying RECs to push the price up. As more RECs from SWH became available and the buying spree continued, the market was long by about seven million RECs.
- Market prices continued declining from their high $30s to $12 in a trade in mid November 2006. This price level was offered despite the position believed to have been taken by SWH agencies that their RECs would not be traded below $18 per REC.
- The general view was that most liable parties have a long REC market position. This was due to the support required for financial backing of new renewable energy projects of wind farm projects.
- There was a general consensus amongst participants that the NGAC price would set the floor price for RECs, with one view that REC prices may not move above the $25 mark.
- Another view was that the other state schemes would push the REC price up, as there would be a shortfall of RECs because the new schemes would attract new investments. Any shortfall in the REC market might not be readily filled in by new investments. In addition RECs that would be converted to NGACs should provide price support to RECs. The recent announcement of NRET caused an increase in the REC price, which was thought to be more of a market manipulation strategy than what some participants believed to be a key effect of the price increase. Prices have risen recently in anticipation of an emissions trading scheme and other complimentary measures being implemented at a Federal or State level.
- Most participants believe that the spot price is not indicative of the bilateral contract price which is maintained above the $40 mark. An example of this was a recent Power Purchase Agreement (PPA) in the last six to twelve months that was signed at a REC price of more than $40.

3.3 Certificate creation

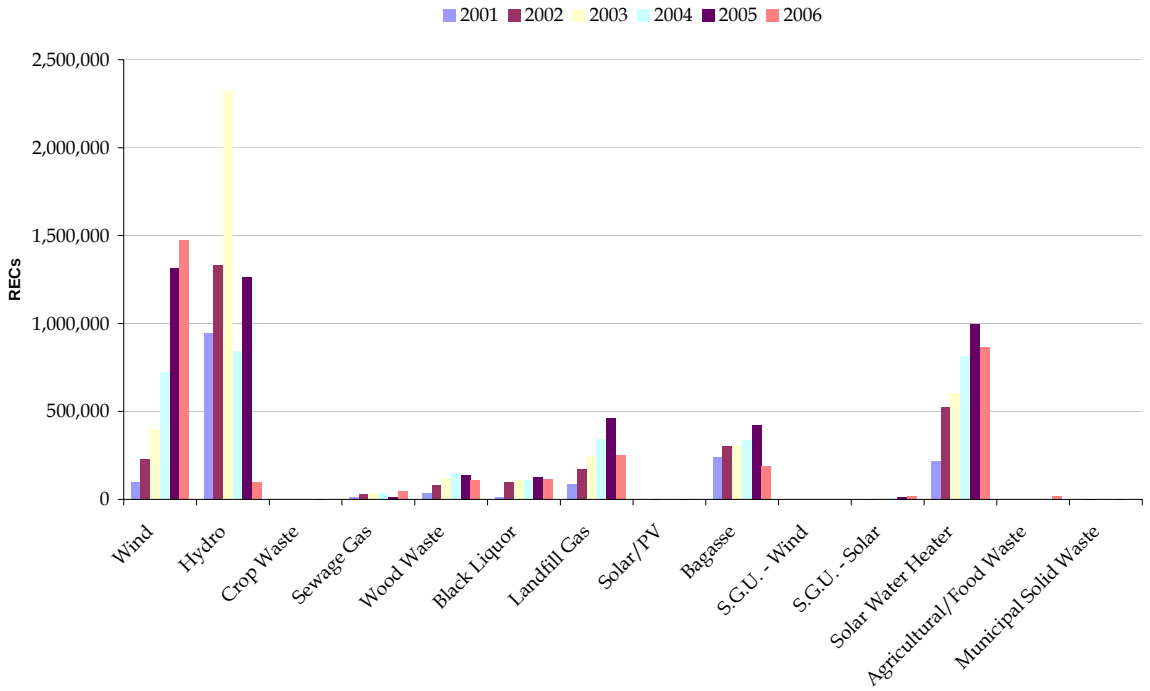
The historic REC creation from 2001 to 2006 by renewable generation type is shown in Table 3-1 and Figure 3-1. It can be seen that hydro-electric, SWH and wind were the major contributors to meeting the REC targets over this period.

Between 2001 and 2004 around six million RECs were banked. The oversupply of the REC market resulted in downward pressure on the REC price. Calculations by MMA revealed that around 900,000 RECs could still be created by eligible generators. The calculation is partly based on historical electricity generation data from Erisk, annual reports and MMA assumptions.

Table 3-1: Historic REC creation by renewable generation type [5]

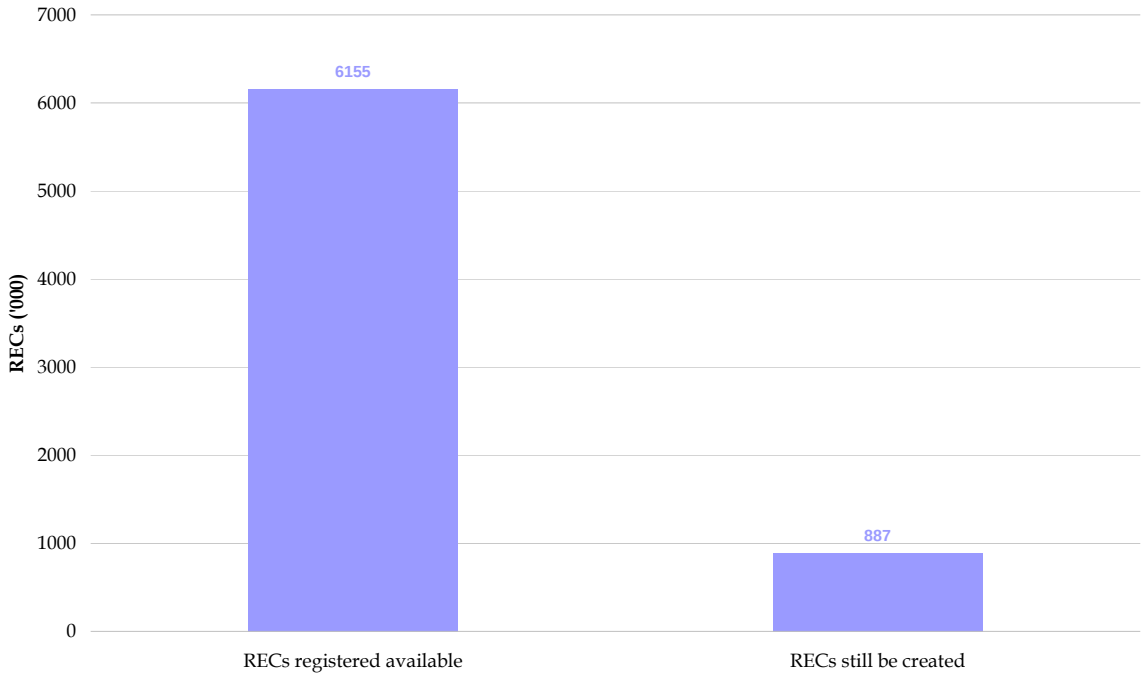
Renewable type	2001	2002	2003	2004	2005	2006
Wind	100,169	226,042	400,711	726,054	1,315,332	1,474,420
Hydro-electric	944,720	1,330,190	2,324,019	840,032	1,262,805	99,204
Crop Waste	0	0	115	511	1,155	0
Sewage Gas	10,948	32,710	33,846	38,981	13,313	49,080
Wood Waste	37,025	82,272	120,161	150,831	139,453	108,131
Black Liquor	15,425	95,611	108,038	110,730	124,743	116,160
Landfill Gas	86,649	174,629	248,297	340,854	461,414	253,719
Solar/PV	532	757	977	1,013	1,074	1,353
Bagasse	241,509	303,109	309,303	339,252	420,738	191,156
S.G.U. - Wind	100	44	70	169	39	17
S.G.U. - Solar	820	2,477	5,699	8,104	12,498	16,920
Solar Water Heater	215,357	525,137	604,472	812,722	997,640	866,652
Agricultural/Food Waste	0	0	0	0	0	20,439
Municipal Solid Waste	0	2,305	542	711	593	31
Total	1,653,254	2,775,283	4,156,250	3,369,964	4,750,797	3,197,282

Figure 3-1: Historic REC creation by renewable generation type



[5] REC Registry, 02.01.2007.

Figure 3-2: REC surplus (end of 2004)



3.4 Market prospects

3.4.1 Spot market

The general view by the participants interviewed was that small volumes are traded on the spot market, with this market consisting of no more than 20% of the total REC market. Most players see the REC market as a compliance market, rather than a financial one, which reflects the small REC volumes traded on the spot.

Most of the participants agreed that the spot market was used for speculative trades and for sending price signals to the REC market of where prices would be heading. However, participants with conservative risk management policies have the provision to trade their unders and overs of their REC portfolios on the spot market. Some spot trades are driven solely by business strategies, such as liquidating a position or meeting their obligation and avoiding the penalty.

The view was that the spot market lacked liquidity, which was considered as a barrier to market entry. Some participants argued that given the size of the REC market and number of players, there was already an expectation that the spot market would sustain a low level of liquidity. It was suggested that an increase in the number of surrender dates within a year could create more trading activity.

Given that more than 80% of the market is contracted on a bilateral structure, any shortfall in the REC market caused by the schemes operating in the different states could create more liquidity to meet the liable parties' obligations.

The volume traded on the spot market is assumed to be between 10,000 and 20,000 RECs per trading day. Recently, the market has seen an increase in the number traded on the spot market, as some of the bilateral long-term deals are dropping off. For example, for the year 2004/05 the number of RECs traded on the spot market was estimated at 1 million RECs and in 2005/06 this increased to about 5 million RECs. This trend is not expected to increase, as liable parties already have a long position.

3.4.2 Market issues

A key issue to participants across the market has been the uncertainty of what targets are to be achieved by the different greenhouse gas emission abatement schemes planned by the state governments. Such uncertainties include eligibility of parties, the type of generators that can create certificates, eligibility of SWH units, administration systems, and so forth.

It was stated by a number of participants that too many schemes were being created (VRET, NRET, SARET, WARET), including MRET, imposing high administrative costs on participants. This is believed to act as a barrier to entry for new retailers wanting to compete in the electricity market. There was broad agreement that all schemes should be amalgamated under the one scheme, as this would improve market efficiency.

With the introduction of the new proposed schemes such as VRET and NRET, there is the opportunity, based on the rules applied to each scheme, for arbitrage of the electricity generated under these schemes.

One participant noted that "*the price of RECs is a bet on the political outcome of state and federal elections*".

It was recognised that the number of RECs created by SWH has been significant in influencing prices. In 2005/06, it was estimated that 920,000 RECs were created by SWH units. This number could decline, due to a potential drop in demand for SWH units because of the impact the lower REC prices may have on the financial incentives offered by the manufacturers.

There is a high level of competition between SWH manufacturers, which is leading them to price RECs at a higher price (included as a rebate component) than what they receive for them. For example, recently SWH manufacturers were pricing RECs at $16/REC and receiving about $11. A decline in the volume of SWH sales has been observed, which could partly be attributed to the lower REC prices offered to SWH buyers.

Electricity retailers with a renewable energy generation portfolio have an interest in keeping REC prices high to achieve higher returns from RECs created through their generation. These retailers have tried to support the spot price by buying small volumes (5,000 RECs) on the spot market.

Comments made by various participants indicated that in general, hydro-electric generation portfolios were contracted for no more than three years, whereas wind farms

were typically contracted for ten to fifteen years. These strategies appear to match the risk profile of the different participants.

There is a view in the market that the voluntary surrender mechanism under the amendments to the Act could take up some of the slack in the REC market. Voluntary surrender may encourage the development of "green" products that would attract businesses willing to offset their greenhouse gas emissions.

It is believed that the following proportions of the renewable energy generators are contracted for at least the next five to ten years:

- Wind generators – 90%.
- Biomass – 50%.
- Hydro-electric – 50%.
- SWH – 50% to 75%.

As stated above, retailers in general are long in their contract position. Government owned retailers could be carrying RECs well above their portfolio requirement, as they may have lower carry costs than the privately owned retailers.

Some long-term PPAs are contracted for over 20 years, with provisions for price reviews every few years, which creates certainty of supply for renewable energy projects. It is believed that the time between signing the PPAs and the commissioning of a renewable energy project is approximately 18 months.

4 LONG-TERM OUTLOOK

4.1 Method and assumption

4.1.1 Bilateral contract model

Projecting REC prices using the bilateral contract model requires the use of two models: an electricity market model, and a REC model. An iterative approach is required, as the electricity price is affected by the quantity of renewable generation available in each region, and similarly, the choice of renewable generation developments in each region is dependent on the electricity market price receivable. Therefore, both models must be used conjointly until a stable solution is obtained.

The MMA wholesale electricity market model, Strategist, depicts each of the generators operating in the electricity market and the demand on an hourly basis. The model accounts for interactions amongst market participants based on the relative marginal costs of generation units and the bidding strategies of generator portfolios. The model assumes that the NSW Greenhouse Gas Abatement (NGGA) scheme continues to operate until 2030. This scheme is assumed to effectively subsidise low emission generation such as gas fired generation.

Projecting REC prices with the bilateral contract market model is based on the assumption that the price of the REC will be the difference between the cost of the marginal renewable generator and the price of electricity achieved for that generation. The basic tenet behind the method is that the REC provides the subsidy, in addition to the electricity price, that is required to recover all costs including investment costs of the last installed (marginal) renewable energy generator required to meet the REC target.

In a simple system, the REC price is determined by identifying the marginal generator and performing a simple subtraction of these two values. However, the following complications arise:

- Introduction of new renewable generators impacts on the electricity price paths, resulting in the requirement for iteration of the electricity market price forecast and the REC estimation.
- The allowance of banking in the REC market results in the requirement for an inter-temporal optimisation.
- Generation resulting from the upgrade of large hydro-electric units is treated in our hydro dispatch model to account for the additional dispatch which could be attained with refurbishment to attain higher efficiency in generation.
- Resource and other constraints limit the uptake of renewable generation.

- Interaction with Green Power schemes. Our model assumes that renewable generators supplying the Green Power markets are not available to supply RECs[6].
- Interaction with the VRET, NRET and WARET schemes[7].

The optimisation requires that the interim targets are met in each year (by renewable generation and banked certificates), and cumulative generation from eligible renewable energy sources covers the total number of certificates required over the period to 2020 when the program is scheduled to terminate.

The certificate price path is set by the net cost of the marginal generators, which enable the above conditions to be met and results in positive returns to the investments in each of the projects. MMA's REMMA model[8] determines the future price path of contracted RECs in the following steps:

- Determine electricity prices in each NEM region. We have used four Queensland zones to appropriately model the transmission losses within Queensland and to better evaluate the trends in marginal loss factors if one region is retained for the purposes of pool pricing.
- Assign regional electricity prices to renewable projects according to location.
- Weight electricity prices according to renewable generation profiles (for example, PV generation tracks sunlight intensity).
- After subtracting the weighted electricity price from the corresponding renewable project levelised cost, determine the merit order of the projects by ascending net costs (apart from those flagged as committed). For each renewable generation option, the net cost is equal to levelised cost of generation over the life of the plant discounted with the electricity sales income and revenues from any other programs (for example, steam sales).
- The REC path is optimised over the life of the scheme, subject to the constraints indicated above. REMMA uses a non-linear programming algorithm to determine the least cost combination of projects that meet the cumulative target over the life of the scheme. The REC price is set by the net cost of the marginal unit required to meet the demand for certificates in each year.
- The plant installed in each year is determined by economic viability subject to the REC price path, and also subject to resource constraints, REC creation and surrender constraints.
- The resulting MW installed and generation levels are then required as inputs to the electricity pool price model to determine the resultant pool price changes that

6 We employ a simple model of the Green Power market, which projects Green Power sales by state as a straight extrapolation of historical trends. This amount of Green Power sales is deducted from above baseline generation from renewable generators eligible for MRET, to get the net amount of generation available for the REC market.

7 For the WARET scheme, we assume a 15% target in 2020.

8 REMMA stands for Renewable Energy Market Model Australia.

additionally determine the REC prices. Note that solar water heater installations are treated as load reductions, not generation in the pool model.

- The resulting regional pool price paths are iteratively input into the initial step above until stable pool price paths are achieved.

The electricity prices utilised in the analysis are determined using our probabilistic dispatch model of the NEM and SWIS (developed using Strategist).

The bilateral contract model is configured to determine simultaneously the price for RECs, the Victorian VRECs[9], the NSW NRECs and the potential West Australian WARECs scheme. The model simultaneously determines entry of new generation under the MRET, VRET, NRET and WARET Scheme and the resulting prices for each certificate. This is done by imposing a constraint in the model that restricts eligible renewable generators in Victoria, New South Wales or Western Australia to only one of the schemes. However, renewable generators are only eligible to earn VRECs, NRECs and WARECs for 15 years. Therefore, there may be incentive for renewable generators to sell RECs in some years and then switch to selling NRECs and WARECs to prolong the period of certificate revenue achievable. For this study, the model will be in accordance with the regulations governing the VRET scheme that prevents new Victorian renewable generators from selling RECs in the early years of their life and then entering the VREC market in the latter years of their life.

This methodology assumes that market participants are well informed of the future at each point in the time horizon and that there are no disruptions to the REC market and energy market. It assumes that the discount rate used by participants to value banked certificates is agreed and known. It assumes that the production of renewable energy is solely driven by economic considerations based on costs and revenues.

Information on the cost and level of generation from new renewable energy generators was obtained from the bilateral contract model. This provides an important input for the short term risk model described in Section 5.1.

4.1.2 MMA Renewable Energy Database

MMA has a detailed database of renewable energy projects covering existing, committed and proposed projects that supports our modelling of the REC price path. The database includes estimates of capital costs, likely reductions in capital costs over time, operating and fuel costs, connection costs, and other variable costs for individual projects that are operating, committed or planned[10]. The database assumes a 9.0%[11] real pre-tax weighted average cost of capital over at most a 20-year investment horizon. The model considers

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9 VRECs = Victorian Renewable Energy Certificates that must be redeemed by Victorian retailers and large electricity consumers under the Victorian Renewable Energy Target scheme.

10 Committed plant means projects that are either under construction or have achieved financial closure. Planned projects are those being actively investigated.

11 Based on debt to equity ratio of 75:25, real pre-tax interest on debt of 6.3% (9.0% in nominal terms) and real pre-tax return to equity of 17%. A premium of 1% applies to biomass projects to account for fuel supply risk.

the time from the commencement of generation to the end of 2020 for REC revenue but only considers energy (electricity) revenue beyond 2020 earned by the renewable energy project if the 20 year investment horizon goes beyond 2020. The weighted average cost of capital estimate is also based on existing market rates for generation investments.

Currently, the data base comprises:

- 500 eligible renewable generators, either existing, committed or planned.
- Existing RE generation accounts for 5,301 GWh per annum of eligible (above baseline) REC creation (excluding the proportion of generation sold on Green Power markets).
- Committed projects account for a further 3,397 GWh eligible REC creation, including 907 GWh attributable to SWH sales, with most of this generation coming into the market over the next two years.
- Planned or generic projects, excluding additional SWH sales, amounting to 42,575 GWh of eligible renewable generation.

Project costs have been obtained from published estimates of costs (usually capital costs), plus estimates of costs inferred from equipment suppliers, market data (for biomass fuel costs) and reports to governments. The costs are believed to be accurate to +/- 10% for existing and committed projects and +/- 20% for planned projects.

MMA has also developed a separate model for forecasting REC creation from SWH, taking into account the impact of a range of new State Government policies.

Certificates are valid for all periods up to 2020. In this analysis, banking of certificates over periods is allowed to occur where economic. This allows generators to hold their certificates until a later date, when a more attractive price may be available. Banking of certificates may also reduce the total cost of the scheme by delaying the introduction of more expensive generation. It also means that all targets could be met by a group of renewable generators creating less than the overall target for a period beyond 2010.

4.1.3 Modelling assumptions

The modelling assumptions include:

- Only modelling renewable resources currently eligible.
- Restricting the level of wind generation by location.
- Restrictions on availability of fuels for biomass projects.
- Network upgrade costs where information is available. An assumption is also made for a cost impost on intermittent generation alternatives (primarily wind generation)

for an additional cost for the provision of ancillary services[12]. This is assumed to be about $10/kW.

- Average hourly electricity market prices to determine revenues earned for intermittent renewable generation, but these are discounted by 10% to reflect the uncertainty due to intermittency of the generation.

- Revenue earned from other potential services provided by renewable generation, such as the ancillary services, avoidance of network costs, and avoidance of waste disposal costs. In the modelling, revenue from other sources is assumed to be zero.

Because of banking, current prices in the RECs market are based on the expectations of future market conditions of all traders involved. Thus, the current price is an expected price based on a number of possible future market scenarios and the probability of these scenarios eventuating. Other short-term factors may also impact on the price.

The modelling attempts to project certificate prices for a most likely outcome in terms of electricity price, availability of renewable resources and generation costs. Therefore, the impact of short-term or other factors that may affect expected prices is not explicitly modelled in the bilateral contract model, but rather in the short-term risk model.

4.1.4 Costs of renewable generation

There are several sources of supply uncertainty that could affect the forecasts of REC prices. Generation from some renewable energy options is intermittent. This affects the reliability of supply and the prices received for the energy. Depending on the penalty for non-compliance, the unreliability of supply may also lead to a high level of renewable generation being required in order to guarantee the targets are achieved. Risk averse retailers may over-contract in order to ensure they can meet their targets, taking into account the probability that the renewable generator may not generate the contracted quantity due to adverse climatic conditions. Or, they may contract for that generation at a discount.

Data on the level of variability of renewable options are sparse. The two most affected technologies are wind and hydro-electric generation. Preliminary data on wind generation indicates a year on year variability of ± 10% (95% confidence interval). Variability in annual hydro generation is about ± 11%, per cent based on data from the Snowy Mountain Scheme and Hydro Tasmania, although generation from these schemes has been lower than the long-term average over the past three years.

However, the impact of intermittent supplies on renewable certificate prices is likely to be minimal. The reasons for this include:

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[12] Because generation from a wind farm can vary from minute to minute, additional resources are required to stabilise voltage on associated network elements. See Arnott, I. (2002), *Intermittent Generation in the National Electricity Market*, National Electricity Market Management Company, Melbourne.

- Retailers can use the banking provisions of the scheme to bank some of the certificates in years when renewable energy generation is higher than expected, for use in years when generation is lower than expected.

- Potential cross-correlation in the supply of renewable energy resources by type and location of the resources. Low wind generation in one region may be made up for by higher than average wind generation in another region, or by higher than average generation by mini-hydro options. There is a dearth of data on the potential for cross-correlation in renewable energy supplies.

- Usage of biomass or co-firing options, which have more stable supply.

Another source of supply uncertainty is the potential limit on the availability of renewable energy resources, due to economic or technical circumstances. For example, some renewable energy resources are only available for limited periods during the year. Bagasse is only available during the sugar cane harvesting period of May to November. The unit cost of the renewable energy is increased, not only because of the lower level of utilisation of assets, but also because the outputs are typically sold in the lower price periods in the electricity market (from May to November of each year). Storage facilities to enable year round usage of bagasse would add to the cost of bagasse based generation. The additional cost of this storage has been included in the analysis.

Because many of the biomass fuels are by-products of other productive activities, their availability is subject to economic factors affecting those activities. For example, bagasse is a by-product of sugar cane production and the amount of sugar cane crushed. Supply of sugar cane is variable due to the variability of sugar prices on world markets and variable weather conditions (which can also affect fibre content). This is included as a premium on the discount rate of 1% to reflect this uncertainty.

The future costs of renewable projects also depend on the forecast reductions in capital prices resulting from technological improvements, the value of the relevant exchange rate and the ability of the project to obtain additional government support. In recent times, increases in labour and material costs have boosted the capital cost of both renewable and fossil fuel generation options. Based on anecdotal evidence plus the cost of recently announced projects, the capital cost of all proposed renewable generation projects have been increased by 35%.

Obviously changes to these costs from those assumed would have a significant impact on prices. Higher capital costs would impact on prices, particularly in the latter period of the scheme when high capital cost options are setting the certificate prices. An increase in fuel costs will also have a moderate impact on prices. Fuel cost increases would increase the cost of biomass generation options as well as change the profile of generation to higher cost options such as wind generation.

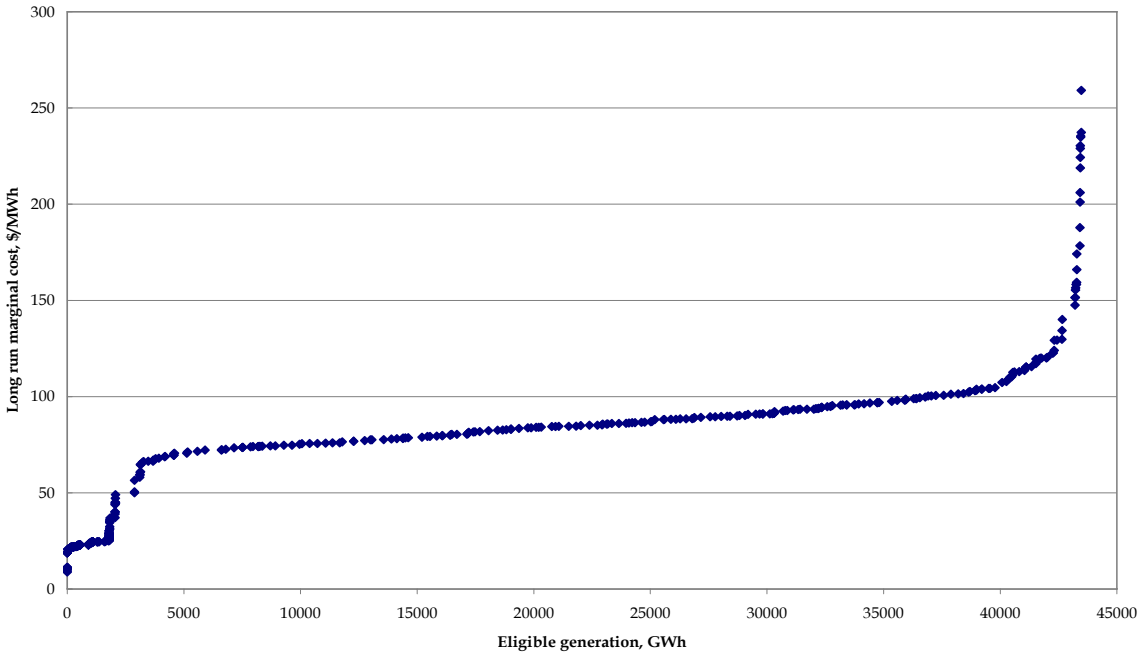
Assumptions on the cost of renewable generation are shown in Table 4-1. The long-run marginal cost curves[13] for available renewable energy in Australia are shown in Figure 4-1. This does not include the creation of RECs from additional SWH sales, which could amount to up to 1,470 GWh by 2010 for REC prices equal to or greater than $35/MWh.

Table 4-1: Long-run average costs of renewable generation options in 2007, $/MWh

Renewable generation type	Low	High
Hydro-electric	78	276
Wind	70	120
Biomass	69	158

Note: Long-run average costs represent average cost (including capital, transmission, operating and fuel costs) calculated using 10.0% pre tax cost of capital. Costs are in mid 2006 dollar terms.

Figure 4-1: Curve of long-run marginal cost for renewable generation in 2007, mid 2006 dollar terms[14]



4.2 Long-term outlook

Prices are forecast to be subdued over the next two years as competition has increased in the REC market reflecting a surplus of generation projects. Because of this surplus, retailers are reluctant to enter into long-term contracts with project developers until they see the market settle.

Over the long-term, the market still needs to achieve a REC price that recovers the cost of renewable generation not recovered from sales on the wholesale electricity market.

13 Net cost is the long run average cost after deducting for revenue earnt on electricity markets.

14 Covers existing, committed and proposed renewable generation projects.

The long-term price for RECs will be set either by the price required to sell more solar water heaters or the price for a new renewable generator, whichever is lowest. Our database indicates the net levelised cost (that is the long-run average cost of new renewable generation minus the average electricity price to be received) for the most likely renewable energy projects to proceed is expected to be around $35/MWh to $40/MWh range. Solar water heater sales will escalate with increasing price for RECs. Our analysis indicates an additional 150 GWh of RECs created from sales of solar water heaters for each $1/MWh increase in the REC price above $23/MWh.

Forecasts of REC certificate prices, in mid 2006 dollar terms, for the current MRET targets are shown in Table 4-2. REC prices are forecast to increase slightly from 2006 levels of about $20/MWh, to around $30/MWh in 2009. This increase is due to the higher cost of bringing on additional solar water heaters during this period. The higher level of solar water heater sales is required to fill the remaining gap in supply to meet the MRET target.

After 2010, REC prices remain steady at $30/MWh until 2020, when they will rise marginally to $31/MWh. By then, enough renewable generation has entered the market and prices are shadowing the cost of the next increment of renewable capacity that would be required to enter the market.

Table 4-2: Forecasts of REC prices – MRET

Year	REC price $/MWh
2007	23.0
2008	28.0
2009	30.0
2010	30.0
2011	30.0
2012	30.0
2013	30.0
2014	30.0
2015	30.0
2016	30.0
2017	30.0
2018	30.0
2019	30.0
2020	31.0

The long-term outlook is based on the assumption of a return to normal inflows for large scale hydro-electric facilities.

The price of $30/MWh is set by the cost required to encourage further sales of solar water heaters. Under the modelling, about 1,400,000 RECs per annum are created from solar water heater sales after 2010[15].

The outlook is based on the economic fundamentals of the renewable energy market. The impact of market participants speculating on future policy changes both at the State and Federal level has not been incorporated into the outlook.

15 A new solar hot water heater is given ten years worth of deemed RECs on installation. Therefore, the purchase of a solar water heater is not impacted by developments post 2020. Therefore, the model continues choosing solar water heaters beyond 2010.

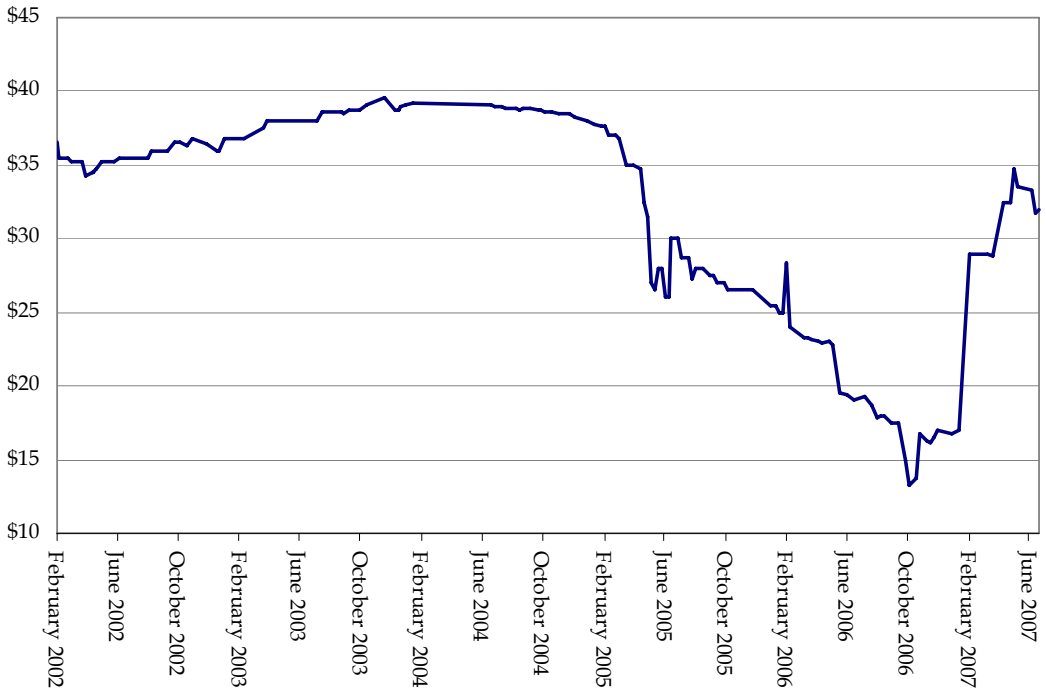
5 POTENTIAL PRICE RANGE

5.1 Historical price variations

Figure 5-1 shows the historic spot price path of RECs. REC prices have been moving upwards since the beginning of 2007 after a prolonged period of depressed prices. At the beginning of 2005, the REC spot price was around $38/MWh, whilst the forward price for 2008 was around $46/MWh to $48/MWh. But prices started to fall in 2005, at first modestly, but over mid-2005, sharply. Spot prices fell to around $27/MWh, whilst the forward price for 2008 fell to $34/MWh in May 2005. For the remainder of 2005, prices steadied at those levels. During 2006 prices again fell so that by the end of the year they were around $16/MWh for 2006 and $31/MWh for 2009.

The fall in spot prices during this period was due to a perception of a large surplus of banked RECs and solar water heaters operators wanting to liquidate their stock of RECs. Liable parties were holding back their purchases of RECs until they perceived the price of RECs had bottomed. Liable parties were reluctant to enter into long-term contracts with renewable generators until they a clear picture emerged of the supply/demand balance for RECs.

Figure 5-1: Historical REC spot price, $/certificate[16]



16 New Generation Energy Solution, *The Green Room Newsletter*.

Our current view is that prices have bottomed and based on the current prices, they are rising again due to the effect of the drought and retailers going back to the market for long-term contracts. Since the beginning of 2007, prices have indeed rebounded to reach $29/MWh in February 2007 and for Cal 07 they are trading at $34.25/MWh as reported by NGeS in May 2007.

The rise in price is driven by three factors. Firstly, the reduced rainfall in most States has lowered the level of generation from hydro-electric facilities, which in a normal year could contribute anything up to 1,600 GWh towards the target. Secondly, the introduction of state-based schemes is diverting renewable projects to those schemes. Thirdly, the solar water heater sales are not increasing as fast as in the past as a result of the low REC price.

5.2 Short-term risk model

5.2.1 Method and assumption

MMA has developed a short term risk model of the REC market that attempts to understand the potential uncertainty around the REC price on the spot market. The model calculates spot price by recognising that renewable certificates under contract to liable parties are effectively out of the market. Thus, the market for RECs represents a residual market to supply the remaining liabilities not covered under existing contracts. The model also recognises that the level of generation from some renewable generation sources (for example, wind and hydro-electric) will be uncertain from year-to-year.

The model was developed as follows:

- Using published information (from annual reports, media releases and *Renewable News Fortnightly*), information was obtained on the contract positions of the liable parties. Only the volume of RECs under contract was required.
- Output modelled for each generator not contracted to a liable party. For all generators, net output (after deducting for contract quantities) was modelled as a distribution of potential outputs reflecting the potential variation in annual output. For solar hot water heaters, a distribution of potential REC creation was developed as a function of REC prices and other factors affecting the sale of eligible solar water heaters.
- Generation output modelled from hydro-electric plant is assumed to be correlated in each year. That means, if the model assumes a prolonged drought period, every hydro generator will be affected and produce less output. The correlation factors for Hydro Tasmania and Snowy Hydro were calculated by using historical generation data from the last ten years.
- Green Power sales were modelled as a distribution of potential sales to identify its influence on the REC market, as it is an additional demand for renewable energy to the MRET target.

- Output modelled from potential new generators that can enter the market. Information on cost and level of generation from new generators was obtained from the bilateral model.
- Variation in cost for renewable energy plants. Cost of biomass fuelled generation in each year is treated as a distribution of potential costs about a mean value. Thus, the short term model considers some variation in short run marginal costs of renewable generators, due to variations in fuel prices for each biomass generator.
- RECs were assumed to be created for all of this output. A REC supply curve was established that maps the amount of RECs available to the market as a function of the REC price. The price at which RECs will become available was determined from the short run marginal cost of generation (after electricity revenue has been deducted) or the opportunity cost of generation.
- Using @Risk software package, the model seeks to establish the price that clears the spot market in each time period as a function of the demand and supply of RECs. As stated above, demand is equal to uncontracted liabilities remaining in each year, plus the remaining liabilities in subsequent years (to reflect the demand for banking). Supply is represented by the output of uncontracted renewable generators in each year. Because many of the input variables are represented by a distribution of possible values, the output is also a distribution of possible prices in the spot market in each year.

The modelling was used to provide information on the potential range in prices in the spot market. Indicative estimates of prices corresponding with confidence levels of 5% and 95% are provided.

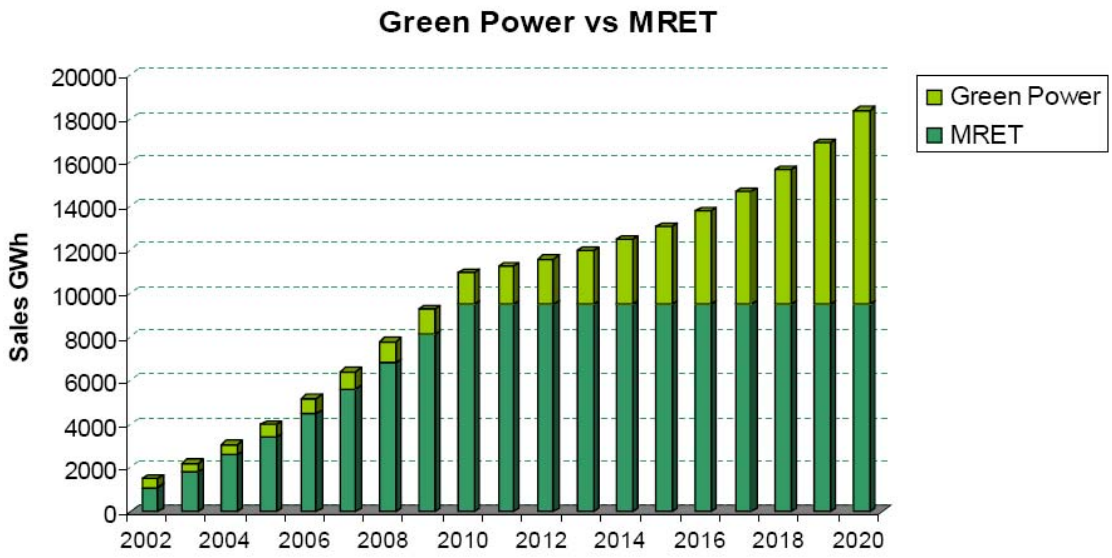
5.2.2 Forecast Green Power sales

Green Power sales have a direct effect on the supply curve of RECs, because renewable generation may be either used for RECs or for Green Power. Thus, Green Power reduces the REC supply on the spot market.

As shown in Figure 2-5, Green Power sales increased more than 60% in 2006. This reflects the rising environmental consciousness of households and companies. At the end of 2006, 381,789 Green Power consumers purchased green energy, which was an increase of 169,487 costumers in this year. It is uncertain how long the rapidly growing trend of the last year will go on and at what point the sales curve will flatten. Figure 5-2 presents the possible Green Power sales, estimated by Sustainability Victoria[17]. It assumes that the recent growth experienced in the Green Power sales could continue to grow exponentially from 2010 onwards. The forecast sales increase from 1,200 GWh in 2010, to over 3,200 GWh in 2015 and around 8,200 GWh in 2020.

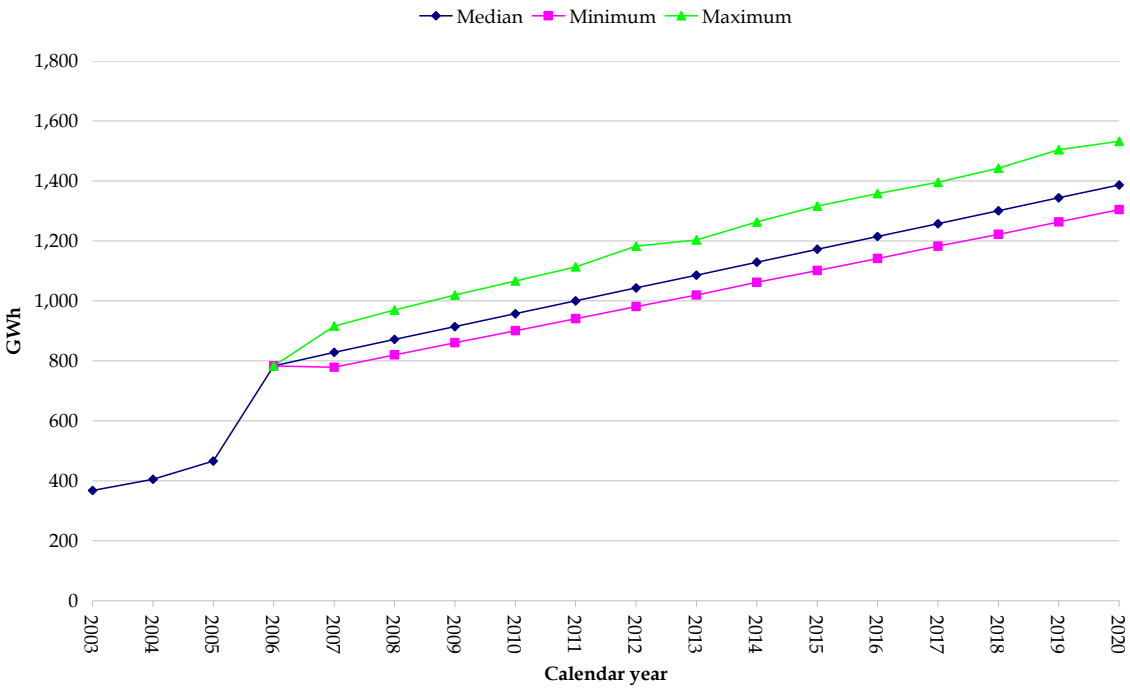
[17] Presentation by Kim Barnett, Program Manager Green Power , Sustainability Victoria.

Figure 5-2: Green Power opportunities[18]



We assume that it is more likely that Green Power sales will increase, rather than to decrease. For our modelling we used a linear rather than an exponential trend, to take a conservative approach on the increase in Green Power sales. Figure 5-3 shows our assumed curves for RECs withdrawn through Green Power.

Figure 5-3: Green Power RECs withdrawn



18 http://www.rega.com.au/Documents/2006%20Forum/Speaker%20Presentations/Kim_Barnett.pdf

5.2.3 Range of forecast REC prices

Prices for RECs in the high and low price scenarios reflect plausible variations in short-term and long-term assumptions, and reflect the 5% and 95% confidence limits around the medium forecast. The range reflects:

- Variations in the cost of renewable generation (lower and higher than the medium price scenario respectively).
- Variations in the amount of Green Power sales, which influence the demand for renewable energy generation.
- Variations in the amount of generation from existing hydro-electric generation, which impacts on the amount of above baseline generation (from 0 GWh in the high price scenario to 2,200 GWh in the low price scenario).
- Higher or lower level of sales of solar water heaters.
- Variations in the amount of wind generation due to low or high wind appearance.

The forecasts for the medium, high and low price scenarios are shown in Table 5-1 and the range of REC price is depicted graphically in Figure 5-4. Forecasts are underpinned by the costs for renewable generation.

- The prices in the medium price scenario are largely underpinned by the need for additional solar water heaters to meet the targets under the MRET scheme. There is an average demand of around 1,400 GWh per year of solar water heaters. Hydro generation is contributing around 950 GWh as a yearly average.
- In the high price scenario, the target can be met by additional solar water heaters until 2008. From 2009 onwards, new renewable generation plants are needed to fulfil the obligations and price rises towards the price cap in real terms in order to provide sufficient financial incentive to encourage new renewable energy generation. SWH contribute, as a yearly average, around 3,000 GWh to the renewable energy market.
- The prices in the low price scenario are mainly set by the short run marginal cost of biomass fuelled power plants or the opportunity cost of a certificate in the NGAC market (which is the alternative market for additional revenue for renewable generation), whichever is higher. The target can be met by existing renewable power plants and no RECs from additional solar water heater sales are needed. Above base line generation from existing hydro-electric power plant is mainly supplying any additional REC requirements.

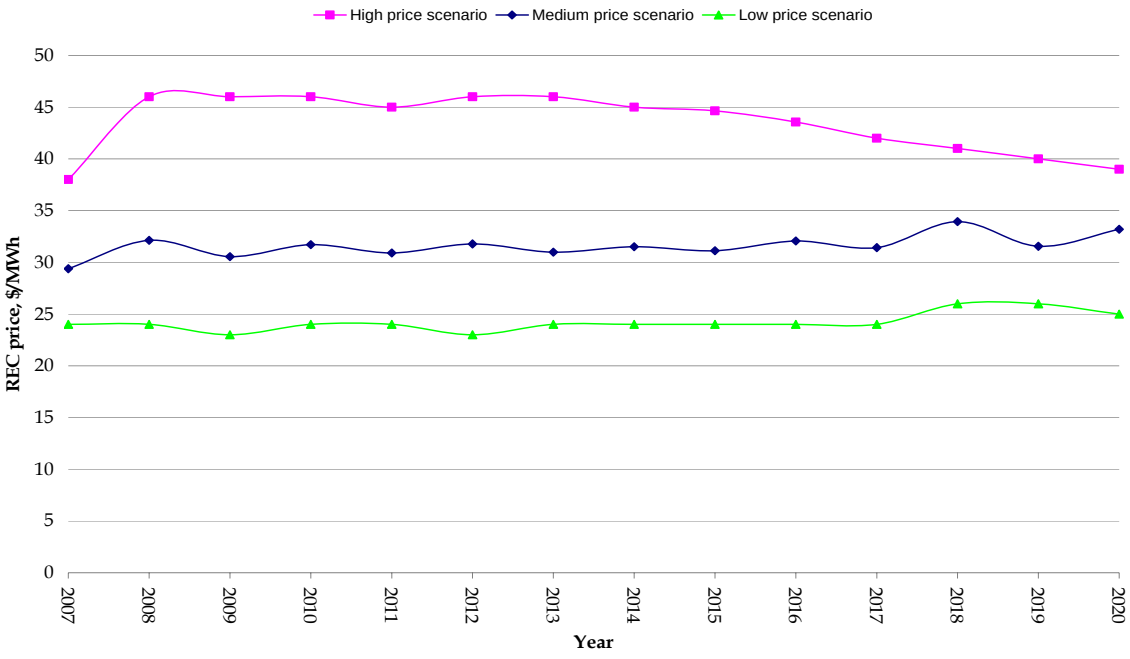
Table 5-1: Forecast REC price – low, medium and high prices, $/MWh

Year	Low	Medium	High
2007	24	29	36
2008	24	32	46
2009	24	31	46
2010	25	32	46
2011	24	31	46
2012	24	32	46
2013	23	31	46
2014	23	32	46
2015	24	31	45
2016	24	32	44
2017	23	31	42
2018	26	34	41
2019	25	32	40
2020	25	33	39

A major uncertainty is the level of water inflow into water storages for existing hydro-electric power stations. If low water inflow conditions continue, the REC price in the high and medium price scenarios will be higher than forecast in the analysis.

As the MRET scheme draws to a close, the range in price narrows. This is due to the penalty which sets the price in the high price scenario from 2014 onwards, regardless of the conditions affecting supply of renewable energy. The floor price is set by the assumed price for a NGAC, which is expected to hover in the mid 20s in real terms.

Figure 5-4: Range of forecast REC prices



5.2.4 Comparison with forward prices

MMA's forecasts of REC prices are based on the fundamental drivers affecting supply and demand for RECs. Therefore, the forecasts are based on the assumption that the market price is largely determined by these drivers and that the assumptions for the drivers are reasonably accurate. Thus, the forecasts should be interpreted as prices that would emerge if the market for RECs is highly competitive and the cost drivers are within the range assumed for the modelling.

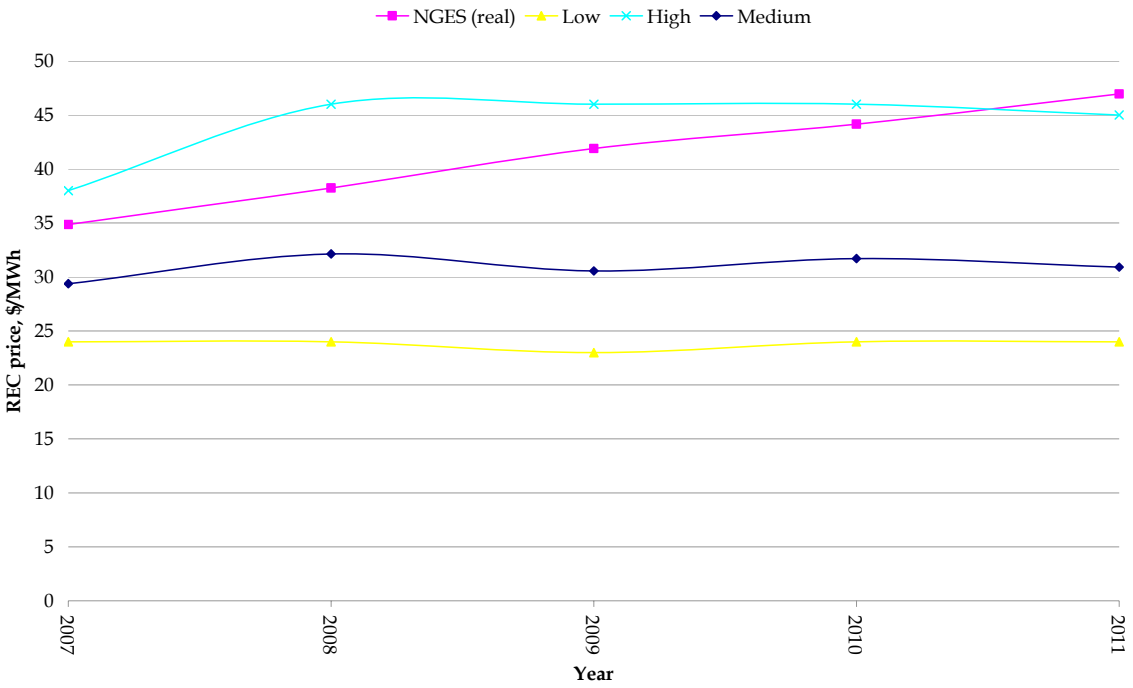
For comparison purposes, we compare MMA forecasts with forward prices currently being quoted in the market. A forward price curve is not a curve of future prices of RECs. The forward price curve represents the contract price today to provide a REC at some future date. The slope of the forward price curve generally represents the cost of carry (about 7% in the example in Figure 5-5) including interest and risk premiums. The future price of a REC is the contract price estimated for the future date in real terms. Forward prices are sourced from NGeS (Next Generation Energy Solutions) and represent actual forward prices as represented by the last trade for parcels of RECs of 10,000 or more. NGeS only provides forward prices to 2011.

Figure 5-5 shows that REC prices in MMA's high price forecast increase faster than the forward prices quoted by traders in 2008. However, forward prices quoted by traders between 2009 and 2011 are closer to MMA's high price scenario and reflect the impacts of the ongoing drought and speculation over the potential impacts of proposed policy changes by Federal and State governments.

Care is needed to interpret the price data provided by traders. Firstly, the forward market puts emphasis on a range of short-term factors and trader expectations. Secondly, the forward market is illiquid and does not reflect the market prices for over-the-counter transactions. The forward prices are determined from a limited number of trades and may not reflect the prices for contracts, which comprise the bulk of the trades. In particular, it appears that forward prices are based on small parcels of RECs, which may reflect short-term factors rather than longer-term fundamentals.

Until recently, there was a view in the market that no new renewable generation was required to meet the target under the MRET scheme, which is similar to the conclusions drawn from MMA's modelling in the medium scenario. In MMA's modelling, additional sales of solar water heaters make up the additional certificates required to meet the cumulative target in the medium scenario. No new renewable generation is required.

Figure 5-5: Comparison of MMA forecast and market forward curve



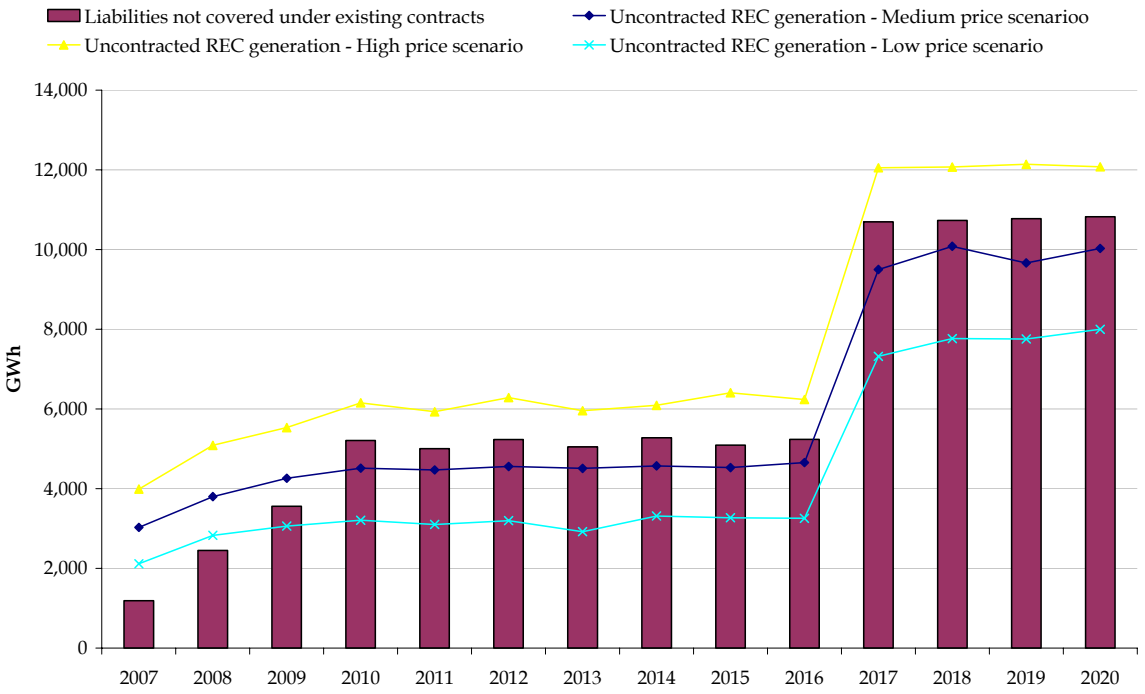
NGeS prices correspond with those reported in *The Green Room* on 9th April 2007.

5.2.5 Forecast REC demand on the spot market

Since the beginning of the MRET scheme liable parties focussed on entering into bilateral arrangements with accredited generators to secure forward contracts to meet their obligations. It is assumed that around 4,200 GWh of REC generation was under contract to liable parties in 2007. This amount will increase over the next two years, due to commissioned renewable energy plants coming into the market. From 2010 on, no additional renewable energy generator will come into the market, and only contracted solar water heaters are responsible for an increase in the contracted REC generation. As MRET draws to a close, it is not likely that liable parties will be in contract position from 2017 onwards.

Figure 5-6 shows the uncontracted REC generation for three different scenarios and liabilities not covered under existing contracts. The generation in the early years significantly exceeds the demand, even in the low generation scenario. This explains the vast amount of banked RECs from earlier years. The MRET target exceeds the supply of existing and commissioned renewable energy generation in 2009 (low price scenario) or in 2010 (medium price scenario) at the earliest.

Figure 5-6: Liabilities not covered under existing contracts and REC supply on the spot market



5.3 Risk factors

The views expressed above are dependent on a number of assumptions. The key assumptions underpinning this outlook and major risk factors based on the results of the short term model simulations are:

- The biggest risk factor is the variation in the amount of generation from existing hydro-electric plant, due to fluctuations in rainfall. It has the most effect on the REC price. Impact of +/- 10% changes in the hydro-electric generation leads to average changes in the REC price of -20% and +42% respectively. This large impact on the price can be explained by the high correlation in generation levels of all hydro-electric plant in a year. Thus, it is assumed that all hydro-electric generators are affected by less rainfall in a year. Less hydro-electric generation has to be absorbed by additional solar water heater sales, which leads to a jump in REC prices. The limits of variation of generation above baseline are between 0 to 2,169 GWh, which reflects the vast demand range for additional solar water heater sales. The penalty price limits the impact on REC price of low water inflows into existing hydro-electric plant.

- The second biggest risk factor is the uptake of solar water heaters. A change in solar water heater sales of +/- 10% produces average changes in the REC price of -12% and +18% respectively. The variability of REC prices increases with time.

- A variation in the amount of wind generation is the third biggest risk factor. Variation of +/- 10% in wind generation, due to unstable wind conditions from year-to-year leads to an average variation in the REC price of -8% and +15% respectively. Less wind

generation has a higher impact on the REC price than higher wind generation. The variability of the REC price increases to the end of the scheme.

- Variations in Green Power sales have only a small impact on REC prices. Banked RECs and solar water heater sales can absorb the changes in Green Power sales until 2018. It is only at the end of the MRET scheme that the REC price is likely to be affected by variations in Green Power sales.

- Reductions in the amount of banked RECs only have an impact on the REC price at the end of the scheme. Unless the reduction of banked RECs is more than about 2,400 RECs, solar water heater sales can absorb the changes. This can be explained by the surplus of around 2,400 GWh towards the end of the scheme in the medium REC price scenario.

- Variations of +/- 10% in the cost of renewable energy projects only have minor impact on the REC price, because subsidy required by solar water heaters acts as a cap on the price in the low and medium price scenarios.

In summary, REC prices are likely to remain around the $31/MWh level in real terms over the long-term, assuming the structure of the scheme and target levels remain as enacted. The analysis indicates subdued prices in the near term, as more renewable projects are commissioned. However, there is the potential for a rise in price over the longer-term, as solar water heater sales increase or a new renewable generator is required to meet the target.

The key uncertainties are the ongoing drought and the availability of RECs from solar water heater sales. If the drought continues, hydro-electric generation above baseline could drop to zero, and more solar water heater sales and additional renewable generation could be required to fulfil the target.

In the base case, the projection is for RECs created from solar water heater sales to reach around 1,400 GWh by 2012 (as long as prices increase to the projected $30/MWh in the medium price scenario). This represents a substantial increase from the current levels of around 867 GWh (as occurred in 2006) and is a key factor putting downward pressure on REC prices over the next few years. The increase in sales of solar hot water heaters is driven by a range of programs implemented by Federal and State governments. There is a high level of uncertainty over the total level of RECs created from solar water heaters. Restricting the high sales to just 1,100 GWh per annum (instead of 1,400 GWh per annum) would see REC prices increase in the long-term. Conversely, increasing the number of RECs created to 2,500 GWh would see prices fall to around $23/MWh in the long run. Thus, developments in the solar water heater market need to be monitored closely.

Other uncertainties affecting the outlook for the REC market include:

- Currently people are holding off selling/buying RECs and this makes it difficult to determine the long-term exposure of retailers and their need for additional RECs in the future.

- Low volume trading at current prices which makes it difficult to discern the market conditions for large volumes of certificate and for long term contracts.
- Liable parties are waiting for all RECs generated but not yet created to be declared, which will have to be done by the end of 2007. Liable parties currently have adequate certificates banked or under contract to cover liabilities over the next two years. They are in no rush to enter into new contracts until they get a full understanding of the supply/demand balance, which will happen at the end of the year.
- Other state schemes complicate the situation, as they are more robust and are not complicated by the inclusion of solar water heaters or existing generators. Project proponents are now likely to target these schemes with new renewable projects, which may put upward pressure on REC prices. Recent announcements by the Federal Government for a higher target (albeit with a scheme expanded to cover low emission intensity fossil fuel options) appear to have put further upward pressure on prices in recent times[19].
- A sizeable proportion of output from renewable capacity is uncontracted or only contracted for a limited time (about nine to ten years). These projects will soon be coming off the contracts and this could impact on the dynamics of the REC market.

19 The impact of the proposed Clean Energy Target has not been factored into our analysis.