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Review of Progress to Achieving Targets Under Section 7 of the Climate Change and Greenhouse Emissions Reduction Act 2007

EP1312839
December 2013

Prepared for the SA Department of Environment, Water and Natural Resources

Citation

CSIRO (2013), *Review of Progress to Achieving Targets Under Section 7 of the Climate Change and Greenhouse Emissions Reduction Act 2007*, Report No. EP1312839.

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1 Executive summary

1.1 Introduction

The Government of South Australia 'Climate Change and Greenhouse Emissions Reduction Act 2007' includes as one of its requirement under Section 7 (5) that a report be prepared by the end of 2013, to assess the extent to which any determination or target made or set under Section 5 of the Act is being achieved and, if it appears relevant, should be revised. The report that follows is CSIRO's independent assessment to meet this requirement. It has been prepared in collaboration with Sinclair Knight Merz (SKM).

1.2 Scope

Part 2 of the Climate Change and Greenhouse Emissions Reduction Act 2007 (the Act) specifies a principal target to achieve a reduction in greenhouse gas emissions within the State of South Australia, as well as two related targets that promote the generation and use of renewable sources of energy. The Act also instructs the Minister for Climate Change (the Minister) on the operation of these targets. Specifically, the Act States in Part 2:

Part 2—Targets

5—Targets

(1) The principal target under this Act is to reduce by 31 December 2050 greenhouse gas emissions within this State by at least 60% to an amount that is equal to or less than 40% of 1990 levels.

(2) Two related targets under this Act are—

(a) to increase the proportion of renewable electricity generated so that it comprises at least 20% of electricity generated in the State by 31 December 2014;

(b) to increase the proportion of renewable electricity consumed so that it comprises at least 20% of electricity consumed in the State by 31 December 2014.

(3) The Minister may, in connection with the operation of subsections (1) and (2) for the purposes of any other provision of this Act—

(a) determine the method for calculating greenhouse gas emissions for the purposes of setting relevant 1990 levels (the ***baseline***), and then determine a figure that represents that baseline;

(b) determine the method for calculating any reduction in greenhouse gas emissions;

(c) set sector-based targets and additional interim targets;

(d) set specific baselines for particular areas of activity (as components of the overall baseline);

(e) make other determinations that assist in measuring greenhouse gas emissions within the State.

An additional target was made by the Minister under Part 2 of the Act stating "33.3% of South Australia's electricity generation to come from renewable energy by 2020".

The Minister is required, on a two-yearly basis, to prepare a report on the operation of the Act. The first report, and thereafter every alternate report, must incorporate a report from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) that:

- Summarises CSIRO's assessment of the extent to which any determination or target made or set under Part 2 of the Act is being achieved and, if it appears relevant, should be revised; and
- Provides advice on the method for calculating the 1990 baseline for the greenhouse gas target consistent with Sections 5 (4) (b) and Section 5 (4) (c) of the Act.

This document reports the assessment of CSIRO in relation to the third of these two-yearly reports.

1.3 Key findings

1.3.1 1990 BASELINE METHODOLOGY

CSIRO recognises that the current methodologies used in the development and maintenance of the State and Territory Greenhouse Gas Inventory are consistent with best national and international practices and accord with the methodologies prescribed by the Intergovernmental Panel on Climate Change (IPCC).

CSIRO is satisfied that while the South Australia Greenhouse Gas Inventory is calculated using the former Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIITCCSRTE) methods and associated data, and routinely updated in response to DIITCCSRTE evaluation processes, that South Australia will have a sufficiently reliable baseline to provide for the assessment of progress towards its greenhouse gas emissions target.

CSIRO is comfortable that the South Australia Greenhouse Gas Inventory is determined using the sum of Scope 1 emissions as defined by the National Greenhouse and Energy Reporting (NGER) Regulations, plus emissions associated with net interconnector flows (imports less exports). The target therefore explicitly includes indirect greenhouse gas emissions associated with purchased electricity that is generated outside South Australia and imported into South Australia via the interconnectors.

However, some consideration may be given to including the fugitive emissions of natural gas (from extracting, processing and interstate transmission) sourced interstate. There is an apparent drop in fugitive emissions from 2008/09 (of around 1.2 Mt CO_2e per annum) onwards and this coincides with the commissioning of the loop from the Ballera hub of the Cooper Basin in Queensland. On a consumption basis, emissions from the use of gas may have not dropped at all. While these emissions may not be defined as scope 1 or 2 emissions[1], it is potentially beneficial for the SA government to consider these emissions to capture a more holistic picture of SA emissions based on economic activity impacts in South Australia.

1.3.2 RENEWABLE ELECTRICITY TARGET METHODOLOGY

CSIRO concurs with previous South Australian Government deliberations in recognising the value of taking measurements for the renewable electricity generation and consumption targets at the interconnection

[1] These indirect emissions are typically classified as Scope 3 emissions

point between the transmission and distribution system, using the NEM regional reference node (RRN) as the locational proxy. This will give the generation and consumption targets a similar locational basis, so they should yield similar results when net imports are zero. This treatment will then be directly compatible with the Federal Government Expanded RET scheme (RET). Details of the methodology are provided in Section 3.2.

CSIRO notes that the NGER Technical Guidelines recognise the difficulty of identifying the physical source of electricity received by each customer. In light of these difficulties the CSIRO supports using a 'physical' basis for defining the consumption of renewable electricity.

CSIRO is satisfied that:

- Renewable electricity generation data found in the ESIPC 2009 Annual Planning Review (2009 APR) and National Electricity Forecasting Report 2012 (NEFR 2012),
- Market data published by Australian Energy Market Operator (AEMO),
- Data on small scale system uptake published by the Commonwealth Department of Environment, Water, Heritage and the Arts and statistics in the 'Solar Homes and Communities Plan' published by the Department of Climate Change (DCC),
- Renewable Energy Certificates (REC) data published on the REC Registry of the Department of the Clean Energy Regulator,
- The Marginal Loss Factors and average Distribution Loss Factors obtained from AEMO data;

provide an acceptable basis for evaluating the renewable electricity values used for the consumption and generation targets.

1.3.3 GREENHOUSE GAS EMISSIONS TARGET (2050)

Assessing progress towards South Australia's 2050 greenhouse gas emission target is subject to considerable estimation risk given the uncertainties associated with technological change, policy decisions, investment behaviour, and consumer demand. However, electricity generation makes up approximately 24%[2] of these emissions and if the current progress towards meeting South Australia's renewable electricity targets is sustained this will significantly enhance the probability of achieving the target.

Some consideration should be given to ensuring the State target of 60% below 1990 levels by 2050 is calibrated to the national target of 80% below 2000 levels by 2050. Changing the level to an 80% reduction by 2000 levels would align the State target with the national target, but needs to be carefully considered based on the relative state/national emissions profiles and ultimate aims of the State in terms of emissions reduction. For example, the national target of 80% reduction by 2050 can be partly met by purchase of eligible emission reductions from overseas so the actual level of abatement in Australia may be less than implied by the target. Aligning the South Australian target to the national may result in a more onerous obligation on the State if emitters cannot also source eligible emission reductions from overseas.

Trajectory to the 2050 target should be considered at a later date once the progress to the national 2020 target is clearer, particularly as, the near term 2020 national target of 5% below 2000 levels has not yet changed and a change to the long term target in 2050 will not likely impact on the trajectory of emissions prior to 2020.

[2] Based on 2011 emissions data

The Government should also monitor the advice of the Climate Change Authority (CCA) to the Federal Parliament about targets to 2020. The Authority is currently undergoing a review (the *Caps and Target Review*) to determine a target for reductions in emissions for Australia in 2020, and a pathway (targets from 2014/15 to 2019/20) to that target. In determining the target, it is examining all the abatement pledges of other countries and also the likely costs and ability to achieve the recommended targets. The review could recommend a cap that is more than the 5% reduction on 2000 levels currently legislated as the minimum reduction for 2020. With the election of a Coalition Government it is unclear what will be implemented from the CCA review, with the Coalition Government currently supporting the current target of 5% reduction of 2000 levels by 2020.

1.3.4 RENEWABLE ELECTRICITY TARGETS (2014 AND 2020)

Based on current installed renewable generation capacity and assuming all announced and committed wind projects go ahead as scheduled, CSIRO expects that South Australia will achieve its 2014 and 2020 Renewable Electricity Generation Targets.

Currently, the renewable energy generation has reached 31.7% and just below the 33 % 2020 renewable energy generation target. However, there are four main risks to achieving a 2020 renewable energy generation target:

- First, the prospect that the national target for large scale renewable energy generation (under the LRET scheme) is revised downward from its current 41,000 GWh. The Federal Coalition is likely to review the scheme in 2014. Recent decreases in electricity demand have seen calls for the national target to be reduced to a true 20%. CSIRO estimates this would entail a reduction in the target from the current 41,000 GWh to around 26,400 GWh. Such a reduction would severely curtail investments in new renewable generation in all regions including South Australia
- Second, the now high penetration of roof-top solar PV and large-scale wind generation is seeing large decreases in wholesale electricity prices (with evidence indicating that volume weighted average price for wind generation now averaging around 17% less than the time weighted average) which could reduce revenue projections if maintained and deter investment in new renewable generation
- Third, repeal of the carbon pricing mechanism could see wholesale electricity prices fall. Several studies have shown that Large-scale Generation Certificate prices may not be able to rise high enough to compensate for the fall in these prices, meaning there is a risk that the national target may not be met
- Fourth, land planning issues or local transmission constraints start to bind the development of new wind farms.

The already high penetration of renewable generation in the State plus stable electricity demand should see the State achieve the Government's target. However, the Government should review progress towards the 2020 target should any of the above factors see the stalling of further investment in renewable energy.

The 2014 targets for consumption and renewable generation of 20% have already been exceeded, with consumption and renewable generation levels at 29.9% and 31.7% respectively. This makes them now less relevant than the 2020 target. A renewable energy consumption target for 2020 could be considered as it could provide a better reflection of the contribution of renewable energy is making to the State energy needs. Although, it may be simpler to have a single 2020 target and keep the 2020 generation target, as a

consumption target should converge to a generation target over the period to 2020, if current trends towards reduced imports of electricity prevails. Alternatively, if the aim is to promote emissions reduction aligned to the greenhouse reduction targets then the renewable consumption may be more relevant than a renewable generation target as the consumption target focusses on South Australia's internal demand[3].

[3] Note the current consumption target assumes all renewable energy generation is consumed in the state which may provide an optimistic view on actual consumption of renewable energy. However, it is difficult to differentiate between renewable and non-renewable generation source for actual electricity consumed and exported. The renewable generation target then becomes a clearer and better defined measure.

2 The Greenhouse Gas Emissions Target

2.1 Calculating a Greenhouse Gas Inventory for South Australia

Greenhouse gas emissions can comprise two sources of emissions:

- Scope 1 emissions - direct emissions produced from an emitting facility
- Scope 2 emissions - indirect greenhouse gas emissions from the generation of purchased electricity.

Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity. Emissions from electricity generation consumed within the electricity, gas and water sector are included for completeness although this electricity use includes own use of generators and does not necessarily meet the definition of scope 2 emissions. The sum of scope 2 emissions is equal to the direct (scope 1) emissions from electricity generation (IPCC Source Category 1.A.1.a).

For this report, the main focus is on Scope 1 emissions in this state. As there have traditionally been high levels of imports of electricity from other States, emissions arising in those States for the electricity transmitted to South Australia are also considered.

The principal target under the Act is to reduce by 31 December 2050 greenhouse gas emissions within South Australia by at least 60% to an amount that is equal to or less than 40% of 1990 levels (SA GHG Target). This requires the establishment and maintenance of a Greenhouse Gas Inventory for South Australia in the form of a time series having a base year of 1990.

Section 5(3)(a) of the Act refers to the "…method for calculating greenhouse gas emissions for the purposes of setting relevant 1990 levels (the baseline), and then determine a figure that represents that baseline".

In determining this method, including a method for calculating reductions in greenhouse gas emissions or the use of renewable electricity, section 5(4)(c) of the Act requires that the Minister seek to provide consistency with the best national and international practices.

The best international practices will continue to evolve over time. The Intergovernmental Panel of Climate Change (IPCC) is a leading international body for the assessment of climate change, established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). As a scientific body, the IPCC reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. IPCC have recommended methodologies for the establishment of national greenhouse gas inventories. These are reviewed and updated as scientific knowledge progresses.

In particular, current international practice is guided by the:

- Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 1997);
- IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC 2000);
- IPCC Good Practice Guidance for Land Use, Land-Use Change, and Forestry (IPCC 2003); and the
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006).

Australia is one of 192 countries that have joined the United Nations Framework Convention on Climate Change (UNFCCC), an international treaty that sets general goals and rules for confronting climate change. The UNFCCC requires precise and regularly updated inventories of greenhouse gas emissions from industrialised countries. Apart from a few exceptions, the base year for assessing greenhouse gas emissions has been set as 1990. UNFCCC parties have agreed to use comparable methodologies, and it has been agreed that Annex I countries such as Australia, should use methods that are consistent with IPCC guidelines for estimating and reporting their national greenhouse gas inventories.

While an amendment to the Kyoto protocol was adopted in Doha, Qatar, on 8 December 2012, the "Doha Amendment to the Kyoto Protocol" will apply for the second Kyoto period from 2013-2020 and will not impact the current review. The amendment includes[4]:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

CSIRO notes that the former Commonwealth Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIITCCSRTE)[5] compiles a State and Territory Greenhouse Gas Inventory that is part of Australia's National Greenhouse Gas Accounts.

The State and Territory Greenhouse Gas Inventory is prepared in accordance with the IPCC Revised 1996 Guidelines for National Greenhouse Gas Inventories and the principles of the IPCC (2000) Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories and the IPCC (2003) Good Practice Guidance for Land Use, Land Use Change and Forestry. Where appropriate, elements of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories are being progressively implemented.

CSIRO also notes that the State and Territory Greenhouse Gas Inventory has been prepared in consultation with the States and Territories, under the guidance of the National Greenhouse Gas Inventory Committee of representatives of the Australian, State and Territory Governments.

CSIRO is therefore of the view that the methodologies used by the DIITCCSRTE in the development and maintenance of the State and Territory Greenhouse Gas Inventory are consistent with the best national and international practices.

The science of climate change is continuing to develop however, and the methodologies used to estimate greenhouse gas emissions are similarly developing. Although the IPCC captures and disseminates changes in the accepted methodologies, the calculation and maintenance of a reliable greenhouse gas emissions baseline remains a challenge. Indeed, the currency of an estimated baseline is short given that inputs, assumptions and methods evolve, requiring ongoing recalculation and therefore historical revision back to 1990 to maintain the integrity of the time-series.

[4] http://unfccc.int/kyoto_protocol/items/2830.php
[5] Note the data is still sourced from websites aligned to the old DCCEE function.

UNFCCC parties have agreed that "As part of its inventory planning, each Party included in Annex I should consider ways to improve the quality of activity data, emission factors, methods and other relevant technical elements of inventories".[6] In Australia's submission to the UNFCCC Secretariat[7], the then Department of Climate Change (DCC) reports on page 5:

> *The DCC has instituted an annual cycle of evaluation through the preparation of an Evaluation of Outcomes document, providing a process for quality assurance and feedback for improvement to the National Greenhouse Accounts. The Accounts are assessed against explicit quality objectives which take into account, inter alia, detailed estimates of uncertainty surrounding Australia's emissions data; UNFCCC Expert Review processes, which aim to review and improve the quality of all Annex I inventories in an open and facilitative manner on an annual basis; and an assessment of Australia's estimation methodologies against IPCC guidelines, international practice and available data.*

CSIRO is satisfied that should the South Australia Greenhouse Gas Inventory be calculated using DIITCCSRTE methods and associated data, and routinely updated in response to DIITCCSRTE evaluation processes, that South Australia will have a sufficiently reliable baseline to provide for the assessment of progress of the SA GHG Target.

The State and Territory Greenhouse Gas Inventory provides time series data for South Australia that represents total emissions including net emissions from Land Use, Land Use Change and Forestry (LULUCF). This is analogous to Scope 1 emissions, as defined by the Commonwealth National Greenhouse and Energy Reporting Regulations 2008 (NGER Regulations), where South Australia is defined as a greenhouse gas emitting facility that uses electricity that is generated outside the facility boundaries.

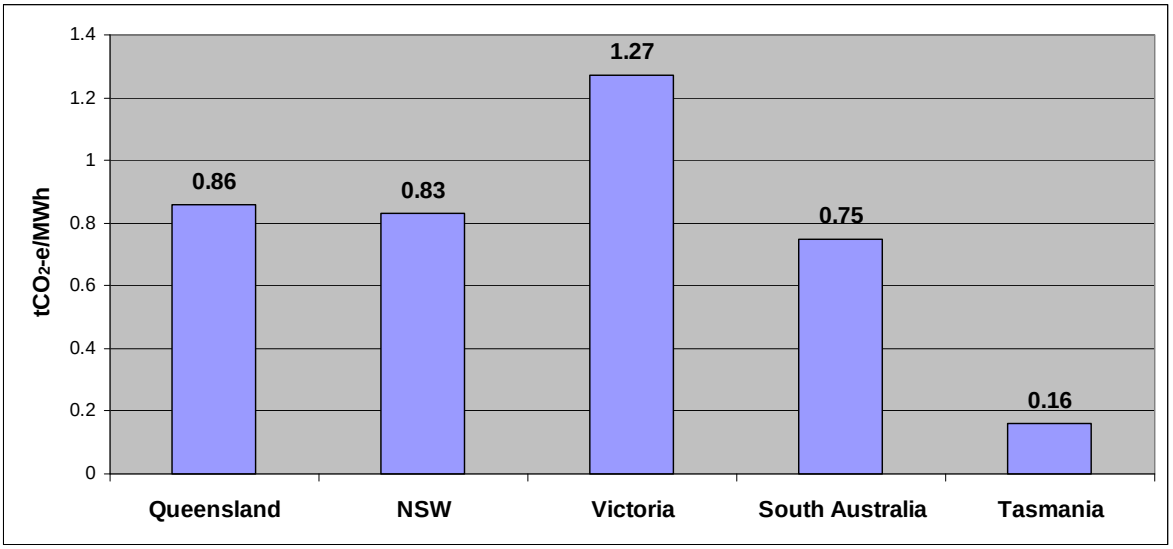
Electricity is supplied in South Australia via a transmission grid that supports the National Electricity Market (NEM). South Australia is directly linked with Victoria via the Heywood and Murraylink interconnectors, and is indirectly linked to New South Wales and Queensland that also share the interconnected transmission grid. Power stations that are connected to the grid have a range of greenhouse gas emission intensities.

A greenhouse gas inventory that is appropriate for measuring progress against the SA GHG Target must include those emissions that are related to electricity that is imported. Given that South Australia has typically been a net importer of electricity, the inclusion of interconnector related greenhouse gas emissions makes the SA target more stringent. This is evident from Figure 2-1: Average emission intensity in each region of the NEM, t CO_2-e/MWh that shows the average emissions intensity for each region in the NEM. Average Victorian emissions are significantly greater than those from South Australia due to the large contribution of brown-coal fired power stations in Victoria. Unlike Victoria, South Australia's indigenous supply of electricity is mostly sourced from either natural gas or low quality black-coal, each producing electricity with lower associated emissions than does brown coal.

6 Decision 19/CMP.1 Annex (reported in FCCC/KP/CMP/2005/8/Add.3)

7 Department of Climate Change (2008), The Australian Government's Initial Report under the Kyoto Protocol: Report to facilitate the calculation of the assigned amount of Australia pursuant to Article 3, paragraphs 7 and 8 of the Kyoto Protocol, Department of Climate Change, Canberra.

Figure 2-1: Average emission intensity in each region of the NEM, t CO_2-e/MWh



Source: SKM MMA analysis based on generation data published by the Australia Energy Market Operator (AEMO) and its predecessor organisation, and the National Greenhouse Gas Inventory methodology workbooks published by the Department of Climate Change and Energy Efficiency.

CSIRO is satisfied that a valid and robust greenhouse gas inventory for South Australia is determined as the sum of Scope 1 emissions as defined by the NGER Regulations, plus emissions associated with net interconnector flows (imports less exports), therefore explicitly including indirect greenhouse gas emissions associated with purchased electricity that is generated outside South Australia and that is imported into South Australia via the interconnectors.

Data in support of this methodology is collected by the DIITCCSRTE as part of its process to prepare Australia's National Greenhouse Gas Accounts:

- Scope 1 Emissions - published directly as part of the State & Territory Greenhouse Gas Inventory by the DIITCCSRTE
- Interconnector Emissions - embedded in the data contained in the National Inventory. Economic Sector

The *Australian Greenhouse Emissions Inventory System* (AGEIS)[8] retains greenhouse gas emissions data from 1990 to 2011 that is used to prepare Australia's National Greenhouse Gas Accounts, including the National, State and Territory inventories and the National Inventory by Economic Sector. AGEIS therefore contains the data that is necessary to calculate and maintain the South Australia Greenhouse Gas Inventory[9].

[8] http://www.ageis.climatechange.gov.au/

[9] For Scope 1 Emissions (EM) – Emissions data can be extracted from AEGIS by submitting a query using the following filters: Location = SA; Accounting Framework = Kyoto; Sector = Total Kyoto; and Gas = Carbon Dioxide Equivalent
For Interconnector Emissions (EI) –Data will need to be calculated as the difference between emissions associated with electricity production (E_Elect_P) and electricity consumption (E_Elect_C) such that net interconnector related emissions: EI = E_Elect_C - E_Elect_P
- Emissions data for E_Elect_C can be extracted from AEGIS by submitting a query using the following filters: Location = SA; Sector = Total of all Economic (ANZSIC) sectors
- Emissions data for E_Elect_P can be extracted from AEGIS by submitting a query using the following filters: Location = SA; Sector = Stationary Energy ->Energy Industries ->Public Electricity and Heat Production.

SA GHG Inventory – Equals (EM + EI) for each year

In accordance with IPCC guidelines, data in AGEIS will be revised as inventory methods improve and more relevant information become available[10]. For this reason, historical greenhouse gas emissions data may change. The re-calculation of the South Australia Greenhouse Gas Inventory will therefore be required from time to time to ensure that progress against the SA GHG Target is measured using the latest information available.

One possibility is that other energy sources apart from electricity may be being imported into South Australia. This principally applies to natural gas transmitted from the Victorian Otway Basin and from natural gas sourced from Queensland.

2.2 Summary of current progress

Using the latest published data from AGEIS, and a definition for the South Australia Greenhouse Gas Inventory that is based on the sum of Scope 1 emissions[11] (as defined by the NGER Regulations), plus emissions associated with net interconnector flows (imports less exports), the following is calculated.

Table 2-1 presents total greenhouse gas emissions (Gg (1000 tonnes) CO_2e) for South Australia for the year 2011 relative to the 1990 baseline. The data is extracted from AEGIS using the recommended methodology. The calculations include net Scope 2[12] emissions related to purchased electricity that is imported from interstate via the Heywood and Murraylink interconnectors, and distinguish between those emissions associated with Land Use, Land Use Change and Forestry (LULUCF). This shows that since 1990 that emissions have increased by 5.9% when LULUCF are not included but have dropped by nearly 9% when LULUCF impacts are included. Also since 2003[13], emissions have fallen over 11% to 2011 (excluding LULUCF but including emissions on imports of electricity). In the same period, the emissions from electricity production (including imports) have fallen over 18% to 2011[14], whilst fugitive emissions fell by 49%, both accounting for most of the reduction in emissions associated with the Energy sector. Emissions have steadily increased for all other energy sector activities. Most of the falls recorded for electricity generation and fugitive emissions have occurred in the past two to three years, and have been due to falling demand and increased penetration of renewable energy. In the case of fugitives, the decline may be due to sourcing of natural gas from interstate gas fields.

[10] As an example, emissions data in AEGIS related to interconnector flows use emissions factors that are calculated as a three-year moving average. These emissions factors will therefore change from year to year.

[11] Direct greenhouse gas emissions

[12] Indirect greenhouse gas emissions from the generation of purchased electricity.

[13] 2003 chosen as it was the peak year in emissions

[14] Since 2011 emissions from the electricity sector (including imports) have reportedly fallen by a further 17% to 2013 - based on data from the July 2013 report "South Australian historical Market Information Report 2013, AEMO".

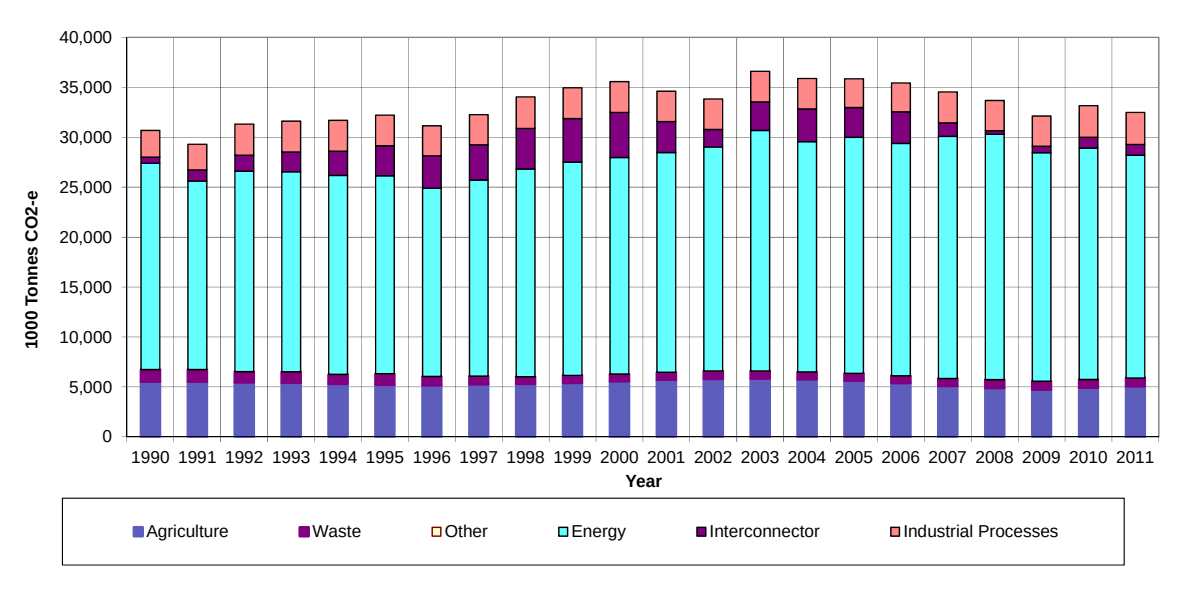
Table 2-1: SA greenhouse gas emissions 1990-2011

SA GHG Emissions [Gg CO2-e]	1990	2007	2008	2009	2010	2011
Total GHG emissions excluding LULUCF and including interconnector	30,682	34,529	33,678	32,123	33,152	32,481
Change since 1990		12.5%	9.8%	4.7%	8.0%	5.9%
Total GHG emissions including LULUCF and interconnector	33,715	31,412	32,404	30,863	31,511	30,779
Change since 1990		-6.8%	-3.9%	-8.5%	-6.5%	-8.7%

Source: The Australian Greenhouse Emissions Inventory System (AGEIS) http://ageis.climatechange.gov.au

Figure 2-2 and Table 2-2 presents total greenhouse gas emissions for South Australia since 1990, excluding LULUCF emissions. There has been significant movement in both the energy component and also the interconnector emissions, particularly since 2003. This is despite a growth in electricity consumption of 15 % over the same period reflecting reducing emission intensity over this period. Interconnector imports increased in the 2011/12 year so this component will be larger for the 2011/12 reporting year.

Figure 2-2: SA greenhouse gas emissions since 1990



Source: SKM MMA analysis

Table 2-2: SA greenhouse gas emissions since 1990

SA GHG Emissions [Gg CO2-e]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Energy	20,654	18,883	20,061	20,032	19,934	19,822	18,864	19,632	20,783	21,339	21,672
Industrial Processes	2,682	2,568	3,116	3,073	3,084	3,066	2,997	3,023	3,152	3,080	3,081
Agriculture	5,542	5,537	5,465	5,432	5,317	5,225	5,172	5,255	5,307	5,420	5,575
Waste	1,188	1,183	1,047	1,068	919	1,083	855	817	704	727	699
Other	17	16	16	16	16	17	17	17	16	16	16
Total, excluding interconnector related emissions	30,082	28,187	29,707	29,620	29,271	29,213	27,905	28,744	29,961	30,582	31,044
Interconnector	601	1,093	1,568	1,929	2,405	2,917	3,088	3,241	4,198	4,347	4,516
Total, including interconnector related emissions	30,683	29,279	31,275	31,549	31,676	32,130	30,993	31,984	34,159	34,929	35,560
Land Use, Land-Use Change and Forestry KP[15]	3,033	-	-	-	-	-	-	-	-	-	-
Total, including interconnector related emissions and LULUCF	33,715										
SA GHG Emissions [Gg CO2-e]	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Energy	22,011	22,417	24,057	23,050	23,622	23,260	24,239	24,578	22,881	23,181	22,282
Industrial Processes	3,038	3,047	3,064	3,039	2,872	2,895	3,099	3,015	3,034	3,170	3,191
Agriculture	5,733	5,812	5,838	5,761	5,647	5,390	5,105	4,894	4,738	4,930	5,075
Waste	716	783	758	731	698	719	734	808	819	795	816
Other	16	16	16	15	15	15	15	14	14	14	14
Total, excluding interconnector related emissions	31,513	32,075	33,733	32,597	32,854	32,279	33,191	33,310	31,486	32,090	31,379
Interconnector	3,054	1,766	3,027	3,305	3,022	3,182	1,363	368	637	1,062	1,101
Total, including interconnector related emissions	34,567	33,840	36,760	35,902	35,875	35,461	34,555	33,678	32,123	33,152	32,481
Land Use, Land-Use Change and Forestry KP[9]	-	-	-	-	-	-	-3,117	-1,274	-1,260	-1,641	-1,702
Total, including interconnector related emissions and LULUCF							31,412	32,404	30,863	31,511	30,779

Source: SKM MMA analysis using AEGIS (2011) data

[15] Note LULUCF values are only provided for the years 1990, 2007, 2008, 2009, 2010 and 2011.

2.3 Progress towards the 2050 target

Assessing progress towards South Australia's greenhouse gas target for 2050 is difficult and subject to considerable estimation risk given uncertainties regarding technological change, policy decisions, investment behaviour, and the impact of the foregoing on consumer demand. The target for 2050 has been set in the context of broader national and interstate policy developments, and typically should complement general efforts around Australia to manage greenhouse gas emissions. Although these broader efforts will combine with the South Australian target to deliver lower emissions for Australia, the regulatory detail and commercial response is continuing to evolve and will affect the pattern and schedule of investments in each jurisdiction.

Energy is the inventory sector with the largest emissions, of which power generation is a major contributor, and therefore an area of significant policy attention. Since the last review the introduction of the Clean Energy Future package has increased the incentives to reduce emissions in the energy sector. The impacts of the Clean Energy Future package, including the carbon price, will not be seen in this reporting period as the measures introduced will not impact until the 2012/13 year[16]. For example, the impact of the carbon pricing mechanism as well as other market impacts has seen recent announcements of commercial decisions to close or mothball coal-fired power generators which will have a major influence on future emission trajectories from the electricity generation sector.

Along with the National Renewable Energy Targets, these schemes will have the greatest impact on the ability for the South Australian greenhouse gas and renewable generation targets to be met. The progress towards the renewable energy targets will assist SA progress towards its emission abatement target. With development of wind and solar over past decade, driven by the RET and FiT schemes, emissions from the electricity sector have fallen. Since 2003 emissions have fallen over 11% contributing the majority of the reduction in overall emissions over the same period[17]. Recent developments to mothball power stations for part of the year, in response to the changed market conditions will also help, if maintained, with achieving the targets. Without such development, South Australia would find it difficult to achieve the 2020 and 2050 emissions reduction targets.

The following summarises a range of developments that will affect South Australia's progress towards its abatement target for 2050, and the related renewable electricity targets.

2.3.1 CLEAN ENERGY ACT AND EMISSIONS TRADING POLICIES

2.3.1.1 Policy initiatives

In establishing policy to reduce emissions, both sides of politics have endorsed a short term 5% reduction on 2000 levels by 2020, although the method of achieving this target is different for both. As will be

[16] Note in a recent report for the South Australia region by AEMO (July 2013), it was reported that emissions in the electricity sector (grid connected) in the 2011/12 and 2012/13 years had reduced by over 10% and 17 % respectively from 2010/11 emissions.

[17] To put this in context, consumption has increased over 14% over the same period, although consumption has declined in more recent times. This reduction includes recent reductions as recorded by AEMO.

discussed below, the labour policy is aligned to carbon pricing while the coalition will look to implement a direct action policy[18].

In January 2004, the First Ministers of State and Territory Governments established the National Emissions Trading Taskforce (NETT) to develop a model for a national emissions trading scheme (NETS). In August 2006, the NETT released a discussion paper detailing the possible design for a NETS, entitled 'Possible Design for a National Greenhouse Gas Emissions Trading Scheme'. With the election of the Federal Labor Government in November 2007 and its promise of implementing an emission trading scheme, the NETT was replaced by a federal program called the Carbon Pollution Reduction Scheme.

Subsequently, the Federal Labor government has introduced the Clean Energy Act and the Carbon Credits (Carbon Farming Initiative) Act 2011. Other legislation[19] dealing with unit charges, excise and household assistance that are part of the broader Australian Government Clean Energy Future Plan are not discussed in detail here.

The Australian Government's legislative package has been designed to drive change in key sectors in the national economy to reduce emissions in both the short and long term. The aligned regulations and detailed legislation provide economy-wide incentives aimed at providing the most efficient, cost effective and equitable response possible. The centrepiece of the Clean Energy Act 2011 is the carbon pricing mechanism. This is a hybrid scheme, in which carbon emissions has a fixed price starting at \$23/t CO_2-e in 2012/13, increasing by 2.5% per annum in real terms for the following two years. The Australian Government will purchase as many permits as is required at these prices in these years.

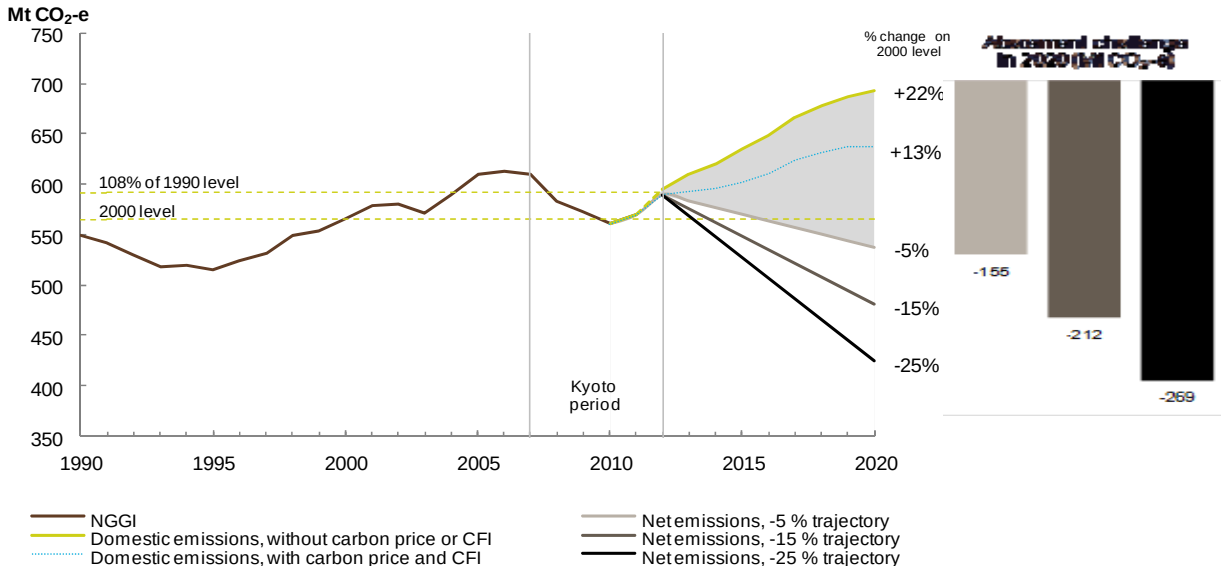
Initially when the legislation was first enacted there was a floor price for carbon set at \$15/t CO_2-e from 1st July 2020. This has since been changed such that there is no floor and the price will be linked to the European Union Emissions Trading Scheme (EU-ETS).

The minimum cap was set to achieve the 5% reduction target (on 2000 levels) in 2020. This would translate into a maximum annual cap on emissions of around 530 Mt CO_2e, which compares with an estimated level of emissions of 570 Mt CO_2-e in 2011. Modelling undertaken by the Australian Department of Treasury suggests that this would require a cut in emissions of 155 Mt CO_2-e on business as usual levels.

[18] Note at the time of writing, detail of direct action policy was limited and therefore has not been discussed in detail. The overarching premise is to implement a reserve auction targeting the lowest cost carbon emissions activities to achieve the 5% target.

[19] Thirteen other Acts are referenced in the Clean Energy Act 2011 directly related to the introduction of this legislation and supporting regulations.

Figure 2-3: Projected emission reduction needed to meet 5% reduction target



Source DCCEE – Australia's Emissions Projections 2012

The scheme covers as many sectors of the economy as possible. However, in the short term only facilities emitting greater than 25,000 tonnes of CO_2-e per annum (of Scope 1 emissions or direct emissions) are included. Some smaller sites are indirectly covered. For example, natural gas retailers are liable for the emissions from the use of natural gas by their customers.

The former Department of Climate Change and Energy Efficiency (DCCEE) estimates that the scheme will cover over 300 businesses, which are responsible for around 70% of Australia's emissions. According to the National Greenhouse Emissions Registrar database published by the Clean Energy Regulator, around 291 companies or entities emitted more than 25,000 t CO_2-e in 2010/11. Around 21 of these companies were identified by CSIRO as having operations in South Australia. This equates to around half of emissions from facilities in South Australia potentially being covered under the scheme[20].

Sectors included are confined to:

- Electricity generation
- Other stationary energy emissions (either directly or indirectly)
- Waste facilities (except "legacy" emissions from waste disposed of prior to 2012 at existing landfills and at smaller landfills)
- Fugitive emissions from gas processing and coal mining (other than from defunct coal mines).

An equivalent carbon price has been set for business transport emissions (not heavy road vehicles for the first two years), non-transport use of liquid and gaseous fuels. This applies in the form of a reduction in

[20] SKM MMA estimate based on a simple sum of emissions of activities above the threshold, based on NGERS and AEGIS data.

excise tax credits on liquid fuel use in mines and other industrial activities. Transport emissions from the agriculture, forestry and fishing entities do not incur a carbon price liability.

Agriculture, forestry and land use change are exempt under the scheme, although the *Carbon Credits (Carbon Farming Initiative) Act 2011* allows for approved land use and soil management activities to be used by liable parties to offset their emissions under the scheme.

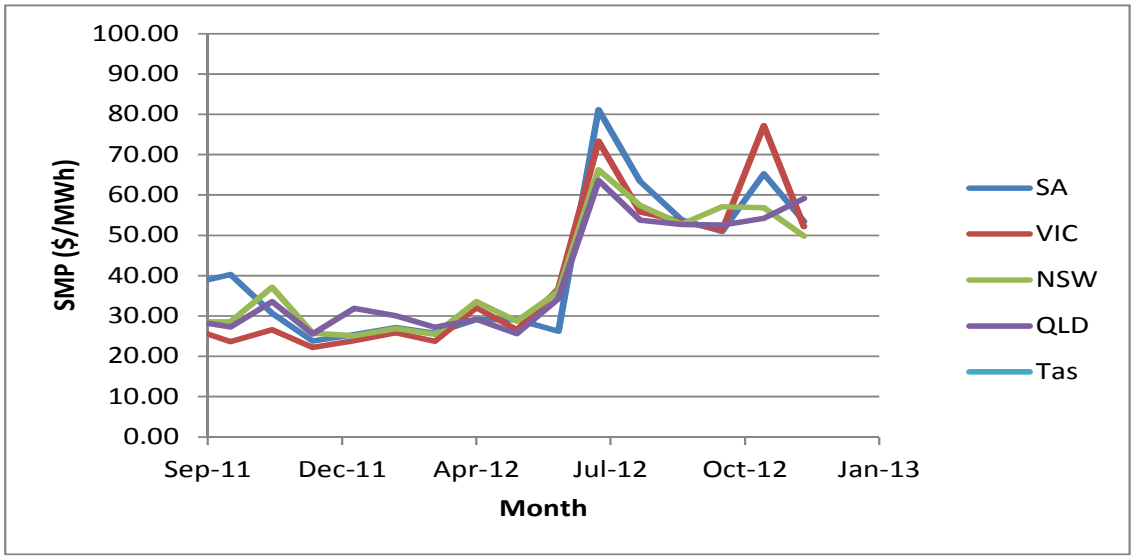
The importance of the exclusions should be noted. This is because the 5% target is a minimum national target and because the excluded sectors contribute around one-quarter to one-third of national emissions. Subsequently, included sectors will be required to abate more or Australia will need to purchase more international credits to meet the scheme caps.

2.3.1.2 Impact on electricity prices

Under the carbon pricing mechanism, electricity prices may increase for two reasons. First, purchasing permits increases the costs of generation. Second, over the next decade, low emission generation options will no longer obtain subsidies for generation under the NSW Greenhouse Gas Abatement Scheme (NGGAS), which helped lower the cost of gas-fired generation (across the NEM) and put downward pressure on electricity prices.

Achieving deep cuts will need the wholesale electricity prices to increase substantially as illustrated in Figure 2-4: Wholesale electricity market prices by region[21].

Figure 2-4: Wholesale electricity market prices by region



Source AEMO data compiled by SKM MMA

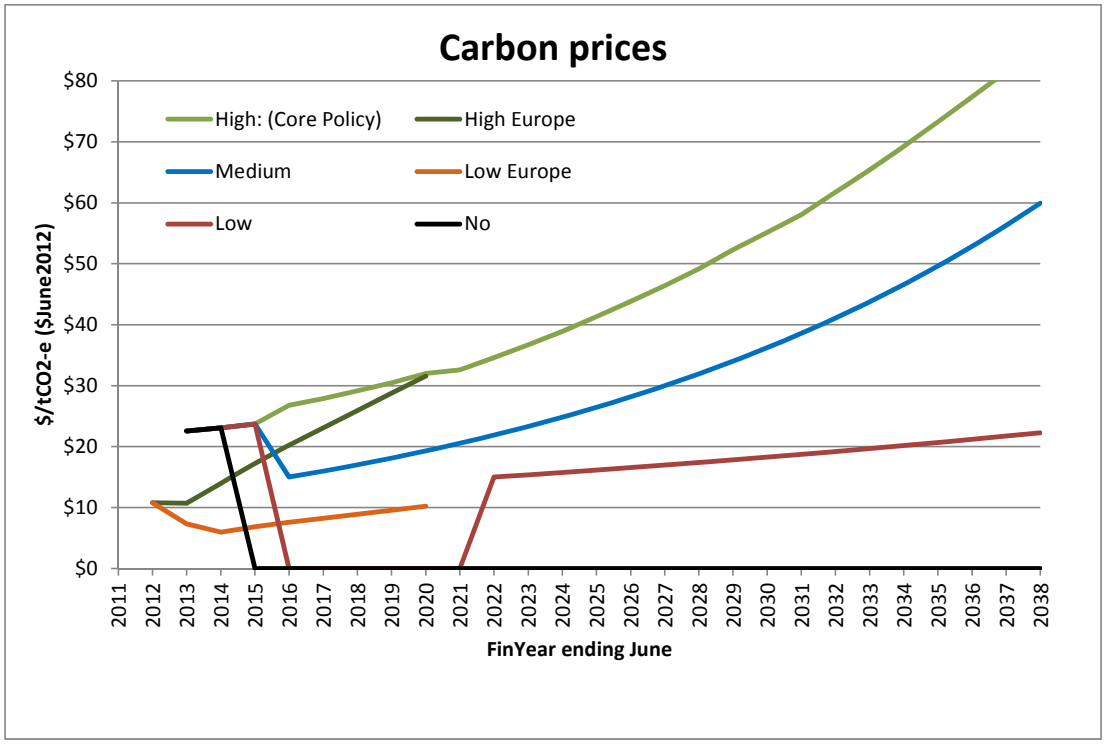
To ensure the cuts required to meet the 2020 emissions reduction target occur the carbon price is expected to increase to above $30/tCO$_2$-e, although recent changes linking the Australian carbon pricing post 2015 to EU-ETS makes it unlikely that such prices will be realised without any change to the current schemes

[21] Note, the increase in wholesale electricity prices will flow through to retail prices but the likely % change will be lower as wholesale prices present less than 40% of the eventual retail price.

(Europe or elsewhere). Currently EU-ETS are trading at €3/t CO_2-e[22] or just under \$4/t CO_2-e which if this was maintained would be too low to influence investment decisions and hence emissions reduction.

In addition the alternative Direct Action scheme, proposed by the Federal Coalition, would see no carbon price. Based on information presented to date, the impact on electricity prices is expected to be minimal as electricity generation is currently not considered in the Direct Action Plan. Figure 2-5: Carbon pricing scenarios illustrates the potential paths for carbon pricing in the short to medium term.

Figure 2-5: Carbon pricing scenarios



Source SKM MMA

In the short period that the carbon price has been operating, prices have jumped across the NEM. Prices have increased most significantly in Victoria due to the high emission intensity of some of the generating plant in that state. However, Victoria has some of the lowest cost emission abatement options (which tend to limit price increases) and this could provide Victoria with a comparative advantage in electricity generation in the long term[23]. This could affect the pattern of interconnector flows through to South Australia depending on how this comparative advantage affects relative prices.

In the NEM, price increases are also likely to be high in New South Wales due to the high cost of low emission generation in that state and the limited opportunities for switching away from coal-fired generation in the short-term. Price increases in South Australia will be muted due to the relatively low emission intensity of generation.

[22] European Parliament convened on 16 April 2013 for a plenary vote on an amendment to the emissions trading law that underpins the EU Emissions Trading Scheme (ETS) with no progress made to rectify the low price.

[23] Note recent planning amendments in 2011 have impacted the development potential of wind farms in Victoria which has reduced this comparative advantage.

The direct impact of carbon prices on abatement is likely to be modest on electricity generators in South Australia. Even though the short-run marginal cost of generation is now higher for high emitting plant, increasing gas prices are thwarting any impact on changes to the merit order. Prices in excess of $35/tCO$_2$-e are required to allow for more gas-fired generation to displace coal-fired generation.

Thus the impact of carbon pricing on reducing emissions from electricity generation (which contributes around one-third of total State emissions) is likely to be indirect:

- Adding to other factors (such as subdued electricity demand and a supply overhang due to high penetration of renewable energy) to entice plant to be mothballed. Already, some coal fired units have been mothballed for part of the year
- By ensuring (through electricity prices) that the Renewable Energy Target (RET) can be met
- The carbon price by increasing electricity prices may reduce electricity demand as people pay more attention to energy efficiency.

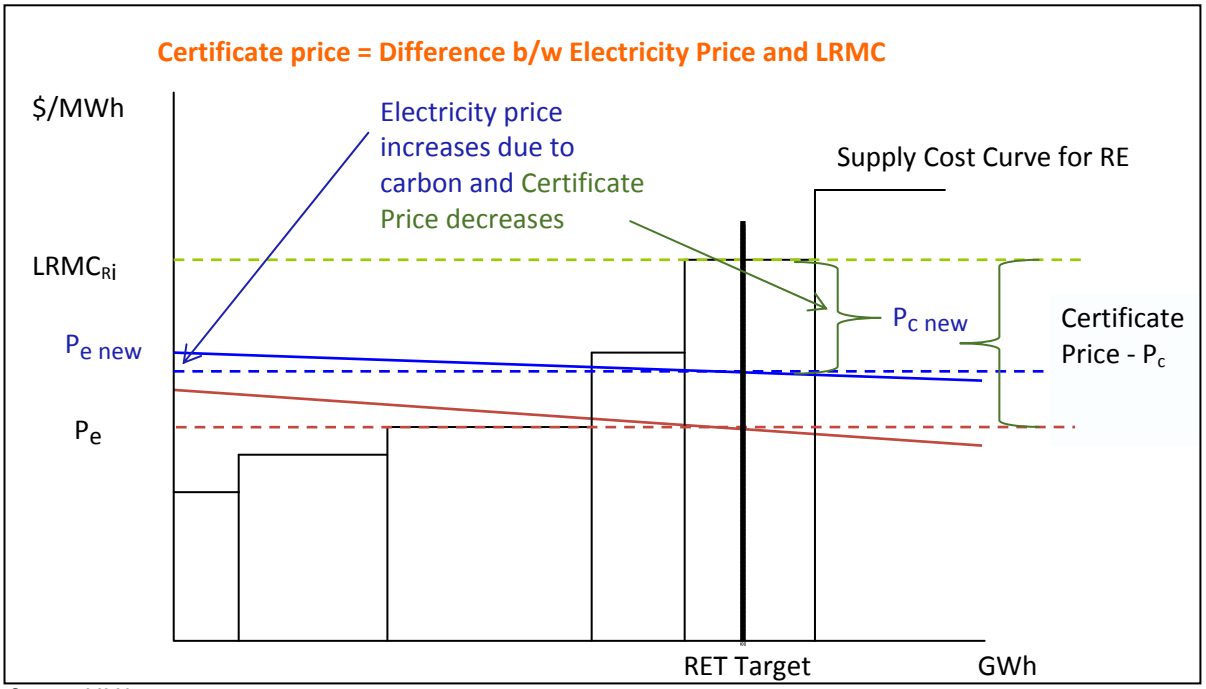
These impacts will be enhanced by a range of complementary measures that support the carbon pricing. Some funding is available to engender emission abatement under the *Food and Foundry Fund*. This fund will provide grants to support the uptake of energy efficiency activities, on-site embedded generation and other abatement activities in manufacturing facilities that do not receive compensation under the Carbon Pricing Mechanism. Funds for low emission activity and renewable energy (including enabling technologies) are also available from the Clean Energy Finance Corporation. Much of this may be repealed under the new Coalition Government.

2.3.1.3 Impacts on the RET Scheme

The impacts on the RET scheme regarding the REC price are illustrated in Figure 2-6 which shows the relationship between REC price, electricity price and the long-run marginal cost (LRMC) of renewable energy generation. The bars in this graph show that with an increasing renewable energy target, generators with higher LRMC enter the market. For example, the first 1,000 GWh of a renewable energy target are generated by renewable power plants with low LRMC, like hydro or bagasse generators. As the target increases, the amount of low cost generation may not be enough and generation technologies with higher LRMC enter the market. The last generator that enters the market to just fulfil the renewable energy target is called the marginal generator. The certificate price reflects the difference between the electricity price and the LRMC of the marginal generator. For a given LRMC, the REC price decreases with increasing electricity prices and vice versa.

With the introduction of the carbon pricing scheme, the electricity prices will increase over time due to rising generation costs of conventional generators drive by higher carbon prices. It follows that the margin from REC sales needed for a renewable generator to enter the market decreases as well. Then depending on the renewable energy target, the REC price should decrease, as shown in Figure 2-6.

Figure 2-6: Certificate price under increasing electricity price



Source: MMA

2.3.2 NATIONAL RENEWABLE ENERGY TARGETS (RET)

In 2009 the RET was expanded and increased to provide a single renewable energy target across Australia, replacing all legislated and proposed state based target schemes. The RET was expanded from 9,500 GWh to 45,000 GWh in 2020. Due to a substantial uptake of PV systems, driven primarily by generous Feed-in-Tariffs across Australia, the RET was split into two separate schemes in 2010 to form the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES). Further the LRET scheme target was set at 41,000 GWh from 2021-2030 with 4,000GWh being attributed to the uptake in the SRES[24]. This was required to help retain the credibility of the RET to promote large scale renewable generation as the REC price had fallen significantly due to the excess supply of REC's from predominantly PV systems. For example from 2001 to 2009, 86,000 solar panel systems were installed with a combined capacity of 123 megawatts (MW). In 2010 there were over 158,000 solar panel installations with a combined capacity of 305 MW.[25]

2.3.2.1 Large-scale Renewable Energy Target (LRET)

Targets for the level of renewable generation in each year under the LRET scheme have been set in the legislation. These interim targets are designed to discourage liable parties from delaying investment, with the risk that such delays would make it difficult to meet the target. The interim targets were also set to allow the industry to build capacity to respond in a timely manner. The interim targets for the LRET Scheme

[24] Note there is no actual target for the SRES but nominal 4,000 GWh was allocated to the SRES from the RET to keep the overall renewable energy target at 45,000 GWh.

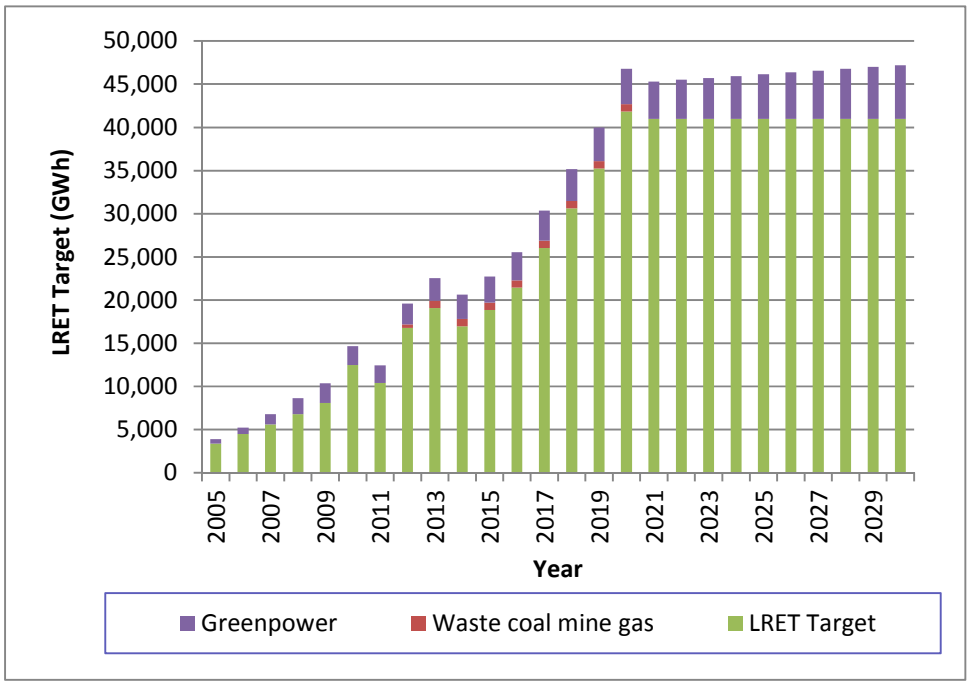
[25] http://ret.cleanenergyregulator.gov.au/About-the-Schemes/sres

are included in the Act, and stipulate a target of 12,500 GWh of renewable generation in 2010 expanding to 41,000 GWh in 2020. The target will increase from 2010 to the ultimate 41,000 GWh target in 2020 and remain at this level until 2030 as shown in Figure 2-7 and Table 2-3 below. In the revised LRET scheme the targets have been adjusted for the years 2012 to 2016 to allow for the absorption of the excess RECs created due to the installation of the PV systems in 2009 and 2010. This is illustrated in Table 2-3, particularly in year 2010.

In addition, there is a component of 850 GWh added to the targets in the years from 2012 to 2020 inclusive to cater for the inclusion of existing waste coal mine gas based generation as an eligible generation option under the LRET Scheme. Only existing waste coal mine generators are eligible under this additional component at a level equal to their generation levels in 2007.

Excluded are recent announcements for the supply of renewable energy to supply new desalination facilities under GreenPower contracts, where the contracts to supply electricity under GreenPower label are not eligible to earn certificates under the LRET scheme.[26]

Figure 2-7: LRET target



[26] Note: Green Power is a voluntary scheme set up by the State Governments allowing retail customers to purchase, at a premium, electricity sourced from renewable energy only. RECs can be acquitted against GreenPower or the RET, but not both, Green Power data is based on extrapolations of historical sales.

Table 2-3: Current targets under the RET schemes

Year	LRET Target (GWh)	LGU Generation (GWh)	SGU Certificates (000's)[27]	Actual certificate creation (GWh)	Cumulative surplus to target (GWh)	Small Scale Scheme - SRES (GWh)
2001	300	1,406	214	1,620	1,320	
2002	1,100	2,194	514	2,708	2,928	
2003	1,800	3,452	691	4,143	5,272	
2004	2,600	2,154	822	2,976	5,647	
2005	3,400	3,319	1,000	4,319	6,566	
2006	4,500	3,538	1,046	4,584	6,650	
2007	5,600	3,338	1,500	4,838	5,888	
2008	6,800	3,285	3,264	6,549	5,637	
2009	8,100	4,372	10,269	14,641	12,177	
2010	12,500	7,078	30,175	37,253	36,931	
2011	10,400	8,461	578	9,040	35,570	747
2012	16,763	10,985	85	11,070	29,878	1,565
2013	19,088					
2014	16,950					
2015	18,850					
2016	21,431					
2017	26,031					
2018	30,631					
2019	35,231					
2020	41,850					
2021 to 2030	41,000					

Source: SKM MMA database and Office of the Renewable Energy Regulator (REC Registry).

[27] SGU – Small Generation Units created under the RET.

2.3.2.2 Penalty for non-compliance

The LRET Scheme will place a legal liability on wholesale purchasers of electricity, defined as liable parties under the Renewable Energy (Electricity) Amendment Act 2009, to proportionately contribute towards the generation of additional renewable electricity. Liable parties are entities that are required to purchase and surrender certificates to show they have met their obligations under the RET Scheme. Liable parties are wholesale customers (retailers, large industrial loads) who purchase electricity from grids with generation capacity greater than 100 MW. Each liable party has to surrender a number of certificates to the Clean Energy Regulator (CER) each year equivalent to their obligations in the previous year. The obligation, in terms of number of certificates required to be surrendered to CER, is calculated as the Renewable Power Percentage (RPP), which is set by CER, multiplied by their share of sales in the eligible grids.

Liable parties who fail to submit the required number of certificates in each accounting period will be required to pay a penalty for the shortfall. This penalty, called the shortfall charge, is set at $65/MWh under the LRET Scheme, with this penalty adjusted annually for movements in the CPI. The penalty is not tax deductible meaning that under current company tax rates a liable party may not distinguish between paying the penalty and purchasing certificates up to a price of $92.86/MWh.

A 10% leeway is available to liable parties who fail to comply fully with the requirements. Shortfalls of more than 10% will be penalised for the full quantum of the shortfall, although this penalty may be redeemed by surrendering additional LGCs in the following three years. Shortfalls within the 10% leeway must also be made up in the following three years.

Compliance with the liabilities has been strong. By the end of 2012, 99.97% of liabilities (that is, number of certificates required to be surrendered) have been met.[28] Of the 1,128 entities that were liable parties at the end of 2012, only six had a shortfall in 2012, with an effective shortfall of 3,231 certificates (equivalent to 3.2 GWh of generation compared with a target in 2011 equivalent to 10,400 GWh).

2.3.2.3 Small-Scale Renewable Energy Scheme (SRES)[29]

The Small-scale Renewable Energy Scheme was created to provide incentive for the development and installation of small scale renewable systems. Such systems include solar panel systems, solar water heaters, heat pumps, small-scale wind systems, or small-scale hydro systems.

Each system can generate Small-scale Technology Certificates (STCs) based on the level of generation or energy they displace.

The number of certificates a system can create is based on the amount of electricity in megawatt hours (MWh):

- Generated by the small-scale solar panel, wind or hydro system, over the course of its lifetime of up to 15 years, or

[28] Source of compliance information is Clean Energy Regulator (2012), 2012 Administrative Report, Commonwealth of Australia, Canberra.

[29] Discussion sourced from http://ret.cleanenergyregulator.gov.au/About-the-Schemes/sres

- Displaced by the solar water heater or heat pump, over the course of its lifetime of up to 10 years.

To improve the viability for these systems the STCs are deemed to allow all the STCs over the allowable life of the units (i.e. provide at the front end of the installation rather than during the life of the project). The maximum capacity for photovoltaic (PV) units to be eligible for deeming has been increased to 100 kW and PV units installed after 31 July 2005 will have an option to create 15 years' worth of STCs in a single up-front transaction or three tranches of 5 years' worth of STCs. The Government provides owners of small scale systems with an upfront payment of STCs equal to the estimated generation levels over a 15 year period.

Further multiple STCs can be earned by small scale generation units from 2009-2010 to 2014-2015 according to Table 2-4 (called "solar credits"). The design includes a multiplier to be applied for RECs created by micro-generation units (including rooftop solar PV systems, small wind turbine systems and micro-hydro systems). For each micro generation system, the multiplier would apply only to the first 1.5 kilowatts of system capacity. As of 1st January 2013 the multiplier is now 1. The additional income that can be earned from the multiplier added a subsidy of the order of $4,000 to $7,000 for a REC price of $50/certificate.

Table 2-4: Multiplier for certificates for small generation units

Period during which system installed	Number of STCs per MWh of Generation
1 July 2009 to 30 June 2010	5
1 July 2010 to 30 June 2011	5
1 July 2011 to 30 June 2012	3
1 July 2012 to 30 June 2013	2
1 July 2013 to 30 June 2014	1
1 July 2014 to 30 June 2015	1

Clean Energy Regulator: http://ret.cleanenergyregulator.gov.au/Solar-Panels/solar-credits

Liable entities have a legal requirement to buy STCs and surrender them on a quarterly basis.

There is no legislated target for the SRES scheme. Each year the regulator sets the Small-scale Technology Percentage (STP), to define the liability or number of STC a liable entity must secure each year. The percentage defines the percentage of relevant electricity sales that the liable entity acquires from relevant electricity grids. This determines how many STCs a liable entity must purchase for each quarter of that year.

The liable entity may purchase their STCs through an Agent who deals with STCs, or transactions may occur at $40 or under. There is a Government guaranteed price of $40/STC (excl. GST) if the seller uses the STC Clearing House. STCs are only sold through the STC Clearing House when there is a buyer and there is no guarantee on how long STCs will take to sell.

2.3.2.4 Creation of certificates

Accredited generators are allowed to create LGCs or STCs (in electronic form) for renewable electricity supplied to an agreed measurement point. Certificates created must be registered with the Clean Energy Regulator (CER).

Each certificate represents 1 MWh of renewable electricity generated. Fractions of a certificate are not issued. A generator producing between 0.5 and 1 MWh per annum would create one certificate with its generation rounded up to the nearest MWh. To maintain confidence in the system, provision is made in the legislation for the auditing of the creation of RECs by accredited renewable generators.

Liable entities are required to acquire and surrender renewable certificates equivalent to the target proportion of their sales or consumption in each accounting period. In any period, liable entities can purchase more certificates than required to achieve their target, with the surplus traded to other liable entities or third parties or banked to be surrendered in a future accounting period. Liable entities can also apply for Partial Exemption Certificate which allows the liable entity not to purchase the required amount of electricity for which exemption can be provided.

Generators will have the option of trading their certificates to a liable entity or through a third party, and will achieve the price premium that supports the development of the project, through the sale of certificates. The price that is likely to be obtained for the certificates will influence any decision to invest in renewable energy generation.

2.3.2.5 Review

Under the legislation, the Climate Change Authority (CCA) on behalf of the Government undertook a review of the RET scheme in 2012. A similar review was undertaken in 2002 for the prior MRET scheme (the Tambling Review). The Government has decided to adopt 28 of the 34 recommendations from the CCA review for implementation over the 2013 year. Of the six not fully endorsed, only three were rejected, with the other three still being considered.

The review endorsed the current form of the LRET and endorsed reviews every four years (the next being in 2016).[30] The review timing was driven by a desire to provide investor certainty while not losing the flexibility to revise the target. The review in 2016 was determined to be an appropriate time to undertake a review of the target and also the penalty. The SRES scheme was also seen to be appropriate although the multiplier for 2013 year was reduced from 2 to 1 (refer Table 2-4: Multiplier for certificates for small generation units). Also the review endorsed keeping the two schemes separated or rolling larger PV systems into the LRET (note this redefinition of large PV system in the LRET was a recommendation by the CCA rejected by the government).

2.3.2.6 Other features

Other features of the MRET scheme which were carried over to the new RET Scheme include:

- Allowing for the publication of data on baselines for each accredited renewable electricity generator
- Providing the Renewable Energy Regulator with information gathering powers to enable effective monitoring and compliance with the provisions of the legislation

[30] Note this four year review was note implemented prior to the election and hence a 2014 review will occur aligned to the existing legislation (ie. 2 year review period).

- Allowing for the suspension of an accredited power station under a number of circumstances, including where gaming is suspected
- Excluding certain forms of biomass generation such as by-products from native forest.

In addition the Renewable Energy Target Scheme will have a number of additional features (based on the legislation passed by the Australian Senate):

- Maintaining the same treatment of banking of Renewable Energy Certificates (LGCs) as under the current MRET scheme. LGCs created or purchased by liable parties to meet annual targets can be 'banked' by the owners for sale or surrender in later years of the scheme. Banking is permitted for the life of the scheme without restriction.
- Renewable generators can create LGCs on all generation occurring in the time period from installation to 2030. That is, all renewable power plants once accredited will be able to create RECs on their generation until the scheme expires. All existing projects eligible under MRET and the Victorian Renewable Energy Target scheme will be eligible to participate in the RET for the life of the scheme. Current generation baselines above which existing projects are able to create RECs were extended to the end of the scheme.

2.3.3 TRANSMISSION INVESTMENT AND REMOTE RENEWABLE GENERATION

National and state level energy policies, including the South Australian renewable electricity targets and related policy initiatives, will lead to a significant shift in the locations where electricity is generated from areas with large coal resources to areas with renewable energy resources, and areas around significant gas infrastructure. The areas with excellent renewable energy resources are along the southern and west facing coasts of South-east Australia and in the outback where solar and geothermal energy is more prospective.

A key challenge for transmission investment under these changes is to provide for an efficient pattern of infrastructure investment, with respect to time and location, and with regard to trade-offs between alternative investment options. This challenge is complicated by economy of scale issues that relate to large lumpy investments, free-rider effects (particularly when transmission expansion is in part funded by generation connection costs) and other system objectives that may have social good characteristics that are not fully reflective in market prices. The latter can include certain aspects associated with reliability or environmental objectives.

Generators setting up in remote locations need to be able to share deep connection costs and to obtain guaranteed network access for their financial commitment to transmission capacity. The current piecemeal bilateral planning processes will not necessarily lead to efficient outcomes. Additional measures are needed to provide better information for planning purposes on the long-run marginal cost of transmission capacity related to the transmission projects that are prospective. In addition, demand side providers and embedded generators need relevant information on the value of their capacity in deferring network investment. This would enable them to bring forward competitive options well before the network projects enter the regulatory approval phase.

To improve the efficiency of transmission development and to provide for the transformation to a low emission generation sector, a number of key issues will need to be progressed, including:

- The provision of information on the long-run marginal cost of alleviating inter-regional and major intra-regional constraints based on the cost of prospective augmentations and the impact of their need in relation to regional generating capacity and peak demand
- The provision of information on the value of the capacity of additional embedded generation at each major transmission node where local generation or demand side response is prospective
- A regulatory approval process that values the benefits of remote grid extension among local generators and local and remote customers having regard to the projected impact of the project on LGC and energy prices
- An inter-regional Transmission Use of System (TUoS) charging regime so that these benefits can be reflected in charges to customers across the regional networks according to the distribution of benefits, including through the impact of REC prices.

In order to provide investor confidence to continue with current resource development and commercialisation of new technologies, it may be necessary to review current planning and risk analysis processes so that sound plans can be laid out for network developments in time for connection of the new large scale resources. In some cases higher voltage levels will be necessary to realise the full potential of the network in the long-term and this necessarily involves financial risk due to the potential for assets to remain under-utilised for an extended period.

The major opportunities for large scale development in South Australia involve:

- A network strategy for connection of new large scale renewable energy resources in NSW and South Australia. This would involve:
    - Augmentation of the Victoria-South Australia interconnection to allow large exports from South Australia to Victoria[31]
    - Direct connection of geothermal resources to Olympic Dam, Port Augusta and/or Adelaide with export of surplus power via the Heywood interconnection.
- Augmentation of the Victoria and South Australia to NSW connections to allow surplus renewable energy to flow north and displace coal fired generation in NSW and Queensland.

2.3.4 GREENPOWER

GreenPower is a voluntary scheme set up by the State Governments allowing retail customers to purchase, at a premium, electricity sourced from renewable energy only. GreenPower sales have started to reduce in recent years after strong growth from 2001 to 2008. Over the past three years sales have declined across all NEM regions.

The growth in GreenPower sales is driven by a number of factors including:

- Growth in consumer income over time
- Price of renewable energy generation (GreenPower) relative to the delivered price of electricity from conventional generation sources
- Niche consumers being willing to pay for renewable generation.

[31] Note the Heywood interconnector capacity is scheduled to be increased from 460 MW to 650 MW by 2016.

With the implementation of the carbon pricing and the RET scheme, additional renewable energy generation will come on stream over the next ten years to the point where renewable energy generation under these two measures will comprise at least 20% of total electricity consumption in Australia. By 2020 South Australia's Renewable Electricity Generation Target will deliver sufficient renewable generation to contribute about a third of total electricity consumption, depending on the level of interconnector imports. GreenPower sales will add to this overall contribution.

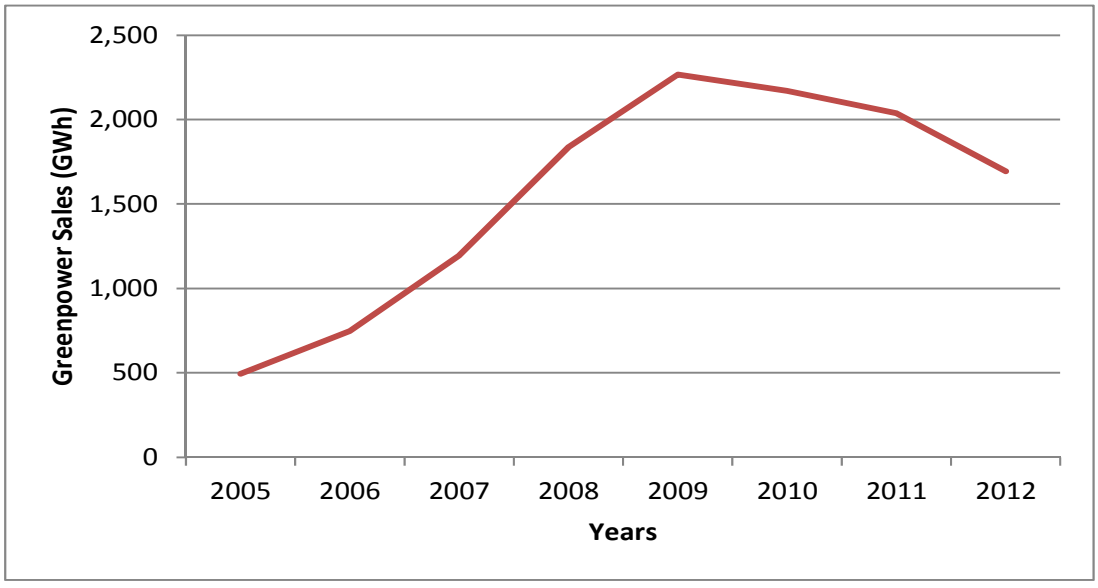
However, as has been seen more recently the implementation of these additional measures may hamper growth in GreenPower sales. Those customers wishing to support renewable energy generation may now feel that the two measures, combined with South Australia's renewable electricity targets, provides enough support to replace the need for individuals to support renewable energy generation. Second, customers wishing to reduce emissions may feel that voluntary action through the purchase of GreenPower may not lead to a net reduction in emissions and therefore it would not be worthwhile to join in a GreenPower scheme. Lower income growth due to the global financial crises may also hamper GreenPower sales in the near future.

On the other hand the gap between the cost of conventional electricity generation and the cost renewable energy generation (under a GreenPower scheme) is likely to reduce, encouraging additional customers to join GreenPower schemes.

The trend in sales has been consistent across most of the states suggesting common factors behind the recent decline in growth. In South Australia the trend has been a decreasing one since 2009 where sales for GreenPower where 273 GWh and in 2012 sales have fallen 20% to 219 GWh.

Major customers of Green Power are the State Governments themselves.

Figure 2-8: Sales of Green Power, 2005-2012



Source: SKM MMA analysis

2.3.5 PREMIUM FEED-IN TARIFFS

State Governments other than Northern Territory and Tasmania have enacted a Feed-in-Tariff (FiT) to support small scale PV installations and, in some cases, other small scale renewable generation. Limits on the maximum size of system supported vary by state with the maximum size in any state being 10 kW.

Tariffs have varied over time with generous initial tariffs seen in all states ranging from $400/MWh to $600/MWh (Figure 2-9: Solar FiT review). The one trend that is consistent is the continued decline in feed in tariffs in all jurisdictions. Some State Governments had placed limits on the level of uptake, either on the basis of installed power, or on the basis of energy produced per annum.

These generous initial tariffs were a key driver for the large uptake in PV systems in the 2010 and 2011 with some significant reduction (in tariff and PV uptake) starting to occur through 2012 and 2013. The States have since reduced the tariff to net exports only and based on a fair and reasonable rate that reflects the value of the exports to the electricity market. Uptake is expected to slow further now the solar credit multiplier is 1.0 and most FiT schemes have been scaled back to provide lower FiTs.

Figure 2-9 shows FiT schemes that have existed or still exist around Australia.

Figure 2-9: Solar FiT review

Table F.1 Mandatory feed-in tariffs across all jurisdictions

Jurisdiction	Type	Scheme name	Closed to new applications	FiT (c/kWh)	Commencement date	Closing application date	Program duration
QLD	net	QLD Solar Bonus Scheme	No	44	1-Jul-08	N/A	2028
NSW	gross/net	NSW Solar Bonus Scheme	Yes	60	1-Jan-10	18-Nov-10	31 December 2016
NSW	gross/net	NSW Solar Bonus Scheme	Yes	20	18-Nov-10	28-Apr-11	31 December 2016
VIC	net	Premium FiT	Yes	60	1-Nov-09	30-Sep-11	until 2024
VIC	net	Transitional Feed-in Tariff	No	25	1-Jan-12	N/A	Until end of 2016
VIC	net	Standard FiT	No	Full retail price		N/A	no end date
WA	net	FiT	Yes	40	1-Aug-10	30-Jun-11	10 years
WA	net	FiT	Yes	20	1-Jul-11	1-Aug-11	10 years
WA	net	Renewable Energy Buyback Scheme	No	from 7 to full retail price		N/A	10 years
ACT	gross	ACT FiT	Yes	50.05	1-Mar-09	30-Jun-10	20 years
ACT	gross	ACT FiT	Yes	40.04	1-Mar-09	30-Jun-10	20 years
ACT	gross	Micro-generator FiT	Yes	45.7	1-Jul-10	30-June-11	20 years
ACT	gross	Medium generator FiT	Yes	34.27	17-Feb-11	13-Jul-11	20 years
ACT	gross	Medium and Small FiT	Yes	30.16	12-Jul-11	13-Jul-11	20 years
SA	net	Solar feed-in scheme	Yes	44 + minimum retailer payment	1-Jul-08	30-Sep-11	2028
SA	net	Solar feed-in scheme	No	16 + minimum retailer payment	1-Oct-11	30-Sep-13	up to 30 September 2016
SA	net		No	Minimum retailer payment	1 –Oct -13		

Source: Solar feed-in tariffs, Setting a fair and reasonable value for electricity generated by small-scale solar PV units in NSW Energy — Final Report, March 2012, Independent Pricing and Regulatory Tribunal

2.3.6 SA LAND USE PATTERNS

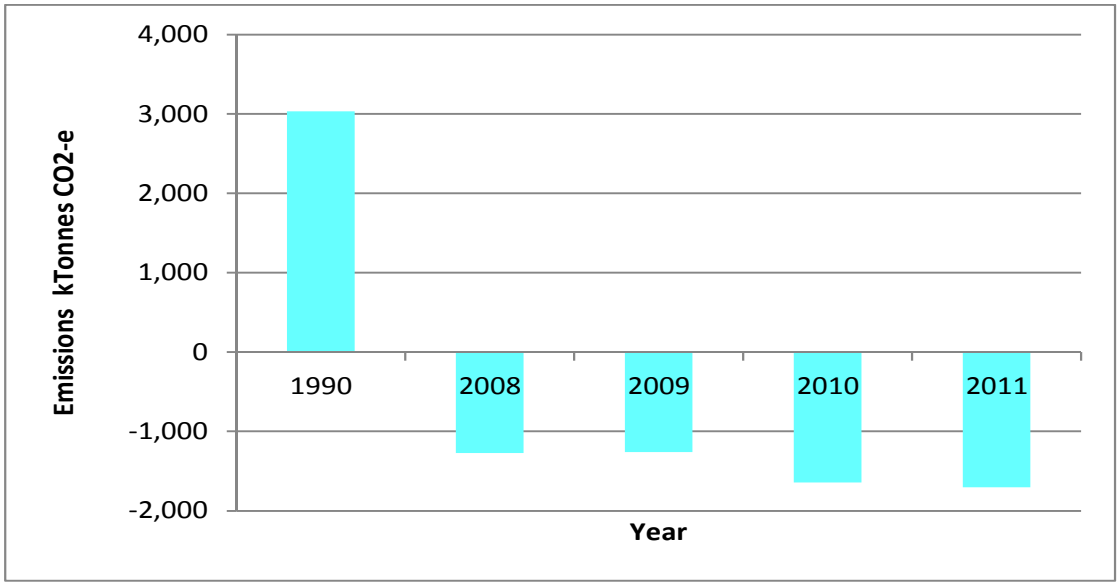
Since the last review, the accounting of Land Use, Land Use Change and Forestry (LULUCF) has been changed and is now required to be reported for the baseline year (1990) and for all years from 2008 onwards. As indicated in Figure 2-10, between 1990 and 2008 there a substantial reduction from 3,033 kt of CO_2-e to -1,702 kt of CO_2-e. Much of this decrease has been achieved because South Australia has moved from an era of net vegetation clearance in 1990 to the present era, which is characterised by re-vegetation and new forestry plantings.

For a growing contribution from LULUCF to be maintained, continued and significant change in SA land-use patterns would be required. South Australia has over 188,000 ha of timber plantations at the end of

2010[32]. It is likely that the extent of plantations will increase in the medium to long term, although recent poor investment returns and the collapse of tax-reducing finance schemes for plantations has seen a stalling of growth (and even a reversal) in the short term. Overtime (as the science is developed and the costs are better known), soil carbon restoration activities may also act as a sink for emissions. And the trend towards direct drilling techniques for cropping will also see significant reductions in emissions.

It is unclear to what extent carbon pricing will impact this growing contribution to emission reductions in South Australia as, although the carbon pricing is proposed to apply to all IPCC sectors except Agriculture and LULUCF, these sectors are included as part of an offset arrangement under the amended Kyoto protocol. LULUCF will play an important role, but the potential for massive reductions (sequestration) through this activity will depend on ever increasing carbon prices. South Australia cannot rely solely on emissions sequestered under LULUCF activities to meet its medium and long term abatement goals.

Figure 2-10: SA greenhouse gas emissions from LULUCF, 2007-2011



Source: The Australian Greenhouse Emissions Inventory System (AGEIS)
http://ageis.climatechange.gov.au

2.3.7 OUTLOOK

There has been a small reduction in emissions in recent times through a combination of new policies (such as carbon pricing and the expanded RET), changes in production practices and recent structural changes in the economy. If these policies are maintained, these trends could accelerate although modelling by the Federal Treasury at the national level predicts national emissions stabilising (with annual targets being partially met by purchases of overseas eligible emission permits).

We see emissions decreasing in the short to medium term through:

[32] Source: PIRSA, http://www.pir.sa.gov.au/forestry/home/forestry_in_south_australia

- Economic restructuring away from energy intensive activities. Recent plant closures include the soda ash plant operated by Penrice. Other plants are also being considered for closure due to lack of competitiveness with imports
- Reductions in electricity demand because households have installed solar PV systems, as energy consumers adopt energy efficient practices and as they react to high energy prices
- Continuing development of large scale renewable energy generation
- Changes to land management practices
- The impact of the carbon pricing mechanism or the Emission Reduction Fund should the Clean Energy Future Legislation be repealed.

However, achieving long term targets will require further action to be taken either through a rebound of carbon prices, a tougher national emission reduction target or sustained subsidy programs supporting adoption of low emission technologies and practices.

2.3.8 REVIEW OF 2050 TARGET

The alignment of the South Australia's greenhouse gas target for 2050 to the national target should be examined. The percentage reduction and baselines used could be aligned to aid communication and stakeholder clarity and also drive an appropriate emissions reduction level for South Australia. At present the 60% of 1990 levels for South Australia compares to a different baseline year and percentage reduction than the national target (80% of 2000 levels).

However, changing the target to assist in reducing community and stakeholder confusion may not be the best outcome for South Australia and any change will require consideration of the following issues:

- 80% of 2000[33] levels would represent a target of 6,200 Gg CO_2-e versus the current 60% of 1990 levels of 12,000 Gg CO_2-e, almost a halving of the eventual 2050 target
- Whether 1990 or 2000 base year is used will have a minimal impact on the 2050 target (i.e. 60% reduction of 1990 target is approximately 12,300 Gg CO_2-e versus 12,400 Gg CO_2-e for the 2000 base year)
- The ability of the national target to include the purchase of up to 50% of international permits should be considered in setting the level of the South Australian target
- The sources of emissions in South Australia will be different to the national sources and other states may have cheaper and more effective emissions reduction opportunities than South Australia. Hence, South Australia may not have to reduce emissions at the same level as other states to achieve the national target
- Is the ultimate driver for South Australia to either reduce emissions aligned to the national target or to target something in excess of the national target? If the latter, the target would require additional policy to be developed to assist in the reduction of emissions

[33] This does not consider interconnector flow emissions or LULUCF emission reductions, the latter as no official estimate exists for the year 2000.

- Other states[34] with legislated targets for 2050 are all based on 1990 levels (Tasmania - 60%[35], Australian Capital Territory – 80%[36]) in contrast to the national target
- Kyoto protocol focuses on emissions reduction aligned to 1990 levels.

[34] Victoria had a legislated target which was repealed in 2012 based on the existence of the national target and policy to reduce greenhouse gas emissions

[35] Climate Change (State Action) Act 2008 (Tasmania)

[36] Climate Change and Greenhouse Gas Reduction Act 2010 (ACT)

3 The Renewable Electricity Targets

3.1 Calculating the Renewable Energy Targets

The Climate Change and Greenhouse Emissions Reduction Act (2007) also sets two related renewable electricity targets, and enables the Minister to set additional interim and sector-based targets. Together with the principal SA GHG Target, these targets seek to deliver the object of the Act which is to assist with "the achievement of ecologically sustainable development in the State by addressing issues associated with climate change."[37]

The related renewable electricity targets are:

*1. To increase the proportion of **renewable electricity generated** so that it comprises at least 20% of electricity generated in the State by 31 December 2014*

[hereafter referred to as the 2014 Renewable Electricity Generation Target];

*2. To increase the proportion of **renewable electricity consumed** so that it comprises at least 20% of electricity consumed in the State by 31 December 2014*

[hereafter referred to as the 2014 Renewable Electricity Consumption Target].

An additional interim and sector based target was made by the Minister under Part 2 of the Act for:

*3. 33.3% of South Australia's **electricity generation** to come from renewable energy by 2020*

[hereafter referred to as the 2020 Renewable Electricity Generation Target].

The distinction between generation and consumption that is a feature of these additional renewable electricity targets addresses the role of the state's two electricity interconnectors, Heywood and Murraylink. In the absence of the renewable electricity consumption target, it would be possible to move towards the achievement of the renewable electricity generation target by increasing electricity imports. The inclusion of the consumption target therefore addresses this, ensuring that the state's performance is effectively independent of interconnector performance in any given year.

South Australia's Strategic Plan 2007[38] specifies that the data sources for these renewable electricity targets are the Electricity Supply Industry Planning Council (ESIPC) and the Australian Greenhouse Office (AGO). On 1 July 2009 ESIPC became part of the Australian Energy Market Operator (AEMO). The AGO is now the DCCEE although more recently[39] it has become the former Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIITCCSRTE).[40] Hence, all relevant data was sourced from these entities.

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[37] Section 3(1)(a)(ii) of the Climate Change and Greenhouse Emissions Reduction Act (2007).

[38] Page 25.

[39] 26 March 2013 and the Energy Efficiency function in now part of Department of Resources, Energy and Tourism.

[40] Note the data is still sourced from websites aligned to the old DCCEE function.

The renewable electricity targets can be calculated as ratios and expressed as a percentage. The calculation of the targets therefore requires the determination of both the numerator and the denominator. The following considers a methodology for each of these renewable electricity targets.

3.2 The methodology for calculating the targets

CSIRO concurs with previous South Australian Government deliberations in recognising the value of taking measurements for the renewable electricity generation and consumption targets at the interconnection point between the transmission and distribution system, using the NEM regional reference node (RRN) as the locational proxy. The rationale for this revision is summarised as follows:

1. The decision to include both a generation and a consumption target is in part to address the State's imports of electricity from outside of South Australia, and therefore to assist a measure of progress that has some independence from interconnector performance in any given year. This logic suggests that the generation and consumption targets should converge when interconnector flows are nil. In this respect the generation and consumption targets are therefore useful when compared. The approach of the SA Methodology Statement does not adopt a common locational basis between measures of the consumption and generation targets, therefore causing transportation losses to introduce a wedge between these targets. This wedge makes a comparison in progress between the two classes of target less intuitive and immediate than is the case in the recommended methodology, which adopts a common locational basis. Insofar that the wedge has the effect of indicating that the generation target is lagging the consumption target, the approach in the SA Methodology Statement may give rise to incorrect perceptions that the State's renewable electricity generation performance is inferior to its renewable electricity consumption performance. The recommended approach mitigates this.
2. CSIRO notes that it is a requirement of the Act that the Minister seeks to provide consistency with best national and international practices with respect to methods for measuring progress in relation to renewable electricity, and further, that the Minister takes into account the relevant methodologies and principles that apply within other Australian jurisdictions. For this reason CSIRO acknowledges the benefit of measuring the renewable electricity targets on a locational basis, consistent with the method adopted for use in the enhanced RET scheme. CSIRO therefore recommends that the location for the measurement of the targets should be the regional reference node used in the National Electricity Market (NEM) for South Australia. This also brings the measurement of the targets in line with the reporting practices in the NEM.

3.2.1 2014 RENEWABLE ELECTRICITY GENERATION TARGET

Essentially the 2014 Renewable Electricity Generation Target is a measure of:

$$Renewable\ energy\ generation\ ration = \frac{total\ renewable\ generation\ in\ South\ Australia}{total\ generation\ in\ South\ Australia}$$

The numerator of this target must measure the total amount of renewable electricity generation in South Australia for each assessment year. The denominator must measure the total amount of electricity generation in South Australia for each assessment year.

The inclusion of both a consumption-based and a generation-based renewable electricity target accommodates the interconnection of South Australia with the transmission grid of the NEM, and the effect that this can have on the achievement of the generation-based target. In particular the effect that imports can have in assisting the achievement of the generation-based targets. The use of both a consumption-based and generation-based target therefore provides a basis for the State's performance to be assessed with some independence from interconnector performance. The implied logic is that both targets can be similarly achieved, and are effectively the same, when there are no net imports of electricity. This suggests that each target should have a comparable measurement basis, therefore requiring a consideration of system losses as part of the methodology.

System losses occur between the point of generation and the point of consumption and are specific to power flows along the length of the transmission and distribution systems. Measures of generation therefore occur prior to system losses, and measures of end-use occur after system losses. For the generation target to have a comparable measurement basis with the consumption target, thereby ensuring consistency when there is no net trade in electricity, the measurements for both targets should be taken in the same location.

CSIRO notes that under the MRET and RET schemes, the liability and the number of certificates created for each renewable generator are calculated using measurements taken at the point of delivery from the transmission system to the distribution system, usually measured for convenience at the regional reference node. For symmetry between State and Federal methodologies, it would seem reasonable for the renewable electricity targets to be measured at this same location. This would also prevent transportation losses from introducing a wedge between the targets, caused by the distance between sources of generation and sources of consumption.

CSIRO therefore suggests that each of the renewable electricity targets be measured at the location of the South Australian regional reference node (Torrens Island), which is part of the NEM.

In practice, this will mean adjusting the data for the numerator (total renewable generation) and denominator (total generation) of each target to take into account transportation losses:

- Data having a locational source within the transmission system should be adjusted by multiplying the data by the square root of the appropriate Marginal Loss Factor (MLF) that is published by AEMO[41]
- Data having a locational source within the distribution system should be adjusted by multiplying the data by the appropriate average Network Loss Factor that is published by AEMO.[42]

With respect to the renewable electricity generation target, data for the numerator can be found in the National Electricity Forecasting Report 2012 as well as sourced from AEMO real time data. *Other Renewable* generation on a 'sent-out' measurement basis are derived from various sources; the historical actuals

[41] http://www.aemo.com.au/electricityops/lossfactors.html. By calculating the square root of the MLF, the average loss factor can be determined.

[42] The Regional Reference Node (RRN) for South Australia sits outside the distribution system; in practice there will be some small transportation loss for flows between the distribution system and the RRN. For the purpose of the methodology these small losses are ignored. The size of these losses may average about 1% of affected flows. http://www.aemo.com.au/electricityops/lossfactors.html

summarise non-scheduled biomass and hydro generation[43] are also sourced from estimates produced by KPMG Econtech. CSIRO has not reviewed the assumptions and methodology used by KPMG Econtech, so does not have a position on the robustness of the projected series.

The actual historical outcomes presented in this table should however provide a reliable and appropriate data source for assessing actual progress.

- Estimates for each assessment year should be multiplied by the average distribution loss factor (HV) published by AEMO[44]
- Estimates for each assessment year and each generation unit should be multiplied by the square root of the relevant MLF for the unit, as published by AEMO[45]. For most generation sites this will have the effect of reducing the generation estimate, reflecting the effect of transportation losses in dissipating some of the sent-out energy before it is delivered to the regional reference node. Intuitively, this reflects the fact that some of the sent-out renewable electricity generation is not realised at the point of consumption
- AEMO forecasts consider solar generation from sub 1 MW installations as a reduction to customer demand rather than as addition to supply. Therefore the numerator will also need to include a measure of this embedded solar generation. Pre 2009 this data was sourced from a time-series measure of installed grid-watts which was collected and published as part of the Solar Homes and Communities Plan (SHCP) of the Commonwealth Department of Environment, Water, Heritage and the Arts[46]; the SHCP was formerly the Photovoltaic Rebate Program that commenced in 2000. SHCP statistics summarise data related to installations under the Photovoltaic Rebate Program (PVRP). It is noted that the PVRP is only available for residential and community projects, and therefore SHCP statistics do not include data relating to commercial installations. Post 2009, the data for solar has been sourced from the Clean Energy Regulator REC registry[47] for both Large-scale Generation Certificates (LGC) and Small-scale Technology Certificates (STC).

CSIRO is of the view that SHCP statistics and the REC registry provides an acceptable basis for approximating a time series of solar generation from sub 1 MW installations. Using the assumptions that all installed grid-watts are operational and that no capacity losses occur over time, the measure of installed grid-watts can be multiplied by an appropriate solar zone rating[48] to deem an estimate of annual generation.

The Zone Rating for Adelaide is 1.382, meaning that a 1KW PV installation is deemed to generate 1.382 MWh per annum. Based on the use of this factor in past reviews and maintaining compatibility between

[43] Other renewables are likely to contribute less than 3% of the total renewable target by 2012.

[44] The High Voltage (HV) DLF should be used. See page 22 of http://www.aemo.com.au/Electricity/Market-Operations/Loss-Factors-and-Regional-Boundaries/Distribution-Loss-Factors-for-the-2011_12-Financial-Year

[45] For scheduled, semi scheduled and non scheduled generation, published MLF's for the respective generation units were used http://www.aemo.com.au/Electricity/Market-Operations/Loss-Factors-and-Regional-Boundaries/List-Of-Regional-Boundaries-And-Marginal-Loss-Factors-for-the-2012-2013-Financial-Year pages 44-46.

[46] See http://www.environment.gov.au/settlements/renewable/pv/pubs/wattsbymonth-sep09.xls

[47] https://www.rec-registry.gov.au

[48] Renewable Energy (Electricity) Regulations 2001

the South Australian Government and Federal Government methodologies, it is recommended to continue to use the Zone Rating for Adelaide of 1.382.

Given that solar PV installations are typically located in the distribution system, estimates should be multiplied by the average Distribution Loss Factor (Low Voltage Demand DLF published by AEMO) to approximate the additional amount of energy that would otherwise need to be supplied to source the energy via the regional reference node. This effectively adds a factor to the actual generation value to reflect the savings in distribution losses that are directly attributable to the embedded generation.

For the data post 2009 from the REC Registry, two times series have been derived for Solar Hot Water (SHW) and solar PV. By definition, solar PV adds to the both consumption and renewable energy generation but SHW adds only to the consumption to obtain a total gross consumption including SHW. For the solar PV certificates, an effective multiplier is applied with 15 years deeming period to calculate the annual installed generation of energy capability. The effective multiplier is based on the proportion of Solar PV systems above and below 1.5kW limit that applies to the multipliers identified in Table 2-4: Multiplier for certificates for small generation units. This is then summed over time to achieve a total solar PV generation figure for each year. For SHW, the certificate are divided by the 10 year deeming period to achieve an energy displaced for each year and this is then summed over time to achieve a total energy displaced by SHW in each year. This measure for SHW is only used in the consumption target calculation. Note only solar PV and SHW systems that are grid connected are included in the analysis.

The denominator requires the summation of renewable electricity generation as defined above, plus a measure of all other generation in South Australia, thereby providing a measure of total electricity generation in South Australia for the assessment year. Data inputs for the denominator include the following:

- Data inputs used to calculate the numerator, plus
- Total SA Generation for year (sourced from AEMO half hourly dispatch data) excluding wind which is already captured in the numerator above)
- Estimates should be multiplied by the square root of the appropriate MLF for the generation unit
- Other non-scheduled generation (particularly renewables other than wind and all other non-renewable non scheduled generation based on estimates produced by KPMG Econtech)
- Estimates of other non-scheduled generation should be multiplied by the average DLF (High Voltage) that is published by AEMO.

3.2.2 2020 RENEWABLE ELECTRICITY GENERATION TARGET

The methodology and data sources for the 2020 Renewable Electricity Generation Target should be the same as for the 2014 Renewable Electricity Generation Target.

3.2.3 2014 RENEWABLE ELECTRICITY CONSUMPTION TARGET

The inclusion of a consumption target ensures that the state's performance is effectively independent of interconnector performance in any given year. Due to the measurement at the RRN, if there were no interconnector flows, the generation and consumption targets would be the same. The consumption ratio is calculated as follow:

$$Renewable\ energy\ consumption\ ratio = \frac{total\ renewable\ electricity\ consumed\ in\ South\ Australia}{total\ electricity\ in\ South\ Australia}$$

The numerator of this target must measure the total amount of renewable electricity that is consumed in South Australia for each assessment year. The denominator must measure the total amount of electricity that is consumed in South Australia for each assessment year.

With respect to the numerator, consideration must be given to whether it should be measured on a physical or contractual basis:

- A contractual basis defines the consumption of renewable electricity based on what is contracted at the customer level, for example, via contracted MRET or Green Power requirements
- A physical basis defines consumption of renewable electricity based on flows that are physically attributed to the sent-out energy of renewable electricity generators in the state, using the assumption that what is generated in the state is consumed in the state.

CSIRO notes that the DIITCCSRTE has considered this issue in the Technical Guidelines that accompany the NGER.[49] In particular, the DIITCCSRTE recognises that "within an electricity grid it is impossible to physically trace or control the actual physical source of electricity received by each customer" (the consequences being increased complexity and a propensity for double-counting).

CSIRO supports the use of a physical basis for defining the consumption of renewable electricity.

Although a proportion of renewable electricity may be supplied into South Australia from renewable generation sources located in other jurisdictions, the means for deeming the quantum of this renewable content at the regional reference node is complex, involving calculations encompassing all NEM generators, interconnector flows and loss factors. CSIRO advises that the consumption target methodology should ignore the calculation of deemed renewable electricity from the interconnectors because of the complexity of the calculation and the likely insignificance of the result.

The numerator should therefore be calculated on the same basis as for the numerator of the renewable electricity generation target.

While the numerator requires a physical measure of consumption based on the sent-out energy of renewable electricity generators that are indigenous to the state, thereby excluding imported renewable power, the denominator requires a measure of the total consumption of electricity, including that which is imported via the interconnectors. Again, this measure of consumption should include the associated system losses that are associated with its delivery to the location of the regional reference node. The denominator also requires an estimate of the generation of embedded solar PV and SHW installations, reflecting the extent that this generation offsets customer demand for alternatively supplied power.

The denominator should be calculated as the sum of the following:

- Total Customer Sales (from Table 6-2 of the NEFR 2012[50])

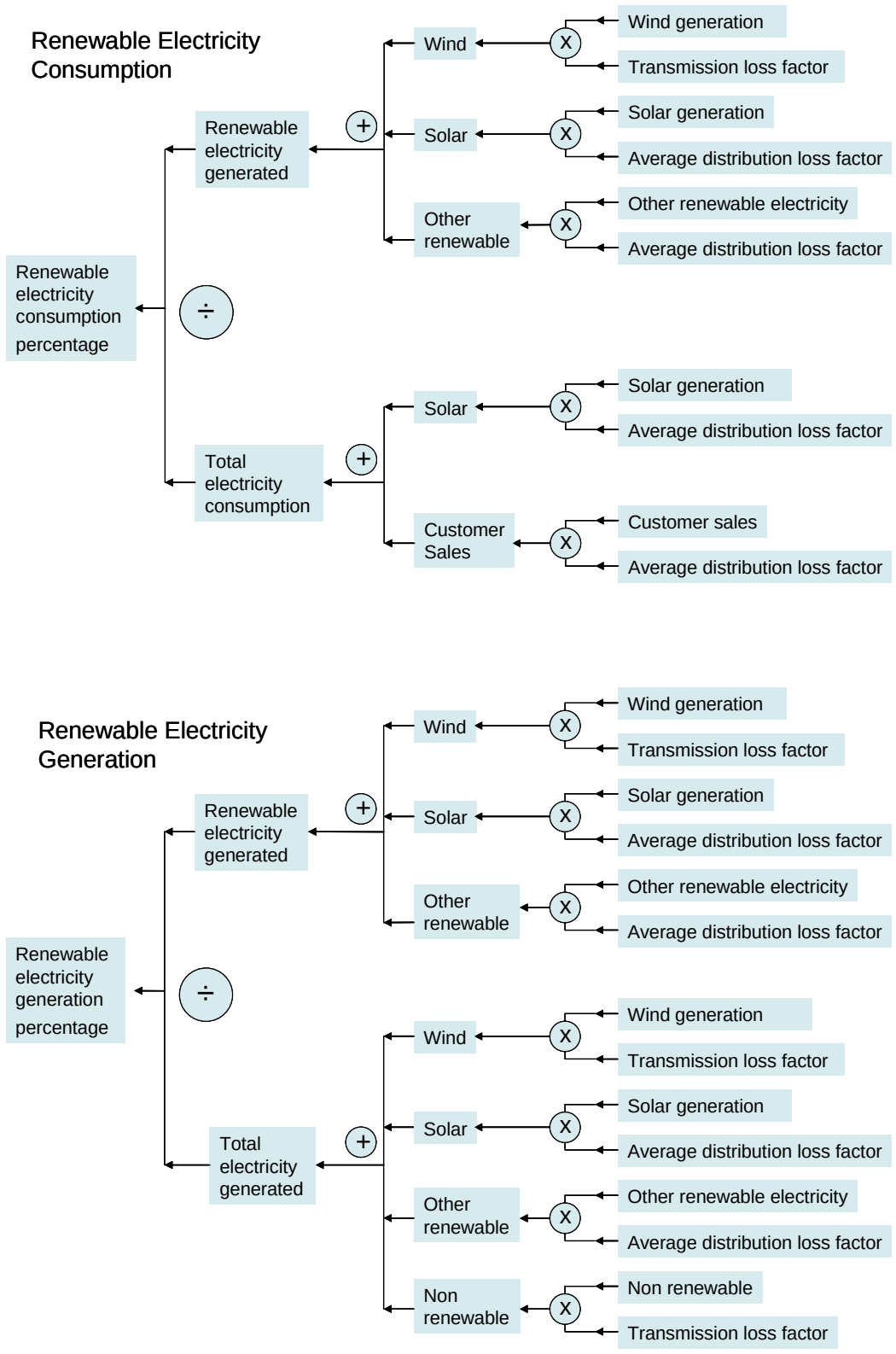
[49] http://climatechange.gov.au/reporting/publications/pubs/draft_nger_technical_guidelines.doc, p366.

[50] Page 6-8

- Solar generation as discussed in Section 3.2.1 including the calculation of SHW energy displaced to gain a gross level of consumption.

The driver trees in Figure 3-1: Calculating the Renewable Electricity Generation and Consumption describes the methodology for both targets.

Figure 3-1: Calculating the Renewable Electricity Generation and Consumption



3.3 Progress Towards the Renewable Electricity Target

3.3.1 RENEWABLE ELECTRICITY GENERATION TARGETS

The data shows that South Australia already exceeds the 2014 generation target of 20%, and is progressing ahead of scheduled in its bid to achieve the 2020 target of 33.3%. Indeed, the estimated average annual output from all wind generation plants in South Australia that are either existing, or proposed for commissioning prior to 2015, makes up 45% of the sent-out energy requirement that is forecast (median) by NEFR 2012 to supply customers in 2014/15.

- Average annual output of existing SA wind units[51]:
    - 3,469 GWh
- Average annual output of wind units that are existing and proposed for commissioning prior to 2015:
    - 5,548 GWh (45.0% of 2014 estimated sent out generation if no net imports[52])
    - Model output indicates a value of approximately 4,500 GWh by 2015.
- Average annual output of wind units that are existing, proposed and announced for commissioning prior to 2020:
    - 14,620 GWh (106% of 2020 estimated sent out generation[53] if no net imports)
    - Generation based on modelling for Wind alone in SA by 2020 is likely to be in the order of 8,000 GWh.

It should be noted that the 2020 number is impacted by a significant decline in the demand forecast since the previous review which has impacted the energy forecast but is yet to impact the proposed wind farms. For example in the NEFR 2012 AEMO have indicated that for South Australia[54] :

- The annual energy demand for 2011–12 is expected to be 5.2% lower than 2010–11, and 10.5% lower than forecast in the 2011 ESOO (medium economic growth scenario);
- Forecast annual energy demand for 2012–13 is expected to only grow by 0.1%, which represents a 12.2% reduction from the 2011 ESOO forecasts; and
- Average growth in annual energy demand for the 10-year outlook period is now forecast to be 0.9%, down from the 1.5% forecast in the 2011 ESOO.

It is unlikely that by 2020 this level of wind could be built and if demand continues on the path indicated in the AEMO NEFR 2012 then future wind farms are likely to be delayed. However, even if by 2020 the level of wind infrastructure predicted for 2015 had been achieved (i.e. wind farm generation of 5,548 GWh) then the percentage of power produced using wind would still reach 44% by 2020 under a medium growth scenario (Scenario 3- Planning in the AEMO 2012 ESOO).

[51] The average annual output of existing and proposed wind units is based on a combination of information from AEMO real time data and supporting data obtained from SKM MMA.

[52] AEMO estimated sent-out energy 2014/15 (50%PoE) from 2012 NEFR – scenario 3 planning (medium growth).

[53] AEMO estimated sent-out energy 2018/19 (50%PoE) from 2012 NEFR – scenario 3 planning (medium growth).

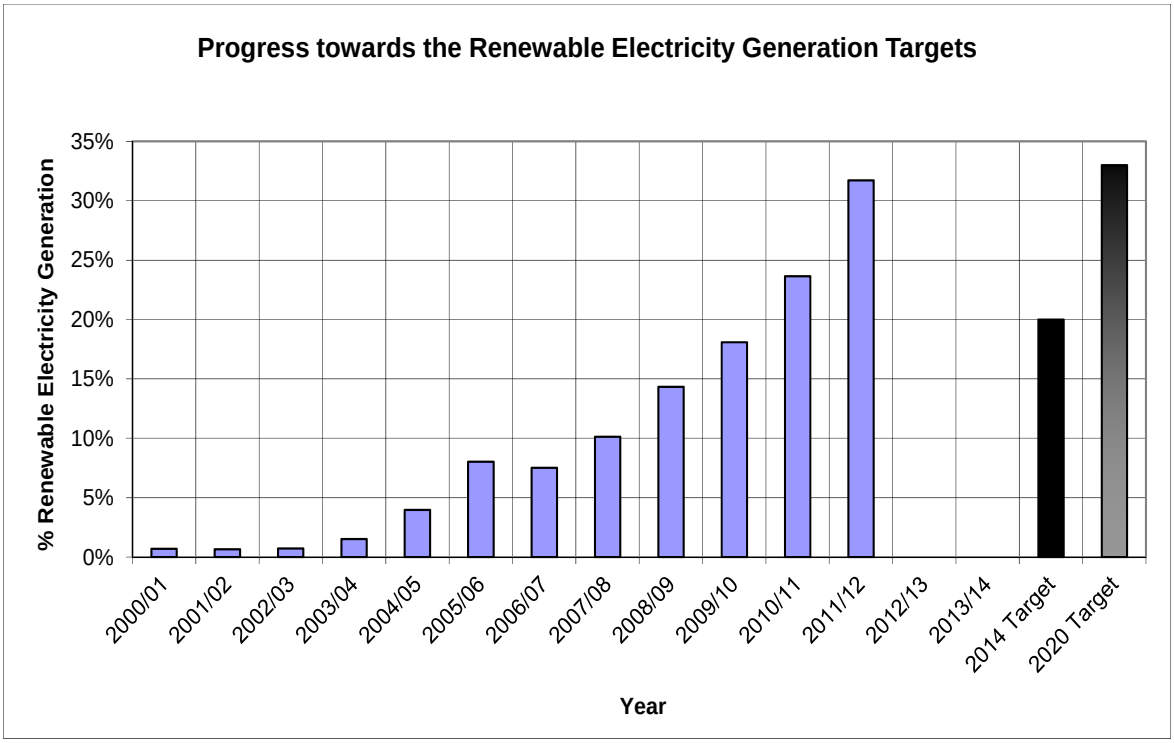
[54] NEFR 2012, chapter 6 page 6-1.

Based on current installed renewable generation capacity and assuming all announced wind projects go ahead as scheduled, CSIRO expects that South Australia will achieve its 2014 and 2020 Renewable Electricity Generation Targets.

Figure 3-2: Progress towards the Renewable Electricity Generation Targets summarises current progress towards the 2014 and 2020 Renewable Electricity Generation Targets.

Table 3-1: Progress towards the Renewable Electricity Generation Targets shows the historical performance in tabular form.

Figure 3-2: Progress towards the Renewable Electricity Generation Targets



Source: SKM MMA analysis

Table 3-1: Progress towards the Renewable Electricity Generation Targets

Year	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/ 10	10/ 11	11/ 12
Target	0.7%	0.8%	1.6%	4.2%	8.0%	7.5%	10.1%	14.3%	18.1%	23.6%	31.7%

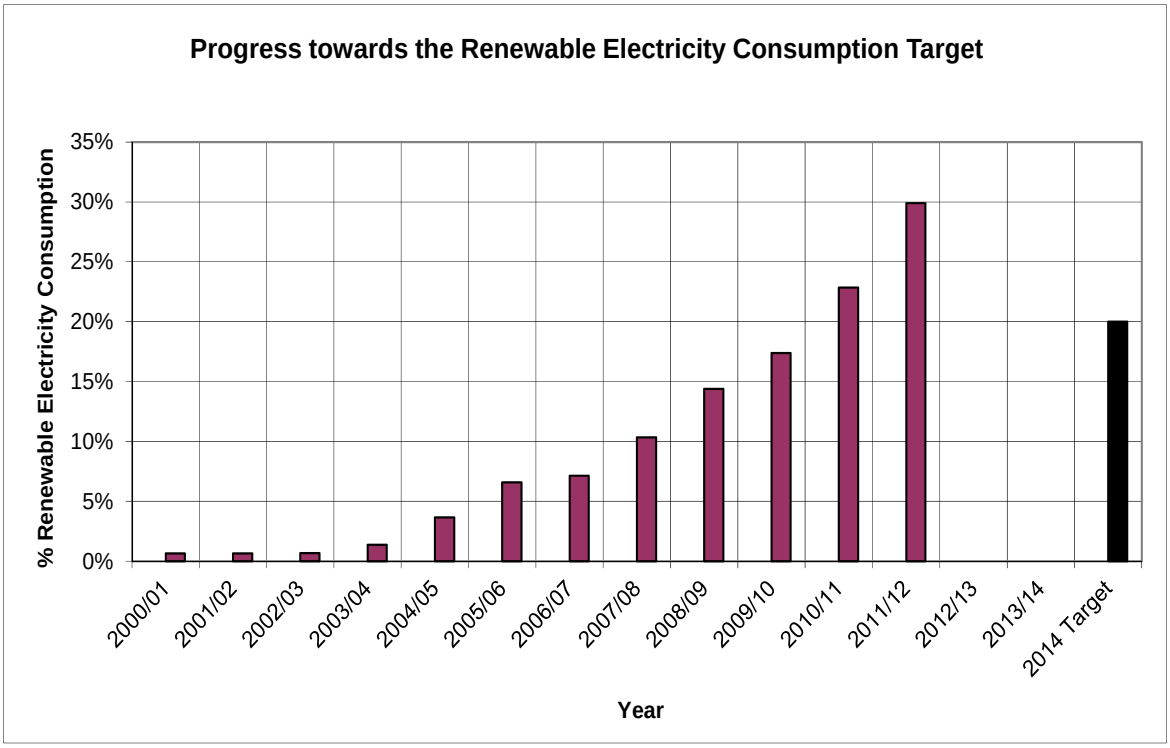
Source: SKM MMA analysis

The data shows that South Australia has already achieved the 2014 target and is well progressed to achieve the 2020 Renewable Electricity Generation Targets.

3.3.2 RENEWABLE ELECTRICITY CONSUMPTION TARGETS

Figure 3-3: Progress towards the Renewable Electricity Consumption Target summarises current progress against the 2014 Renewable Electricity Consumption Target.

Figure 3-3: Progress towards the Renewable Electricity Consumption Target



Source: SKM MMA analysis

Table 3-2: Progress towards the Renewable Electricity Consumption Target

Year	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/ 10	10/ 11	11/ 12
Target	0.7%	0.7%	1.4%	3.7%	6.6%	7.1%	10.3%	14.4%	17.4%	22.8%	29.9%

Source: SKM MMA analysis

The data shows that South Australia has already surpassed its 2014 consumption target of 20%. The estimated average annual output from all wind generation plants in South Australia (existing, or proposed for commissioning prior to 2015) will make up 45% of the sent-out energy requirement that is forecast (median) by AEMO in the NEFR 2012 to supply customers in 2014/15. This well exceeds the determined target.

Based on current installed renewable generation capacity and assuming that a reasonable number of the announced wind projects go ahead as scheduled, CSIRO expects that South Australia will be well in excess of its 2014 Renewable Electricity Consumption Target.

3.3.3 RELEVANCE OF RENEWABLE ELECTRICITY TARGETS

The already high penetration of renewable generation in the State plus stable electricity demand should see the State achieve the Government's target. However, the Government should review progress towards the 2020 target if the following risks materialise:

- First, the prospect that the national target for large scale renewable energy generation (under the LRET scheme) is revised downward from its current 41,000 GWh. The Federal Government will review the scheme in 2014. Recent decreases in electricity demand have seen calls for the national

target to be reduced to a true 20%. CSIRO estimates this would entail a reduction in the target from the current 41,000 GWh to around 26,400 GWh. Such a reduction would severely curtail investments in new renewable generation in all regions including South Australia

- Second, the now high penetration of roof-top solar PV and large-scale wind generation is seeing large decreases in wholesale electricity prices (with evidence indicating that volume weighted average price now averaging around 17% less than the time weighted average) which could reduce revenue projections if maintained and deter investment in new renewable generation
- Third, repeal of the carbon pricing mechanism could see wholesale electricity prices fall. Several studies have shown that Large-scale Generation Certificate prices may not rise high enough to compensate for the fall in wholesale electricity prices, meaning there is a risk that the national target may not be met
- Fourth, land planning issues or local transmission constraints start to constrain the development of new wind farms.

The 2014 targets are already exceeded and this makes them less relevant than the 2020 target.

There is potential for consideration of a 2020 renewable energy consumption target depending on the drivers for the South Australia government. While the renewable electricity consumption and generation targets are similar, the renewable electricity generation target promotes development of renewable generation that can be used to serve internal and external demand (i.e. interconnector flow to Victoria). Whereas, the consumption target is more focussed on South Australian demand and the effective supply of this (i.e. exports of electricity are effectively removed). In theory[55], with only a consumption target less renewable generation may be developed.

If the aim is to promote emissions reduction aligned to the greenhouse gas reduction targets then the renewable consumption target may be more relevant than a renewable generation target as the consumption target focusses on South Australia's internal demand and hence emissions generation[56]. However, if the aim is to promote renewable electricity generation as well as reduce greenhouse gas emissions then the generation target may be more relevant.

[55] Based on supporting policy and legislation to support this target

[56] Note the current consumption target assumes all renewable energy generation is consumed in the state which may provide an optimistic view on actual consumption of renewable energy. However, it is difficult to differentiate between renewable and non-renewable generation source for actual electricity generated, consumed and exported. The renewable generation target then becomes a cleared and better defined measure.

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