Impact of green energy policies on electricity prices

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Executive Summary

Synergies/ROAM Consulting has assessed the costs of green energy policies from 2001-02 to 2013-14 on retail electricity costs, for both small (residential/small business) and large (consumption of greater than 5 gigawatt-hours (GWh) per annum) customers across the mainland National Electricity Market (NEM). This includes thousands of businesses, some that qualify for government assistance under the Renewable Energy Target (RET) and carbon price, and others that do not, such as non-trade exposed manufacturing, dairy farms, office buildings and large commercial outlets.

There has been a proliferation of green energy policies over the last decade both at the federal and state levels. They have similar underlying policy objectives – essentially encouraging renewable energy, reducing carbon emissions and encouraging greater energy efficiency.

The gross cost of green energy policies, in total, is now approximately 4c/kWh and as such is comparable to the wholesale cost of electricity (absent the carbon price) highlighting the significance of the cumulative impact of these policies.

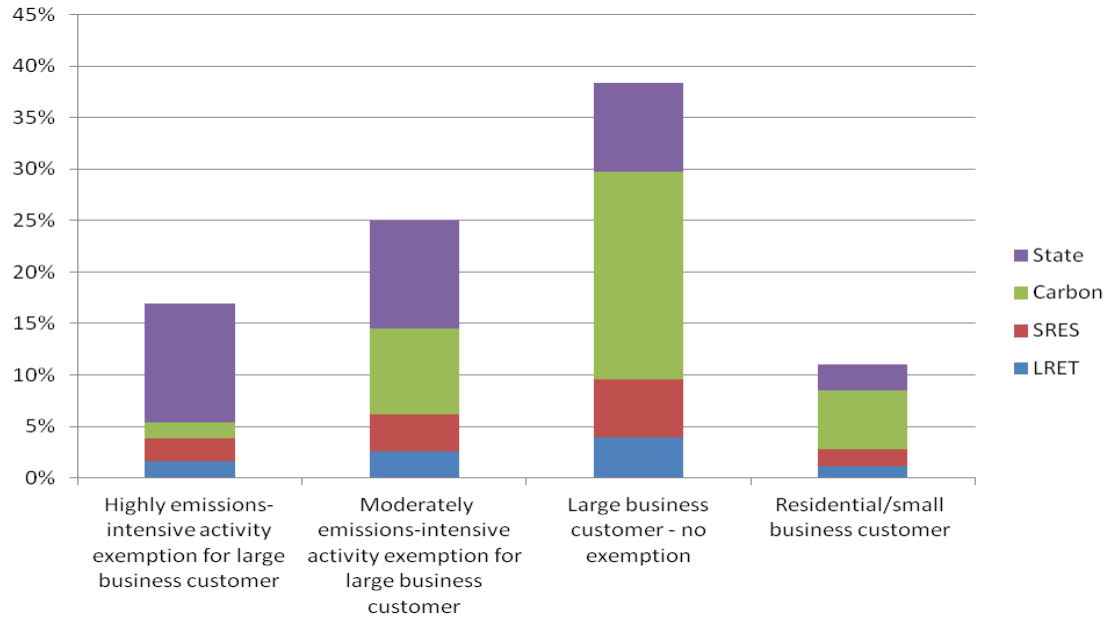
Over the past five years, the residential cost of electricity has increased by 60%, from 23c/kWh in 2009-10 to 37c/kWh in 2013-14 (based on the NEM mainland average), and have more than doubled since 2003-04.

For large business customers, average electricity tariffs have increased by 30% over the period 2009-10 to present, and by 88% since 2004-05. Current average annual bills for large business customers are in the range 9-16c/kWh.

The gross cost of green energy policies has varied impacts for business and residential consumers of electricity. As Figure 1 shows, the approximately 4c/kWh incurred in green energy policy costs represents:

- up to 40% of the total electricity bill for a large business customer that does not qualify for government assistance;
- 25% of the total electricity bill for a business that qualifies for moderately emissions-intensive government assistance;
- 17% of the total electricity bill for a business that qualifies for highly emissions-intensive government assistance; and
- 11% of a typical total household electricity bill.

Figure 1 Average cost of green energy policies as a proportion of electricity bills, by customer class (2013-14)

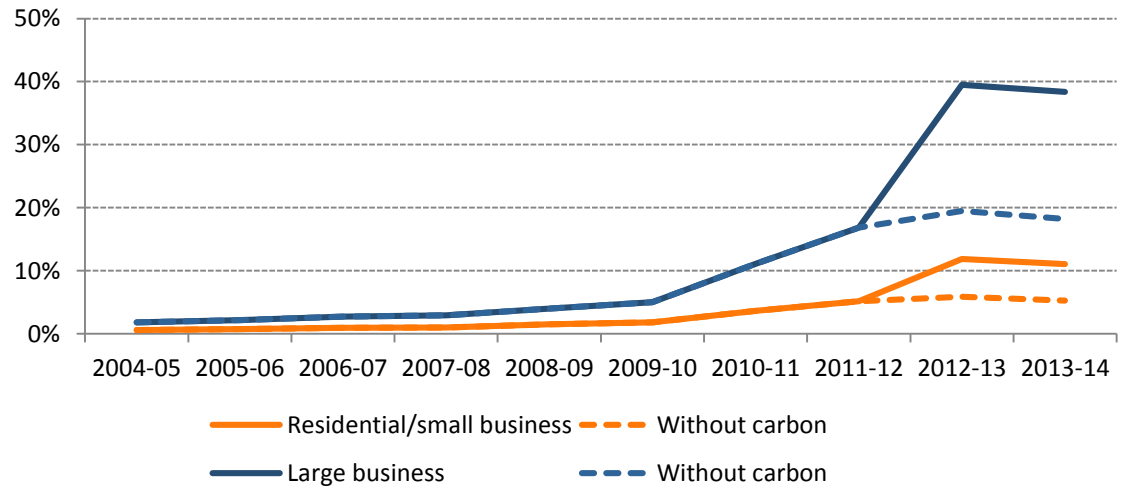


Source: ROAM Consulting and Synergies Economic Consulting.

Note: State based energy schemes including energy efficiency schemes and feed-in tariffs (state), carbon tax (carbon) Large-scale Renewable Energy Target (LRET) and Small-scale Renewable Energy Scheme (SRES).

The carbon price represents the most significant electricity tariff component of green energy policies, representing approximately half of the total green energy costs faced by both residential and business customers, as shown in Figure 2.

Figure 2 Percentage of green energy policies on mainland NEM average electricity bills (no emissions-intensive trade-exposed (EITE) exemptions)



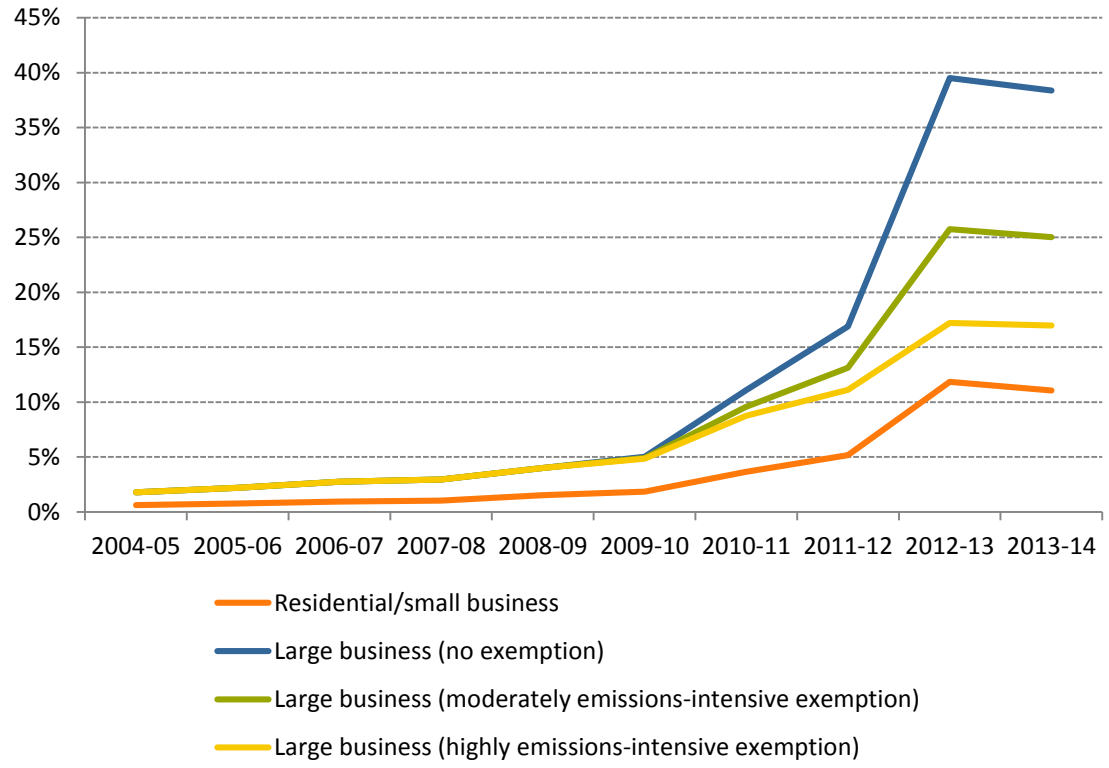
Source: ROAM Consulting and Synergies Economic Consulting.

Carbon pricing adds a further 2.2c/kWh to electricity tariffs - this equates to about 6% for an average household customer's electricity bill (noting that a portion of this cost is returned to some residential consumers through the tax and transfer payment system) and 20% for a large business (noting this is less for those businesses that qualify for government assistance).

Government assistance for large consumers of electricity is made available to emissions-intensive trade-exposed (EITE) industries through partial exemptions for the impact of the price on carbon, Large-scale Renewable Energy Target (LRET) and Small-scale Renewable Energy Scheme (SRES) liabilities. These exemptions have applied since the introduction of the carbon price and since 2009-10 for RET schemes.

Figure 3 shows how the impact of green energy policies has grown over time as a proportion of an overall average residential/small business and large business electricity bill, including those large businesses involved in both moderately and highly emissions-intensive activities.

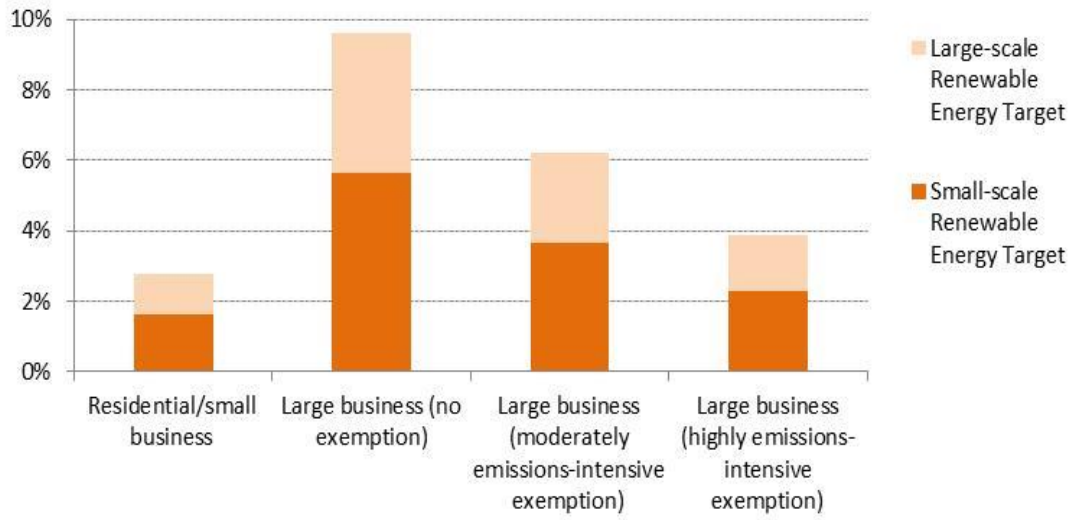
Figure 3 Percentage of green energy policies on mainland NEM average electricity bills (with and without EITE exemptions)



Source: ROAM Consulting and Synergies Economic Consulting.

As Figure 4 shows, the LRET and SRES are estimated to now cost consumers 0.4c/kWh and 0.6c/kWh, respectively, during 2013-14 with the total RET costs estimated to comprise almost 10% of a typical electricity bill for a large business (or less, depending on its eligibility for partial exemption certificates) and 3% of a typical residential customer's electricity bill.

Figure 4 Average cost of Renewable Energy Target as a proportion of electricity bills (2013-14)

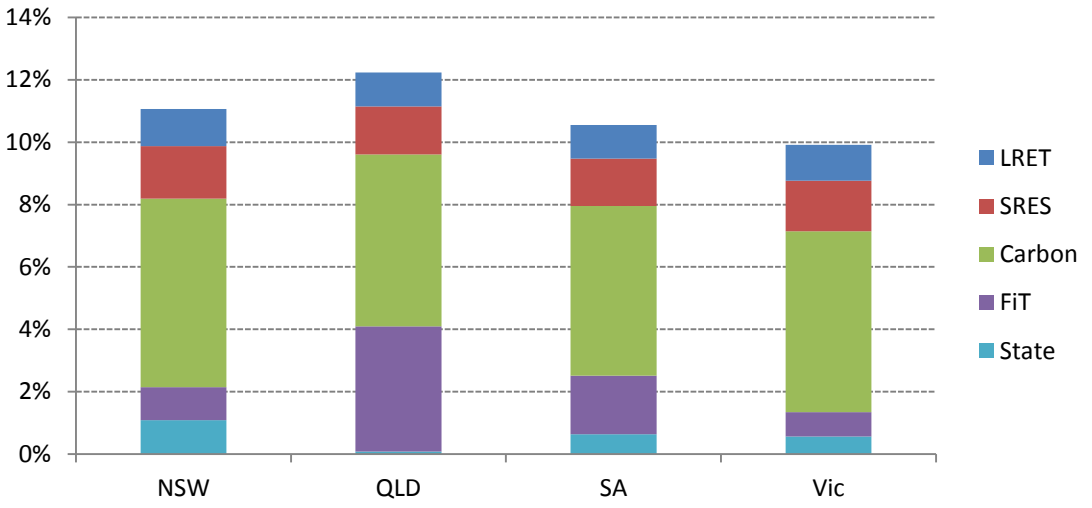


Source: ROAM Consulting and Synergies Economic Consulting.

The state-based energy policies, including feed-in tariffs (FiTs), impose comparable or higher costs than the LRET and SRES combined. State-based green energy policies contribute an average of 0.9c/kWh, of which a majority is due to FiTs. This accounts for 2% of a typical households electricity bill, but up to 12% for a large business, as there is no government assistance for state-based green energy policies.

As Figure 5 shows, these costs can also vary significantly between regions, with FiTs being the most significant in Queensland where they account for about 4% of a typical household electricity bill.

Figure 5 Average cost of green energy policies as a proportion of state residential electricity bills, by region (2013-14)

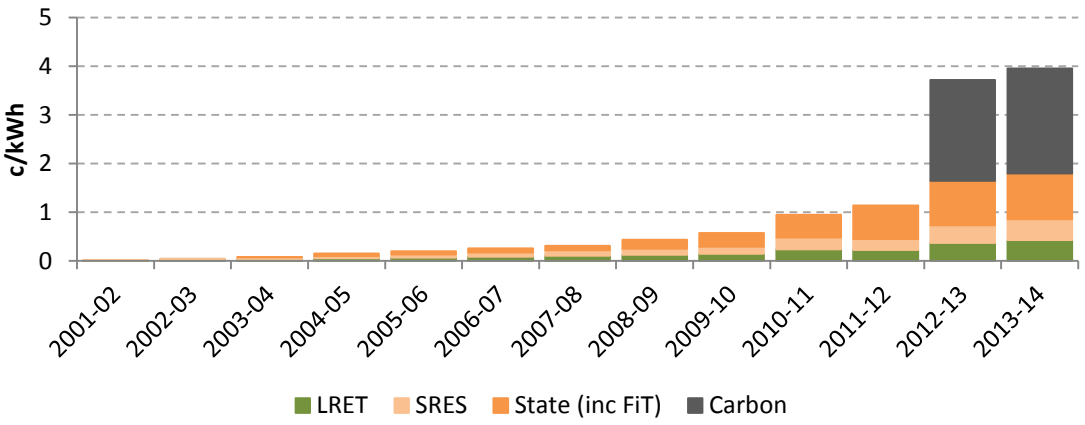


Source: ROAM Consulting and Synergies Economic Consulting.

Green energy policy costs have increased over the past decade, driven by increasing liabilities of existing schemes, particularly the RET since it was first introduced in 2001, the entry of new schemes (including carbon pricing) and generous feed-in tariffs. These policies amount to approximately 4c/kWh (Figure 6), out of total average residential/small-business retail bills of around 37c/kWh and large customer bills of 9-16c/kWh.

In recent years, the share of green energy policies (excluding the carbon price) as a fraction of total bills has remained relatively constant, despite increasing in absolute terms, due to strong growth in other components of tariffs, particularly network costs.

Figure 6 Cost of green energy policies on mainland NEM average electricity bills (nominal c/kWh)



Source: ROAM Consulting and Synergies Economic Consulting

Whilst each policy results in an impost which is significant in its own right, what is striking is the collective impact of these policies, particularly on large customers who do not qualify for government assistance. Notwithstanding the benefits that electricity customers have received from green energy policies, their gross cost, in total, is now approximately 4c/kWh and makes up a significant share of the overall electricity costs faced by consumers.

It would appear that there has been little or no regard has been given to the collective cost of green energy policies on electricity users as new schemes have been introduced or liabilities increased under existing schemes.

Contents

Figures and Tables

1 Introduction

Synergies/ROAM Consulting has been engaged by the Business Council of Australia (BCA) to assess the impact of Commonwealth and state green energy policies on residential and business customers over time and across Australian jurisdictions. Accordingly, this report examines the impact of various green energy policies over the period 2001-02 to 2013-14 for the following NEM jurisdictions:

- New South Wales;
- Queensland;
- South Australia; and
- Victoria.

In addition, the analysis examines the impact on a "mainland NEM" category, reflecting a weighted average of the above jurisdictions.

Impacts are examined for the residential/small business customer group and the large business customer group (with annual consumption in excess of 5 GWh).

The remainder of this report is structured as follows:

- Section 2 sets out the various green energy policies and the methodology used to determine the costs associated with each of these schemes;
- Section 3 provides an overview of the green energy policy and retail billing data underpinning this report; and
- Section 4 examines the growth in green energy policy costs over time, both in aggregate and as a proportion of retail electricity bills for residential/small business customers and large business customers and across jurisdictions.

Retail billing data and green energy policy costs are provided at Appendix A and B respectively. Appendix C provides details of the contribution of green energy policies in each of the above NEM jurisdictions.

2 Green energy policy components

Green energy policies operate at both the national and the State level. Set out below is a summary of each of the schemes at each level of Government that were assessed for this report.

2.1 National schemes

Although national energy policies are applied uniformly to all liable parties, the cost passed through to retail customers can vary in each region and each year, due to the diversity of methodologies applied in developing regulated retail tariffs (e.g., whether prices are based on market costs or long-run marginal costs) and the diversity in actual costs incurred by different retailers. To allow for direct comparison across years, we have chosen to develop one set of prices for all national schemes, which are applied to all regions.

2.1.1 Carbon pricing

Carbon costs for retailers are bundled into the wholesale energy price. However, not all the carbon price paid by generators is passed onto electricity consumers – some of it is absorbed by generators. This is because the level of carbon price pass-through is not dependent on the average emissions of the region but rather the bid of the marginal generator (which would include an allowance for its carbon emissions), which will vary by time of day and by season.

For example, coal generators are likely to be the marginal bidder overnight; assuming their full carbon costs are passed through in their bids, this could often result in an overnight emissions factor of above 1.0[1]. In comparison, if gas plant is the marginal bidder during daytime or shoulder periods, the average emissions factor at these times across the market would be closer to 0.5.

The average emissions factor will also vary between regions, depending on the specific mix of technologies and generator emissions factors. For simplicity we have assumed a 90% national average carbon pass-through[2], meaning that $1/tonne of CO2 adds $0.9/MWh to electricity wholesale price.

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[1] The price of electricity is usually expressed as $/MWh at the wholesale level. The carbon price is $/tonne CO2-e. For black coal generators, the conversion from the carbon price to the wholesale electricity price is about 1.0. For brown coal generators the ratio is around 1.2 to 1.4. For the most efficient gas fired generators, the ratio is only 0.4.

[2] For example, a 2012 paper from the University of Queensland (http://www.uq.edu.au/eemg/docs/workingpapers/2012-5.pdf) reviews a number of studies suggesting an emissions intensity of 0.94; we have rounded down to 0.9 to represent the continued growth of renewables and likely

2.1.2 RECs, LGCs and STCs

The Mandatory Renewable Energy Target (MRET) was introduced in 2001[3], requiring liable entities (large users of electricity) to surrender Renewable Energy Certificates (RECs) based on a percentage (the Renewable Power Percentage (RPP)) of their annual usage. RECs were produced by eligible large- or small-scale systems.

In 2010, the original target was extended, and additional incentives for small-scale systems were introduced by allowing small-scale systems to create additional certificates (five times their actual production, with fifteen years deemed up-front). The combination of the bringing forward the recognition of RECs for these energy policies, the falling cost of solar PV panels and the additional feed-in tariffs, led to a significant oversupply of RECs.

This oversupply of RECs led to the MRET scheme being split into two separate schemes in 2011: the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES). Liability for the current LRET is in the form of Large-scale Generation Certificates (LGCs), which are broadly equivalent to RECs, but currently only able to be produced from medium- to large-scale generators. In this report, the historical RECs are referred to as LGCs in most charts. LGCs must be surrendered according to the published Renewable Power Percentage (RPP) in each year.

Liability for the SRES is managed through Small-scale Technology Certificates (STCs), which are produced from small-scale renewable systems. All STCs produced must be purchased, with Small-scale Technology Percentages (STPs) announced in each year based on forecast production; historically, these forecasts have underestimated production, with additional liability passed through to subsequent years. Responding to falling rooftop PV and solar hot water system costs, the five times multiplier was reduced more quickly by the Commonwealth than originally planned, reducing the effective number of certificates (and, therefore, subsidy) provided to small-scale generation and hence reducing STPs.

We have chosen to use LGC prices drawn from spot market data collected from various traders and online publications, including Green Energy Trading and the Clean Energy Council. These prices were combined with the historical RPPs to determine the retailer liability in that year.

[3] An Enhanced Renewable Energy Target scheme originally replaced the MRET, before the split into the LRET and SRES; for simplicity, we have not explicitly discussed this scheme.

Sources of uncertainty

In practice, retailers may actually pay higher prices for LGCs than the published spot prices we have relied upon in this report. This is especially true for vertically integrated generators which have effectively signed "self PPAs" at the levelised cost of renewable generation. Therefore, the cost of LGCs set out in this report is likely to underestimate true retailer costs in some years.

Balancing that, however, is that we have not assessed the "avoided" cost to both retailers and consumers, due to the downward pressure on retail prices caused by the entry of large- and small-scale renewables under the RET. That is, any additional capacity in the system (renewables or otherwise) or reduction in demand will tend to reduce wholesale prices, by displacing the need for higher bidding generators in the short-run. In other words, absent the RET scheme, the wholesale price would have tended to be higher than the prices which actually prevailed because the operation of the renewable generation meant more expensive generators did not get dispatched and therefore did not influence spot prices in the NEM. This impact is difficult to quantify on a historical basis, and avoided wholesale costs lack the transparency of explicit bill components (e.g., LGC costs); nevertheless, avoided wholesale energy costs represent a genuine saving to consumers that is not quantified in this report.

Although we have not quantified either of these components, we estimate that they are of comparable magnitudes, and therefore the estimates in this report represent appropriate central estimates of costs.

2.2 State-based green energy policies

This section considers the State based green energy policies for each of the jurisdictions under consideration. In addition to the schemes in this section, each region has a feed-in tariff scheme, discussed in Section 2.2.4.

2.2.1 New South Wales

Greenhouse Gas Reduction Scheme

The NSW Greenhouse Gas Reduction Scheme (GGAS)[4] was an emissions trading scheme operating in NSW that commenced in January 2003 and terminated in July 2012 when the federal carbon price scheme commenced.

[4] http://www.ipart.nsw.gov.au/Home/Industries/Greenhouse_Gas_Reduction_Scheme/NSW_Greenhouse_Gas_Reduction_Scheme_-_Strengths_weaknesses_and_lessons_learned_-_Final_Report_-_July_2013

Participants were required to limit emissions to the baseline levels set by the scheme, if necessary by purchasing abatement certificates (including NSW Greenhouse Abatement Certificates (NGACs)). The "outcome based" design of the scheme, i.e., the requirement to limit emissions to a certain level, potentially with certificate offsets, rather than the requirement to purchase a specific volume of certificates like as in the LRET scheme, means it is difficult to establish the true cost of the scheme to consumers.

A report from Origin Energy[5] was used to provide the original retail cost of the scheme. A number of retail bills were used to determine the average price of interim years, with linear interpolation used for other values. A discrepancy exists between the price charged on at least some bills and the recommendation by IPART of a zero pass-through cost[6] in later years, reflecting a surplus of certificates. We have used the average retail cost in those years, as a conservative estimate that better reflects the costs for retailers. We expect costs for large customers who chose to manage their own benchmarks (as opposed to through a retailer) to be broadly similar.

Energy Savings Scheme

The NSW Energy Saving Scheme (ESS) aims to reduce electricity consumption in NSW by creating financial incentives for organisations to invest in energy savings projects and assisting households and businesses to reduce consumption and costs[7]. Energy savings projects produce certificates which are purchased by liable parties (such as retailers).

Certificate spot prices were sourced from Green Energy Trading publications[8], while retailer liabilities were taken from published compliance obligations[9]. As these are percentages of retail loads, these can be combined to produce robust estimates, subject to the accuracy of spot prices in reflecting total costs.

Climate Change Levy

The Climate Change Levy funds the NSW solar PV feed-in tariff, as well as other environment related projects. As such, it is included as a green scheme, but the costs of the solar PV feed-in tariff have been calculated separately (Section 2.2.4) and netted off this component to ensure there is no double counting.

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5 http://www.originenergy.com.au/1130/files/gas_scheme.pdf

6 Changes in regulated electricity retail prices from 1 July 2011, IPART report (2011)

7 http://www.ess.nsw.gov.au/

8 http://greenenergytrading.com.au/images/uploads/Docs_presentations/RIC_BRAZZALE,_Managing_Director,_Green_Energy_Trading.pdf

9 http://www.ess.nsw.gov.au/For_Liable_Entities/Targets_and_penalties

2.2.2 Queensland

Queensland gas scheme

The Queensland Gas Scheme commenced in 2005 and was established to encourage the state's gas industry and reduce greenhouse gas emissions by requiring electricity retailers to source a prescribed percentage (increasing to 15%) of their electricity from gas-fired generation. The scheme ceased on 31 December 2013.

A number of sources were used to estimate the cost of Gas Electricity Certificates (GECs) to retailers/consumers, although limited data was available. A report from The Energy Retailer's association of Australia from November 2005 provided data for the first year of the scheme, with longer term costs sourced from the Queensland Competition Authority.[10] Some interim values were determined by reference to a small number of retail bills available to Synergies/ROAM, with remaining values determined through linear interpolation.

2.2.3 South Australia

South Australia Residential Energy Efficiency Scheme

This scheme requires energy retailers to provide energy audits and energy efficiency activities to South Australian households[11]. Costs are recovered through retail tariffs for residential customers. Scheme costs have been estimated by ROAM based on standing contract price reports published by ESCOSA[12].

2.2.4 Victoria

Victorian energy efficiency certificates

Victorian energy efficiency certificates (VEECs) are electronic certificates created under the Victorian Energy Efficiency Target Act 2007 (the Act) and the Victorian Energy Efficiency Target Regulations 2008 (the Regulations). Each VEEC represents one tonne of carbon dioxide equivalent (CO2-e) abated by specified energy saving activities.

The number of VEECs that a given activity can yield depends on the amount of CO2-e abatement that the activity will cause. The abatement is calculated by comparing the

[10] http://www.qca.org.au/getattachment/c83a068e-daf7-4d5a-ab94-10a1f4aafe62/Final-Report.aspx

[11] http://www.escosa.sa.gov.au/library/140611-ResidentialEnergyEfficiencyScheme_2013-AnnualReport.pdf

[12] For example, http://www.escosa.sa.gov.au/library/101208-ElectricityStandingContractPrice-FinalPriceDetermination-PartA.pdf

difference between (i) the energy use of the new product and (ii) the 'baseline' energy use, which refers to the amount of energy that would have been used if the new high efficiency product had not been installed.

Spot prices for certificates were sourced from Green Energy Trading publications. Annual liabilities (i.e., number of certificates required to be surrendered) were sourced from the Essential Service Commission.[13]

2.3 Feed in Tariffs

In all regions, feed-in tariffs for small-scale self-generation systems, predominantly rooftop photovoltaics (PV), have had large impacts on the power system in recent years. All state governments introduced generous subsidies, funded in the first instance by networks, with costs ultimately passed on to consumers through network charges. These schemes have produced significant costs for non-self-generating customers.

Synergies/ROAM maintains a database of the underlying feed-in tariff rates offered, and the estimated capacity of solar PV installed in each year under each scheme. Information for these were sourced from sources including regulators (such as IPART, Queensland Competition Authority (QCA), Essential Services Commission of South Australia (ESCOSA), Victorian Essential Services Commission, etc.), transmission network service providers, retailers and other industry groups. For example, the QCA published summaries of the feed-in tariff volumes and costs on their annual tariff reviews[14], ESCOSA provided advice on the increase in residential bills due to the SA feed-in tariff scheme[15], and Powercor published a report from consultant Oakley Greenwood that included estimates of the costs of feed-in tariffs in each year.

However, due to the unexpectedly rapid uptake of many of these schemes, regulator forecasts of cost pass-through may not reflect the true system costs in those years, even if those costs were not passed through immediately to consumers. This is because the subsidies that are paid are based on actual energy production whereas the charges that are recovered in any year are based on the regulator's forecast. Because rooftop PV up-take has been greater than expected, the subsidies paid in some years are higher than the recovery of those subsidies through network charges, while in subsequent years the reverse is true. For instance, the regulatory period for Queensland network charges means that additional cost recovery will be required for the next period to compensate

[13] Essential Services Commission (2013), Analysis of Electricity Retail Prices and Retail Margins 2006-2012.

[14] For example, http://www.qca.org.au/getattachment/c83a068e-daf7-4d5a-ab94-10a1f4aafe62/Final-Report.aspx

[15] http://www.escosa.sa.gov.au/library/120607-ElectricityStandingContractPriceAdjustment-FactSheet.pdf

networks for the (unrecovered) costs of the Solar Bonus Scheme. Similarly, IPART has included additional cost pass-through recovery component in some years on their regulated tariffs to recover subsidies paid in previous years. In essence, this means that the cost of feed-in tariff schemes through charges in any year may under- or over-state the true cost of the scheme (the difference being made up in subsequent years' network charges).

Consequently, to better reflect the true cost of the feed-in tariff schemes, we have provided our own estimate of feed-in tariff costs in each year, based on published rates and uptakes. This will therefore both over and underestimate consumer costs each year, but provide a smoother, more transparent, trajectory, and a better representation of the annual system costs of feed-in tariffs. We note, however, that any future extension of this work should take this approach into account to avoid double-counting future cost recoveries.

These schemes have, to date, been recovered across the whole customer base. Due to a lack of information for large customers, Synergies/ROAM have assumed that c/kWh costs are the same for all customers. If large customers pay a smaller share, feed-in tariffs will constitute a smaller percentage of large customer retail bills, while consumer costs will increase.

Recent estimates have put the "fair value" (to retailers) of PV exports at between 5 to 12 c/kWh, which represent the avoided costs for retailers due to not having to purchase energy from the market (plus other components). This therefore depends on wholesale price and carbon price assumptions, as well as other components, such as network charges. In existing feed-in tariff schemes funded by distribution companies, this saving to retailers is not recovered from retailers to consumers[16], representing a windfall gain to retailers. Retailers may then offer an *additional* feed-in tariff to incentivise customers to their network. Any additional feed-in tariffs paid by retailers is assumed to be cost-neutral (or profitable for the retailer) and is not included in this analysis. In the future, it is possible that mandatory retailer contributions (paid to the DNSP) will reduce the net impact of existing feed-in tariffs on other consumers.

2.4 EITE exemptions

Emissions intensive trade exposed (EITE) industries receive partial exemptions for their scheme costs.

[16] See, for example, http://www.qca.org.au/getattachment/c83a068e-daf7-4d5a-ab94-10a1f4aafe62/Final-Report.aspx

Partial exemption is available for the LRET and SRES (but not the original MRET[17]), and is set at 60% for a moderately emissions-intensive activity or 90% for a highly-emissions intensive activity[18], where such industries are defined in Schedule 6 of the relevant Regulations.[19] These exemptions apply only to the electricity use associated with the EITE activity.

Under the Clean Energy Act, free carbon units are allocated to EITE industries[20], with moderately emissions-intensive activities receiving 66% of their industry-average liability and highly emissions-intensive activities receiving 94.5%.[21] This compensation declines by 1.3% per year. As this determination is based on industry-average usage, more energy efficient producers may be eligible for further savings, while less energy efficient producers would receive less compensation as a percentage of their costs. For the calculations in this report, we have assumed that average energy efficiency and that the EITE compensation is put pro-rata towards meeting electricity costs.

17 Exemption is therefore only granted to the portion of the annual LRET target above the original MRET target (9,500 GWh). Therefore, a highly-emissions intensive activity would not see a full 90% exemption from LRET costs, and the effective exemption percent will increase over time as the LRET grows relative to the MRET.

18 http://ret.cleanenergyregulator.gov.au/For-Industry/eites

19 http://www.comlaw.gov.au/Details/F2014C00241/Html/Text#_Toc382818564

20 http://www.cleanenergyregulator.gov.au/Carbon-Pricing-Mechanism/Industry-Assistance/jobs-and-competitiveness-program/free-carbon-units/Pages/default.aspx

21 http://www.comlaw.gov.au/Details/F2013C00938/Html/Text#_Toc373316656

3 Green energy policy and retail billing data overview

Synergies/ROAM Consulting has drawn on a number of sources to develop the best available dataset representing the historical cost of green energy policies on retail electricity bills over the period.

3.1 Green energy policy data

Synergies/ROAM Consulting has assembled green energy policy costs for the period 2001-02 to 2013-14 for New South Wales, Queensland, South Australia and Victoria. In many cases, we found multiple data sources or methodologies for each data point (defined as a scheme, region and historical year).

We have therefore taken two approaches to determining green energy policy costs – a bottom up approach reconciled against a top down approach (each of which are now considered in turn).

A bottom-up approach was used to develop estimates of the costs of each scheme based on annual liabilities (e.g., LGCs required for surrender) and per-unit costs (e.g., cost of an LGC). At the same time, historical billing data was obtained for a limited number of regions/retailers to provide a benchmark of actual costs.

When these approaches reconciled, they provided confirmation of the accuracy of the results and confidence in our methodology.

For some items, however, there were discrepancies or key data was unavailable. Sources of uncertainty in the resulting data set therefore include:

- poor data availability, sometimes due to difficulty in accessing data across different billing systems within retailers, and insufficient detail in published reports;
- different approaches and methodologies for estimation of annual costs which have evolved over time;
- genuine differences between regions or companies, for example competitive pressures between different retailers or regional wholesale price differences;
- short-term markets may also not reflect the true costs to retailers (i.e., the price charged in one year is not the true cost incurred, with the difference being made up through over-recovery in the following year(s)), for example due to the cost of hedging against risk, and so may yield higher or lower retail bills; and
- differing approaches to cost recovery across the customer base.

The data sets developed for this report should therefore be treated as representing central estimates for each region. Individual customers or retailers could have higher or lower costs (in both absolute terms and as a percentage of total bill).

For each item, discussed below, Synergies/ROAM Consulting has made a decision as to whether "consumer costs" (retail tariffs that year), "retailer costs" (costs incurred by retailer that year) or "system costs" (costs incurred across the whole system, e.g., higher than expected feed-in tariff payments not recovered from retailers) provides the most appropriate annual figure. Although these approaches will tend to be equivalent in cumulative total over time (assuming that all costs are ultimately passed through to consumers)[22], delays in regulatory or price response have meant that cost recovery has sometimes lagged expenditure. Some cost in each year might therefore equally be considered as being attributed to a year earlier or later; we have again taken central estimates based on our analysis.

The data sources for each item are discussed below. In addition to the explicit references provided, we reviewed over 100 separate reports and reviews from bodies such as the New South Wales Independent Pricing and Regulatory Tribunal, the Australian Energy Market Commission, government hearing transcripts and retailer publications (many of which are no longer available online). These reports were used to provide confirmation or recommendations on how to develop the dataset. Additionally, we maintain a database of industry information, which has been used throughout the development of this report.

Finally, for our top down assessment, we obtained a high-level set of retail costs from a leading energy retailer which was used to benchmark the total costs (grouped by federal green energy policies (excluding carbon), state-based green energy policies and carbon costs) in each region. We found that these prices were consistent with our bottom-up approach, given the discussion above, providing additional confidence in our methodology.

In addition to the nominated jurisdictions, we developed a mainland NEM category to provide a consolidated view of the impact of green energy policies in the identified NEM jurisdictions. Green energy policy costs for the mainland NEM are based on a weighted average of the NSW, Queensland, South Australian and Victorian green energy policy costs, weighted by the 2012-13 energy demand of each jurisdiction.[23]

[22] One exception to this approach arises with carbon emissions related charges for the reasons outlined in section 2.1 above.

[23] Energy demand for 2012-13 for each jurisdiction was sourced from the Australian Energy Market Operator 2013, National Electricity Forecasting Report 2013.

3.2 Retail billing data

In order to provide the context for the change in green energy policy costs over time, it was necessary to determine the contribution of green energy policies to typical residential /small business and business customer electricity bills over time (that is, a sense of changes in the cost of electricity over time). [24]

Accordingly, we sought to identify retail billing data for the small and large customer groups for the period 2003-04 to 2013-14 for NSW, Queensland, South Australia and Victoria.

Business customer billing data was supplied by a leading energy retailer who was able to provide average annual billing data for its greater than 5 GWh per annum customer cohort for the period April 2004 to March 2014 for NSW, Queensland, South Australia and Victoria on a commercial in confidence basis which has been aggregated and averaged for the purposes of this report.

For the residential and small business customer group the required retail billing data is publicly available from the AER's *State of the Energy Market 2013*. This data was supplemented by movements in the ABS's Electricity cost index to determine price movements by jurisdiction in earlier periods. A brief outline of the methodology used to derive annual retail billing estimates for the residential/small business customer group is provided below.

The AER provides average annual price increases for regulated and standing offer electricity prices for NEM jurisdictions for the period 2009-10 to 2013-14.[25] In addition, the AER provides the associated estimated annual cost based on a customer using 6,500 kilowatt hours of electricity per year on a single-rate tariff at August 2013. Based on this information, the estimated annual cost can be expressed as a cents/kilowatt hour value. Average annual price increases have been applied to the estimated annual cost (c/kWh) as at August 2013 to determine estimated annual costs (c/kWh) for each of the years 2009-10 to 2013-14 for each of the relevant NEM jurisdictions.[26]

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[24] Price movements and c/kWh rates for small business customers are assumed to be the same as those applying to residential customers.

[25] Australian Energy Regulator 2013, State of the Energy Market 2013, December, p. 130.

[26] Where price increases relate to calendar years or six month periods, these are assumed to provide a reasonable approximation of price increases in the subsequent financial year. For example, where data are for the calendar year ended December 2013, these are assumed to be reflective of price movements in financial year 2013-14. Where price data are provided for multiple distribution network service providers within a jurisdiction, a simple average has been applied to derive representative state estimates.

Price movements for the period 2003-04 to 2008-09 are derived from the ABS Consumer Price Index series.[27] In particular, annual electricity price movements for capital cities in each of the NEM jurisdictions were determined.[28] These price movements were applied to the estimated annual costs (c/kWh) determined above to derive estimated annual costs (c/kWh) for the 2003-04 to 2008-09 period for each of the relevant NEM jurisdictions.

As was the case for the green energy policy cost estimates, we developed a mainland NEM category to reflect average retail electricity bills across the four NEM jurisdictions. The mainland NEM average annual retail bill for residential/small business and large business customers is derived on the basis of the weighted average of the 2012-13 energy demand in each jurisdiction.

Annual retail electricity bills (c/kWh) for the period 2003-04 to 2013-14 for residential/ small business in New South Wales, Queensland, South Australia, Victoria and the mainland NEM are provided at Appendix A.

[27] Australian Bureau of Statistics 2014, Consumer Price Index, Australia (Cat # 6401.0), March, Table 11.

[28] Price movements are based on the June on June movements in the ABS Original series for each capital city. Movements in capital cities prices are expected to be reflective of price changes at the State level.

4 Contribution of green energy policies over time

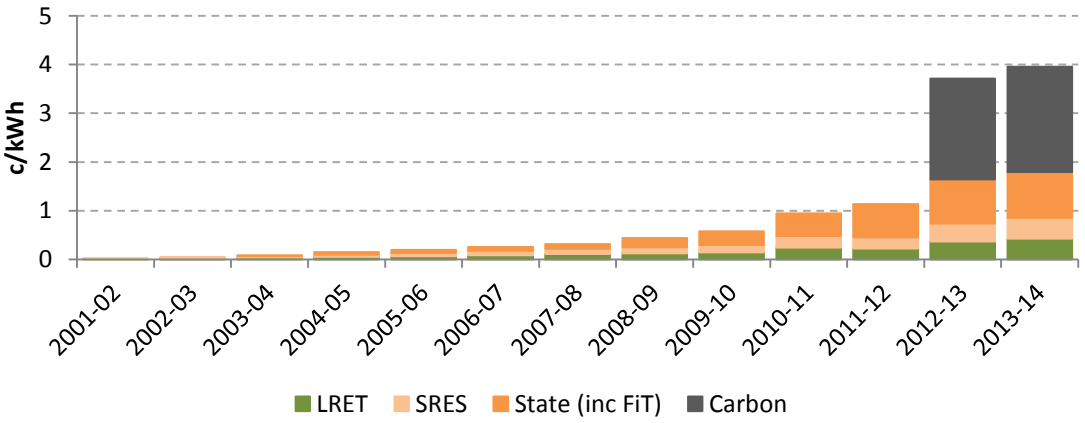
Costs of green energy policies depend on two distinct factors: the annual scheme requirement (e.g., the LRET target) and the per-unit cost (e.g., LGC price). As total "green" obligations have generally increased over time in aggregate, the cost of green energy policies (in aggregate) has also generally increased over time in absolute terms. However, due to other components of customer energy bills also increasing, the impact of green energy policies as a proportion of retail bills has been less pronounced. These comparisons are considered in turn.

All prices are nominal dollars. Figures are presented on a financial year basis, with any calendar year data converted to financial years through a simple average, or directly mapped to a financial year depending on the quality and availability of data.

4.1 The cost of green energy policies in absolute terms

Figure 7 shows the contribution of green energy policy costs to mainland NEM average electricity bills in terms of c/kWh over the period 2001-02 to 2013-14. The figure demonstrates the increase in the cost of green energy policies over the period. This is despite recent reductions in the requirements of some components (such as the SRES) as short-term effects (such as the five times solar multiplier for certificates from small generating units) are resolved, and a reduction in unit-costs for some components (e.g., the NSW GGAS scheme) as schemes are fulfilled. Figure 7 shows that the cost of these green policies now amount to approximately 4c/kWh.

Figure 7 Cost of green energy policies on mainland NEM average electricity bills (nominal c/kWh)



Source: ROAM Consulting and Synergies Economic Consulting

Growth in the contribution of the various green energy policies over time to NSW, Queensland, Victoria and South Australia retail electricity bills is provided at Appendix

C. The data indicates the significant and growing impact of the various green energy policies over the 2001-02 to 2013-14 period in each of the individual NEM jurisdictions. In particular, the Commonwealth green energy policies have increased markedly over the past five years, increasing from an estimated 0.15c/kWh in 2009-10 (representing the costs of the RET) to 3.19c/kWh (including the LRET, SRES and carbon price). That is an increase of over 2000%

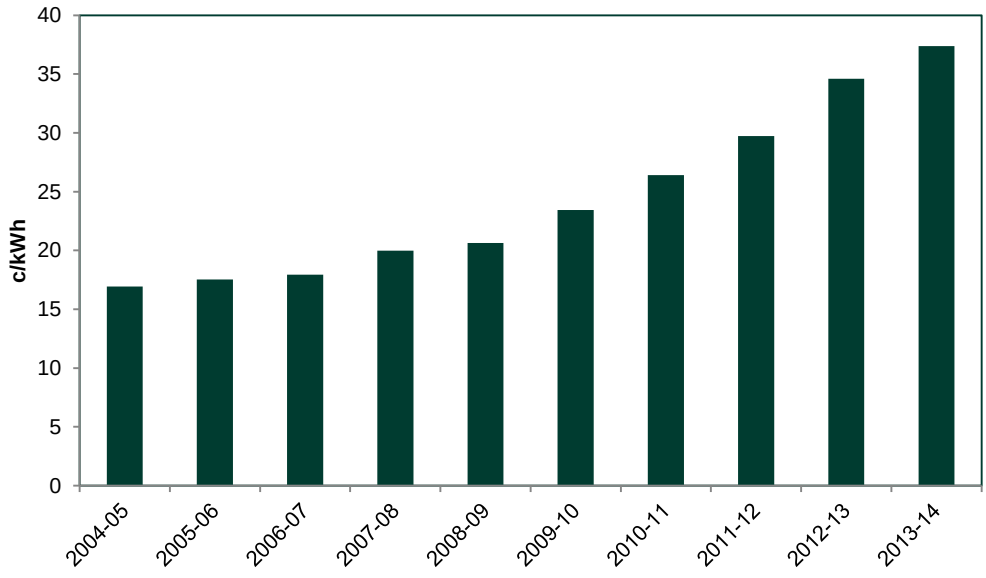
The State-based feed-in tariffs also make a significant contribution to green energy policy costs, particularly in Queensland and South Australia with feed-in tariffs that peaked at rates of 1.57c/kWh and 0.75c/kWh, respectively. Generous feed-in tariffs resulted in a rapid uptake of rooftop PV, and significant costs which are recovered from consumers, particularly those without PV of their own. For example, in Queensland, the flow on cost to electricity prices of its feed-in tariff in 2013-14 is estimated at 1.57c/kWh – more than the LRET and SRES costs combined.

4.2 Green energy policies as a proportion of retail bills

Retail tariffs have increased

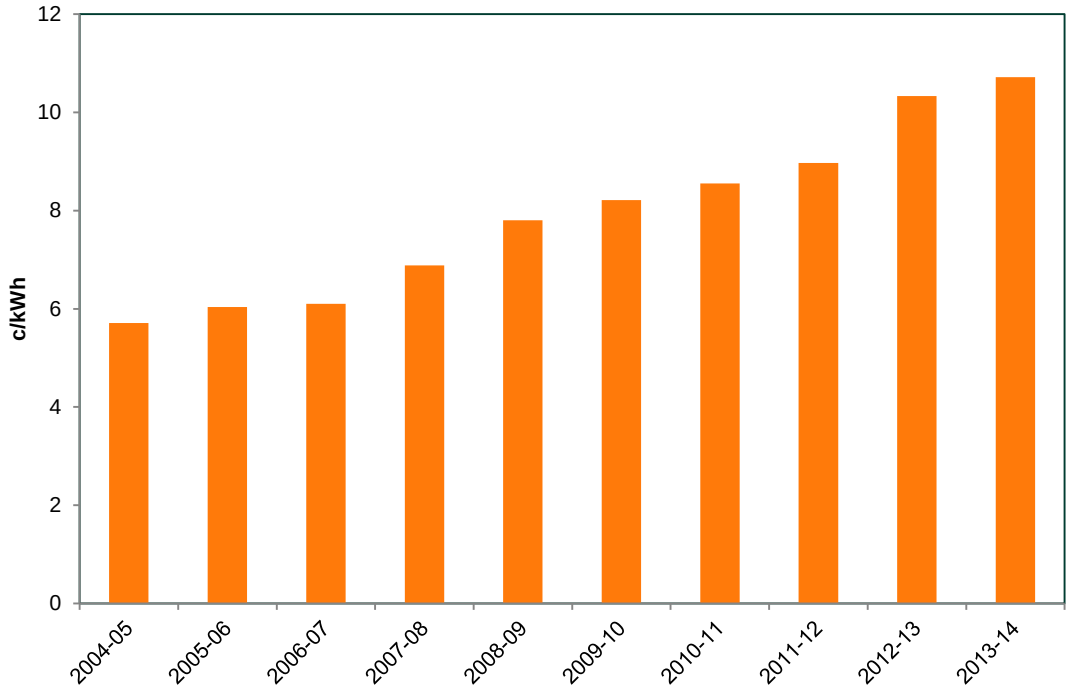
At the same time as green energy policy costs have grown, the other components of retail electricity bills have also increased, particularly the network components. Figure 8 and Figure 9 show the increase in mainland NEM retail electricity bills for residential and large business customers (expressed in c/kWh) over the period.

Figure 8 Mainland NEM Residential/Small Business electricity bills growth



Source: ROAM Consulting, Synergies Economic Consulting and a leading energy retailer

Figure 9 Mainland NEM Commercial electricity bills growth



Source: ROAM Consulting, Synergies Economic Consulting and a leading energy retailer

Appendix A provides an estimate of the total annual average cost of supply for residential customers (which includes daily fixed charges averaged over annual consumption). Over the past five years, residential cost of supply has increased by around 60%, from 23c/kWh in 2009-10 to 37c/kWh in 2013-14 (based on the NEM mainland average), and have more than doubled since 2003-04. (Changes are expressed in nominal dollars; changes in real dollars will be lower.)

For large business customers, data supplied by a leading energy retailer shows that average tariffs have increased by 30% over the period 2009-10 to present, and by 88% since 2004-05. Current average annual bills for business customers are in the range 9-16c/kWh; the lower rate compared to residential/small business customers reflects, amongst other things, lower network and retail charges (on a c/kWh basis).

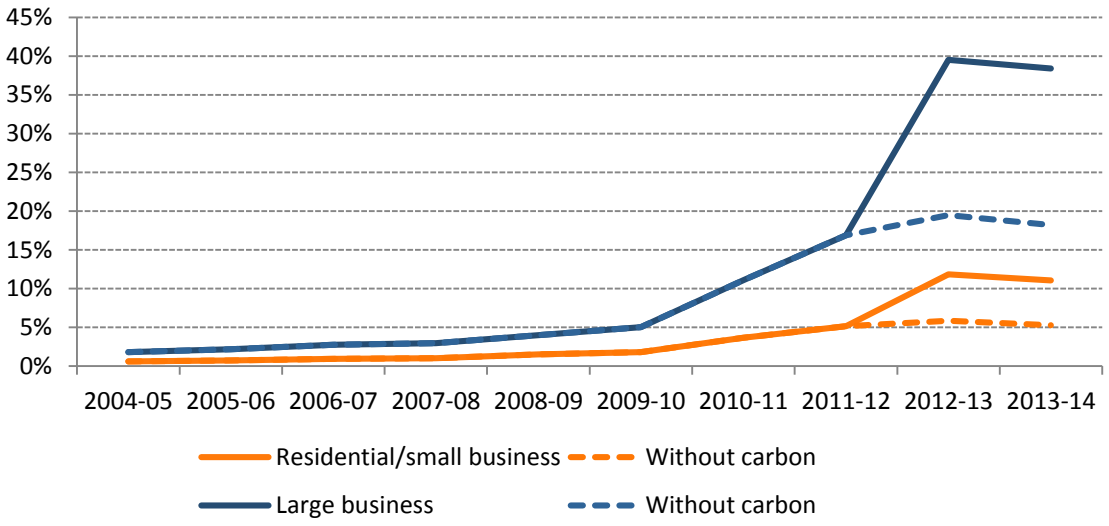
Green energy costs represent an increasing percentage of retail bills

Figure 10 shows the relative growth of both green energy policies and other tariff components expressed as the percentage of the mainland NEM annual retail electricity bills due to green energy policies.

The share of green energy policy costs on retail bills increased over the period 2003-04 to 2011-12, reflecting the introduction of new schemes and increasing liabilities under

each scheme. When the carbon price commenced (1 July 2012), the contribution of green energy policies approximately doubled for both large and small customers. If the carbon price is not considered, however, for the past three years, the remaining green energy policies have remained approximately constant as a percentage of retail bills (for both small and large customers). This reflects the significant increase in the other components of retail costs (mainly network charges).

Figure 10 Percentage of green energy policies on mainland NEM average electricity bills (no EITE exemptions)



Source: ROAM Consulting and Synergies Economic Consulting.

Green energy policies are a larger share of large business customer bills

For residential and small business customers, green energy policies currently represent 11-12% of retail bills, or 5% excluding the carbon price.

For large business customers, green energy policies represent up to 40% of their retail bills, or up to 20% excluding carbon. This is significantly higher than residential or small business customers because energy purchases (and associated liabilities) represent a higher fraction of retail bills than other components (network, retailer margin, etc.) for large users of energy on an energy "pro rata" basis.

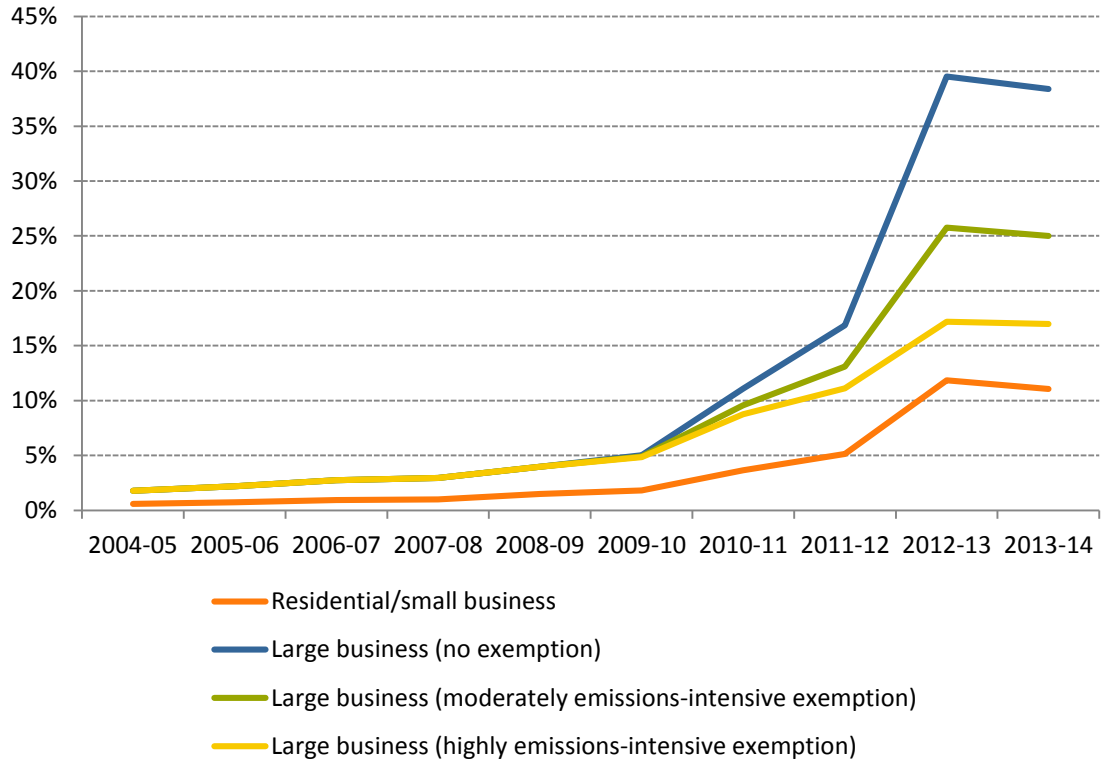
Exemptions for EITE industries provide a partial shield

As discussed, EITE industries receive partial exemptions for carbon, LRET and SRES liabilities. Exemptions for LRET and SRES costs are approximately 47% (moderately emissions-intensive activity) to 70% (highly emissions-intensive) in 2013-14, while for carbon emissions exemptions are between 66% to 94.5% respectively. For the amount of

electricity used for these activities, these exemptions can reduce the total cost of green energy policies by approximately 70 percent.

Figure 11 below provides the impact of green energy policies as a percentage of electricity bills for residential/small business customers and large business customers, including those large businesses involved in both moderately and highly emissions-intensive activities. The data show that for highly emissions-intensive activities, the effective cost of green energy policies is approximately 17% of the retail bill, still higher than the approximately 11% for residential/small-business customers. Green energy policies therefore currently place a greater relative impost on large customers than small.

Figure 11 Percentage of green energy policies on mainland NEM average electricity bills (with and without EITE exemptions)



Source: ROAM Consulting and Synergies Economic Consulting.

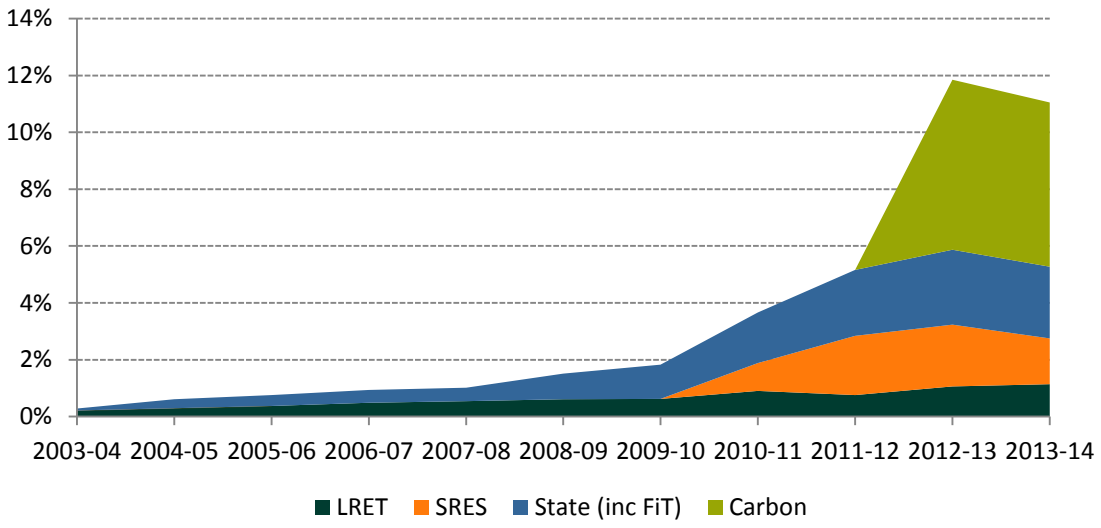
Both state and federal energy policies are significant contributors

Figure 12 to Figure 15 show the impact of the various green energy policies as a percentage of mainland NEM residential/small business and large business customer electricity bills (including EITE exemptions). The carbon price represents the most significant tariff component of green energy policies, being approximately 7% of the

retail cost (although we note that a portion of that cost was returned to some residential consumers through reduced taxation).

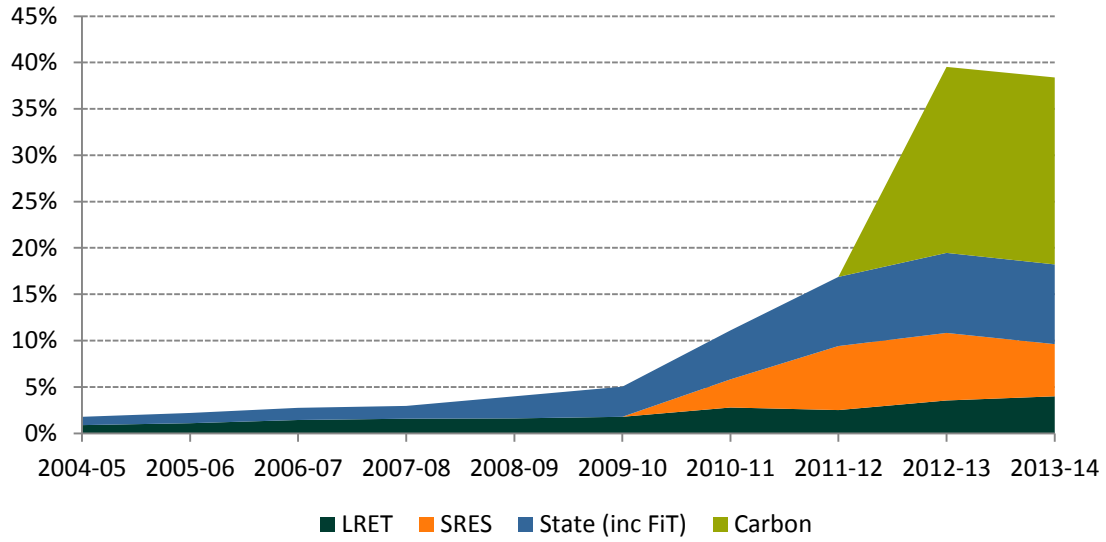
Figure 12 and Figure 13 show the increase in the contribution of green energy policies to mainland NEM charges to residential and large business customers respectively over the period from 2003-04 to 2013-14. Over this period, the impact of green energy policies on retail electricity prices grew from a negligible contribution to up to nearly 40% and 12% for residential and large business customers respectively. However, for eligible large customers, these impacts have been ameliorated by partial exemptions from charges.

Figure 12 Contribution of green energy policies to mainland NEM residential/small business electricity bills (% of total bill)



Source: ROAM Consulting and Synergies Economic Consulting.

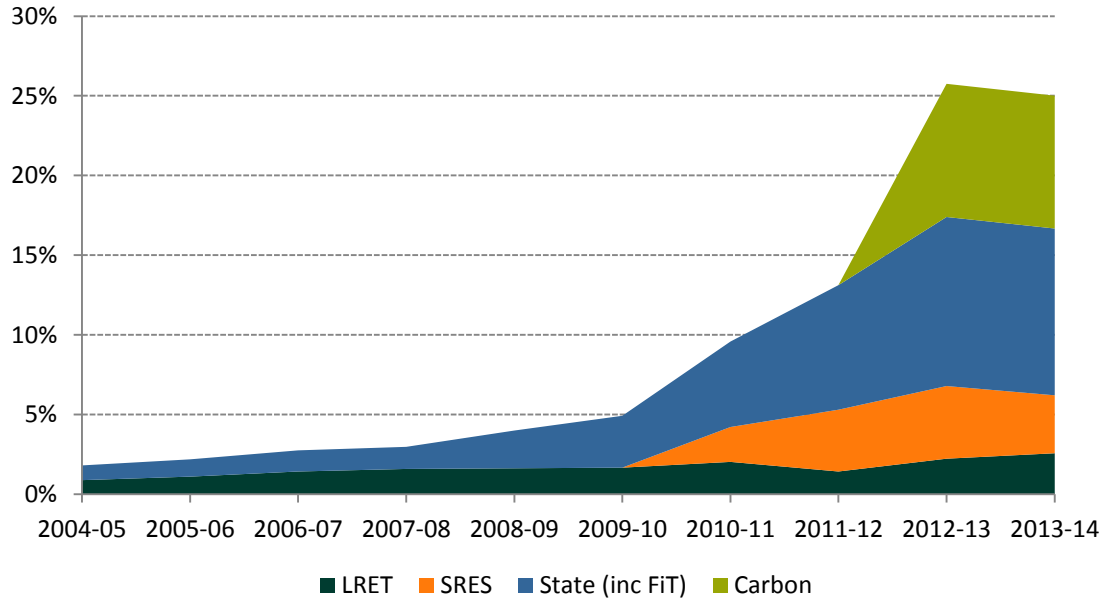
Figure 13 Contribution of green energy policies to mainland NEM large business electricity bills (% of total bill) (no exemptions)



Source: ROAM Consulting and Synergies Economic Consulting.

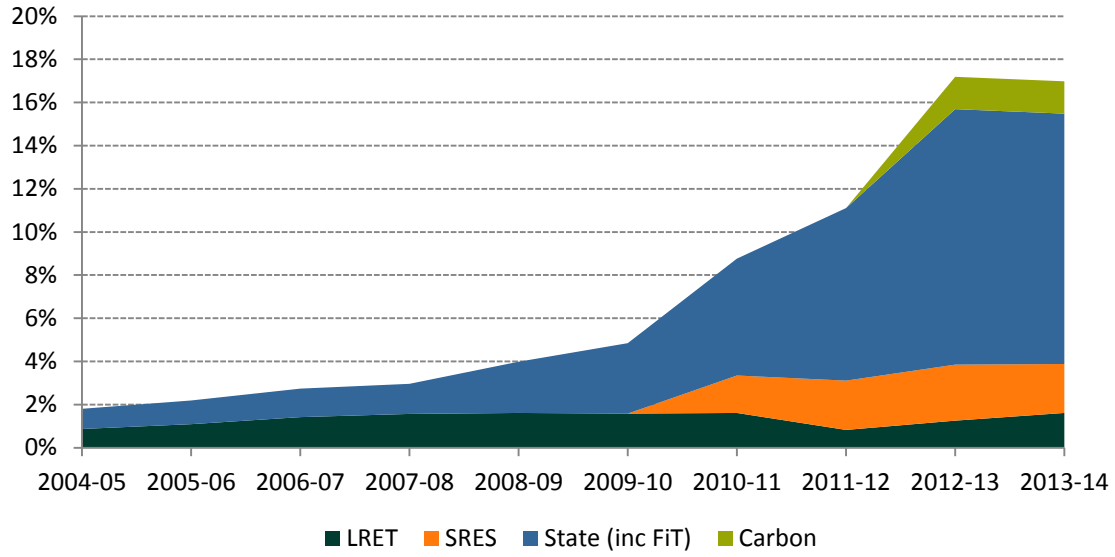
Figure 13 and Figure 14 indicate that the EITE exemptions applying to the federal energy policies reduce the impact of these schemes, especially carbon, for eligible large business customers, and increase the relative contribution of State green energy policies.

Figure 14 Contribution of green energy policies to mainland NEM large business electricity bills (% of total bill) (moderately emissions-intensive activity exemptions)



Source: ROAM Consulting and Synergies Economic Consulting.

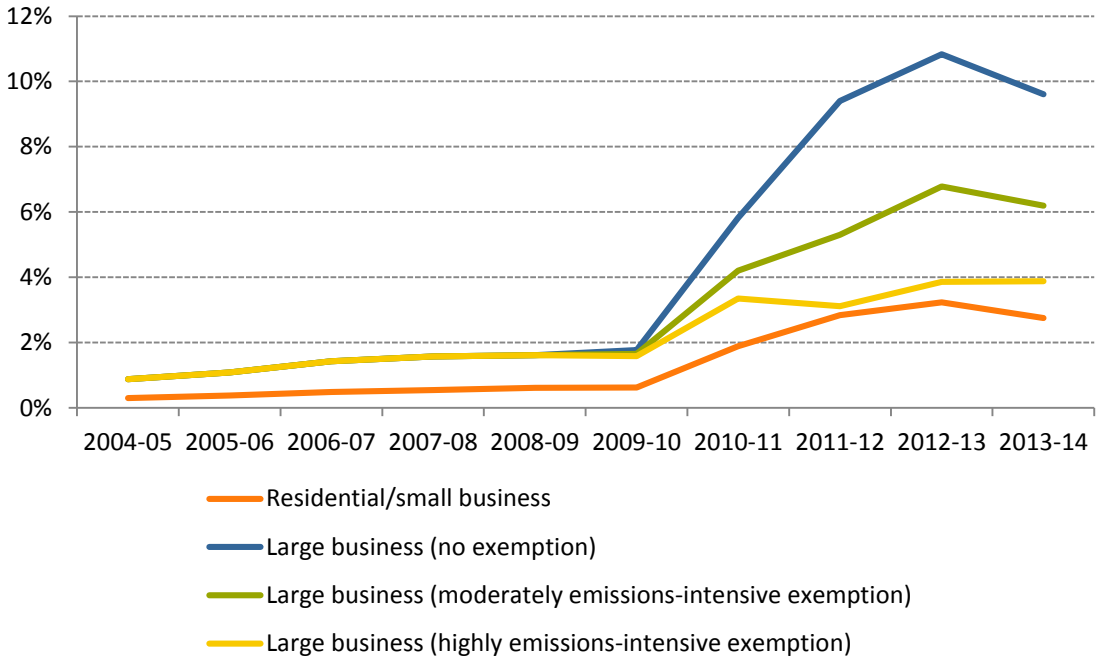
Figure 15 Contribution of green energy policies to mainland NEM large business electricity bills (% of total bill) (highly emissions-intensive activity exemptions)



Source: ROAM Consulting and Synergies Economic Consulting.

Figure 16 shows the impact of the renewable energy target scheme (LRET and SRES) on mainland NEM electricity bills over the 2004-05 to 2013-14 period. The sharp increase in 2010-11 reflects the introduction of the (uncapped) SRES. For a large business with no exemptions, the RET peaked at approximately 10.8% of the mainland NEM electricity bill in 2012-13.

Figure 16 Contribution of renewable energy target schemes to mainland NEM electricity bills (% of total bill)

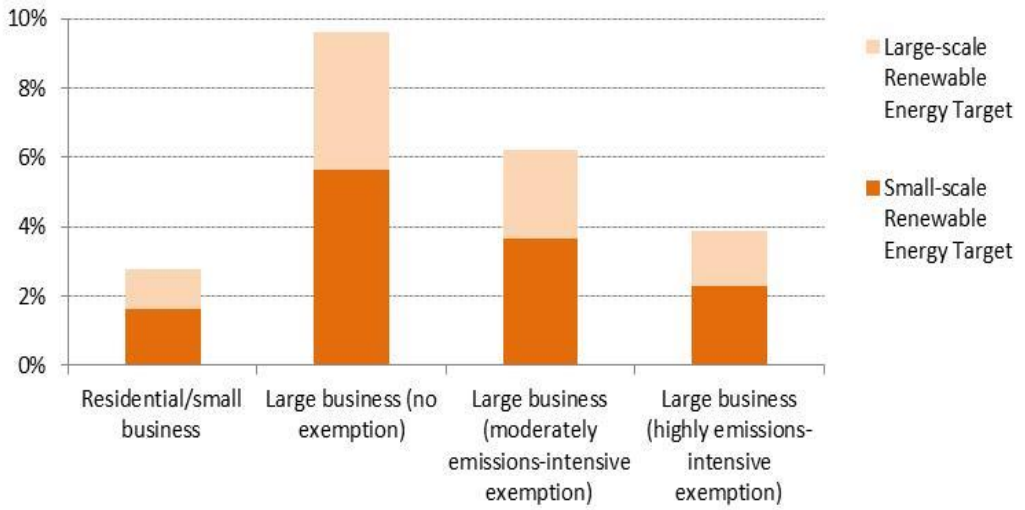


Source: ROAM Consulting and Synergies Economic Consulting.

LRET and SRES constitute 3-10% of retail bills

Figure 17 indicates that the Commonwealth renewable energy target schemes makes a significant contribution to retail electricity bills. During 2013-14, it is estimated that the RET comprised 3% of the typical household or small-business electricity bill and between 3.9 – 9.6% for a large business that consumes more than 5 GWh of electricity per annum, depending on its eligibility for partial exemption certificates. Therefore, as with other schemes, the LRET and SRES contribute a relatively higher percentage of costs for large businesses.

Figure 17 Renewable Energy Target as a proportion of electricity bills (2013-14)

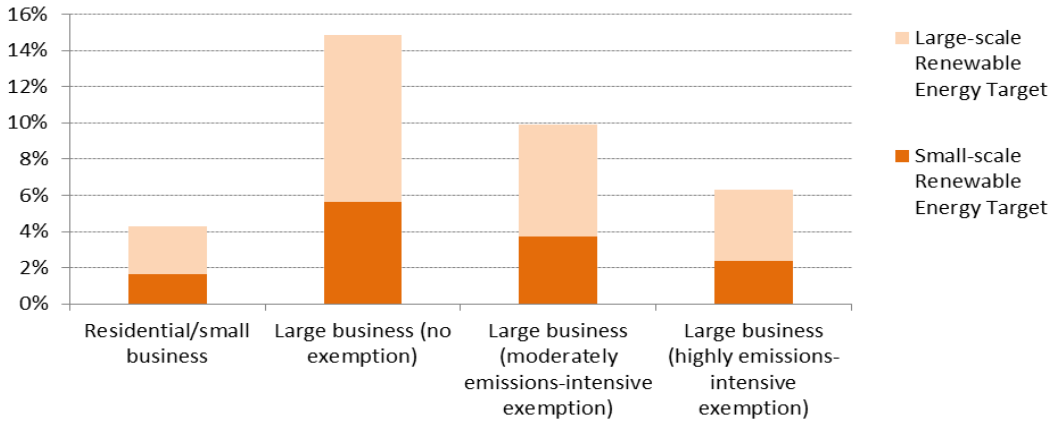


Source: ROAM Consulting and Synergies Economic Consulting.

As Figure 18 below shows if the value of Large-scale Generation Certificates (LGCs) under the RET were to reach the effective penalty price of $93 this would increase the RET as a proportion of an electricity bill for a large business customer to 15% and 4% for a typical household.[29] There is a risk of this occurring should the substantial wind investment required to meet the legislated mandatory LRET not be built in time, forcing up the value of LGCs.

[29] The modelled cost of the LRET is on the basis of the 2014 LRET liability of 16.95 million large scale generation certificates.

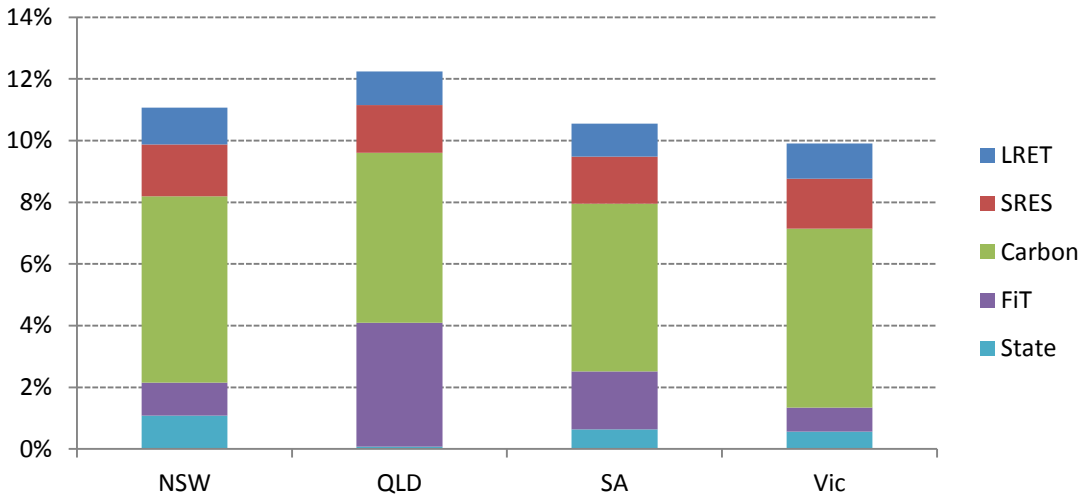
Figure 18 Renewable Energy Target as a proportion of electricity bills with LGCs at the effective penalty price of $93



Source: ROAM Consulting and Synergies Economic Consulting.

It is also notable that that there remains differences between each regions, with feed-in tariff costs significantly higher in Queensland, and state-based green energy policies being more significant in NSW, as demonstrated for residential bills in Figure 19. It shows that in 2013-14, the proportion of state residential electricity bills attributable to green energy policies was 11.1%, 12.2%, 10.5% and 9.9% in New South Wales, Queensland, South Australia and Victoria respectively. Comparable trends are observed for large-business customers.

Figure 19 Average cost of green energy policies as a proportion of state residential electricity bills, by region (2013-14)



Source: ROAM Consulting and Synergies Economic Consulting.

A Retail billing data

Residential tariffs were derived using the methodology described in Section 2.2.1. NEM mainland averages were calculated on an energy-weighted basis, defined by the 2012-13 annual regional energies published by AEMO in the 2013 National Electricity Forecasting Report.

Table A.1 Implied annual average c/kWh bill for residential and small business customers

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Queensland	15.29	15.69	16.47	16.92	19.44	21.07	24.34	27.57	29.39	32.51	39.14
New South Wales	16.06	17.44	18.66	19.00	20.42	19.36	23.24	25.60	30.01	35.26	35.76
Victoria	16.13	16.20	16.20	16.59	19.14	21.11	22.44	25.61	28.42	34.73	37.22
South Australia	21.63	21.63	20.76	21.32	22.92	23.93	24.67	29.19	34.26	38.62	39.70
Mainland NEM average	16.27	16.93	17.54	17.94	19.99	20.64	23.43	26.41	29.72	34.60	37.37

Source: AER 2013, State of the Energy Market 2013, December. Table 5.3, p. 130, Australian Bureau of Statistics 2014, Consumer Price Index, Australia (Cat # 6401.0), March, Table 11, Synergies Economic Consulting.

Retail billing data for large business customers (greater than 5GWh per annum) was provided by a leading energy retailer on a commercial in confidence basis.

B Green energy policy data

Table B.1 Cost of green energy policies on NSW electricity bills (nominal c/kWh)

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
LRET	0.0096	0.0248	0.0352	0.05	0.0656	0.0868	0.108	0.1256	0.1456	0.2392	0.2248	0.366	0.426
SRES	0	0	0	0	0	0	0	0	0	0.259	0.6184	0.7534	0.6036
FiT	0	0	0	0	0	0	0	0	0.06	0.35	0.38	0.37	0.38
CC Levy (net of FiT)	0	0	0	0	0	0	0.003017	0.01934	0.060874	0	0	0.214615	0.204615
GGAS/NGAC	0	0	0.02762	0.05505	0.08248	0.10991	0.13734	0.16477	0.1922	0.1126	0.033	0	0
ESS/ESC	0	0	0	0	0	0	0	0	0.009	0.072	0.109	0.151	0.184
Carbon	0	0	0	0	0	0	0	0	0	0	0	2.07	2.16

Source: ROAM Consulting

Table B.2 Cost of green energy policies on QLD electricity bills (nominal c/kWh)

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
LRET	0.0096	0.0248	0.0352	0.05	0.0656	0.0868	0.108	0.1256	0.1456	0.2392	0.2248	0.366	0.426
SRES	0	0	0	0	0	0	0	0	0	0.259	0.6184	0.7534	0.6036
FiT	0	0	0	0	0	0	0	0.02	0.09	0.36	0.88	1.46	1.57
GEC	0	0	0	0.115	0.127675	0.14035	0.153025	0.23	0.1795	0.129	0.065	0.048	0.031
Carbon	0	0	0	0	0	0	0	0	0	0	0	2.07	2.16

Source: ROAM Consulting

Table B.3 Cost of green energy policies on SA electricity bills (nominal c/kWh)

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
LRET	0.0096	0.0248	0.0352	0.05	0.0656	0.0868	0.108	0.1256	0.1456	0.2392	0.2248	0.366	0.426
SRES	0	0	0	0	0	0	0	0	0	0.259	0.6184	0.7534	0.6036
FiT	0	0	0	0	0	0	0	0.028948	0.061854	0.214623	0.489374	0.72941	0.746903
REES	0	0	0	0	0	0	0	0.219	0.251	0.251	0.251	0.251	0.219
Carbon	0	0	0	0	0	0	0	0	0	0	0	2.07	2.16

Source: ROAM Consulting

Table B.4 Cost of green energy policies on VIC electricity bills (nominal c/kWh)

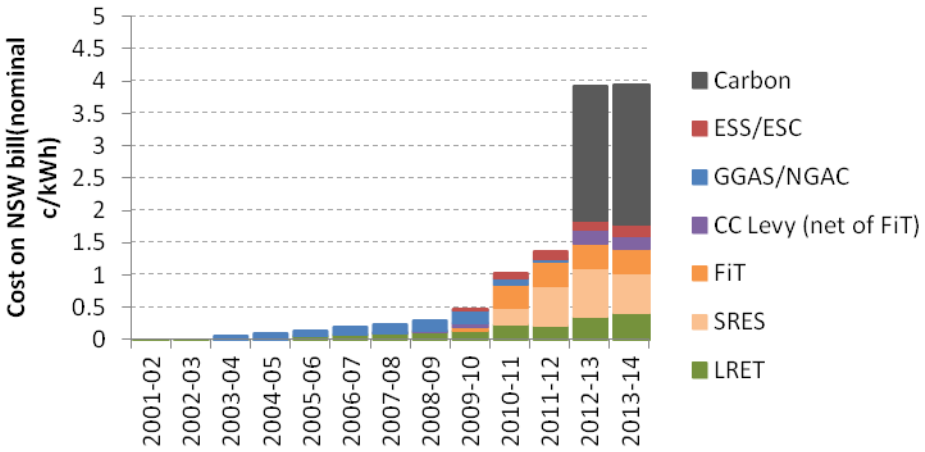
	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
LRET	0.0096	0.0248	0.0352	0.05	0.0656	0.0868	0.108	0.1256	0.1456	0.2392	0.2248	0.366	0.426
SRES	0	0	0	0	0	0	0	0	0	0.259	0.6184	0.7534	0.6036
FiT	0	0	0	0	0	0	0	0	0.06	0.16	0.24	0.28	0.29
VEET	0	0	0	0	0	0	0	0.164724	0.182719	0.197606	0.40982	0.253147	0.209279
Carbon	0	0	0	0	0	0	0	0	0	0	0	2.07	2.16

Source: ROAM Consulting

C Green energy policy impacts

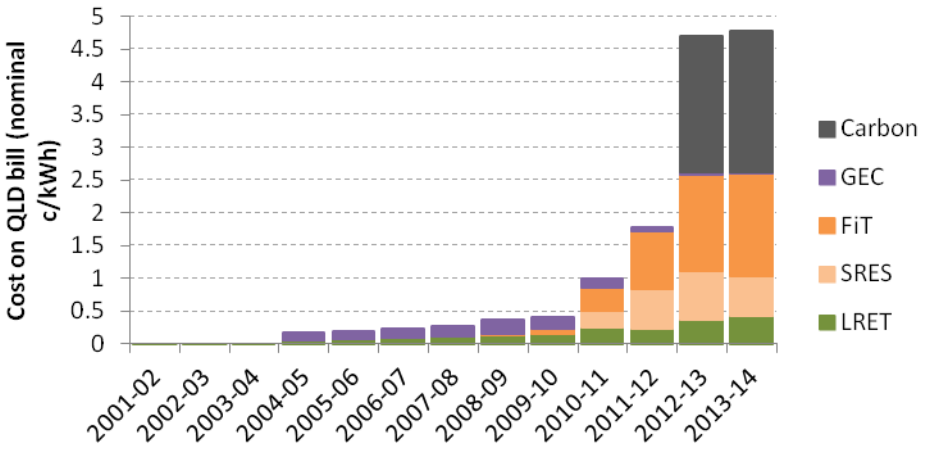
The charts below show growth in the contribution of the various green energy policies to NSW, Queensland, Victoria and South Australia retail electricity bills over the period 2001-02 to 2013-14.

Figure C.1 Cost of green energy policies on NSW electricity bills (nominal c/kWh)



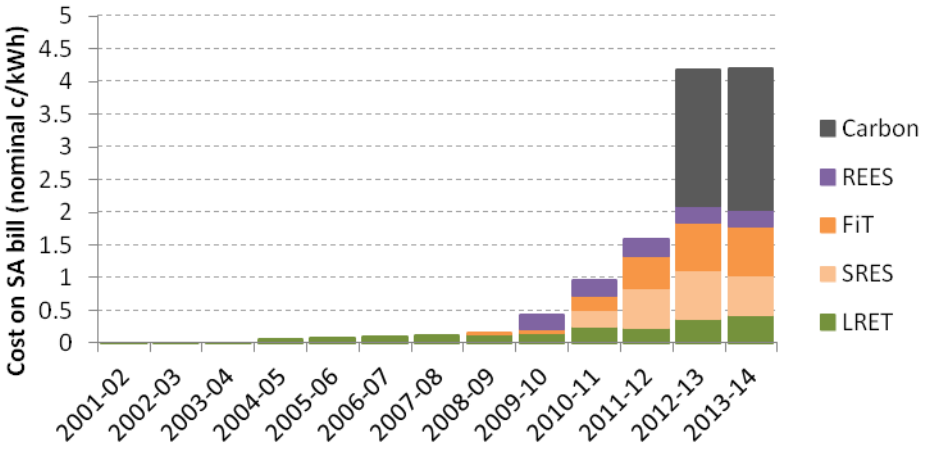
Source: Synergies Economic Consulting and ROAM Consulting

Figure C.2 Cost of green energy policies on QLD electricity bills (nominal c/kWh)



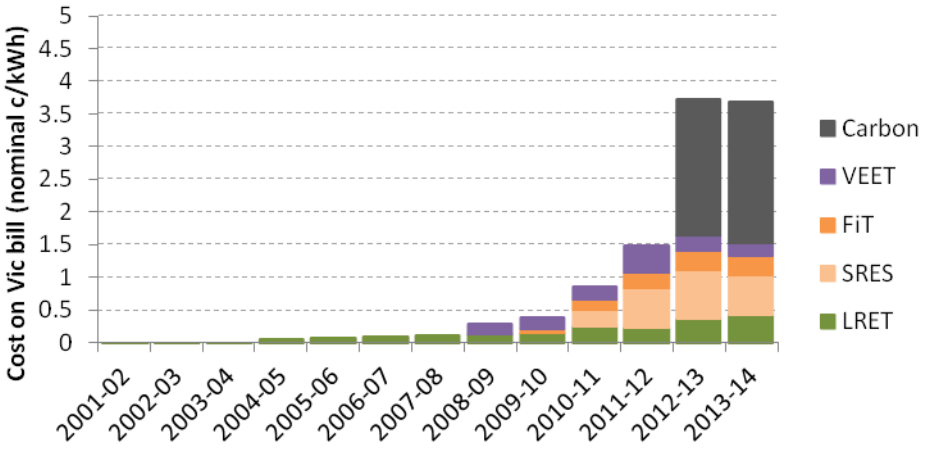
Source: Synergies Economic Consulting and ROAM Consulting

Figure C.3 Cost of green energy policies on South Australian electricity bills (nominal c/kWh)



Source: Synergies Economic Consulting and ROAM Consulting

Figure C.4 Cost of green energy policies on Victorian electricity bills (nominal c/kWh)



Source: Synergies Economic Consulting and ROAM Consulting