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Assessing the impact of the renewable energy target

Australian Chamber of Commerce and Industry (Lead Sponsors)
Business Council of Australia
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Acronyms

ACCI	Australian Chamber of Commerce and Industry
AEMO	Australian Energy Market Operator
CGE	Computable general equilibrium
DAE	Deloitte Access Economics
DEMM	Deloitte Electricity Market Model
DREMM	Deloitte Renewable Energy Market Model
DAE-RGEM	Deloitte Access Economics – Regional General Equilibrium Model
DGM	Deloitte Gas Model
ESO	Electricity Statement of Opportunities
GDP/GSP	Gross domestic/state product
GHG	Greenhouse gas emissions
GNP	Gross national product
LGC	Large scale generation certificates
LRET	Large scale renewable energy target
NEM	National Electricity Market
NTNDP	National Transmission Network Development Plan
REC	Renewable energy certificate
RET	Renewable energy target
SRES	Small scale renewable energy scheme
STC	Small-scale Technology Certificates

This project was in part funded by the Consumer Advocacy Panel (www.advocacypanel.com.au) as part of its grants process for consumer advocacy projects and research projects for the benefit of consumers of electricity and natural gas.

Key messages

- The Renewable Energy Target (RET) scheme, which encompasses the Large-scale Renewable Energy Target (LRET) and the Small Scale Renewable Energy Scheme (SRES), was developed with the intention to ensure that 20% of Australia's electricity demand was met by renewable energy technologies by 2020. Both LRET and SRES schemes involve subsidies paid by consumers to the renewable energy industry to encourage a greater level of investment in renewable energy than the market would otherwise deliver. The schemes were designed to reduce the negative externalities associated with traditional fossil fuel generation.
- The LRET offers subsidies to large-scale renewable power stations and sets a fixed, legislated target, requiring that 41 TWh of Australia's electricity must come from renewable sources by 2020. In contrast, the SRES is an uncapped scheme, and provides financial incentives for the installation of small scale generation technologies such as rooftop solar PV and solar hot water.
- The fixed 41 TWh LRET target was developed on the basis of electricity demand forecasts made in 2009. However, as Australia's current and projected electricity demand has fallen, the RET in its current form will result in an overshooting of the intended 20% target, leading to an estimated 28% of demand being met by both large and small scale renewable energy generation.
- In providing a subsidy to both large and small scale renewable energy generators, the RET brings forward renewable energy investments (particularly large scale renewable energy generation). This report examines how the current RET scheme is likely to impact on the Australian electricity market and the broader economy in the near and long term. In doing so, it explores a wider set of issues than some recent reports that have focused just on the implications for the electricity sector.

Scenarios and methodology

- Since its inception, the RET scheme has evolved in line with the findings from expert reviews and climate change priorities at the time. Acknowledging the inherent uncertainties involved in forecasting policy impacts over a long modelling horizon, we have developed three alternative RET scenarios.
- The RET continuation counterfactual assumes that the current scheme will lead to renewable energy sources representing 28% of Australia's fuel mix by 2020, which is much higher than the 20% share initially anticipated. The alternative scenarios compared against this counterfactual are:
  - RET abolished scenario: All requirements under the RET are removed from July 2014. The present share of 17% of renewable energy generation is held constant to 2030.
  - RET grandfathering scenario: Requirements under the RET are removed from July 2014, although support is continued for existing renewable energy generators. The present share of 17% of renewable energy generation is held constant to 2030. However, the continued payment for LGCs means that retail electricity prices are higher than for the first scenario.
  - RET real 20% scenario: The fixed RET is adjusted for changes in electricity supply and demand. A real 20% target is imposed for 2020 and held constant until 2030.
- Modelling of electricity and LGC prices are inherently complex and vastly variable based on the inputs and the assumptions. As a result, the costs and benefits estimated in this report will also vary accordingly. Electricity price and renewable energy generation projections are modelled through the Deloitte Electricity Market Model and Renewable Energy Model. Computable General Equilibrium modelling is used to measure the economy-wide impacts of a RET.

Medium term impacts on electricity users

- Under the current RET scheme, wholesale prices are projected to fall across the National

Electricity Market regions. The sharpest reductions in wholesale prices are in Victoria, New South Wales and South Australia — where wind power generation is also the highest. However, due to the higher costs of procuring certificates to comply with the RET, retail electricity prices increase by more than the reduction in wholesale prices. Overall, this results in a net increase in electricity prices.

- Retail prices for residential, commercial and industrial consumer groups are projected to be the lowest under the RET abolished scenario. For example, compared to the RET continuation counterfactual, projected yearly residential customer bill impacts range from a reduction of $47 to $65 per year over the period 2015 to 2030 under the RET abolished scenario. Similarly, under the RET grandfathering scenario, residential customers' bills could reduce by between $17 and $39 per year over 2015 to 2030 relative to the counterfactual, while the RET 20% by 2020 scenario could result in reductions of between $21 and $36 per year over the period.
- These results are similar in magnitude to those presented in the ACIL Allen draft results for the period to 2020. However, the results diverge after 2020 with ACIL Allen predicting that households would be better off if the RET were to remain in place after 2020. In contrast, we found that households would continue to be worse off if the RET was not to be abolished out until 2030. The differences in the two analyses appear to arise from differences in the capital costs, fuel and contracting.

Economic benefits of adjusting the RET

- Adjusting the current RET scheme is projected to result in economic gains for the Australian economy. The gains are largely driven by reductions in electricity prices (compared to the current RET) due to a redirection of investment to efficient and less costly energy sources. However, there are some offsetting factors associated with the fact that there is less investment in renewable energy generation.
- The full benefits derived by completely abolishing the RET can be gauged by comparing the RET abolished scenario to the RET continuation counterfactual. Here, our model projects that abolishing the RET results in an increase in GDP over 2014 and 2030 of $28.8 billion in NPV terms. The effective cost of carbon abatement to GDP due to the RET is estimated to be $103 per tonne of CO_2-e — more than four times the carbon tax.
    - The rise in industry output also leads to an increase in labour demand, with an average of 5,000 full-time jobs created over the modelling period if the RET is completely abolished. Over the same time horizon, household consumption is estimated to rise by $20.5 billion should the RET be completely removed.
    - At a State-level, owing to its heavy brown coal power base, Victoria is forecast to gain more jobs than any other State by 2020 - around 1,300 FTE workers. This is compared to South Australia, where there is a higher share of wind generation; around 240 job gains are projected in 2020.

Table I: National impacts of alternative RET policies relative to the current RET scheme (NPV 2014-2030)

Macroeconomic variable	RET abolished	RET grandfathering	RET real 20%
Absolute deviations relative to the RET continuation counterfactual			
Real GDP ($M)	28,837	16,554	13,931
Real household consumption ($M)	20,473	12,130	10,041
Real Investment ($M)	-10,229	-10,229	-7,616
Employment (Average, FTE)	5,049	2,863	2,419
Average yearly earning per person ($)	1,257	678	579

- Comparing the other two scenarios (RET grandfathering and RET real 20%), against the current

RET scheme represents the benefits of moving to alternative RET schemes going forward. As both these scenarios assume that at least some of the requirements of the RET are either removed or adjusted downwards, their implementation would mean benefits in the form of *cost reductions* from the current RET, relatively speaking.

- The RET grandfathering scenario is expected to increase GDP by $16.5 billion, involving the gain of almost 2,900 full-time jobs on average compared to continuing the RET in its current form. In comparison, moving to the RET real 20% scenario would increase GDP by $13.9 billion in NPV terms, with a gain of around 2,400 full-time jobs on average.
- Much like the national results, State impacts for the real 20% scenario are relatively muted when compared to a RET continuation counterfactual. In 2020, Queensland is projected to experience increase in GSP of around $440 million, followed by gains of around $330 million in both New South Wales and Western Australia at the same point in time.

- The RET in its current form is also associated with wealth transfers and LGC payments.
  - Wealth transfers arise because renewable energy displaces existing energy. Relative to the RET grandfathering scheme, continuing the RET is projected to result in gross transfers from fossil fuel generators to renewable energy generators of around $5.7 billion over the 2015-2030 period. Similarly, in comparison to the RET real 20% arrangement, the current RET is associated with revenue transfers of around $5.4 billion from fossil fuel generators to renewable energy generators.
  - Apart from revenue earned in the electricity market, renewable energy producers also receive income from generating LGCs. The cost of LGCs is then passed on to electricity customers. Continuing the RET is estimated to be associated with around $17 billion in gross LGC payments in NPV terms over the 2015-2030 period. In contrast, the RET real 20% and RET grandfathering scenarios are projected to result in gross LGC payments of $8 billion and $7 billion (in NPV terms) respectively.

1 Introduction

Climate change presents a considerable challenge for policy makers across the globe, often requiring a trade-off between environmental and economic objectives. In Australia, electricity is predominantly generated from coal which accounted for around 35% of our greenhouse gas (GHG) emissions in 2010. A key area of interest for policy makers has therefore been to engineer a means of reducing the GHG emissions associated with electricity generation — and do so at the least possible economic cost.

Over the past decade or so, there have been several attempts at both a State and Federal level to reduce our carbon footprint. One such response is the Commonwealth Government's Renewable Energy Target (RET) scheme, which encompasses two elements:

- Large-scale Renewable Energy Target (LRET), which requires that 41 TWh of Australia's electricity must come from renewable sources by 2020. As part of the LRET scheme, financial incentives are provided for the establishment or expansion of renewable power stations, intended to bring forward investment in renewable energy.
- Small Scale Renewable Energy Scheme (SRES), which provides an upfront subsidy to small scale generation technologies such as rooftop solar PV and solar hot water.

The RET scheme was implemented with the intention of lowering the externalities associated with carbon emissions from fossil fuel energy generation and encouraging the commercialisation of renewable energy technologies. Both LRET and SRES schemes involve subsidies paid by consumers to the renewable energy industry to encourage a greater level of investment in renewable energy than the market would otherwise deliver, given the externalities. Once the market for renewable energy is more developed, this rationale is less important.

Since the current RET scheme's introduction, investment in renewable energy has helped shift our electricity generation mix to cleaner and more diverse sources – supporting growth and employment in the renewable energy sector.

However, such subsidy-induced investment generates costs to broader parts of the economy that need to be offset against these gains. In influencing the electricity generation mix, the RET scheme affects the price paid for electricity, which is an important input into many economic activities.

Our task and approach

The Government is currently undertaking a review of the RET scheme by an expert panel. As part of their submission to the review, the Australian Chamber of Commerce and Industry (ACCI) has engaged Deloitte to quantify the impacts of the RET scheme on the Australian energy market and the ensuing implications for the broader economy.

In order to isolate electricity market impacts from those faced by the wider economy, we have drawn on economic models developed and operated by Deloitte and Deloitte Access

Economics. These include the Deloitte Electricity Market Model (DEMM), Deloitte Renewable Energy Market Model (DREMM) and the Deloitte Access Economics Regional General Equilibrium Model (DAE-RGEM).

On the basis of the retail electricity prices and investment patterns forecasted from the energy and electricity market modelling, the CGE model estimates the changes in key macroeconomic variables caused by altering the current RET scheme.

Acknowledging the uncertainty around the future direction of the RET scheme and its components, we have modelled three possible alternative policy scenarios against the continuation of the RET scheme. The deviation between each alternative scenario and the RET continuation counterfactual represent an estimate of the gains associated with altering the current RET over the period 2014-2030.

Report structure

The remainder of this report is organised as follows:

- **Chapter 2,** provides the overarching framework, parameters and data sources that have been used in the quantification process.
- **Chapter 3,** presents outputs from the energy and electricity modelling, including detailed electricity price paths, fuel mix projections and level of carbon abatement.
- **Chapter 4,** outlines the range of economy-wide impacts that are likely to occur at both a national and state level.

2 Methodology

Altering the RET will have both positive and negative impacts. The RET's more direct and immediate effects manifest in the electricity market via changes in supply and investment in renewable energy generation. The reliance of our modern economy on electricity as a vital input to many day-to-day activities means that induced changes in electricity prices has the potential to affect large segments of the economy. In contrast, the changes to investment activity in energy generation are likely to impact smaller niches.

It is important to note that we have not included an assessment of the environmental costs and benefits of adjusting or abolishing the RET. We also have not modelled potential benefits of developing local expertise within renewable energy. Including an assessment of these elements would be likely to influence the broader costs and benefits of the RET.

A description of the scenarios, models, key assumptions and relevant source documents are outlined below.

2.1 Scenario development

Forecasting over an extended time horizon is always associated with uncertainty. While policy changes, technological advancements and economic growth rates have considerable influence on the decision to invest in renewable energy sources, they are inherently difficult to predict. Indeed, since its inception, the RET scheme has evolved in line with the findings from expert reviews and climate change policy priorities at the time.

For this reason, with guidance from ACCI, we have developed a total of three scenarios, aimed at reflecting a spectrum of alternative policy options. These include the complete RET abolishment from July 2014, a grandfathering scheme and adjustments to the RET to account for changes in electricity demand and supply.

We have adopted an incremental approach whereby each scenario is compared against a single counterfactual over the period 2014 to 2030. The ***counterfactual considered in this study is the continuation of the RET scheme in its current form***, which include both LRET and SRES components.

The electricity market results present *absolute* price paths and the energy generation mix under the three alternative RET scenarios and the RET continuation counterfactual. The CGE modelling, however, presents results in the form of *deviations* between each scenario and the counterfactual. In this respect, there are three sets of CGE results, each highlighting the incremental economic benefits of a complete RET removal, a partial removal (grandfathering) or the adoption of a revised real 20% target relative to the current RET scheme.

The scenarios developed in this analysis are discussed in more detail below.

1) RET abolished scenario

The RET abolished scenario is designed to reflect a scenario where the requirements under the RET are completely removed. That is, from 1 July 2014, retailers will not be obligated to purchase Renewable Energy Certificates (RECs) or Small Scale Technology Certificates (STCs).

Renewable energy generators are characterised by low marginal costs of production. Once in operation, they are essentially self-sufficient, able to draw on natural inputs for production. This is a key difference between fossil fuel producers that generally experience higher marginal costs as they move up the supply curve and resources become depleted or need to be extracted from harder to reach areas.

Key assumptions

- Existing renewable energy generators will remain in the electricity market until 2030.
- In the NEM, renewable energy generators are always dispatched before scheduled fossil fuel generators such as gas and coal fired generators. This is because renewable energy has a very low marginal cost of production.
- No impact on risk premium generally due to this change in government policy (political risk).

2) RET grandfathering scenario

Under the RET grandfathering scenario, the RET requirements cease from 1 July 2014 onwards. Similar to the RET abolished scenario, retailers are no longer required to purchase RECs from new renewable energy generators. However, those renewable energy generators that are already in the electricity market are assumed to continue to receive support through the payments of RECs.

In terms of the LRET and SRES components, the grandfathering scenario specifies that:

- No LRET from 1 July 2014: The annual LRET target as at 1 July 2014 (16,100 GWh) remains frozen through to 2030. That is, there is no additional requirement to create or purchase new Large Scale Generation Certificates (LGCs) beyond the target set for 2014.
- No SRES from 1 July 2014: There is no legislated requirement for liable entities to purchase or surrender STCs (created from installing hot water heaters, heat pumps and small scale solar panel, hydro and wind systems) from 1 July 2014.

Key assumptions

- Existing renewable energy generators are still assumed to exhibit low marginal costs of production. In addition to the marginal price of electricity they receive from being awarded wholesale contracts, they will continue to receive the revenues from REC payments.
- As the scheme ceases, there is no new RET-led investment in renewable energy going forward. This means that investment patterns under the RET grandfathering scenario and the RET abolished scenario are the same.

- No impact on risk premium generally due to this change in government policy (political risk).

3) RET real 20% scenario

Since the fixed RET 2020 target of 41 TWh of renewable energy generation was set, Australia's current and projected electricity demand has fallen. When the RET target was originally put in place, Australia's electricity demand was forecast to be 300 TWh by 2020. As electricity demand is now forecast (by AEMO, IMO and other sources) at around 230 TWh, attempts to meet the original 41 TWh target will result in a much higher share of renewable energy in the national fuel mix than initially expected.

The RET real 20% scenario specifies that rather than enforcing a fixed renewable energy target regardless of changes in demand and supply, the LRET is adjusted to require liable entities to procure 20% of their energy from renewable sources until a real 20% from 2001 demand levels is reached.

Compared to both the RET abolished and grandfathering scenarios, there are likely to be some new renewable energy entrants in to the market. Investment is also likely to be somewhat higher, driven by the need to encourage more renewable energy entrants into the market as long as there is a shortfall between the current share of renewables in the electricity market and the adjusted real 20% LRET target.

Key assumptions

- SRES support is discontinued. Rooftop solar is assumed to continue to grow even without the support of SRES.
- Legislated requirements to comply with a real 20% RET remain in place until 2030.
- No impact on risk premium generally due to this change in government policy (political risk).

2.2 Electricity market modelling

We have calculated the retail price of electricity for the residential, commercial and industrial customer segments. Retail prices incorporate wholesale costs, network costs, cost to serve, cost of complying with the RET (including the cost of LGCs and STCs) and retail margin.

Wholesale costs

Modelling of electricity and LGC prices are inherently complex and vastly variable based on the inputs and the assumptions. As a result, the costs and benefits estimated in this report will also vary accordingly. We have used our DEMM to forecast wholesale prices for each of the NEM regions, Western Australia and the Northern Territory. For the NEM (which is an energy only market) our model uses a combination of optimisation and game-theory models to simulate the investment, bidding and dispatch behaviour of the Australian electricity market to meet long term growth in electricity demand and emission constraints.

Demand is modelled using a load duration curve approach. This approach divides the half hourly load from peak to off-peak into 40 load blocks for each quarter. Peak blocks are typically smaller in order to capture the market behaviour and peak prices during these periods. This approach significantly reduces the size of the model and allows the dispatch and investment behaviour to be modelled in a single optimisation.

Key outputs from the model include an optimised capacity entry plan, generation dispatch, transmission flows and electricity prices. The iterative interaction between the bidding model and capacity optimisation captures the essence of a market-led expansion strategy.

For Western Australia and the Northern Territory, our model relies on plant data, contracts and market information.

The key assumptions underpinning our wholesale cost modelling are listed below:

- Demand and energy sales for the NEM region are based on the 2013 Electricity Statement of Opportunities (2013 ESOO) as published by the Australian Energy Market Operator (AEMO). We have adjusted for the closure of the Alcoa smelter in Victoria and slightly higher penetration residential of Solar PV
- Generation plant data is obtained from the National Transmission Network Development Plan 2013 (NTNDP 2013), as published by AEMO. We have updated generation capacity for known public announcements for specific generation plant (such as Tarong Power Station)
- Fuel costs for coal based power station are based on the assumptions in the NTNDP 2013
- Gas prices for Combined Cycle Gas Turbine (CCGT) and Open Cycle Gas Turbine (OCGT) generation are based on the Deloitte Gas Model (DGM)
- New generation entry is restricted to gas and renewables
- Carbon prices are set to zero from 1 July 2014 – consistent with government objectives
- Hydro generation is restricted to long term averages
- Under the RET continuation counterfactual we assume that fossil fuel generators will be unable to be highly contracted in the market and this lower contract position will be reflected in their bidding behaviour. This is in contrast to their higher contract position under the RET grandfathering scenario. This change in generator contracting and bidding behaviour results in narrowing of the wholesale price spread between the two scenarios.

We have not modelled wholesale costs based on a Long Run Marginal Cost (LRMC) methodology. Given the dominance of large vertically integrated players in the NEM, we believe that wholesale costs calculations based on a LRMC methodology would provide estimates of efficient and sustainable wholesale prices. This is particularly relevant in an energy only market, such as the NEM, as cheaper renewable generation displaces other more expensive forms of generation lowering wholesale spot prices. For example, in setting standard contract prices for residential customers, IPART predominantly uses a LRMC methodology to estimate wholesale costs.[1]

Network costs

Network costs are based on the 2014 published network tariffs. We have kept network tariffs constant in real terms over the forecast period. This assumption is consistent with the current view that network investment has peaked and that going forward network prices should move in line with inflation.

However, we note that additional investment in transmission assets may be required to connect renewable generation (particularly onshore wind). As it is difficult to quantify this increase in investment and its impact on network costs, we have not included these additional costs in our analysis.

Cost to serve

Our assumptions are as follows:

- Residential customers - $100/customer. This is largely consistent with regulatory benchmarks
- Commercial customers - $2000/customer, based on market knowledge
- Industrial - $10,000/customer, based on market knowledge.

Cost of complying with the RET

In calculating the cost of the LRET, we have forecasted the prices for LGCs based on our DREMM. The DREMM is a partial equilibrium model used to assess the impacts of the LRET. The demand for LGCs is essentially governed by legislation (i.e. perfectly inelastic).

The LGC price is the price of renewable energy generation less wholesale electricity prices, capped by the LGC price penalty. The model assumes that the LRET target (subject to financial viability) is met and that banked LGCs used over a three year period.

Our DREMM allows mainly onshore wind generation. The cost of entry of onshore wind generation is based on the NTNDP 2013 as this is consistent with recent market outcomes.

We have based the price of STCs as $40/MWh based on the clearing price.

Retail margin

Our approach to setting retail margin for the three customer segments is outlined below.

- Residential customers – We have calculated the retail margin for each state for 2014 based on the average discounted market offer less the total cost to supply (includes wholesale costs, network costs, RET costs and retail cost to serve). We have kept this retail margin constant over the forecast period

[1] IPART, Review of regulated retail prices and charges for electricity, Final Report June 2013, page 58

- Commercial customers – retail margin is kept constant
- Industrial customers – retail margin is kept constant.

2.3 CGE modelling

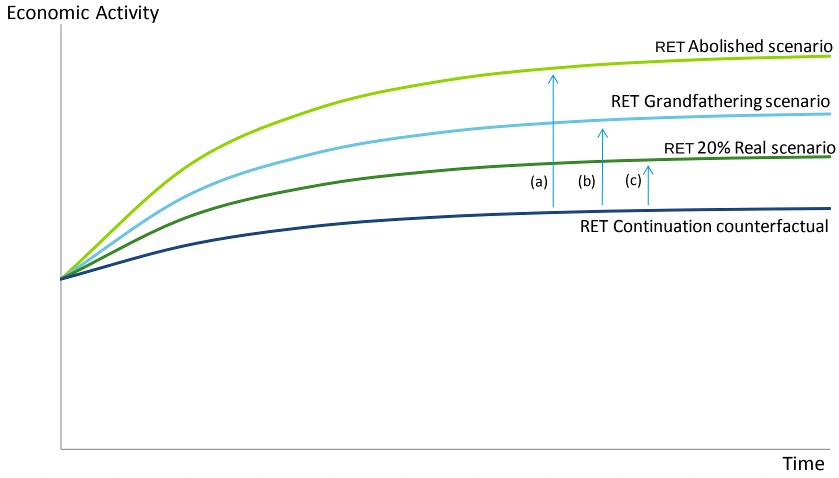
To simulate how the RET scheme permeates across the wider economy, we have used Deloitte Access Economics' in-house General Equilibrium Model (DAE-RGEM). We modelled alternative RET scenarios by reducing the retail electricity price below the RET continuation counterfactual. This was achieved by lowering renewable energy investment levels.

DAE-RGEM is a recursive dynamic model that solves year-on-year over a specific time. The model is then used to project the relationship between variables under different scenarios, over a predefined period. This is illustrated in Figure 2.1 below. The variable represented on the vertical axis of Figure 2.1 could be one of the hundreds of thousands represented in the model, ranging from macroeconomic indicators such as real gross domestic product (GDP), gross national product (GNP), consumption, exports, imports or employment. In the figure, the percentage changes in the variables have been converted to an index (= 1.0 in 2014) and are projected to increase by 2030.

The diagram provides a stylised representation of the scenarios and counterfactual that forms the basis of our analysis. The model is solved year-by-year from time 0, which reflects the base year of the model (2007), to a predetermined end year (in this case 2030). We compare the RET continuation counterfactual against each of the alternative RET scenarios. These scenarios represents the impacts of modifying the current RET scheme. The impacts of adjusting the current RET scheme are reflected in the differences in the variable at time T.

It is important to note that the deviations between the scenarios and current RET scheme are tracked over the entire timeframe of the simulation.

Figure 2.1: Dynamic simulation using DAE-RGEM



The modelling results presented in the following sections show the impact of altering the current RET scheme to alternative scenarios. Specifically, the results should be interpreted as follows:

- **RET abolished scenario:** this scenario illustrates the economic benefit of completely abolishing the RET scheme. The economic results illustrate the deviation between the RET abolished scenario relative to the RET continuation counterfactual. This is illustrated by deviation (a) in Figure 2.1.
- **RET grandfathering scenario:** this scenario illustrates the economic benefit of modifying the current RET scheme to a scenario where the RET maintains the existing target of 17% with a grandfathering arrangement. The economic results illustrate the deviation between the RET grandfathering scenario relative to the RET continuation counterfactual. This is illustrated by deviation (b) in Figure 2.1.
- **RET real 20% scenario:** this scenario illustrates the economic benefit of adjusting the current RET scheme compared to a scenario where the RET target is adjusted to a real 20% target in 2020. The economic results illustrate the deviation between the RET Real 20% scenario relative to the RET continuation counterfactual. This is illustrated by deviation (c) in Figure 2.1.

The net present value results are the sum of deviations in macroeconomic variables per year over the modelling period discounted back to current day terms. In addition, each scenario is compared with the estimated change in emissions to determine the environmental credentials of the policy.

More detailed information about the underlying workings of CGE modelling can be found in Appendix A.

3 Electricity market impacts

Renewable energy investment and generation

At the national level, investment in renewable energy is projected to fall by $10.2 billion in net present value terms, should the current RET be abolished from July 2014 (see Table 3.1). This is because the RET scheme subsidises investments in renewable energy, bringing forward capacity in these sources. By abolishing the RET, renewable energy generators will no longer receive assistance to fund the upfront capital costs associated with installing capacity.

Table 3.1: Renewable energy investment across Australia ($bn, NPV)

Scenarios	2014-2020	2021-2030	2014-2030	Deviation* 2014-2030
RET continuation	15.8	9.3	25.1	--
RET abolished	5.7	9.1	14.8	-10.2
RET grandfathering	5.7	9.1	14.8	-10.2
RET real 20%	8.3	9.1	17.4	-7.7

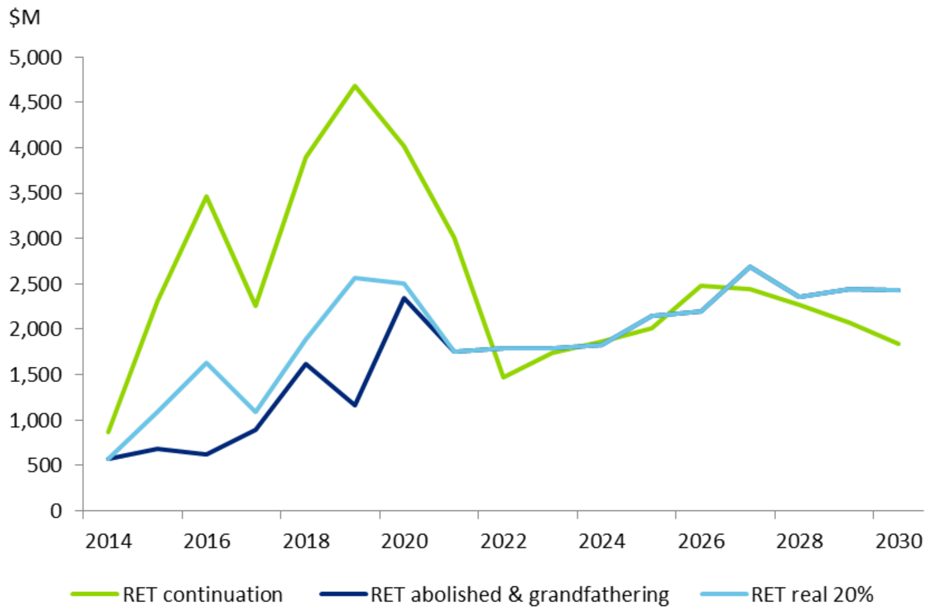
Note: *Deviations are presented between the scenarios and the RET continuation counterfactual
Source: Deloitte Access Economics

The RET grandfathering scenario is associated with the same investment reduction as the RET abolished scenario ($10.2 billion in net present value terms). This is because both scenarios are designed to ensure that the reduction in future investment in renewable energy is not buoyed by REC subsidies and those only already operating renewable energy generators (that no longer require large upfront investments) remain in the market.

Should the current RET be adjusted to a RET real 20% scheme, the reduction in investment in renewable energy over 2014 and 2030 is estimated to be $7.7 billion in net present value terms. Unlike the other two scenarios, REC support will continue to be provided to both existing *and* new renewable energy generators until 20% of Australia's fuel mix is accounted for by renewable sources in real demand terms. While investment is lower than what would be the case if the current RET scheme continued, the levels are, unsurprisingly, higher than the RET abolished and grandfathering scenarios. Once the real 20% target is achieved, investment levels for all three scenarios converge from 2020 onwards.

Chart 3.1 illustrates aggregated renewable energy investment patterns under the three alternative RET policy scenarios and RET continuation counterfactual.

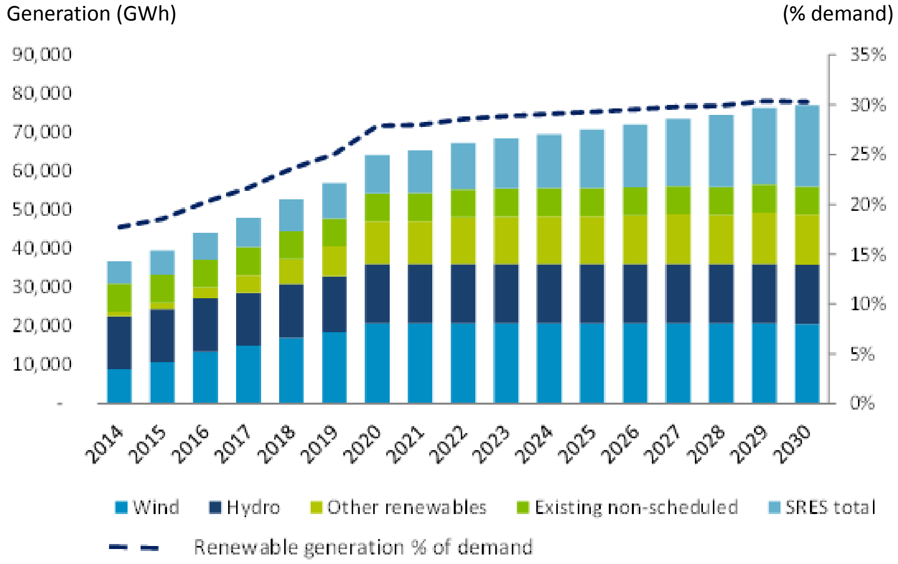
Chart 3.1: Renewable energy investment levels across Australia ($M)



Source: Deloitte

Figure 3.1 shows the total generation from renewable sources that have been driven by the investments outlined above. We forecast that renewable generation will represent about 28% of total Australian demand by 2020 if the RET continues as legislated. This is significantly higher than the 20% renewable generation by 2020 that the RET was designed to achieve. The forecast fuel mix under the RET abolished and RET grandfathering scenarios are the same. This is because under both cases, existing renewable energy generators continue to operate in the market, while no new investment in renewable sources are incentivised.

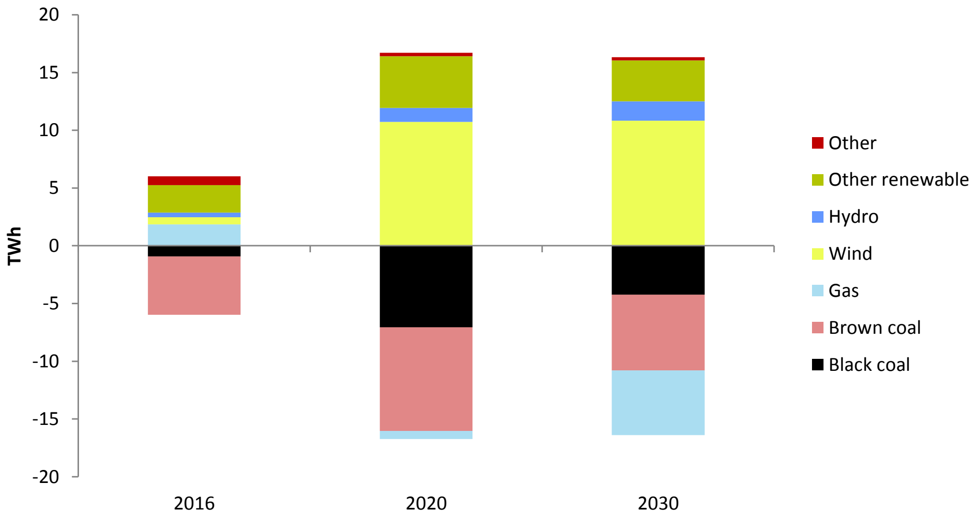
Figure 3.1: Total generation from renewable sources — RET continuation



Source: Deloitte

Chart 3.2 shows the difference between the generation mix in the NEM for the RET continuation counterfactual and the RET grandfathering scenario. In the RET continuation, generation from renewable sources (mainly wind) increases significantly, while we see a corresponding reduction in existing coal and both existing and new entrant gas generation.

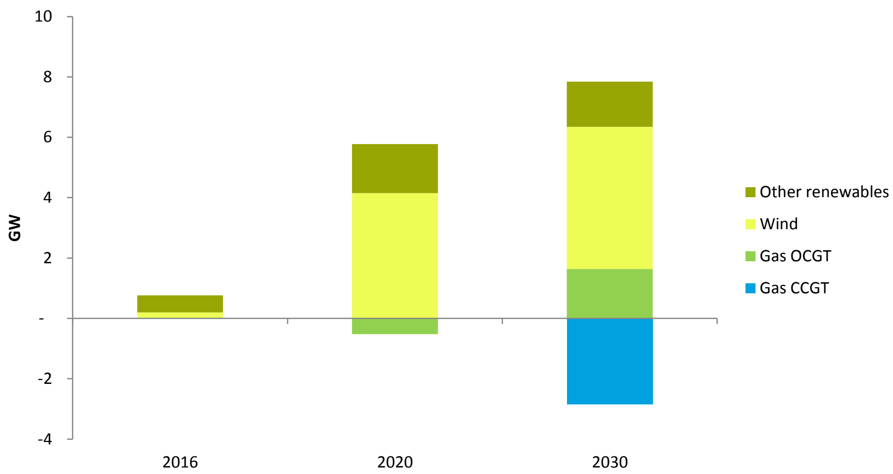
Chart 3.2: NEM generation mix, RET continuation relative to RET grandfathering



Source: Deloitte

Chart 3.3 shows the difference in investment in new capacity for the NEM under the two scenarios. Significant investment in wind generation enters at the expense of new gas CCGT. Investment in peaking gas OCGT increases in the RET continuation counterfactual, largely to support intermittent wind generation.

Chart 3.3: NEM capacity additions, RET continuation relative to RET grandfathering



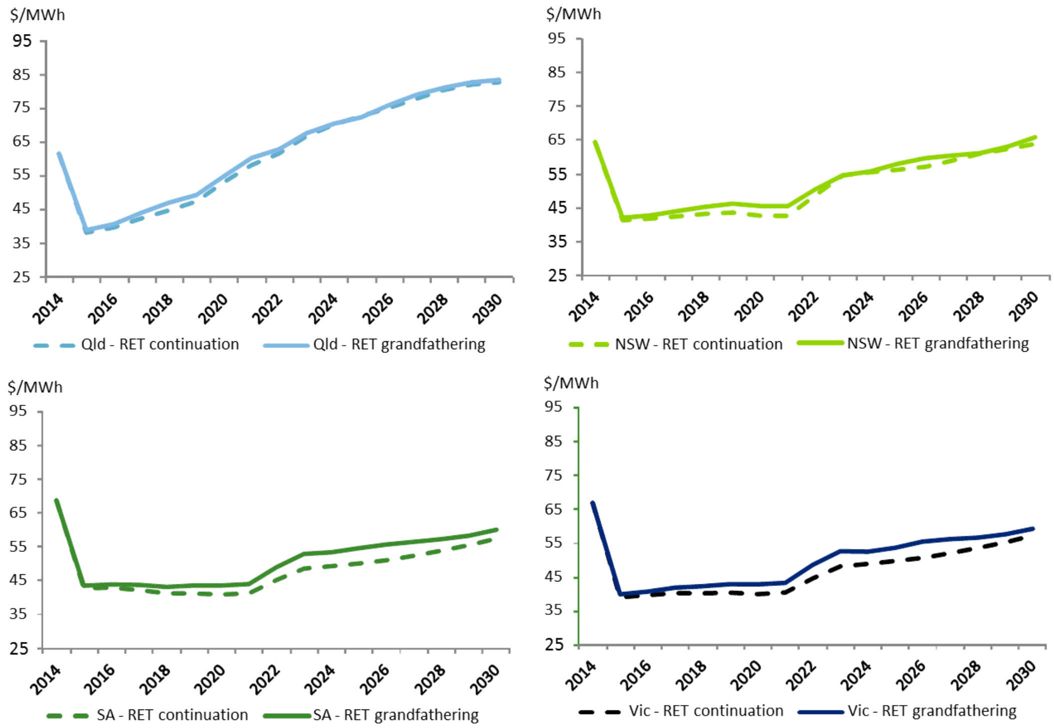
Source: Deloitte Access Economics

Wholesale and retail electricity prices

Under the RET continuation counterfactual, wholesale prices fall in the NEM regions. However, retail prices increase reflecting the higher cost of procuring LGCs and STCs to comply with the RET.

Chart 3.4 shows the wholesale prices for the NEM regions. Wholesale prices drop the most in Victoria, New South Wales and South Australia under the RET continuation counterfactual reflecting higher wind penetration. The sharp drop off in wholesale prices in 2015 reflects the abolishment of carbon pricing. The wholesale prices for the RET abolished scenario and RET grandfathering scenario are the same.

Chart 3.4: Wholesale electricity prices across NEM regions



Source: Deloitte

We note that our wholesale price reductions for the NEM are lower than those projected by ACIL Allen.[2] It is extremely difficult to reconcile the differences in results between models given the number of input variables that go into the model. Having said that, the following differences may explain some of the results:

- Lower gas prices forecast for Victoria under the Deloitte model – this results in a lower cost of new generation in Victoria under the RET abolished and RET grandfathering scenario. This may have a flow on impact to the SA and NSW markets.

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[2] ACIL Allen Consulting 2014, RET Review Workshop Preliminary Modelling Results, 23 June

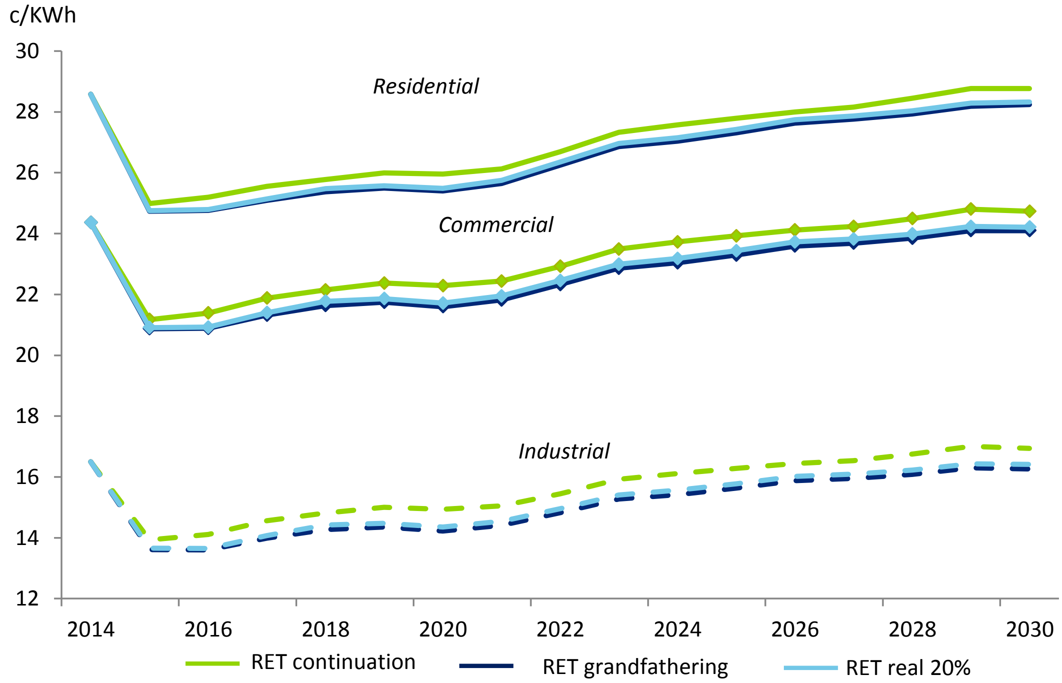
- Difference in expected contracting and market response of the existing generators to falling demand and supply variability due to increased penetration of intermittent renewable energy generation – this results in a higher wholesale price in the RET continuation counterfactual.
- Differences in capital cost assumptions.

Chart 3.5 shows the average retail electricity prices that are likely to be faced by consumers under the alternative scenarios and counterfactual comparison. The price paths for residential, commercial and industrial consumers are highest under the RET continuation counterfactual. This is because the entry of more renewable energy into the electricity market is effectively paid for by the revenues from RECs, purchased by obligated retailers. Under the various State retail electricity market regulations, retailers are permitted to pass on the expected cost imposts of the RET to consumers through the prices they charge.

Retail electricity prices for each consumer group are therefore projected to fall under each of the scenarios, with prices the lowest in the case where the RET is fully abolished from July 2014 onwards. This is because the small increase in wholesale prices is offset by the reduction in the costs associated with procuring the required LGCs and STCs as specified by the LRET and SRES. The price paths for the real RET 20% and grandfathering cases are very similar. This implies that the current share of renewables in Australia’s fuel mix is already close to a real 20% target for 2020.

The retail electricity price is marginally higher under the RET real 20% scenario (compared to the grandfathering and abolished scenarios) because retailers are still required to purchase the RECs generated by both existing and new renewable energy participants in the market. In the grandfathering scenario, there are assumed to be no new entrants, with RECs obligations limited to the standing base of renewable energy generators. The retail price reductions in 2015 are a direct result of the repeal of the carbon tax.

Chart 3.5: Average Australian retail electricity prices

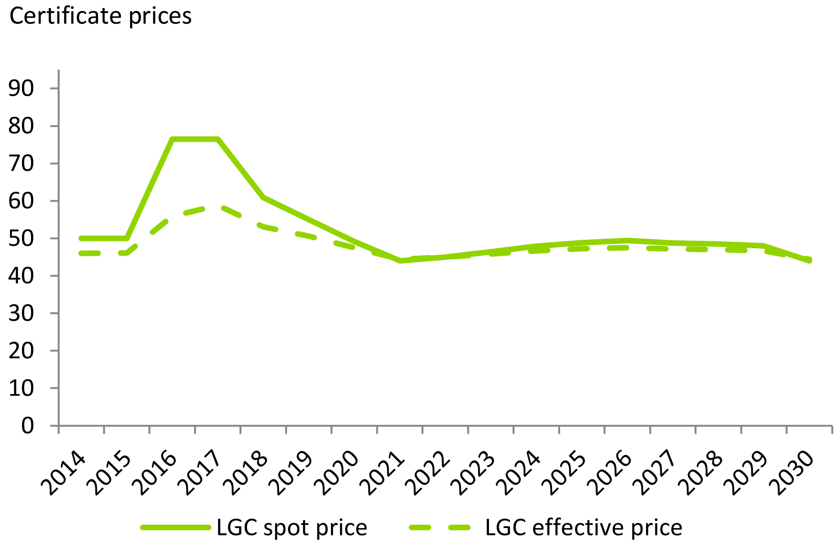


Source: Deloitte

The economic impacts of lower retail electricity prices (compared to the RET continuation counterfactual) will be different across the economy, depending on customer usage intensities, the economic composition of States and Territories, retail electricity market regulation policies and other localised factors.

Chart 3.6 shows the LGC price forecast under the counterfactual where RET continues. We predict that LGC prices will initially increase significantly, largely driven by the reduction in wholesale prices. LGC prices then fall reflecting the increase in wholesale prices and a reduction in capital costs of onshore wind generation. Our model assumes that retailers are 80% contracted for current requirement of LGCs based on a contracted price of $45/MWh and hence the impact on retail prices is muted.

Chart 3.6: LGC price forecasts — RET continuation



Source: Deloitte

Comparison of retail electricity price forecasts to ACIL Allen

Our modelling output for continuing the RET scheme would mean that on average, residential customers may be worse off by around $49 per year over the forecast period. However, ACIL Allen's draft results indicate that residential customers will be worse off on average, by around $54 per year through to 2020, but will then benefit by an average of $56 per year for the rest of the forecast period.[3]

Based on our high-level analysis, we believe that these differences are likely to be due to the following reasons:

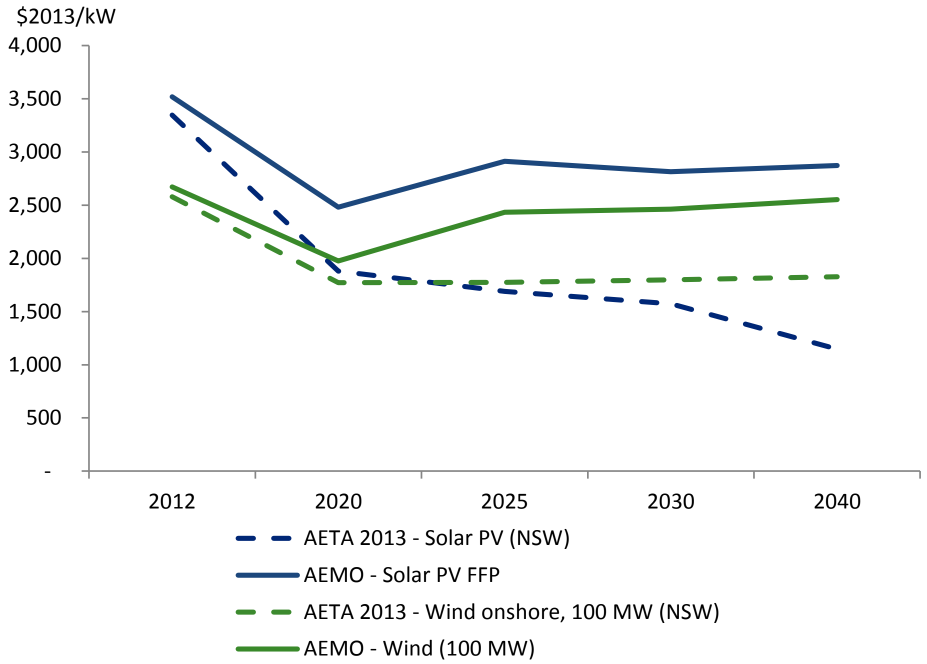
- Our estimated wholesale price reductions are around $4/MWh for Victoria and NSW for the period 2020-2030, as compared to ACIL Allen's NEM average estimate of around $10/MWh. As noted previously, this may be due to a number of reasons, such as differences in fuel cost assumptions, capital cost assumptions and assumptions on contracting positions in the market. Beyond the NEM regions, ACIL Allen project a sharp increase in wholesale prices for the WA and Northern Territory under their RET repeal scenario. However, we have kept the underlying wholesale price constant for the WA market. This is because, in contrast to the NEM, WA has a capacity and energy market, which is currently operating with excess capacity. According to the SWIS Electricity Demand Outlook (June 2014), as published by the Western Australian Independent Market Operator, no additional generation capacity will be required in the SWIS until 2023-24.[4] As such, we would expect wholesale prices to remain relatively constant under a RET repeal scenario.

[3] ACIL Allen Consulting 2014, RET Review Workshop Preliminary Modelling Results, 23 June, slide 39

[4] IMO, 2014, SWIS Electricity Demand Outlook (June 2014), p3

- We note that ACIL Allen has used the BREE AETA 2013 capital cost forecast for onshore wind and other renewable energy technologies, which forecasts significant reductions in capital costs for onshore wind leading up to 2020 and beyond. In contrast, we have used AEMO's 2013 capital cost assumptions. Figure 3.7 shows that these two forecasts diverge significantly from 2020, with BREE forecasting wind costs to plateau at around $1,800 per kW in 2020, while AEMO expects these costs will plateau in 2025 at around $2,500 per kW. Given the significant investment in wind expected under some scenarios this is a key point of difference between the two models.

Chart 3.7: Capital costs for new generation technologies – AEMO vs BREE AETA 2013



- Our retail prices are based on average retail load profiles, whereas ACIL Allen may have used more detailed load profiles in calculating retail prices.

Emission forecasts and abatement costs

Adjusting the RET will have implications for carbon emissions. Compared to the RET continuation counterfactual, carbon emissions are projected to increase by 7% under the RET real 20% scenario and by 8% under the RET grandfathering/RET abolished scenarios.[5]

Based on the cost of the LGCs alone, the direct cost of carbon abatement (represented by higher electricity prices for customers) is calculated at $72/t in 2020, increasing to $82/t in 2030. This is a partial estimate of the implied abatement cost of the RET (as it does not

[5] Projected emissions are the same under the RET abolished and grandfathering scenarios as the investment and fuel mix is identical.

include the negative impact to GDP as a result of bringing forward investment and higher electricity prices as a consequence of complying with the RET).

There are three key issues in relation to transfers and payments relating to the RET: foregone returns to existing fossil fuel generators; payments made to cover the cost of generating RECs; and the impact on end user prices.

Transfers via foregone returns

Continuing the RET in its current form results in gross transfers from fossil fuel generators to renewable generators. This is because renewable energy displaces existing electricity generation capacity. As shown in Table 3.2, relative to the RET grandfathering arrangement, continuing the RET scheme would result in gross transfers from fossil fuel generators to renewable generators of $5.7 billion over the period 2015-2030. Similarly, relative to the RET real 20% arrangement, continuing the RET scheme is projected to result in transfers of $ 5.4 billion over the same period.

Table 3.2: Revenue loss, transferred from fossil fuel generators ($M, NPV)

Scenarios	Revenue transfer from fossil fuel generators, 2015 - 2030
RET continuation counterfactual vs RET grandfathering	-5,652
RET continuation counterfactual vs RET real 20%	-5,465

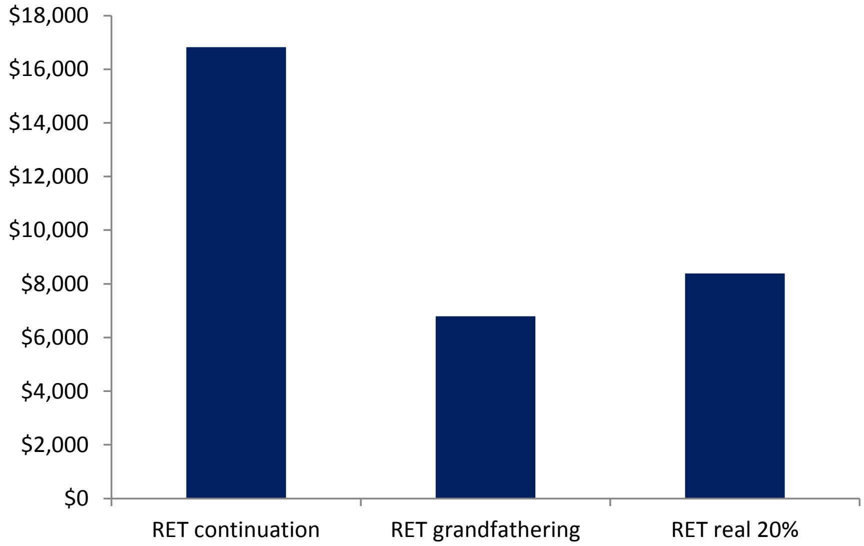
Source: Deloitte

Payments for RECs

Apart from revenue earned in the electricity market, renewable energy producers also receive income from generating RECs. The cost of RECs are then passed on to electricity customers.

Chart 3.8 shows the gross REC payments expected to be transferred from energy retailers to REC generators and passed on to end users over the period 2015-2030.

Chart 3.8: Gross REC payments, 2015-2030 ($M, NPV)



Source: Deloitte

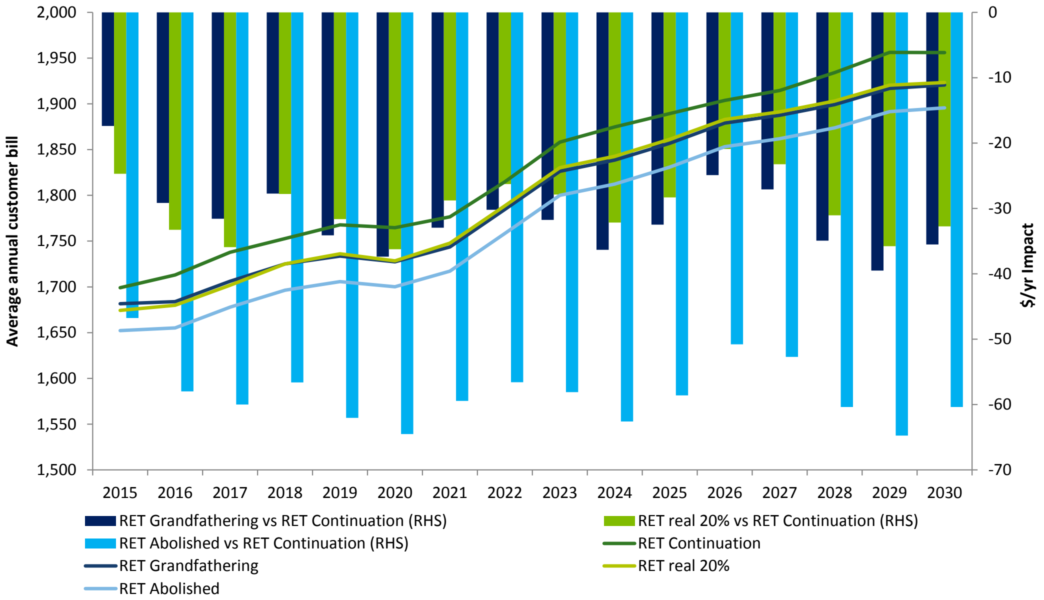
While continuing the RET is associated with the highest gross REC transfers of around $17 billion in net present value terms, the RET grandfathering and the RET real 20% arrangements are projected to result in gross REC transfers of around $7 billion and $8 billion in net present value terms respectively.

Price impacts

Each year, the RET contributes to projected increases in electricity bills for residential, commercial and industrial customers. We present the average annual bill and $/year impacts for each customer type in the charts below. The average $/year difference between the RET continuation and alternative RET arrangements are shown on the right hand side of the chart, while the average annual bill is shown on the left hand side.

Chart 3.9 shows the estimated average annual bill and $/year impacts for residential customers over the forecast period. As can be seen, complete abolishment of the RET is associated with the greatest reductions in residential customers' average annual bill. Compared to the RET continuation counterfactual, projected yearly impacts range from a reduction of $47 per year in 2015 to $65 per year in 2030.

Chart 3.9: Average annual bill and $/year impacts for residential customers

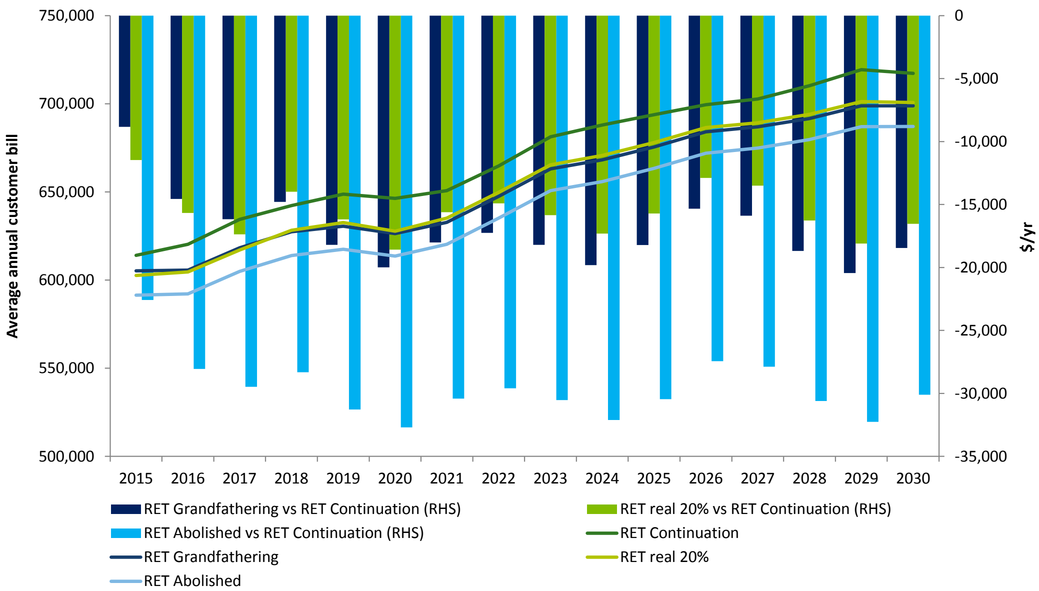


Source: Deloitte

Altering the RET to a real 20% or grandfathering scheme is also projected to result in smaller, but still significant reductions in residential customers' average annual bill. We estimate that moving to a RET grandfathering arrangement could reduce residential customers' average annual bill by between $17 and $39 per year, while moving to a RET real 20% scheme could generate annual reductions of between $21 and $36 per year.

Chart 3.10 shows the projected average annual bill and $ per year impacts for commercial customers over the forecast period.

Chart 3.10: Average annual bill and $/year impacts for commercial customers



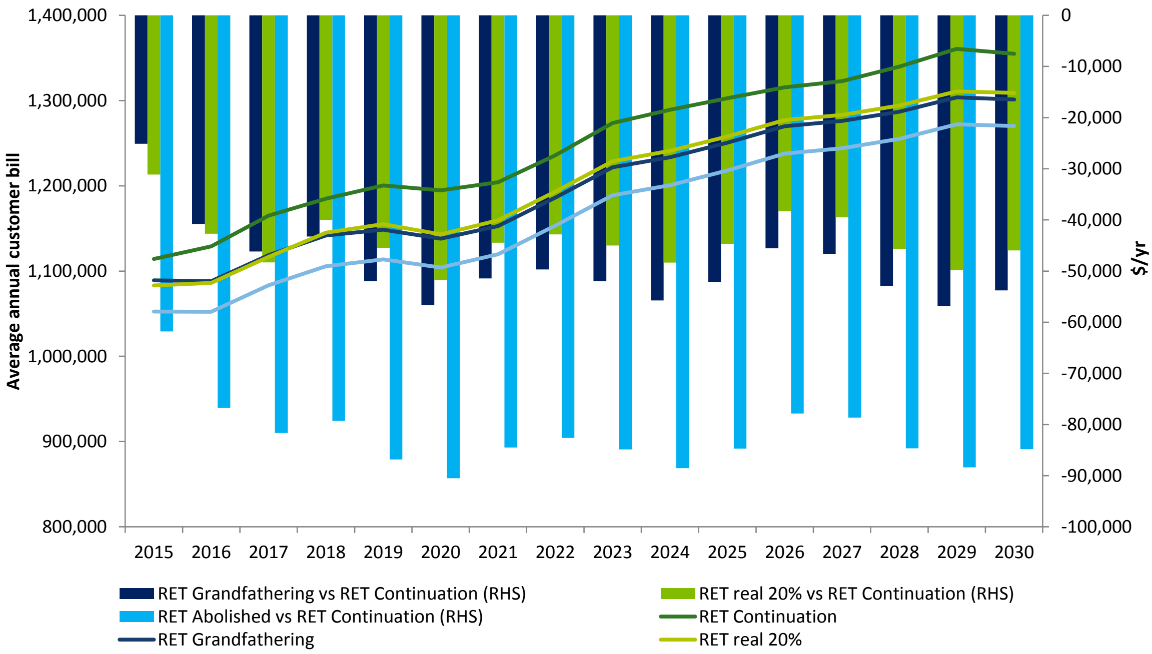
Source: Deloitte

Similar to our analysis for residential customers, abolishing the RET yields the greatest reductions for commercial customers' average annual bill, with estimated yearly reductions ranging from between $22,589 to $32,705 per year over the forecast period.

Moving to a RET real 20% arrangement is projected to save commercial customers' between $11,465 and $18,581 on their average annual bill, while transitioning to a RET grandfathering scheme could generate annual savings of between $8,831 and $20,446.

Chart 3.11 shows the estimated average annual bill and $/year impacts for industrial customers. Compared to the RET continuation counterfactual, abolishing the RET is projected to reduce industrial customers' average annual bill from between $61,787 to $90,527 over the forecast period.

Chart 3.11: Average annual bill and $/year impacts for industrial customers



Source: Deloitte

We estimate that altering the RET to a real 20% arrangement could generate average annual bill savings ranging from $31,114 to $51,723, while moving to a RET grandfathering scheme could reduce industrial customers' average annual bill from between $25,120 to $56,886.

4 Economy-wide impacts

This section examines the economic impact of altering the RET for the Australian and State and Territory economies. The approach uses CGE modelling to estimate the net economic outcomes associated with reduced investment in renewable energy and lower electricity prices under the set of alternative RET arrangements against the present RET scheme.

CGE models account for a wide range of economic factors, including competition in labour and capital markets, and energy demand elasticities. This makes them a useful tool to provide insight around both the potential upside and downside consequences for particular segments of the economy.

4.1 Australian impacts

At the national level, adjusting the current RET scheme to one of the alternative arrangements is projected to generate economic benefits for the Australian economy. As all alternative scenarios assume that at least some of the RET requirements are either removed or adjusted downwards, their implementation would mean benefits in the form of cost reductions relative to the current RET. Table 4.1 illustrates the estimated national net present value impacts of the alternative RET scenarios relative to the current RET scheme.

Table 4.1: National impacts of alternative RET scenarios relative to the RET continuation ($M, NPV 2014-2030)

Macroeconomic variable	RET abolished	RET grandfathering	RET real 20%
Absolute deviations relative to the RET continuation counterfactual			
Real GNP ($M)^	33,149	20,534	16,973
Real GDP ($M)	28,837	16,554	13,931
Real household consumption ($M)	20,473	12,130	10,041
Real government consumption ($M)	2,812	1,817	1,478
Real Investment ($M)	-10,229	-10,229	-7,616
Export volumes ($M)	16,356	11,911	9,492
Import volumes ($M)	575	-923	-536
Employment (Average, FTE)	5,049	2,863	2,419
Average yearly earning per person ($)*	1,257	678	579

Source: Deloitte Access Economics

Note:* Based on Average Yearly Earnings of approximately $58,000, as indicated by the latest release of the ABS for total weekly earning of persons in Australian in 2013.

^ While Gross Domestic Product (GDP) represents the total value of goods and services produced in Australia within a given period, Gross National Product (GNP) represents the total value of goods produced within Australia and from overseas investments and earnings. That is, GNP comprises GDP plus net receipts of primary income from non-resident sources.

The economic gains associated with altering the current RET scheme are driven by the net result of two opposing factors: a *contractionary* impact that is caused by the reduction in renewable energy investment and an *expansionary* impact from lower electricity prices due to the alternative RET arrangements redirecting investment to less costly and more efficient energy technology.

The direct contractionary impact of reducing investment construction can be seen in Table 4.1, with the deviation in real investment falling by around $10.2 billion in NPV terms under RET abolished and grandfathering scenarios and by $7.6 billion in NPV terms under the real 20% scenario, relative to the current RET scheme.

The indirect contractionary impacts caused by a fall in aggregate investment are more subtle. The construction, installation and operation of renewable energy capacity require goods and services from other industries that specialise in these activities. These goods and services can either be procured from domestic suppliers or imported from international sources. The general decline in demand can result in negative growth for national import volumes. Moreover, lower demand for goods and services to construct new investment places downward pressure on domestic output prices. This encourages domestic producers to shift their attention away from the domestic markets towards servicing the needs of the export market.

The second, more dominant force, is the expansionary impact brought about by the alternative RET arrangements redirecting investment towards more efficient and less costly non-renewable technologies. For example, by completely abolishing the RET, investment in gas generation that would otherwise be delayed is brought forward, while existing coal generators regain market share over time.

A lower cost national fuel mix drive gains in the electricity sector. Reducing retail electricity prices below current RET scheme levels lowers the cost of many day-to-day electricity-dependent functions for residential, commercial and industrial customers. This effect tends to strengthen economic activity, resulting in higher industry output, consumption, imports and exports.

The net results in Table 4.1 demonstrate that the expansionary impact from the lower retail electricity prices significantly outweighs the contractionary impact from lower investment in renewable energies. The estimated gains to the Australian economy are highest when the RET abolished scenario is compared to RET continuation counterfactual as this induces the largest fall in retail prices.

Completely abolishing the RET is projected to increase real GDP by $29 billion in net present terms, relative to the RET continuation counterfactual. This increase corresponds to gains of around $33 billion in GNP in net present value terms (see Table 4.1).

The RET real 20% arrangement is estimated to lead to the lowest deviation in electricity retail prices and investment. This is because moving away from the current RET scheme to the RET real 20% scenario does not require as much reduction in effort as the projected share of renewables in the current scheme is 28% in 2020. The alternative RET real 20% arrangement is projected to increase real GDP by $14 billion in net present terms, relative to the RET continuation counterfactual. This increase corresponds to gains of around $17 billion in GNP in net present value terms (see Table 4.1)

Following from the GDP impacts, moving towards alternative RET scenarios also causes an increase in national employment. Higher levels of industry output place upward pressure on the demand for labour and the real wage rate. On average, over the modelling period, altering the current RET is projected to increase FTE employment by around 5,000 workers under the RET abolished scenario, around 2,900 workers under the RET grandfathering scenario, and around 2,400 workers under the RET real 20% scenario. The higher real wage is projected to subsequently increase average yearly earnings by approximately $600 to $1,300 in net present value terms.

Altering the current RET also leads to an increase in both real household and government consumption. Households are projected to gain the most given the two-fold impact of higher real wages and the relatively larger reduction in residential retail electricity prices, relative to the RET continuation counterfactual. The alternative RET arrangements are projected to increase household consumption by approximately $10 to $20 billion in net present value terms when compared to the RET continuation counterfactual.

Adjusting the current RET scheme is estimated to increase national export volumes. The modelling results indicate that national export volumes are projected to rise by approximately $10 to $16 billion dollars in net present value terms relative to the RET continuation counterfactual.

Changing the RET arrangements is expected to have a mixed effect on national import volumes. When the RET abolished scenario is compared to the current RET scheme, national imports are projected to rise by approximately $600 million in net present value terms. On the other hand, national import volumes are projected to fall by approximately $540 million and $920 million in net present value terms when the RET real 20% and grandfathering scenarios is compared to the RET continuation counterfactual, respectively. The RET abolished scenario increases national import volumes as the relatively lower retail electricity price deviation causes the expansionary impact on imports to overpower the contractionary impacts on imports.

RET abolished scenario compared with the RET continuation counterfactual

If the current RET scheme was completely abolished, real GDP is projected to rise by 0.16% above the RET continuation counterfactual in 2020 and by 0.17% in 2030 (see Table 4.2). This increase corresponds to gains of around 0.18% and 0.24% in GNP for the same points in time. Over the course of the modelling horizon, the gains from abolishing the current RET scheme to GDP is forecast to be $28.8 billion in net present value terms, equating to an increase of $33.1 billion in GNP.

A general trend observed from the modelling is that the gains of abolishing the RET scheme increase over time. This is largely due to a tapering off in the contractionary impacts which is caused by less investment in new renewable energy capacity over time. Moreover, to allow for the penetration of large quantities of intermittent (especially wind) generation encouraged by the RET, substantial investment in transmission infrastructure, smart load control systems and closely located peak generation capacity would have also be required. Such network infrastructure investment would not be needed in the RET abolished scenario. This is reflected by a significant decline in the deviation in aggregate investment between 2015 and 2020 in particular, when investment falls from about $1.6 billion to $2.1 billion below the RET continuation counterfactual.

Importantly, the expansionary impacts from reductions in retail electricity prices (compared to the RET continuation counterfactual) increase over time. This is because the complete abolishment of the current RET redirects investment towards more efficient and less costly non-renewable technologies.

The net increase in national income is accompanied by a projected increase in net employment of approximately 0.05% at 2030, translating to a gain of around 5,800 full-time equivalent positions. Higher aggregate output levels also places upward pressure on the demand for labour. The national real wage rate is projected to rise by 0.14% (equivalent to $83 in annual average income) in 2015; the increase in national real wage rate is projected to grow to 0.25% (equivalent to $169 in average yearly earnings) in 2030.

On the back of residential electricity price reductions and real wage increases, household consumption is also projected to rise above the RET continuation counterfactual under the RET abolished scenario. By 2030, this increase in consumption is estimated to be in the order of $4 billion.

The gains from the RET abolished scenario relative to the current RET are accentuated in GNP measures due to the impacts on consumer prices resulting from the policy. As the larger levels of renewable investment is no longer required in the RET abolished scenario, there is lower demand for imported inputs to build and install renewable energy. In 2015, national import volumes are projected to deviate negatively by $541 million; rising to $1.7 billion above the RET continuation counterfactual in 2030. At the same time, crowding out factors are lowering the increase in exports should the RET be completely abolished.

Based on the emissions reductions between the RET abolished scenario and RET continuation counterfactual of 278 Mt, the cost per tonne of carbon abated to GDP and GNP under the current RET are likely to be around $103 and $119 respectively.

Table 4.2: National economic impacts, RET abolished relative to the RET continuation

Macroeconomic variable	2015	2020	2025	2030
Absolute deviations relative to the RET continuation counterfactual				
Real GNP ($M)	1,746	3,280	4,569	5,304
Real GDP ($M)	2,107	3,036	3,491	3,691
Real Household Consumption ($M)	1,001	1,836	2,857	4,031
Real Government Consumption ($M)	110	242	423	571
Real Investment ($M)	-1,586	-2,152	-67	479
Export volume ($M)	2,042	2,488	1,004	307
Import volume ($M)	-541	-623	726	1,697
Employment (FTE)	3,096	4,655	5,692	5,845
Average yearly earning per person ($)*	83	128	159	169
%, deviations relative to the RET continuation counterfactual				
Real GNP	0.11	0.18	0.23	0.24

Macroeconomic variable	2015	2020	2025	2030
Real GDP	0.13	0.16	0.17	0.17
Real Household Consumption	0.13	0.20	0.26	0.27
Real Government Consumption	0.05	0.09	0.13	0.13
Real Investment	-0.37	-0.53	-0.02	0.10
Export volume	0.57	0.59	0.18	0.05
Import volume	-0.18	-0.16	0.12	0.19
Employment	0.03	0.04	0.05	0.05
Wage rate	0.14	0.21	0.25	0.25

Source: Deloitte Access Economics
Note:* Based on Average Yearly Earnings of approximately $58,000, as indicated by the latest release of the ABS for total weekly earning of persons in Australian in 2013.

RET grandfathering scenario relative to RET continuation counterfactual

When the RET grandfathering alternative is compared against the RET continuation, the gains to the economy are still sizable. Whereas the RET abolished to RET continuation comparison reveals the full gains of abolishing the scheme, the RET grandfathering represents the potential cost reductions in moving from the current RET scheme to an alternative RET grandfathering policy.

Here, GDP and GNP are projected to rise by 0.10% (approximately $1.8 billion) and 0.11% (approximately $2.0 billion) respectively by 2020 (see Table 4.3). A decade on, the gains of altering the current RET to a grandfathering scheme continue to rise, with GDP rising by 0.11% (approximately $2.3 billion) in 2030 and 0.16% ($3.7 billion) for GNP. Compared to the RET abolished scenario above, these impacts are milder, largely owing to the smaller reduction in retail electricity price between the RET grandfathering scenario relative to the RET continuation counterfactual.

On balance, the GDP gains associated with altering the current RET scheme to a RET grandfathering scenario is projected to amount to approximately $16.5 billion in net present value terms for the period 2014 to 2030. Similarly, GNP is estimated to be approximately $20.5 billion above the RET continuation counterfactual in net present value terms.

Investment activity is projected to be lower over the initial modelling period due to the reduction in required investment in renewable energy. Should the RET be modified to a grandfathering scenario, national investment in 2015 is projected to fall by 0.37% below the RET continuation counterfactual, and to 0.53% in 2020. After this time, these contractionary impacts start to recede and the expansionary price impacts dominate the net economic outcomes for the later period. For instance, household consumption rises by 0.11% in 2020 to 0.18% in 2030 should the current RET scheme be modified to a grandfathered scheme from July 2014. This is equivalent to an increase of approximately $1 billion and $2.9 billion in household consumption at the same points in time.

Once again, higher industry output levels flow on to impact the demand for labour, with job increases of approximately 2,400 and 3,800 FTEs expected in 2020 and 2030 respectively.

This associated with small increases in average annual incomes of around $66 by 2020 and $109 in 2030.

While real national household consumption, government consumption, import volumes and employment continue to rise above the RET continuation counterfactual, national export volumes are project to fall. This is largely driven by domestic producers shifting their sales away from export markets towards the domestic market due to the downward pressure on prices.

When taking into account the incremental emissions reductions in the RET grandfathering scenario of 278 Mt, the cost per tonne of carbon abated to GDP and GNP under a grandfathered RET are likely to be around $60 and $74 respectively.

Table 4.3: National economic impacts, RET grandfathering relative to RET continuation

Macroeconomic variable	2015	2020	2025	2030
Absolute deviations relative to the RET continuation counterfactual				
Real GNP ($M)	535	1,996	3,138	3,702
Real GDP ($M)	811	1,757	2,176	2,339
Real Household Consumption ($M)	237	989	1,902	2,876
Real Government Consumption ($M)	32	143	302	421
Real Investment ($M)	-1,586	-2,152	-67	479
Export volume ($M)	1,514	2,027	547	-102
Import volume ($M)	-614	-749	509	1,335
Employment (FTE)	822	2,437	3,541	3,763
Average yearly earning per person ($)*	20	66	98	109
%, deviations relative to the RET continuation counterfactual				
Real GNP	0.03	0.11	0.16	0.16
Real GDP	0.05	0.10	0.11	0.11
Real Household Consumption	0.04	0.11	0.17	0.18
Real Government Consumption	0.01	0.05	0.09	0.09
Real Investment	-0.37	-0.53	-0.02	0.10
Export volume	0.44	0.48	0.09	-0.02
Import volume	-0.20	-0.20	0.09	0.15
Employment	0.01	0.02	0.03	0.03
Wage rate	0.03	0.11	0.15	0.16

Source: Deloitte Access Economics
Note:* Based on Average Yearly Earnings of approximately $58,000, as indicated by the latest release of the ABS for total weekly earning of persons in Australian in 2013.

RET real 20% scenario relative to the RET continuation counterfactual

Economic outcomes under a RET real 20% scenario largely mirror those projected for the RET grandfathering scenario. The key difference between the two scenarios is the renewable energy target, with the grandfathering scenario maintaining the existing renewable energy share of 17%, whereas the target continues to until it reaches a real 20%

levels under the real RET 20% scenario. In driving this additional 3% worth of capacity investments in renewable sources, efficiencies in the electricity sector culminate in a 0.8% increase in GDP in 2020 and 0.9% in 2030 (see Table 4.4).

Between 2014 and 2030, the gains of altering the current RET scheme to a RET real 20% alternative are estimated to be approximately $14 billion to GDP and $17 billion to GNP in present value terms.

Much like the other scenarios, the reduction in investment in the economy does have a contractionary effect, with aggregate investment falling by 0.26% in 2015 and 0.40% in 2020. However the benefits of these investments are outweighed by the more pervasive reduction in retail electricity prices (i.e. the expansionary impacts). Under a RET real 20% scenario, employment is expected to rise by around 3,000 full-time workers from 2025 onwards. Real wage increases for the average Australian worker also rise by around $90 a year at the end of the modelling period.

Lower residential electricity prices and upward pressure on output, labour demand and wages are also expected to impact household consumption. Should the current RET scheme be switched to a RET real 20% scheme, household consumption is projected to rise by around $830 million in 2020, to $2.4 billion in 2030.

Based on the emissions reductions between the RET real 20% scenario and RET continuation counterfactual of 244 Mt, the cost per tonne of carbon abated to GDP and GNP under the current RET are likely to be around $70 and $57 respectively.

Table 4.4: National economic impacts, RET real 20% relative to RET continuation

Macroeconomic variable	2015	2020	2025	2030
Absolute deviations relative to the RET continuation counterfactual				
Real GNP ($M)	568	1,667	2,497	3,044
Real GDP ($M)	774	1,492	1,759	1,978
Real Household Consumption ($M)	283	832	1,483	2,390
Real Government Consumption ($M)	35	116	235	338
Real Investment ($M)	-1,114	-1,630	-67	479
Export volume ($M)	1,153	1,609	488	-92
Import volume ($M)	-417	-565	380	1,138
Employment (FTE)	932	2,134	2,871	3,215
Average yearly earning per person ($)*	24	59	79	93
%, deviations relative to the RET continuation counterfactual				
Real GNP	0.03	0.09	0.12	0.14
Real GDP	0.05	0.08	0.09	0.09
Real Household Consumption	0.04	0.10	0.13	0.15
Real Government Consumption	0.02	0.04	0.07	0.07
Real Investment	-0.26	-0.40	-0.02	0.10
Export volume	0.33	0.38	0.08	-0.02
Import volume	-0.14	-0.15	0.06	0.13

Macroeconomic variable	2015	2020	2025	2030
Employment	0.01	0.02	0.03	0.03
Wage rate	0.04	0.10	0.12	0.14

Source: Deloitte Access Economics
Note:* Based on Average Yearly Earnings of approximately $58,000, as indicated by the latest release of the ABS for total weekly earning of persons in Australian in 2013.

4.2 State impacts

Much like the results at the national level, the deviations between the RET abolished scenario and RET continuation counterfactual reveal the full benefits of removing the current scheme for State and Territory economies over time. These results are outlined in Table 4.5.

Similar to the national impacts, State economies also face the same expansionary and contractionary effects driven by each respective State's retail electricity price and investment deviations. In addition, variations in consumer segment usage intensities, the industrial composition of regions, retail electricity market regulation policies and other localised factors also influence the size of the RET burden.

By 2020, Victoria and Queensland are projected to experience the largest increase in employment, at around 1,400 FTE job gains each. This largely owes to the heavier reliance on brown coal and fossil fuels in these States. In the States where wind penetration is already relatively high, the impacts are lower. For example, there are projected to be employment increases of around 240 FTEs in South Australia.

In 2030, when the contractionary impacts caused by reduced investment in new renewable energy sources slow down, increases in employment and gross state product (GSP) become more pronounced. In New South Wales, real GSP is projected to rise by just over $1 billion in 2030, associated with the gain of around 1,700 FTE workers. In Queensland, the increase in GSP is projected to be around $900 million in 2030, once again resulting in the gain of around 1,400 full-time jobs.

Table 4.5: State-wide economic impacts, RET abolished relative to RET continuation

	NSW	Vic	Qld	SA	WA	Tas	NT
2020, absolute deviations relative to the RET continuation counterfactual							
Real GSP ($M)	744	638	814	175	569	54	42
Employment (FTE)	1,108	1,319	1,335	236	555	44	58
2030, absolute deviations relative to the RET continuation counterfactual							
Real GSP ($M)	1,037	795	876	225	653	72	33
Employment (FTE)	1,687	1,657	1,344	376	643	98	40

Source: Deloitte Access Economics

In the RET grandfathering scenario, Queensland is forecast to experience the largest increase in GSP ($525 million) and employment (approximately 900 FTEs) in 2020. By 2030, the benefits of altering the current RET to a grandfathering arrangement are highest for

New South Wales, which is estimated to see increases of around $600 million in GSP and 1,027 FTE job growth.

Table 4.6 outlines measures of the benefits when a grandfathering alternative is put in place from July 2014.

Table 4.6: State-wide economic impacts, RET grandfathering relative to RET continuation

	NSW	Vic	Qld	SA	WA	Tas	NT
2020, absolute deviations relative to the RET continuation counterfactual							
Real GSP ($M)	357	338	525	84	407	17	29
Employment (FTE)	418	659	876	73	379	-9	41
2030, absolute deviations relative to the RET continuation counterfactual							
Real GSP ($M)	625	483	588	131	459	35	19
Employment (FTE)	1,027	1,028	938	227	465	54	23

Source: Deloitte Access Economics

The economic impacts of switching to a RET grandfathering or real 20% policy rather than continuing with the current scheme are broadly similar. In 2020, Queensland is again forecast to experience a larger impact in economic activity, with an increase in GSP of about $440 million and job gains for around 740 FTE workers.

In 2030, the economic benefits of altering the current RET scheme to a real 20% target is projected to have a rather balanced impact on GSP and employment for New South Wales, Victoria and Queensland (see Table 4.7).

Table 4.7: State-wide economic impacts, RET real 20% relative to RET continuation

	NSW	Vic	Qld	SA	WA	Tas	NT
2020, absolute deviations relative to the RET continuation counterfactual							
Real GSP	329	294	438	66	328	14	23
Employment (FTE)	427	576	734	40	340	-16	32
2030, absolute deviations relative to the RET continuation counterfactual							
Real GSP	528	401	547	103	363	25	12
Employment (FTE)	859	859	874	180	384	43	16

Source: Deloitte Access Economics

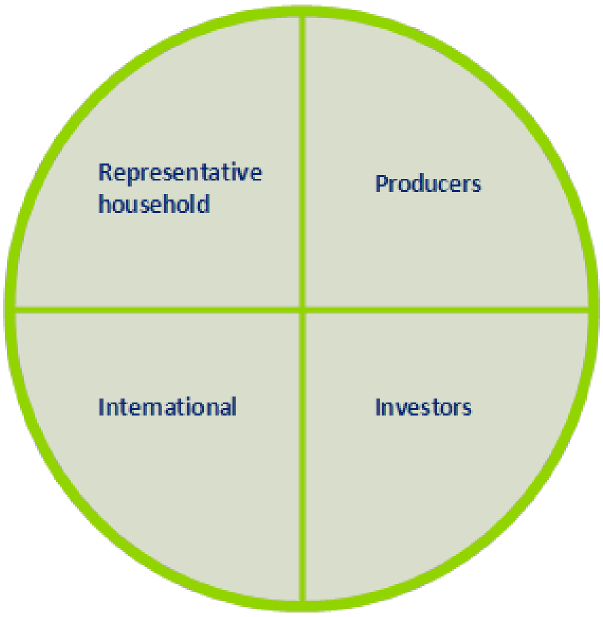
Appendix A: CGE modelling

The Deloitte Access Economics – Regional General Equilibrium Model (DAE-RGEM) is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy. The model allows policy analysis in a single, robust, integrated economic framework. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced.

The model is based upon a set of key underlying relationships between the various components of the model, each which represent a different group of agents in the economy. These relationships are solved simultaneously, and so there is no logical start or end point for describing how the model actually works.

Figure A.1 shows the key components of the model for an individual region. The components include a representative household, producers, investors and international (or linkages with the other regions in the model, including other Australian States and foreign regions). Below is a description of each component of the model and key linkages between components. Some additional, somewhat technical, detail is also provided.

Figure 4.1: Key components of DAE-RGEM



DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key assumptions underpinning the model are:

- The model contains a 'regional consumer' that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).

- Income is allocated across household consumption, government consumption and savings so as to maximise a Cobb-Douglas (C-D) utility function.
- Household consumption for composite goods is determined by minimising expenditure via a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases, the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a C-D utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a CES production function.
- Producers are cost minimisers, and in doing so, choose between domestic, imported and interstate intermediate inputs via a CRESH production function.
- The model contains a more detailed treatment of the electricity sector that is based on the 'technology bundle' approach for general equilibrium modelling developed by ABARE (1996).
- The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply.
- Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. A global investor ranks countries as investment destinations based on two factors: global investment and rates of return in a given region compared with global rates of return. Once the aggregate investment has been determined for Australia, aggregate investment in each Australian sub-region is determined by an Australian investor based on: Australian investment and rates of return in a given sub-region compared with the national rate of return.
- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.
- Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports).
- For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But, in relative terms, imported goods from different regions are treated as closer substitutes than domestically-produced goods and imported

composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.

- The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions, which are converted to good-specific sales taxes that impact on demand. Emission quotas can be set by region and these can be traded, at a value equal to the carbon tax avoided, where a region's emissions fall below or exceed their quota.

Households

Each region in the model has a so-called representative household that receives and spends all income. The representative household allocates income across three different expenditure areas: private household consumption; government consumption; and savings.

Going clockwise around Figure 4.1, the representative household interacts with producers in two ways. First, in allocating expenditure across household and government consumption, this sustains demand for production. Second, the representative household owns and receives all income from factor payments (labour, capital, land and natural resources) as well as net taxes. Factors of production are used by producers as inputs into production along with intermediate inputs. The level of production, as well as supply of factors, determines the amount of income generated in each region.

The representative household's relationship with investors is through the supply of investable funds – savings. The relationship between the representative household and the international sector is twofold. First, importers compete with domestic producers in consumption markets. Second, other regions in the model can lend (borrow) money from each other.

- The representative household allocates income across three different expenditure areas – private household consumption; government consumption; and savings – to maximise a Cobb-Douglas utility function.
- Private household consumption on composite goods is determined by minimising a CDE (Constant Differences of Elasticities) expenditure function. Private household consumption on composite goods from different sources is determined is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption on composite goods, and composite goods from different sources, is determined by maximising a Cobb-Douglas utility function.
- All savings generated in each region is used to purchase bonds whose price movements reflect movements in the price of generating capital.

Producers

Apart from selling goods and services to households and government, producers sell products to each other (intermediate usage) and to investors. Intermediate usage is where one producer supplies inputs to another's production. For example, coal producers supply inputs to the electricity sector.

Capital is an input into production. Investors react to the conditions facing producers in a region to determine the amount of investment. Generally, increases in production are accompanied by increased investment. In addition, the production of machinery, construction of buildings and the like that forms the basis of a region's capital stock, is undertaken by producers. In other words, investment demand adds to household and government expenditure from the representative household, to determine the demand for goods and services in a region.

Producers interact with international markets in two main ways. First, they compete with producers in overseas regions for export markets, as well as in their own region. Second, they use inputs from overseas in their production.

- Sectoral output equals the amount demanded by consumers (households and government) and intermediate users (firms and investors) as well as exports.
- Intermediate inputs are assumed to be combined in fixed proportions at the composite level. As mentioned above, the exception to this is the electricity sector that is able to substitute different technologies (brown coal, black coal, oil, gas, hydropower and other renewables) using the 'technology bundle' approach developed by ABARE (1996).
- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of production (through a CES aggregator). Substitution between skilled and unskilled labour is also allowed (again via a CES function).
- The supply of labour is positively influenced by movements in the wage rate governed by an elasticity of supply is (assumed to be 0.2). This implies that changes influencing the demand for labour, positively or negatively, will impact both the level of employment and the wage rate. This is a typical labour market specification for a dynamic model such as DAE-RGEM. There are other labour market 'settings' that can be used. First, the labour market could take on long-run characteristics with aggregate employment being fixed and any changes to labour demand changes being absorbed through movements in the wage rate. Second, the labour market could take on short-run characteristics with fixed wages and flexible employment levels.

Investors

Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor ranks countries as investment destination based on two factors: current economic growth and rates of return in a given region compared with global rates of return.

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.

International

Each of the components outlined above operate, simultaneously, in each region of the model. That is, for any simulation the model forecasts changes to trade and investment flows within, and between, regions subject to optimising behaviour by producers, consumers and investors. Of course, this implies some global conditions that must be met, such as global exports and global imports, are the same and that global debt repayment equals global debt receipts each year.

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