

A wide-angle, high-angle photograph of a vast solar farm. The rows of solar panels stretch far into the distance under a bright blue sky with scattered white clouds. The ground is dry and brownish-yellow.

RESILIENCE OF ORIGIN'S GENERATION PORTFOLIO TO A LOW CARBON ECONOMY

ORIGIN'S POSITION ON CLIMATE CHANGE AND
ANALYSIS OF CARBON REDUCTION SCENARIOS

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IMPORTANT NOTICE

This report provides results of economic modelling on the potential impact to Origin's wholesale electricity generation portfolio under a number of emission reduction scenarios. These results do not represent an expected or preferred view of the future. As such, caution should be exercised when interpreting the results.

This report contains forward looking statements, including statements of current intention, statements of opinion and predictions as to possible future events. Such statements are not statements of fact and there can be no certainty of outcome in relation to the matters to which the statements relate. These forward-looking statements involve known and unknown risks, uncertainties, assumptions and other important factors that could cause the actual outcomes to be materially different from the events or results expressed or implied by such statements. Those risks, uncertainties, assumptions and other important factors are not all within the control of Origin and cannot be predicted by Origin and include changes in circumstances, events or economic conditions that may cause objectives to change as well as risks, circumstances and events specific to the industry, countries and markets in which Origin operates.

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A MESSAGE FROM OUR CEO

As a leading energy company, some of the most common questions we are asked by our stakeholders – customers, investors, suppliers, our people and the community at large – revolve around climate change.

What are you doing to combat climate change? Do you support Australia's emissions reduction target? Is your business resilient to a low carbon economy?

This is the first time we have produced a standalone document to convey our position and outline the preparedness of our business to prosper in a lower carbon world.

We have consistently stated our unequivocal support for measures to reduce carbon emissions, including the Paris Agreement, in order to hold global average temperature rises to well below 2°C. We support Australia's 2030 emissions reduction target¹ and have advocated for the implementation of government policies to ensure this can be achieved.

We also believe a goal of net zero emissions in the electricity sector by 2050 or earlier is possible. Stable long term policy provides the necessary certainty to unlock investment in low carbon technologies and deliver effective and efficient solutions to reduce carbon emissions at the lowest cost for customers.

In Australia, electricity accounts for about one-third of national emissions. With its ready access to a range of low carbon solutions which can be rolled out at scale, we believe the electricity sector should be responsible for more than one-third of any national emissions reduction target.

At a time when energy security has been called into question in Australia and power prices have risen sharply, Origin is acutely aware of our responsibility to help transition to a lower emissions economy in a way that maintains security of supply and energy affordability for Australian homes and businesses.

It is understandable that our stakeholders expect us to play a leading role in delivering solutions for emissions reduction both on a utility scale and in the home that delivers a cleaner, smarter and more modern energy system. This is exactly what we're doing.

Origin was the first energy company globally to commit to seven of the 'We Mean Business' coalition commitments including setting a science-based emissions reduction target. We are well progressed on this commitment and on track to announce a target for emissions reduction across our business before the end of 2017.

We are rapidly growing the share of renewables in our portfolio with a target of renewables comprising more than 25 per cent of our generation mix by 2020 – up from around 10 per cent today. This will not only contribute to emissions reduction, but also increase energy supply which is a critical action required to put downwards pressure on electricity prices. Beyond 2020, we expect the share of renewables in our portfolio to grow even further.

We own Australia's largest fleet of peaking gas-fired power stations, which is able to respond quickly and with significant capacity to periods of high demand. This will play an increasingly important role in firming the intermittency of renewables in the energy system to maintain security of supply.

We continue to see an important role for natural gas into the future as both a lower emissions firming fuel to complement growth in renewables in Australia, and globally as a lower emissions substitute for coal in power generation.

As well as demonstrating how our position on climate change is integrated into our core strategy, this report presents analysis of three emission reduction scenarios and the potential impact on the value of Origin's wholesale electricity generation portfolio:

1. Existing Australian climate change policies (BAU scenario);
2. A path to meeting Australia's Nationally Determined Contribution to the Paris Agreement (NDC scenario); and
3. A path consistent with the goal from Paris to limit global warming this century to 2°C (2°C scenario).

(1) Australia is targeting a 26-28 per cent reduction in emissions on 2005 levels by 2030.

A MESSAGE FROM OUR CEO

As demonstrated by our analysis, we believe Origin's wholesale electricity generation portfolio is not only resilient but is well-placed to prosper in a low carbon economy – its value increasing under both the NDC and 2°C scenarios.

We are confident our generation strategy focused on growth in renewables and natural gas will provide a pathway towards a cleaner and smarter energy future.



Frank Calabria
Chief Executive Officer

KEY POINTS

- Origin supports the Paris Agreement, Australia's 2030 target and a goal of net zero emissions in the electricity sector by 2050 or earlier
- We are committed to a science-based emissions reduction target and will announce this by December 2017
- We believe our wholesale electricity generation portfolio is not only resilient, but is well placed to prosper in a low carbon economy



THE GLOBAL ENERGY LANDSCAPE

THE PARIS AGREEMENT

The Paris Agreement, reached in December 2015, brings the global community together to combat climate change. The agreement's central aim is to strengthen the global response to the threat of climate change by keeping the global average temperature rise this century to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to less than 1.5°C.

PARIS AGREEMENT REQUIREMENTS

- An overall goal to limit global warming to less than 2°C and to pursue efforts to limit the rise to less than 1.5°C
- Reaching net zero emissions in the second half of the century

Australia's commitment to the Paris Agreement sets a target to reduce emissions by 26–28 per cent below 2005 levels by 2030. Given electricity generation accounts for approximately one-third of Australia's carbon emissions², the sector has a significant role to play in achieving this and future targets.

GLOBAL POWER GENERATION

Both the International Energy Agency (IEA)³, and the Intergovernmental Panel on Climate Change (IPCC)⁴ highlight the need for power generation to do the heavy lifting on decarbonisation. This is for two reasons:

1. The pathway to decarbonising power generation is relatively well understood, and of great importance given it represents 40 per cent³ of global emissions; and
2. As the emissions intensity of power generation declines, electrification will facilitate decarbonisation in other sectors, such as transport.

ROLE FOR NATURAL GAS

In the medium to long term, we believe renewable energy intermittency will be firmed by gas-fired generation as well as emerging technologies such as battery storage. However, at present battery technology is not at a scale or economic competitiveness to provide an immediate solution for a reliable supply of electricity over extended peak periods.

The IEA has identified gas as a transitional fuel to support significant growth in renewable energy globally. We believe this is for two reasons:

1. Emissions from gas can be up to half that of coal per unit of electricity generated⁵; and
2. Gas-fired generation technologies can respond quickly, and with significant capacity, when renewable energy is unable to generate (particularly for extended periods of time).

Gas therefore has a role to play in both displacing coal generation (in Australia and overseas), as well as supporting growth in variable, non-dispatchable renewable generation.

(2) Department of Environment and Energy, Quarterly Update of Australia's National Greenhouse Gas Inventory: August 2017.

(3) IEA's Energy Technology Perspectives 2016.

(4) IPCC's 5th Assessment Report in the Representative Concentration Pathway 2.6 (RCP 2.6) scenario: 2014.

(5) Australian Power Generation Technology Report, CO2CRC, 2015

ORIGIN'S POSITION ON CLIMATE CHANGE

We unequivocally support the Paris Agreement and view Australia's current 2030 emission reduction target as a starting point, with greater ambition expected over time. In October 2015, we were the first energy company in the world to sign up to seven of the 'We Mean Business' climate change commitments. These commitments include setting a science-based emissions reduction target, which we aim to announce by December 2017 and which will see our emissions decline in line with the IEA's 450 Scenario⁶.

We believe the electricity sector should be responsible for more than its proportionate share of any national carbon reduction measure, because it has viable options at scale and the ability to help unlock abatement in other sectors.

We have advocated for clear government policies to achieve Australia's 2030 emission reduction target and a goal of net zero emissions for the electricity sector by 2050. We have supported all 50 recommendations of the Finkel report and the government has endorsed 49 of the recommendations. On 17 October 2017, the government announced the National Energy Guarantee which we believe has the potential to address the objectives of ensuring security, affordability and facilitating the transition to a modern, cleaner energy future by unlocking investment in more supply.

Origin has structured its generation portfolio to grow and prosper in a carbon constrained world. We believe that the transition to a low carbon future presents Origin with opportunities to create value, given the resilience of our existing operations and a strategy focused on growth in renewables, gas and cleaner, smarter customer solutions.

RESILIENCE TO A CARBON CONSTRAINED WORLD

- **Short generation** - We produce less electricity than we sell to our customers which provides flexibility to bring low cost renewables into our portfolio without stranding existing generation assets.
- **Limited coal exposure** - We have no exposure to high-emissions brown coal and only one black coal-fired power station, Eraring, which plays a significant role in maintaining energy security and affordability, particularly as older and higher emissions-intensive coal-fired generators retire.
- **Gas peaking fleet** - We own Australia's largest fleet of gas-fired peaking power stations which plays a significant role in supporting the growth of intermittent renewable energy. The capacity of our gas-fired peaking power stations is sufficient to support our increased uptake of renewable energy.
- **Gas supply** - We are also a large supplier of gas, which is a lower-emissions energy source than coal. Gas is the only fossil fuel whose demand grows under the IEA's 450 scenario as it provides a source of firm generation supply and helps to displace coal.

FIVE PILLARS OF DECARBONISATION

We are taking a five pillar approach to drive the progressive decarbonisation of our business:

1. exit coal-fired power generation by early 2030s;
2. significantly grow renewables in our portfolio;
3. leverage our strong gas position as a lower emissions firming fuel;
4. empower customers with cleaner, smarter energy solutions; and
5. demonstrate leadership in climate change advocacy.

See Origin's 2017 Sustainability Report for more details on these five pillars at www.originenergy.com.au/sustainability

(6) IEA, World Energy Outlook 2016. The 450 Scenario seeks to limit the concentration of CO₂e in the atmosphere to 450 parts per million, which is consistent with a 50 per cent chance of limiting global warming to 2°C above pre-industrial levels by 2100. This scenario represented the most aggressive decarbonisation scenario modelled by the IEA in 2016.

ORIGIN'S POSITION ON CLIMATE CHANGE

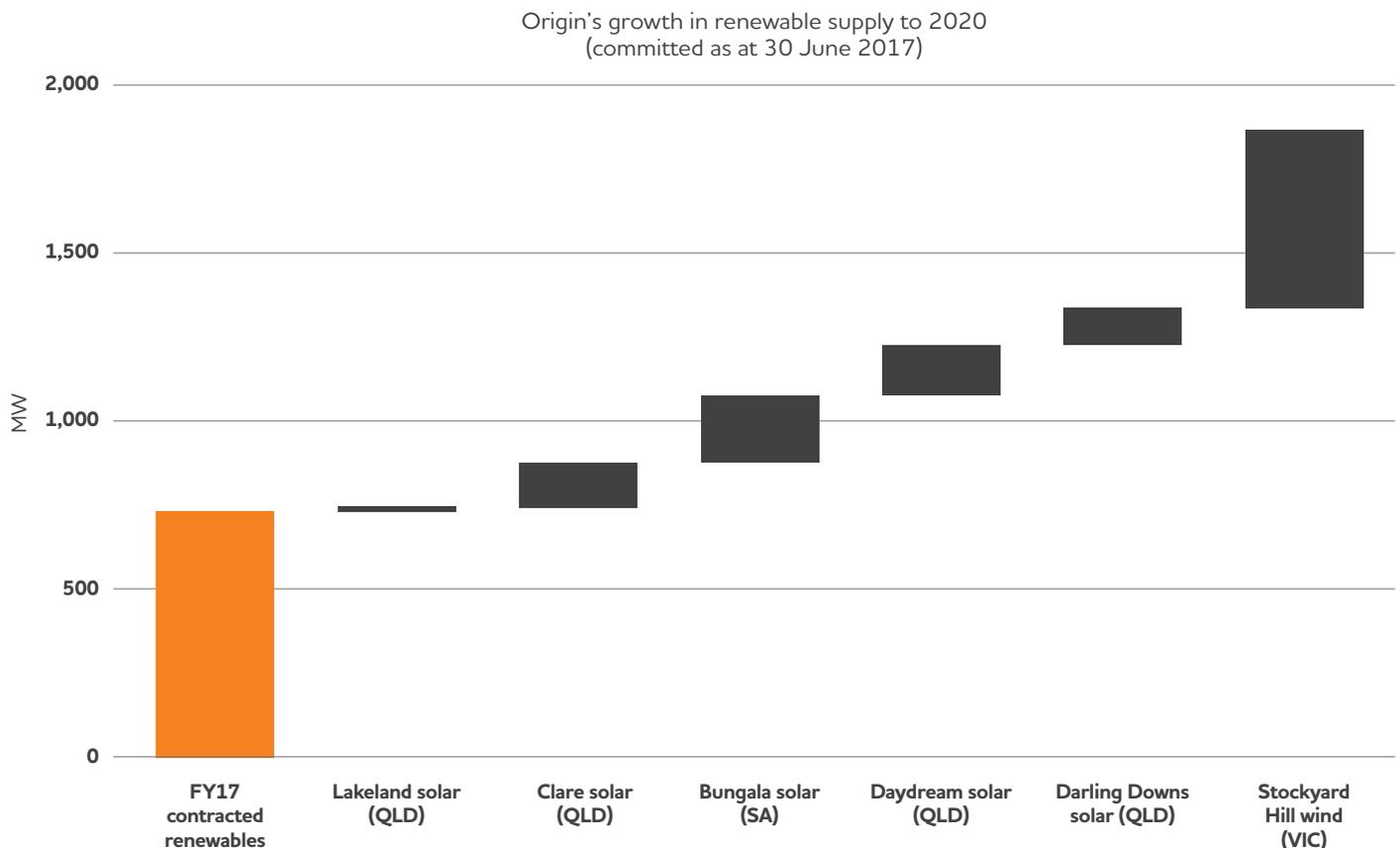
STRATEGY FOCUSED ON RENEWABLES AND GAS

Growth in renewables

We believe renewables represent the lowest cost investment in new electricity generation today. The majority of future investments in power generation are likely to be in renewable energy – firmed with natural gas, and battery storage in the medium to long-term. We estimate that approximately 4,000 MW of committed new renewable generation will come online in Australia between now and 2020 (almost doubling existing solar and wind capacity).

Since March 2016, we have committed to approximately 1,200 MW of new renewable energy supply which will come on line progressively over the coming years and support a competitive cost of energy.

By 2020, we are targeting renewables to grow to more than 25 per cent of the energy in our generation mix⁷, up from approximately 10 per cent today. Beyond 2020, we expect renewables will continue to play a key role in maintaining a competitive cost of energy and achieving our emission reduction targets.



(7) Consists of owned and contracted generation.

ORIGIN'S POSITION ON CLIMATE CHANGE

Benefits of Origin's natural gas position

Natural gas has long been recognised for its lower carbon profile (compared to coal) and its role in maintaining energy security. Its flexibility also makes it an ideal fuel to support the intermittency of renewables.

Unlike coal which requires a baseload (minimum) output, gas-fired generation can react quickly to peaks and troughs in demand. For example, Origin's Ladbroke Power Station can commence generating electricity in 6 minutes and can be taken to full load in 15 minutes.

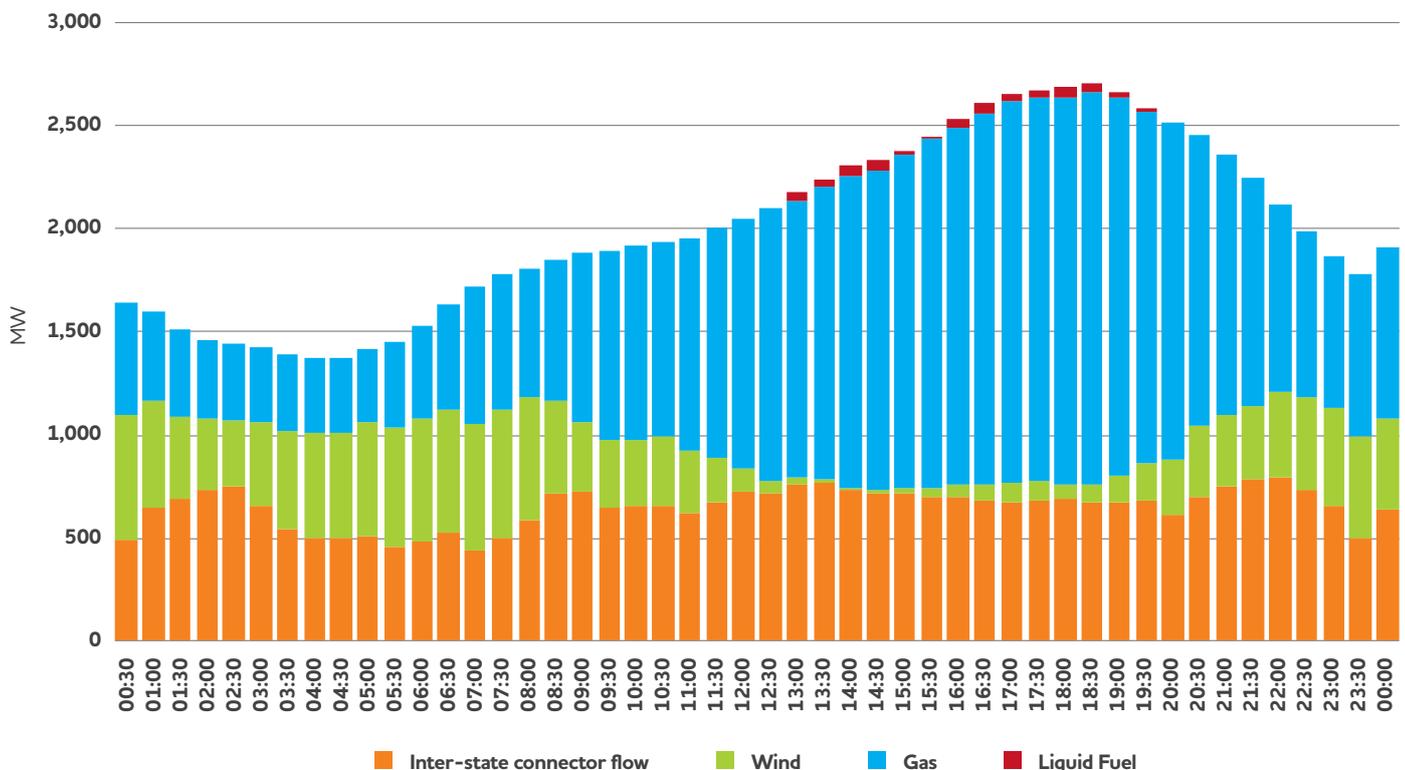
The ability of gas-fired generation to support renewables is demonstrated in the chart below which shows a particularly high demand day in South Australia earlier this year when variable wind generation declined and gas-fired generation significantly increased to maintain security.

On this day, gas-fired generation moved from a low of 356 MW to a high of 1,906 MW. All six gas generators in South Australia were operating (only one of two units at Pelican Point) supporting 70 per cent of total market load.

Since this date in South Australia, Origin has announced 200 MW of new solar generation to come online in late FY2018 and entered into a gas supply agreement with Engie that has brought the second unit at Pelican Point (240 MW of gas-fired generation) back on line. Both of these are examples of steps taken to improve the diversity of supply and overall energy security in South Australia.

We will continue to supply natural gas to meet the needs of major industries including manufacturing and residential customers. As the owner of Australia's largest fleet of gas-fired peaking power stations, we also expect to play an increasingly significant role in supporting the growth of renewable energy within our own portfolio and across the National Electricity Market (NEM).

South Australian Electricity Supply / Demand - 28 February 2017

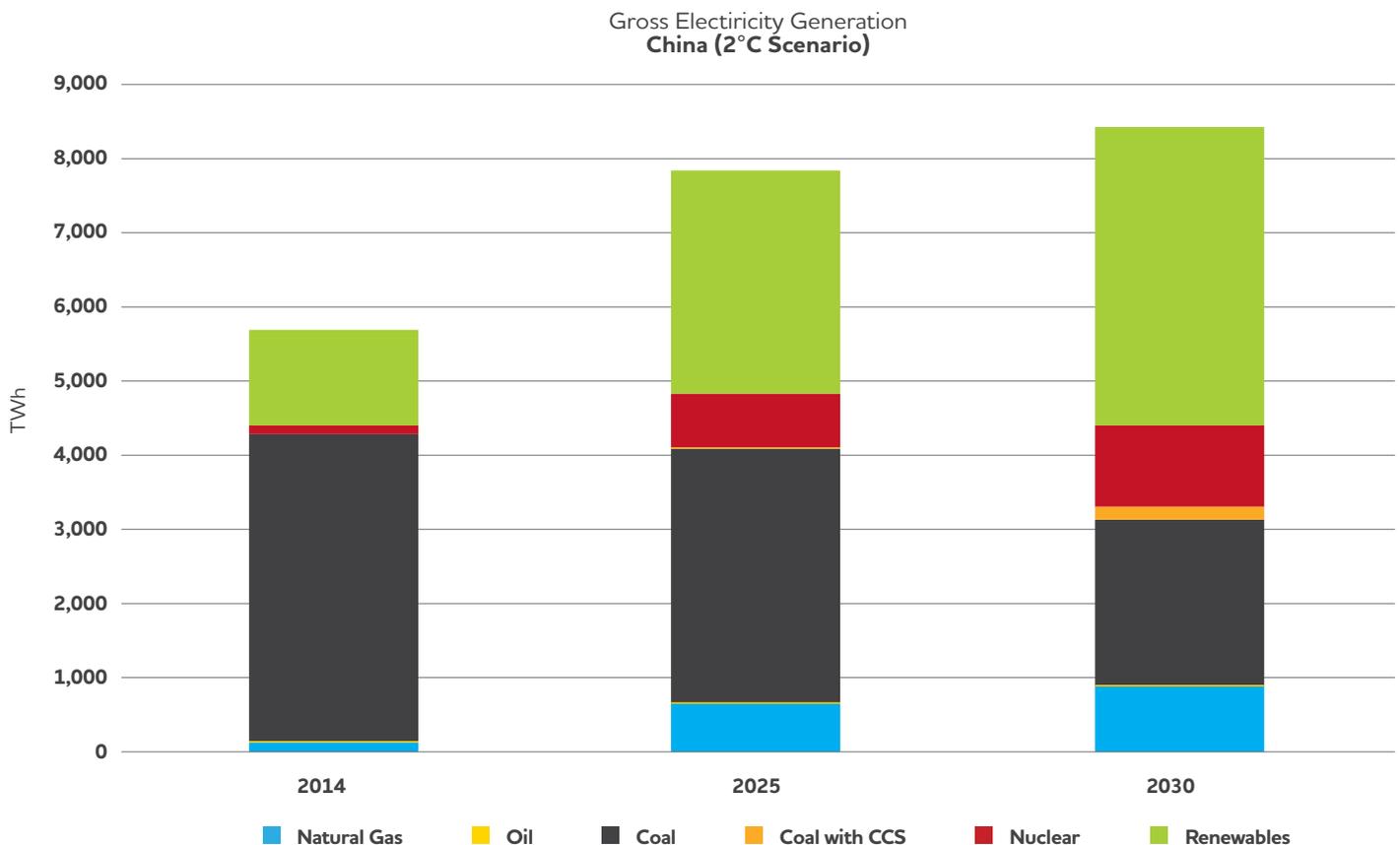


Source: AEMO

ORIGIN'S POSITION ON CLIMATE CHANGE

Origin is upstream operator and holds a 37.5 per cent interest in Australia Pacific LNG which supplies approximately 20 per cent of Australia's total annual east coast gas demand, and will continue to play a role in meeting the needs of larger gas customers such as manufacturers.

Australia Pacific LNG, through its long-term offtake contracts, is also a major exporter of liquefied natural gas (LNG) to customers in Asia and this gas will play an important role in supporting regional carbon reduction as gas is expected to displace coal-fired generation. The role of gas as a transition fuel to replace coal and firm up renewables in order to decarbonise the electricity sector is demonstrated by the IEA's 2°C scenario in the graph below.



Source: IEA's Energy Technology Perspectives 2017
 Note: CCS refers to Carbon Capture and Storage

EMISSION REDUCTION SCENARIOS

SCOPE OF ANALYSIS

Our Energy Markets business accounted for 91 per cent of our Scope 1 and 83 per cent of our Scope 1 + 2 emissions in FY2017. As such, we have chosen to focus this emissions reduction scenario analysis on the impact to Origin's wholesale electricity generation portfolio.

Origin's Integrated Gas business is excluded from this analysis. However, as demonstrated above, we believe gas has an important role to play in supporting emission reduction efforts domestically and internationally. Furthermore, Origin has committed to, by the end of 2017, publish a Company-wide science-based emission reduction target that will be consistent with the IEA's 2°C scenario and which will include a direct-emissions reduction target for the Integrated Gas business.

EMISSION REDUCTION SCENARIOS

Three scenarios are presented in this document based on greenhouse gas (GHG) reduction goals for Scope 1 electricity emissions in the NEM to 2030:

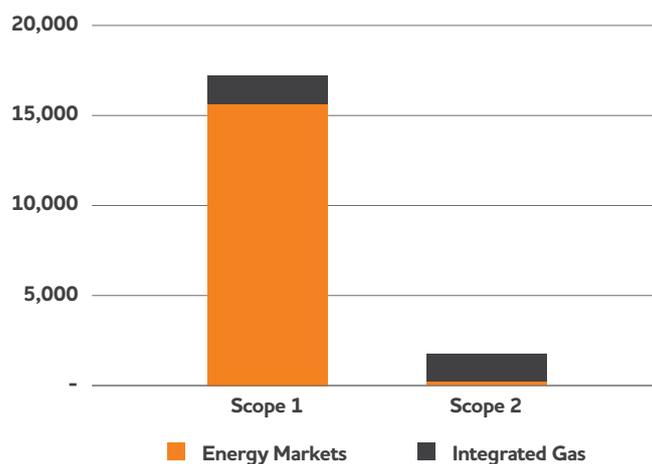
- Business as Usual (BAU)** – reflecting existing Australian federal and state government policy. This scenario assumes the Large Scale Renewable Energy Target (LRET)⁸ and the Victorian Renewable Energy Target⁹ are both met and there is no further renewable build, apart from the continued uptake of distributed solar generation.
- Nationally Determined Contribution (NDC)** – electricity emissions reductions are in line with Australia's Paris NDC commitment to reduce absolute emissions by 26–28 per cent from 2005 levels. In the absence of a defined electricity sector target, we have assumed the NEM needs to achieve at least its pro-rata share of this target.
- 2°C** – emissions reduction trajectory consistent with the Paris Agreement to hold global temperature rise to below 2°C, effectively decarbonising the electricity sector by 2050. In 2030 this is equivalent to a 45 per cent reduction on 2005 levels, in line with the minimum level proposed by the Climate Change Authority¹⁰, with a pro-rata target for the electricity sector.

(8) As per the GHG Protocol (a global provider of GHG accounting and reporting platforms): Scope 1 emissions are direct emissions from our owned or controlled operations and Scope 2 emissions are indirect emissions from consumption of purchased electricity

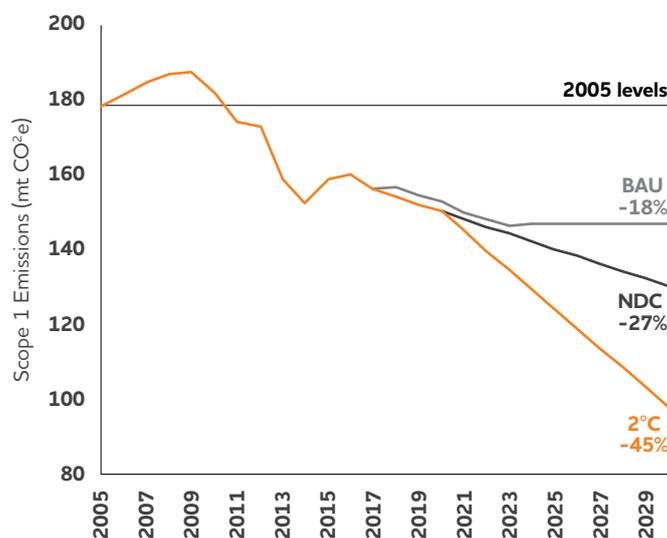
(9) <https://www.energy.vic.gov.au/renewable-energy/victorias-renewable-energy-targets>

(10) <http://climatechangeauthority.gov.au/sites/prod.climatechangeauthority.gov.au/files/files/CFI/Final-report-Australia-future-emissions-reduction-targets.pdf>

Origin emissions FY2017 (KtCO₂-e)



Modelled NEM emissions targets



EMISSION REDUCTION SCENARIOS

MODELLING APPROACH

The emission reduction scenarios above were modelled assuming a form of emissions trading scheme from 2020 which operates by setting an annual carbon intensity target for the market declining at a rate consistent with meeting the relevant 2030 emissions reduction goal. While there is uncertainty with respect to the mechanism that will be implemented to achieve Australia's Paris Agreement commitments, similar electricity market outcomes would be required for a given abatement target regardless of the mechanism adopted.

Based on this approach, an individual generator would either pay a carbon cost, or create a carbon credit at a rate equal to the difference between its carbon intensity and the target market carbon intensity for each unit of energy it generates. The modelling was done assuming a closed scheme operated within the electricity sector. The carbon cost/credit of generation is incorporated into a generator's marginal cost and therefore its bidding and dispatch behaviour.

By taking the carbon intensity of existing power stations in the NEM, we utilised an in-house carbon pricing model which solved for the least cost abatement options given certain estimated electricity demand profiles, gas and coal prices, renewable technology costs and emission reduction targets.

The impact of the three emission reduction scenarios was modelled using the third party market software PLEXOS¹¹ which simulates expected half-hourly electricity dispatch volumes and pricing across the NEM as well as price signals for new capacity to be built. This analysis ensured that the operational limitations of coal and gas generation plants were adhered to, including minimum generation levels for coal-fired generation.

Outputs from PLEXOS were then fed in to an in-house financial model to assess the valuation impact to Origin's wholesale electricity generation portfolio (presented on the following page).

KEY ASSUMPTIONS

System reliability

Sufficient supply is maintained to meet maximum demand with a minimum reserve requirement in each state. Time taken to build new generation is taken into account and differs by type of generation.

Linkage between climate change schemes

The value of LRET certificates is equivalent to the value of carbon abatement under any new policy mechanism. Under each scenario Origin's existing contracted renewables portfolio is valued by comparing the bundled cost of Origin's Power Purchase Agreements (PPAs) against the modelled outlook for electricity spot and LRET/carbon market prices.

Fuel costs

Generator fuel costs are a blended mix of estimated contracted and uncontracted pricing (for both gas and coal) plus transport costs to the individual generator.

Generator new build and retirement

Renewable and battery new entry and coal plant retirement are dictated by economic outcomes. The modelling approach bids generation plant at short-run marginal cost plus a premium to cover overhead costs such as major maintenance which are generally incurred on an irregular basis.

The rate of renewable build is an output of the carbon pricing and abatement modelling undertaken. Plant retirement occurs when fuel plus fixed costs are not being covered over an extended period.

Demand and distributed generation

We modelled national electricity demand scenarios which included estimates of behind the meter solar PV and battery uptake and improvements in energy efficiency across the residential, commercial and industrial sectors.

Under high wholesale electricity pricing, a demand-side response from the industrial sector was modelled (providing an effective cap to pricing).

SUMMARY OF SCENARIOS

Scenario	Abatement (% reduction from 2005)	Utility scale renewables ¹² (TWh in 2030)	Coal Retirements (GW by 2030)	Distributed Solar Generation (GW in 2030)	Grid batteries (GW in 2030)
BAU	-18%	38	4	15	0.1
NDC	-27%	50	7	15	0.1
2°C	-45%	50	9	15	2.0

The primary driver of emissions reduction in both the NDC and 2°C scenarios is the effective carbon price. Installation of renewables is the cheapest form of emissions reduction in all scenarios. Under both the NDC and 2°C scenarios, renewables are installed to the maximum amount without supply exceeding demand. Emissions reduction is higher in the 2°C case as a result of a higher carbon price, leading to higher coal retirements, replaced by gas and firming with additional battery build.

(11) See <http://energyexemplar.com/software/plexos-desktop-edition/> for further information on the PLEXOS modelling software

(12) Excludes existing hydro generation

SCENARIO ANALYSIS RESULTS

The chart below shows the estimated change in the value of Origin's wholesale generation portfolio under the NDC and 2°C scenarios.

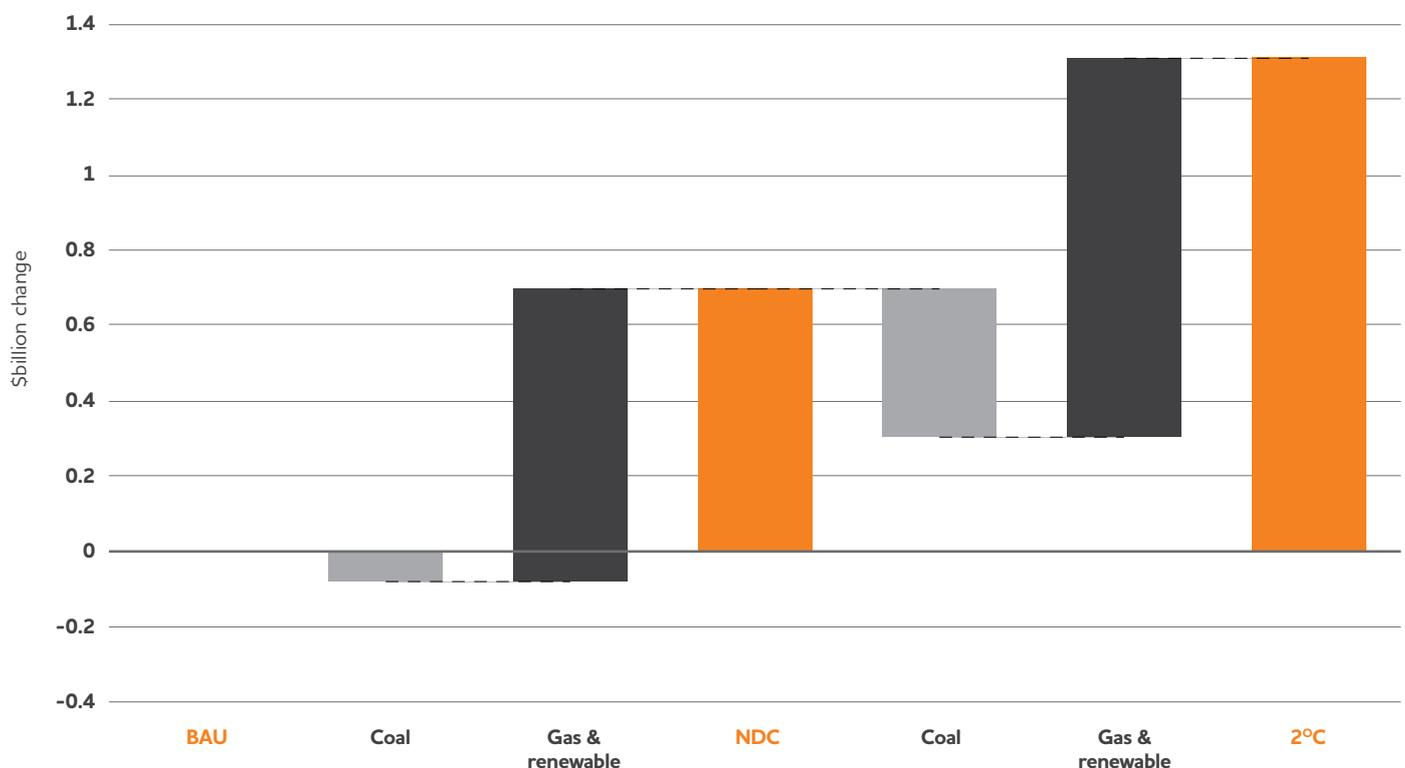
Importantly, this analysis covers Origin's existing owned and committed contracted generation portfolio only and does not consider any future expansion of, or change in the portfolio (e.g. continued growth in renewables).

Under the NDC scenario, we estimate our wholesale generation portfolio increases in value relative to BAU, with the benefit to our renewable and gas portfolios outweighing the increased carbon cost to our single coal-fired generation plant, Eraring. As our gas assets remain below the target market intensity, their value is increased as they become more cost competitive and as coal-fired generation retires, the role of our gas fleet in meeting peak demand increases. Our renewables portfolio benefits from having a zero-carbon generation position being directly valued.

Under the 2°C scenario, we estimate the value of our wholesale generation portfolio increases further relative to BAU. While a higher carbon impost in this scenario sees the value of Eraring fall by more than the NDC scenario, this is more than offset by an increase in the value of our existing gas and renewables portfolio. Our lower emissions intensity combined cycle Darling Downs gas generation plant significantly increases output with an improved competitive position and an increased role in the market as coal-fired generation retirements increase. Our renewable portfolio continues to benefit from having a zero carbon generation position.

While the value of Eraring declines under both the NDC and 2°C scenarios, it retains a net positive value and is an important asset providing secure and affordable base load power, particularly in the short to medium term.

Origin Climate Change Scenarios - Change in Net Present Value



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