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RENEWABLES: POWERING QUEENSLAND'S FUTURE

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Contents

Key Findings

1

Queensland is leading Australia in large-scale renewable power projects.

- Queensland has the largest number of large-scale renewable energy projects under construction of any State in Australia. That represents one quarter of all projects across the nation, $1.6 billion in investment and over 1,300 new renewable energy construction jobs.
- Over 5,000MW of additional renewable energy capacity is currently in the development pipeline in Queensland. More than the equivalent of three coal fired generators.
- Queensland could host Australia's biggest solar power plant, with a 1GW (1,000MW) solar farm approved near Wandoan.

2

New Queensland wind and solar projects are at significantly lower costs than new fossil fuel projects.

- The Coopers Gap wind farm in Queensland has set a record low price of under $60/MWh, half the estimated cost of energy from a new coal plant.

3

The Sunshine State's solar households are national leaders.

- 31.6% of households in Queensland have solar rooftops.
- There are 14 postcodes in Queensland where more than 50% of households have rooftop solar.
- Elimbah leads the state with 63% of households with rooftop solar.

4

Queensland's energy system is one of the most secure and reliable in Australia.

- The Australian Energy Market Operator has concluded Queensland has "no material risk" of insufficient electricity supply over the coming decade.
- Queensland leads in integrating large-scale solar with energy storage technologies ensuring renewable energy is "backed up" where required.

5

Policy and business decisions made in the next few years will be crucial to the future development of renewable power, and associated jobs, in Queensland.

- The renewable energy industry in Queensland currently provides 2,710 full time equivalent jobs across the state.
- It is estimated that reaching 50% renewable energy across Australia in 2030 would create over 6,000 jobs in Queensland.

Introduction

Queensland is rich in energy resources of the past and future: coal and gas; as well as the sunshine and wind powered technologies which now dominate global investment. The state is fast approaching a crossroads for which future it will pursue. This report describes the opportunities and benefits that flow from deciding to pursue a clean, renewable future.

Climate change, largely driven by the burning of coal and gas, is worsening extreme weather events that threaten Queensland's unique natural assets and tourism industry. Climate change is also contributing to the bleaching of the Great Barrier Reef, which supports 69,000 jobs and is estimated to contribute $7 billion to the Queensland economy (Climate Council 2017a).

Queensland is currently heavily reliant on fossil fuels for its electricity supply, and is a major exporter of coking coal and liquefied natural gas (LNG) (Queensland Government 2017a). Coal provides 73% and gas 18% of the state's power supply (Department of Environment and Energy 2017). However, high domestic gas prices, driven up by LNG exports, are contributing to higher electricity prices across the National Electricity Market, particularly in gas-heavy markets like Queensland (ACCC 2017).

The Queensland Government has also encouraged the development of fossil fuels for domestic use and export in the Galilee Basin (thermal coal) and Surat Basin (coal seam gas) and other areas of the state (Queensland Treasury 2017).

In response to these challenges, and in the absence of Federal Government policies on power or pollution, Queensland can lead the transition to a modern, clean renewable powered grid (Climate Council 2017a).

Renewable energy can bring many benefits to the Sunshine State. Queensland households with solar use 18% less electricity from the grid than the average residential user (ACCC 2017) while around 6,000 new jobs could be created with a renewable energy target of 50% across Australia (Climate Council and EY 2016).

On the other hand, Queensland households are leaders in distributed rooftop solar and a large-scale solar construction boom is just kicking off in the aptly named "Sunshine State." Australia's largest solar power plant has been approved in Queensland, which when built, will become one of the largest in the world.

As the world increasingly shifts away from fossil fuels to a renewable energy future, which path will Queensland choose?

This report provides a status update on electricity and renewable energy in Queensland.

Queensland households lead in rooftop solar.

1. Queensland Electricity Update

QUEENSLAND'S ELECTRICITY IS DOMINATED BY FOSSIL FUELS

Queensland's electricity is currently dominated by fossil fuels - coal (73%) and gas (18%). The state has a relatively low, but increasing, share of renewable energy (7%), mostly generated from household solar and bioenergy (Department of Environment and Energy 2017).

QUEENSLAND CONTINUES TO LEAD IN HOUSEHOLD SOLAR

Queensland households are leading the country in solar PV. Almost a third (31.6%) of Queensland homes now have solar panels (ahead of South Australia 30.5% and Western Australia 25.4%). There are 14 postcodes in Queensland where more than 50% of households have rooftop solar (APVI 2017).

Elimbah leads the state with 63% of households with rooftop solar, the second highest in the country after Baldivis in WA (69%).

Queensland households with solar use 18% less electricity from the grid than the average residential user (ACCC 2017).

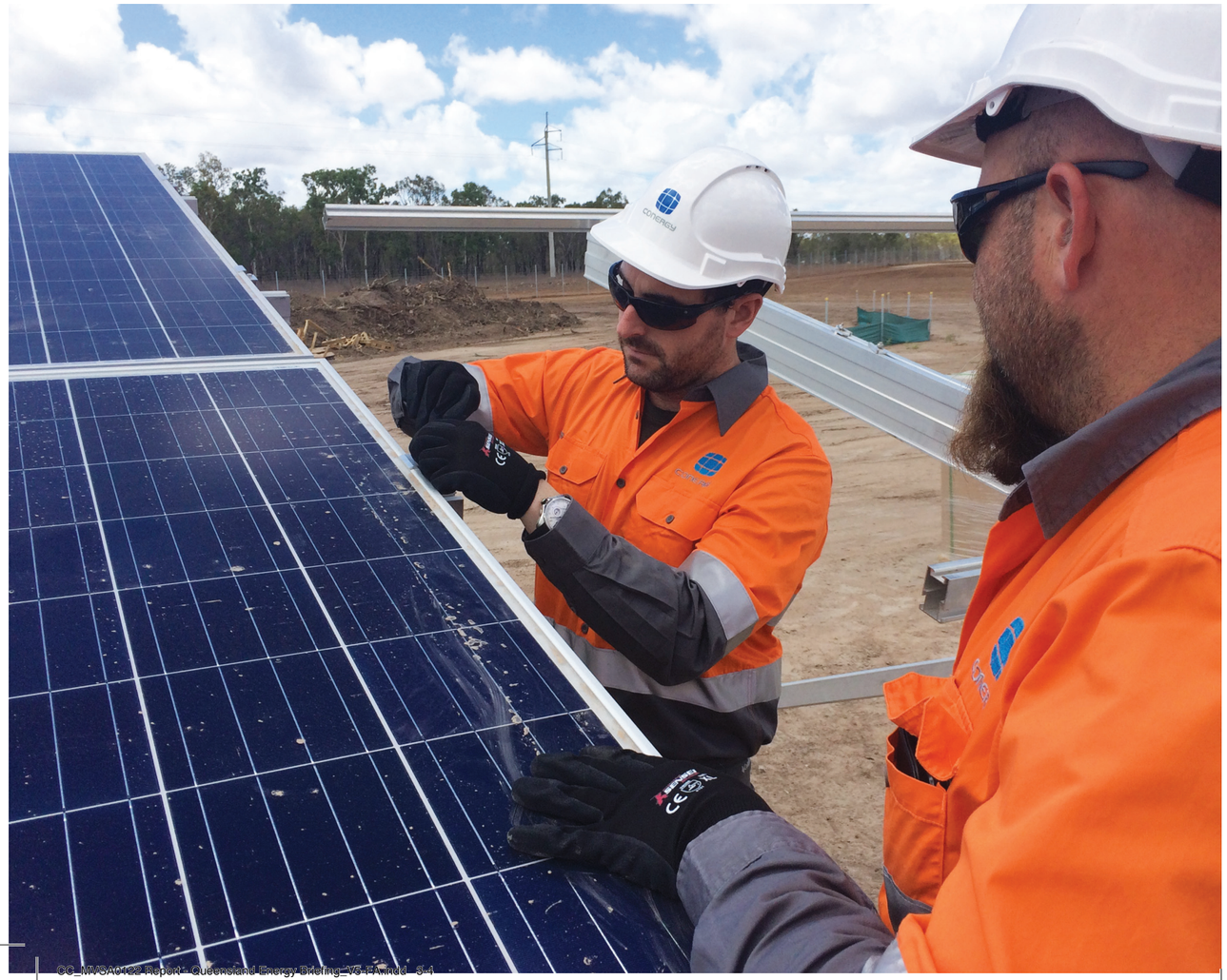
Figure 1: Rooftop solar at University of Queensland.

LARGE-SCALE RENEWABLES CONSTRUCTION BOOM UNDERWAY IN QUEENSLAND

Queensland has at least 14 large-scale renewable energy projects (totaling 853MW) under construction in 2017, more than any other state (Clean Energy Council 2017).

Other sources indicate even more large-scale renewable energy under construction in Queensland. Green Energy Markets (2017) reports 1,759MW under construction in Queensland in September 2017.

Figure 2: Lakeland Solar and Storage project under construction.



Australia's largest solar power plant has recently been approved near Wandoan in Queensland (AFR 2017). When built, the 1,000MW solar farm will be among the largest solar power plants in the world (PV Magazine 2017).

Over 5,000MW of additional renewable energy capacity is currently in the development pipeline in Queensland (AEMO 2017).

Australia's largest solar power plant has been approved in Queensland.

Table 1: Queensland projects under construction.

Project	Capacity	Investment	Jobs
Mt Emerald Wind Farm	180MW	$380m	150
Sunshine Coast Solar Farm	15MW	$50m	60
Lakeland Solar and Storage (Figure 2)	10.8MW	$42.5m	60
Ross River Solar Farm	148MW	$225m	150
Clare Solar Farm	100MW	$190m	200
Sun Metals Solar Farm	116MW	$155m	250
Kidston Solar Farm	50MW	$126m	100
Tableland Sugar Mill (bagasse)	24MW	$75m	80
Normanton Solar Farm	5MW	$14m	20
Longreach Solar Farm	17.4MW	$31m	30
Oakey 1 Solar Farm	30MW	$56m	50
Collinsville Solar Farm	42MW	$100m	120
Whitsunday Solar Farm	57.5MW	$122m	116
Hamilton Solar Farm	57.5MW	-	-
14 projects	**853.2MW**	**$1,566.5m**	**1,386**

Source: Clean Energy Council 2017.

2. Secure Renewables: Queensland Leads in Integrating Large-scale Solar and Storage

Numerous studies have consistently found there are no technical barriers to Australia achieving secure power from a high proportion of renewable electricity (AECOM 2012; AEMO 2013; Elliston et al 2013; CSIRO 2016; Lenzen et al 2016; Teske et al 2016; Finkel 2017; Stocks et al 2017). In fact, renewable energy can improve the security of electricity supply through providing greater geographic diversity and a broader range of technologies.

A high renewable, modern power grid can balance demand and supply for electricity through a mix of variable renewables (wind and solar PV), on-demand, or "dispatchable" renewables (such as solar thermal, biomass or established hydro power), energy storage technologies (such as pumped hydro or batteries) together with energy efficiency and demand response.

Complementing wind and solar PV with large-scale energy storage, improves the ability for reliable renewable power to meet continuous demand. There are a number of projects underway in North Queensland combining solar with wind and/or energy storage, including:

- Lakeland integrated solar and battery storage power plant will be the Southern Hemisphere's first large-scale integrated solar and battery storage facility. The project combines a 13MW solar power station together with 5.3MWh battery storage and will be able to provide reliable power quality and supply (Conergy 2016; Figure 3).

North Queensland projects are combining large-scale solar plants with energy storage.

- Kennedy Energy Park combines solar, wind and battery storage (19MW solar PV with 22MW wind and 4MWh of battery storage) with plans in place to scale up to 600MW of solar PV and 600MW of wind power (ARENA 2017).
- GenexPower's Kidston project combines up to 330MW of solar PV (phase one 50MW, phase two 270MW) with pumped hydro storage, utilising a former gold mine. The pumped hydro storage stores energy by pumping water from a lower water storage reservoir to an upper reservoir; the water can later be released (generating electricity) at times of high demand. The project will potentially provide up to 330MW of power on-demand into the National Electricity Market (GenexPower 2017).

Figure 3: Lakeland solar and battery storage project.

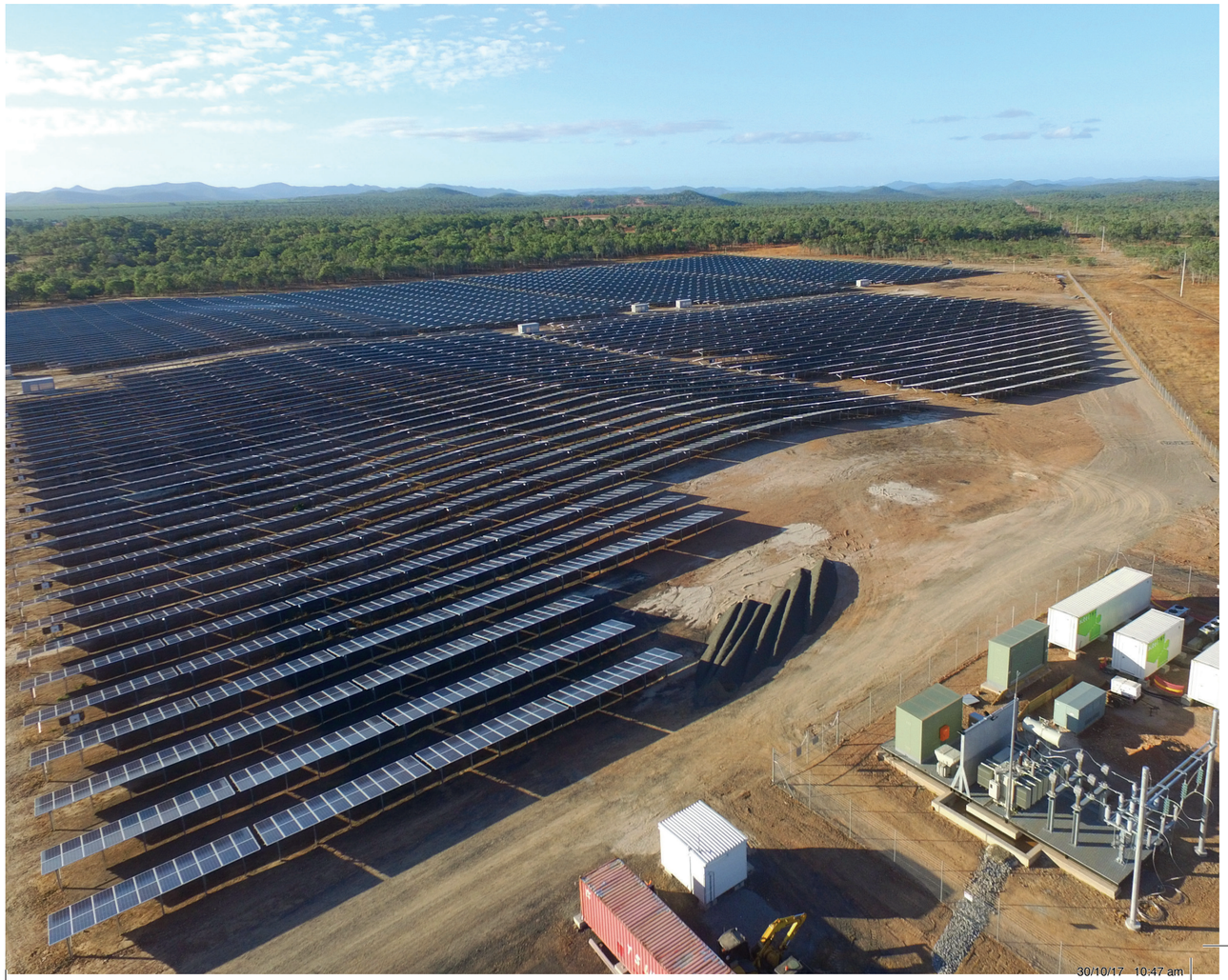
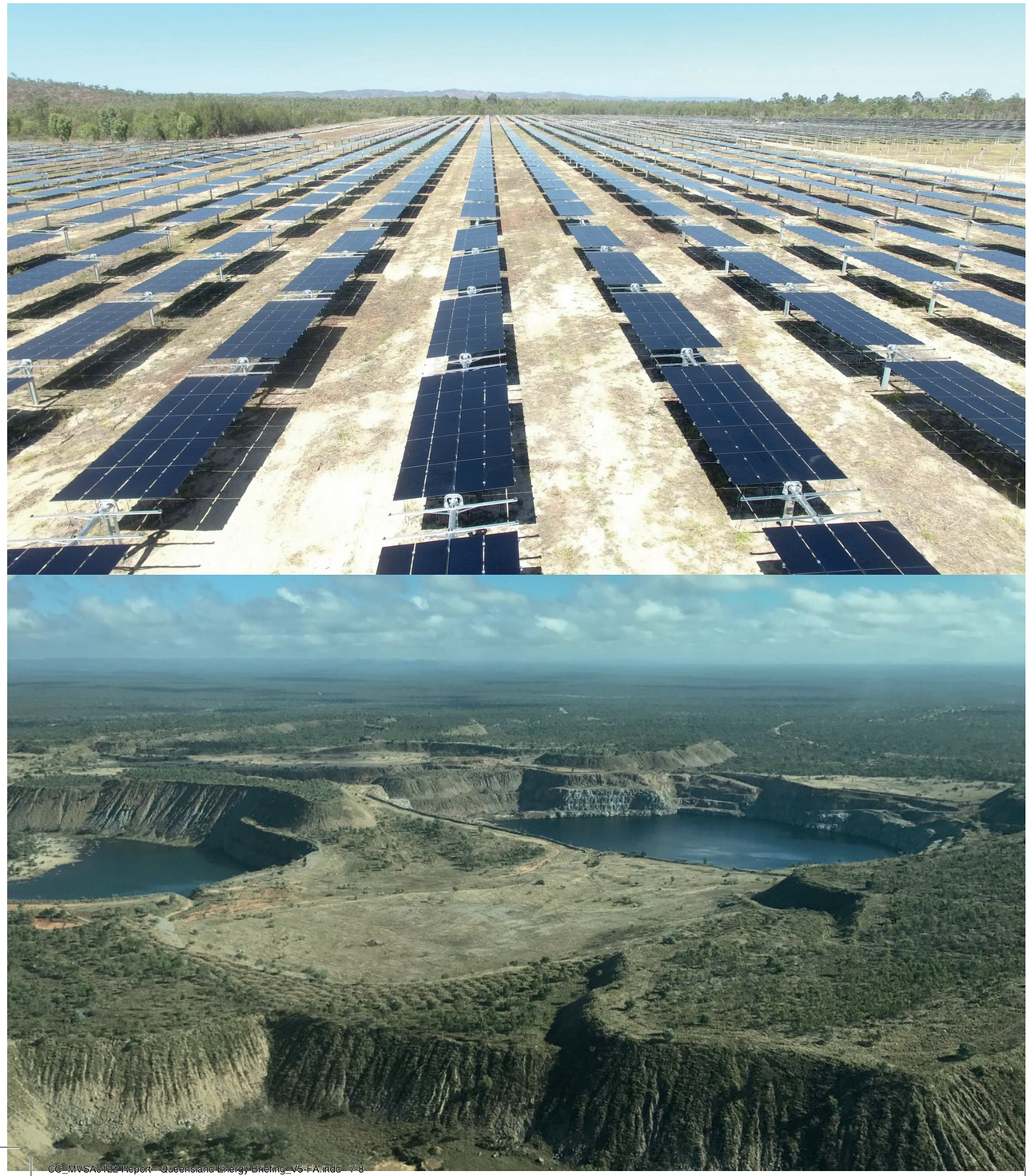


Figure 4: Kidston solar and pumped hydro project.



3. Jobs

According to data from the Australian Bureau of Statistics (2017), the renewable energy industry in Queensland currently provides 2,710 full time equivalent jobs across the state.

Employment modelling has shown that transitioning to 50% renewable energy by 2030 will lead to over 28,000 new jobs nationally, nearly 50% more than would be created under business as usual conditions (Climate Council and EY 2016). Over 6,000 new jobs would be created in Queensland - particularly in rooftop and large-scale solar and wind (Climate Council and EY 2016).

50% renewable energy across Australia in 2030 would create around 6,000 new jobs in Queensland.

4. Costs

Renewable energy is the cheapest form of new power generation. Even with all of the existing subsidies and externalised costs associated with coal and gas power (diesel fuel rebates, health and environmental impacts, carbon emissions), renewable power technologies are now cost competitive or cheaper than new coal and gas power plants (Table 2).

Wind is the cheapest form of new power generation. Recent prices for Australian wind farms, such as Stockyard Hill in Victoria and Coopers Gap in Queensland have set record low prices of between $52 - 60/MWh (RenewEconomy 2017a).

Large-scale solar PV plants are being built in Queensland for less than $80/MWh. A solar thermal plant in Port Augusta, South Australia, capable of providing round-the-clock power has been contracted for between $78-88/MWh (Government of South Australia 2017).

Companies are starting to take advantage of the low and rapidly falling costs of renewable energy, by signing contracts directly with solar and wind farms (RenewEconomy 2017b,c). For example, SunMetals, a zinc refinery in Townsville is building a 116MW solar farm to provide around a third of its electricity needs and support the company's plans for expansion (RenewEconomy 2017c).

Queensland wind and solar have set record low power prices.

Table 2: Cost of new build power plants.

Power Technology	Levelised Cost of Energy (LCOE)$ (aus)/MWh
SA Solar Thermal Plant	$78[1]
Wind	$60 - 118[2]
Solar	$78 - 140
Gas Combined cycle	$74 - 90[3]
Coal	$134 - 203
Coal with CCS	$352

Sources: BNEF Research 2017.
[1] Government of South Australia 2017.
[2] Note recent prices for wind are "well below" $60/MWh.
[3] Based on gas prices of $8/GJ. Current gas prices are much higher than this, and at peak times can be up to 2-3 times higher.

5. Current Queensland Government Policies

Queensland has a target to reach 50% renewable energy generation by 2030 and 1 million solar rooftops or 3,000MW of distributed solar PV by 2020.

The State Government collaborated with the Australian Renewable Energy Agency to support the development of 150MW of large scale solar energy in the state.

Queensland's expert panel released its final report into the 50% Renewable Energy Target. For the state to achieve a 50% target, 4,000-5,500MW of new large-scale renewable energy generation capacity would need to be built by 2030. There are no technical barriers to reaching the 50% target, provided complementary measures are put in place over the coming decade. Achieving the 50% target is projected to be broadly cost neutral to electricity consumers out to 2030 (Queensland Renewable Energy Expert Panel 2016). The 50% renewable energy target is a net positive when the avoided externalities of coal and gas generation are considered, particularly in terms of heath costs borne directly by communities and the State Government (ATSE 2009).

The Government is yet to detail its final plan for reaching the target (Queensland Government 2017b). The State Government has outlined its initial response to the report, including a 400MW renewable energy and storage reverse auction (Queensland Government 2017c). A reverse auction is a competitive process for purchasing power for the lowest cost.

The State Government introduced a target for net zero emissions by 2050 (Queensland Government 2017d).

While the Queensland Government is actively pursuing a strong renewable energy and net zero emissions target, the State Government also provides support for fossil fuels, principally the opening up of the Galilee Basin for thermal coal and additional areas in the Surat Basin for exploring and developing coal seam gas.

All Australian governments have responsibilities for reducing carbon emissions from the electricity sector. Climate change, driven by the burning of coal and gas, is worsening extreme weather events that threaten Queensland's unique natural assets and tourism industry. Climate change is also contributing to the bleaching of the Great Barrier Reef, which supports 69,000 jobs and is estimated to contribute $7 billion to the Queensland economy (Climate Council 2017).

Developing new fossil fuel deposits, like the Galilee Basin, will significantly worsen Australia's greenhouse gas pollution and threaten thousands of jobs (Greenpeace 2012). Policies to promote coal and renewables cannot be pursued in isolation.

6. Is New Coal a Good Idea for Queensland?

Building new coal-fired power plants in Queensland is expensive, polluting and unnecessary for the reliability of Queensland electricity supply.

The Australian Energy Market Operator has assessed supply in Queensland over the coming decade and has concluded Queensland has "no material risk" of insufficient electricity supply (AEMO 2017). In addition, Queensland will have more than sufficient electricity supply, given AEMO's assessment did not include additional capacity provided under the state's reverse auctions for 300MW of new renewable electricity and 100MW of energy storage.

Building new coal plants is an expensive and time-consuming option for replacing Australia's existing ageing, inefficient coal fleet. Furthermore, new coal plants are generally considered too risky for private investors (Climate Council 2017b; Table 2).

Building a new coal fired power station in Queensland would effectively lock in over 40 years of pollution. This is well beyond 2050 when the Queensland Government and Australian Government have committed to net zero emissions in line with the Paris Climate Agreement (WRI 2016; Queensland Government 2017d).

In addition, coal and gas plants take much longer to develop and construct than new renewable energy or large-scale energy storage (Table 3).

Table 3: Timeframes for energy projects.

Technology	Timeline From Feasibility to Completion
Large-scale battery storage	4- 6 months (e.g. South Australia's large-scale battery, California large-scale battery rollout)
New wind and solar plants	1-3yr
Solar thermal	2-3yr (e.g. South Australia's solar thermal power plant)
Large-scale pumped hydro	Environmental impact assessment 1yr+ Minimum 6 yr to build (e.g. Snowy Hydro 2.0)
Coal or gas power station	6 yr+

Sources: NSW Business Chamber 2009; Clean Energy Council 2013; ABC 2017; Energy Storage News 2017; Government of South Australia 2017; News.com.au 2017; Snowy Hydro 2017.

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