Renewable energy and jobs in Queensland

August 2020

AUSTRALIAN CONSERVATION FOUNDATION

Green Energy Markets

Front cover. Haughton Solar Farm. *Photo*. Ross Budd.

Key **findings**

The renewable energy boom is well underway in Queensland, with current renewable projects on track to provide more than one-third of the state's power consumption by 2025.

This report details how projects contracted and committed to over the last five years will produce more than 10,000 GWh of Queensland's electricity needs — equivalent to the annual consumption of more than 2 million Queensland households.

The majority of these contracted projects are in the South-West and northern regions of the state, leaving Central Queensland, specifically the Gladstone region, slated as the next growth area for renewable energy projects. Four significant solar farms are proposed within the Gladstone Council region. These are expected to produce almost 1,000 MW, which is equivalent to the consumption of 380,000 Queensland households.

This report also highlights the great potential Queensland harbours for further renewable energy growth and jobs.

If all proposed projects were pursued across the state, the renewables boom could open up more than 78,000 job-years of construction employment for a diversely skilled population — including engineers, finance professionals, truck drivers, electricians, mechanics, welders and labourers — and add 65,000 GWh in power to the grid, which is greater than all the power generated by coal and gas combined in Queensland.

Delivered as part of a 15-year program, these proposals could help achieve self-sufficiency in renewables and build an industry exporting renewable energy (for example via hydrogen, green steel or aluminium production), helping Queensland to provide permanent full-time employment for around 5,200 people in constructing these projects. It would also create employment for another 4,100 people in operating and maintaining the facilities.

Yet, as other Australian states invest in renewable energy, Queensland could face significant competition for private sector investment dollars. To realise its potential as a renewable powerhouse, Queensland needs stronger political will, better planning and policies to rejuvenate its energy system and phase out polluting energy.

With investment in high-quality transmission infrastructure, a supportive government policy that recognises the importance of tackling the threat of a changing climate, and a skilled and enthusiastic workforce, Queensland could be a national leader in renewable energy projects.

The reneweable energy boom **is well underway in QLD**

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This report was produced with the analytical assistance of Green Energy Markets and draws upon employment survey research prepared by the Institute for Sustainable Futures at the University of Technology Sydney.

Green Energy Markets specialise in economic analysis of renewable energy, energy efficiency and other carbon abatement solutions and associated markets.

Renewable projects on track to deliver **one-third of Queensland's power**

Over just five years, Queensland has experienced a transformation in the scale and cost of renewable energy.

Previously, renewable energy was such a small part of the power supply that many ignored it. Yet substantial advancements in technology over the last 20 years have allowed us to extract substantially more energy from the wind and sun at vastly lower costs.

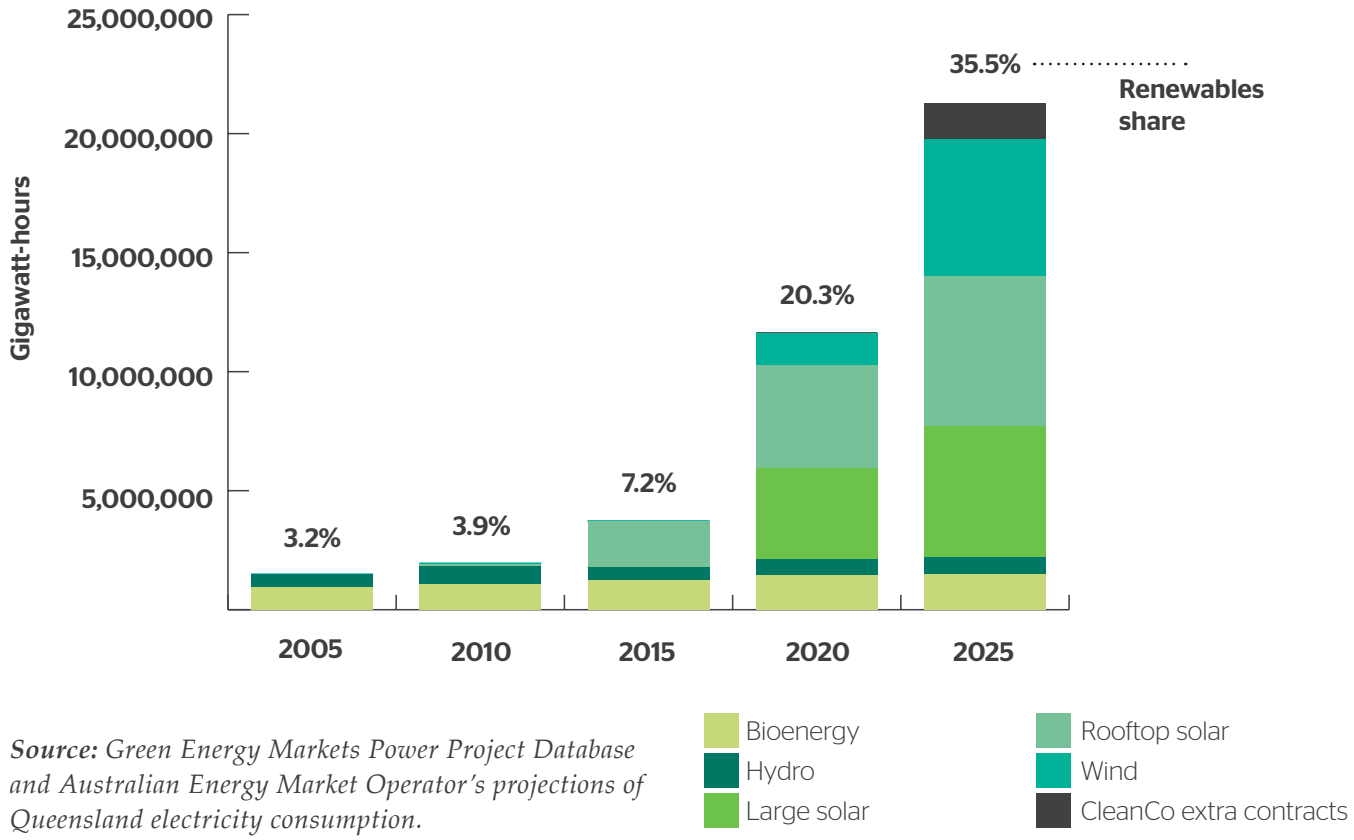
By 2016, these technologies — in conjunction with clear government policy and rapidly rising fossil fuel costs — led to a massive expansion of renewable energy in Queensland.

Figure 1.1 illustrates renewable energy power-generation levels and share of Queensland power consumption from 2005 to 2025, based on projects in construction or contracted.

Between 2000 and 2010, renewables made up less than 4% of Queenslanders' power consumption and barely grew. Then, from 2010, Queensland householders began enthusiastically adopting solar systems for their rooftops. This growth further accelerated from 2016 as large-scale solar and wind farms were committed to construction. Now, in 2020, renewables make up slightly more than 20% of power consumption.

Renewables will continue to expand after 2020 to reach over a third of Queensland power consumption by 2025. Much of this growth will be due to just two very large projects - the Macintyre Wind Farm and the Western Downs Solar Farm - as well as households and businesses added solar systems to their rooftops.

Figure 1.1 Queensland renewable energy power generation and share of consumption



***Source:** Green Energy Markets Power Project Database and Australian Energy Market Operator's projections of Queensland electricity consumption.*

If all proposed renewables projects were pursued across the state, **they could add 65,000 GWh in power to the grid, which is greater than all the power generated by coal and gas combined in Queensland**

Previous page. Haughton Solar Farm. *Photo.* Unknown.

Projects contracted over the last five years will **generate 12,000 job-years of construction jobs**

The map in Figure 2.1 illustrates the construction employment that will be generated by utility scale renewable energy projects committed to or contracted since 2015.

The Darling Downs and South-West Queensland has so far been the leader in capturing renewable energy construction projects, with 6,313 job-years of construction employment.[1] Two-thirds of this have been tied to two major wind farm projects — the 453 MW Coopers Gap and the 1026 MW Macintyre projects. The Macintyre project was recently underpinned by a power purchase agreement with the Queensland Government's CleanCo.

Far North Queensland is the next biggest hot spot, recently boosted by the Kidston Pumped Hydro project securing an offtake agreement with Energy Australia and a commitment from the Queensland Government to build new transmission infrastructure.

This is followed by the north-east region which includes Townsville, Mackay and Charters Towers. So far, all renewable energy projects in this region have been in solar.

In contrast, the Central and Burnett-Wide Bay regions of Queensland have lagged behind other regions in renewable energy construction projects. Yet this is not for lack of potential, as explained in the next section of this report.

In terms of ongoing permanent employment, all projects committed to or contracted in the last five years are expected to support close to 700 full-time jobs in operations and maintenance.

Table 2.2 shows that these projects will produce more than 10,000 GWh of Queensland's electricity needs, equivalent to the annual consumption of over 2 million Queensland households.

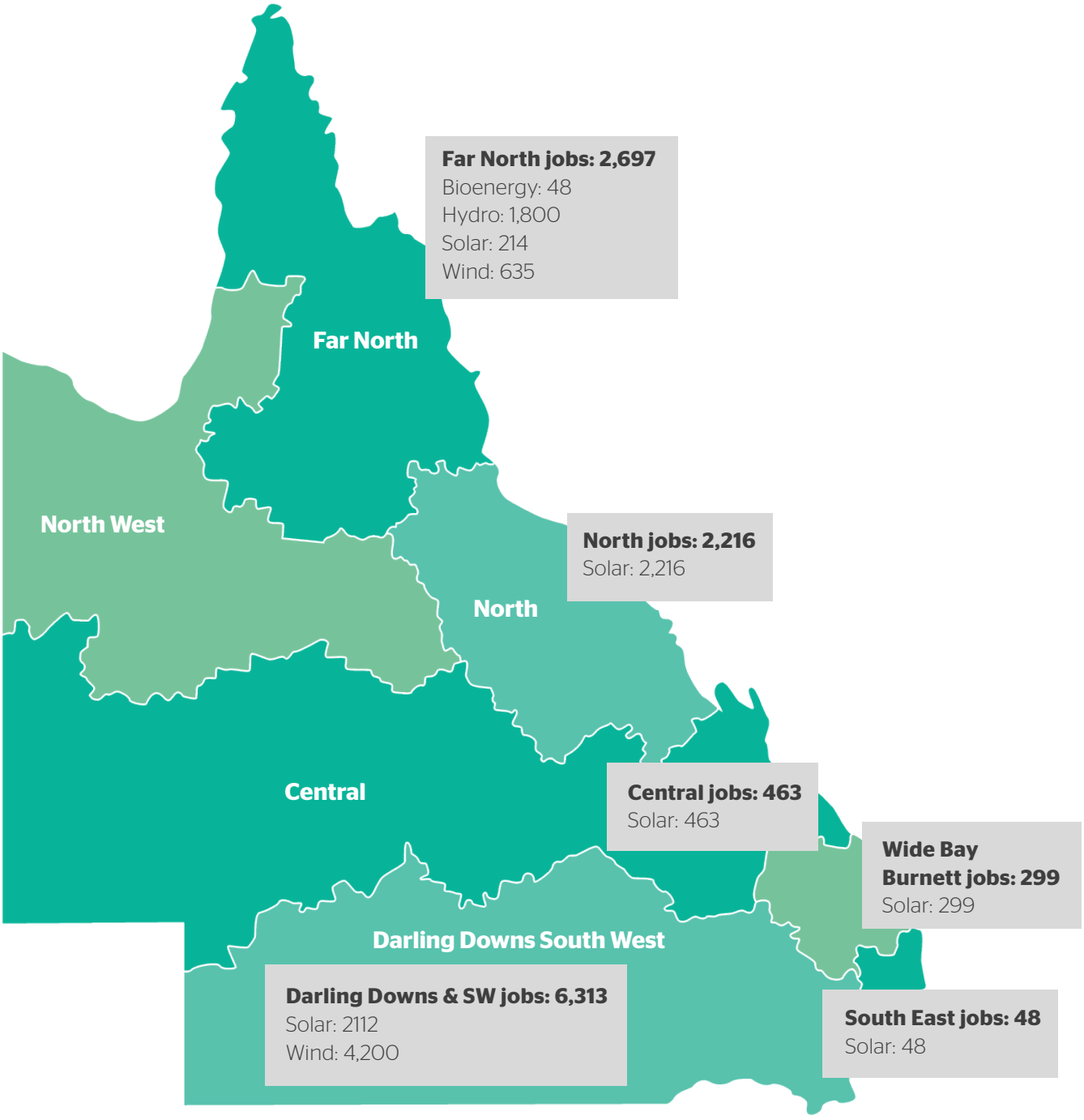
Table 2.2 Annual power production from renewable energy projects committed or contracted since 2015.

Region	Power produced (GWh)	No. of households powered
Far North	1,005	191,800
North-East	2,062	393,496
Darling Downs South West	6,907	1,318,217
Central	456	87,082
Wide-Bay & Burnett	283	54,093
South-East	36	6,871
Total	**10,750**	**2,051,559**

Source: *Green Energy Markets Power Project Database for power production. Average Queensland household electricity consumption provided by Australian Energy Market Commission's Residential Electricity Price Trends 2019.*

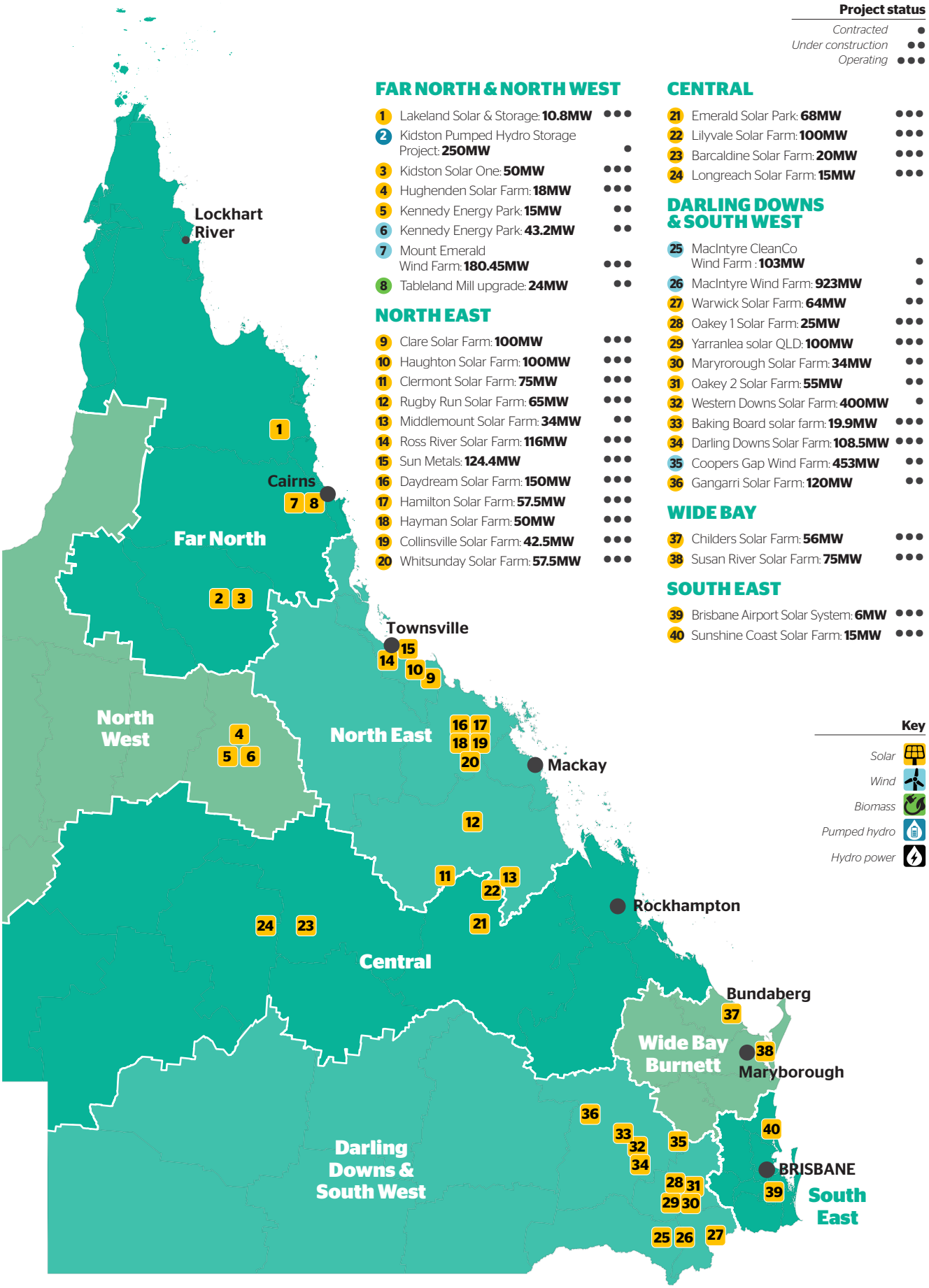
[1] A job-year is a measure of the labour required to develop and construct a project and represents a single person employed full time over a year.

Figure 2.1 Construction employment created by renewable energy projects committed or contracted over last five years.



Source: *Green Energy Markets analysis with employment factors derived from University of Technology Sydney Institute for Sustainable Futures (2020) Renewable Energy Employment in Australia: Methodology – June 2020.*

Queensland renewable energy projects committed or contracted since 2015.



A possible 78,000 job-years of construction employment **and more power than coal and gas**

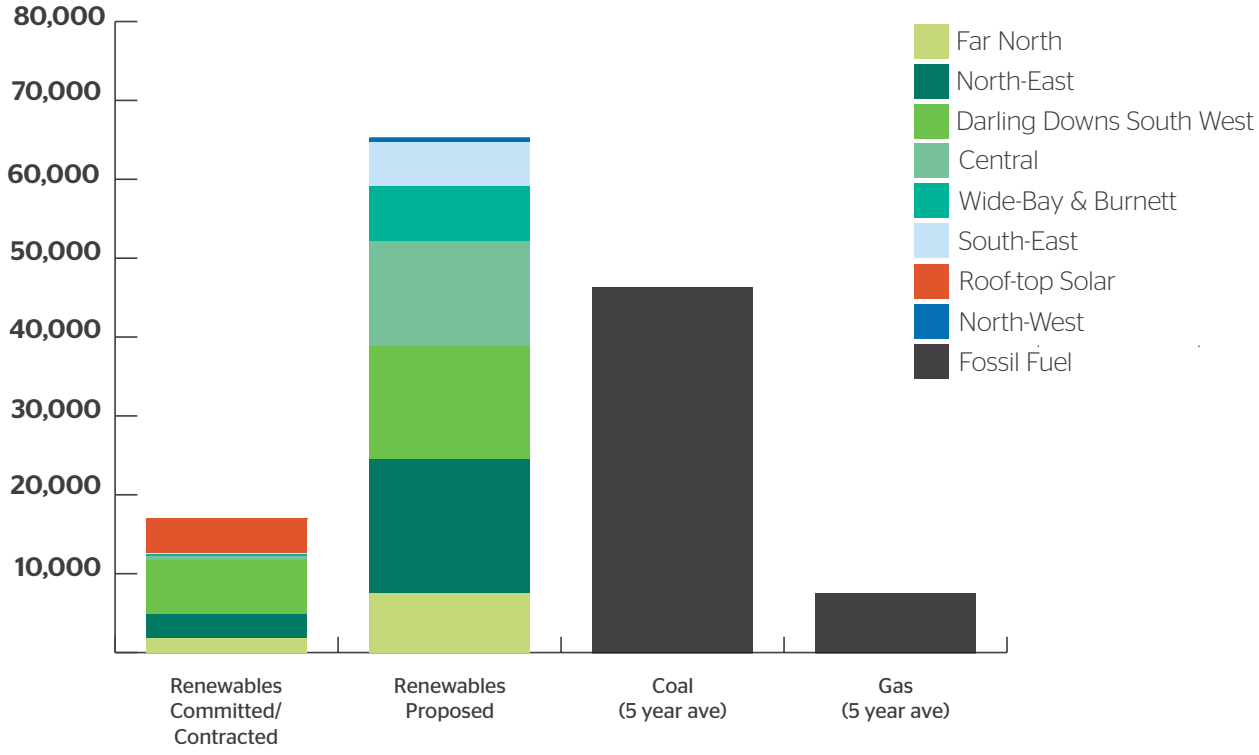
While the scale of renewable energy project construction activity over the past five years has delivered substantial employment and additional power, it is just a glimpse of the potential Queensland possesses.

Project sites identified by developers and in planning could provide more than 78,000 job-years of construction employment if they were all to proceed. There would also be a further 4,100 ongoing full-time jobs in operations and maintenance.

The map in Figure 3.2 illustrates where projects proposed for North-East Queensland have the potential to create the greatest employment, involving a mix of hydro, solar, wind and a small amount of bioenergy. The Darling Downs South-West region comes in second and the Central region — which includes Gladstone, Rockhampton, Emerald and Barcaldine — is third.

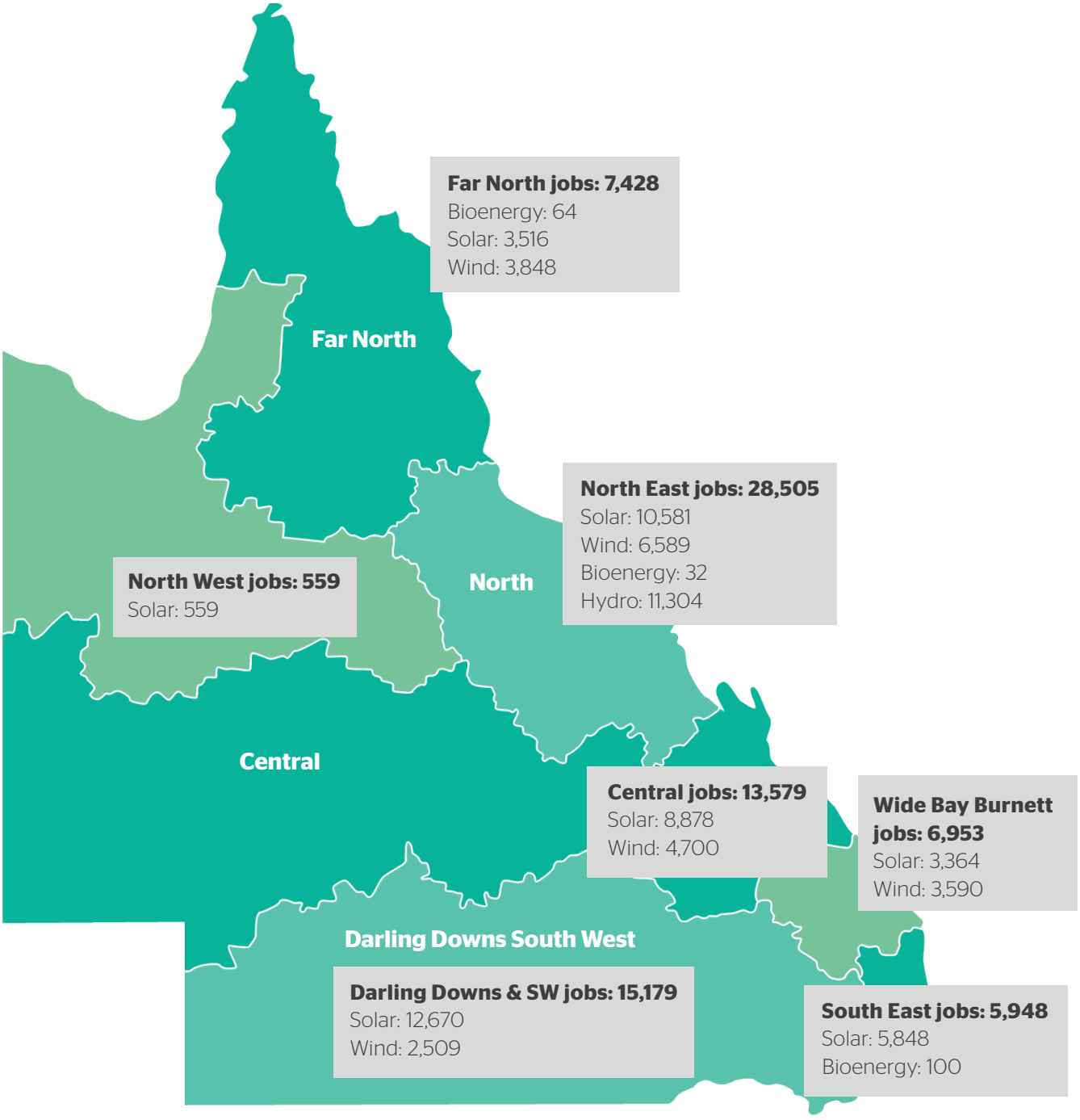
The scale of power these proposed projects could deliver is substantial. Figure 3.1 details the amount of power generated by renewable projects already in operation or in construction on the far left. This shows renewables is already on track to be a more significant supplier of power to Queenslanders than gas. Yet new proposed projects now being pursued would add around another 65,000 GWh. This is greater than all the power generated by coal and gas combined in Queensland.

Figure 3.1 Power generation from Queensland operational, committed and proposed renewable energy projects compared to coal and gas (GWh).



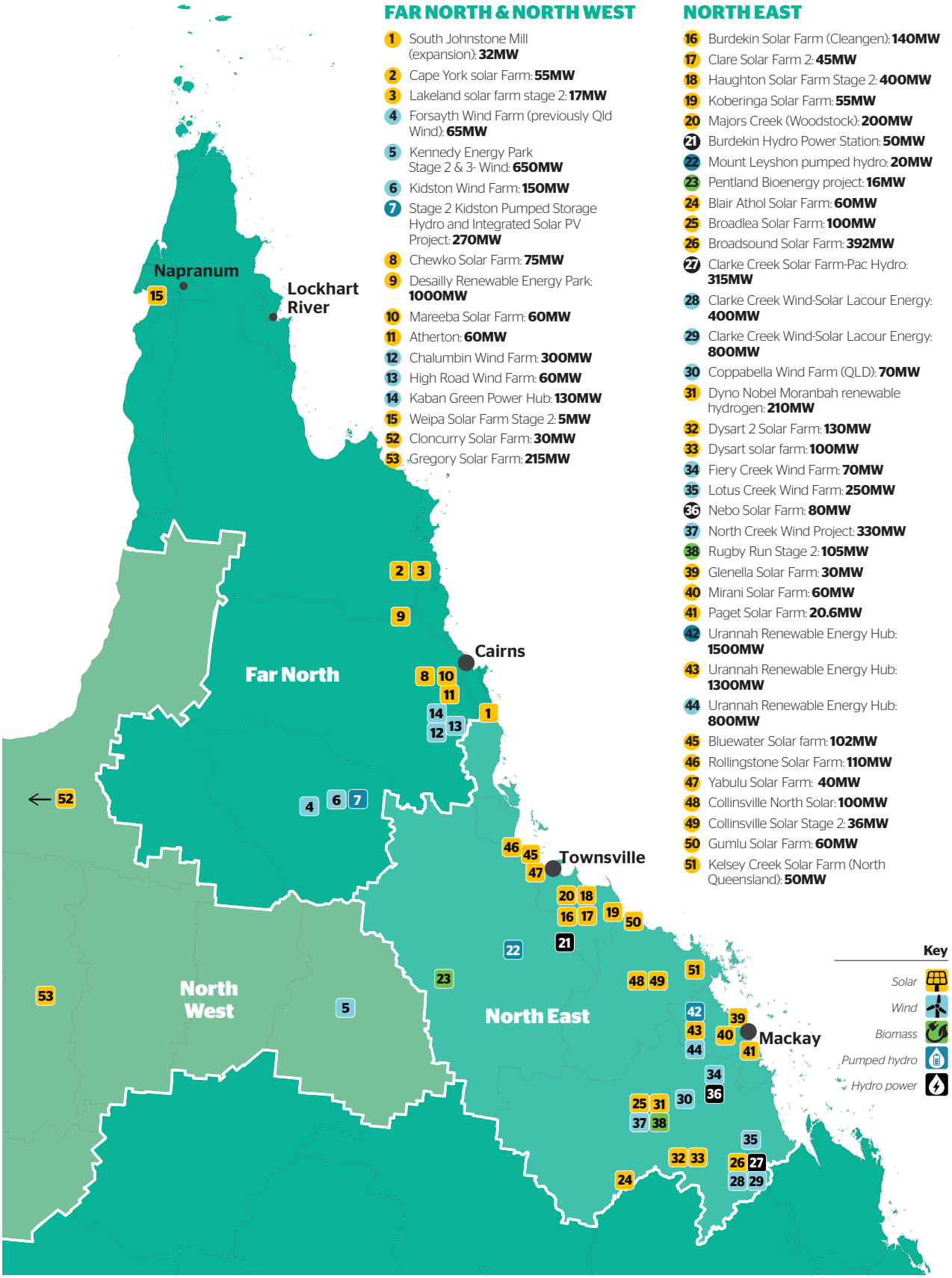
Source: *Coal and gas power generation provided by Australian Energy Market Operator, power generation of renewables based on Green Energy Markets' Power Plant Database.*

Figure 3.2 Potential future construction employment from renewable energy projects not yet committed.



Source: *Green Energy Markets analysis with employment factors derived from University of Technology Sydney Institute for Sustainable Futures (2020) Renewable Energy Employment in Australia: Methodology – June 2020*

Development pipeline for renewable energy projects proposed for Queensland (North QLD)



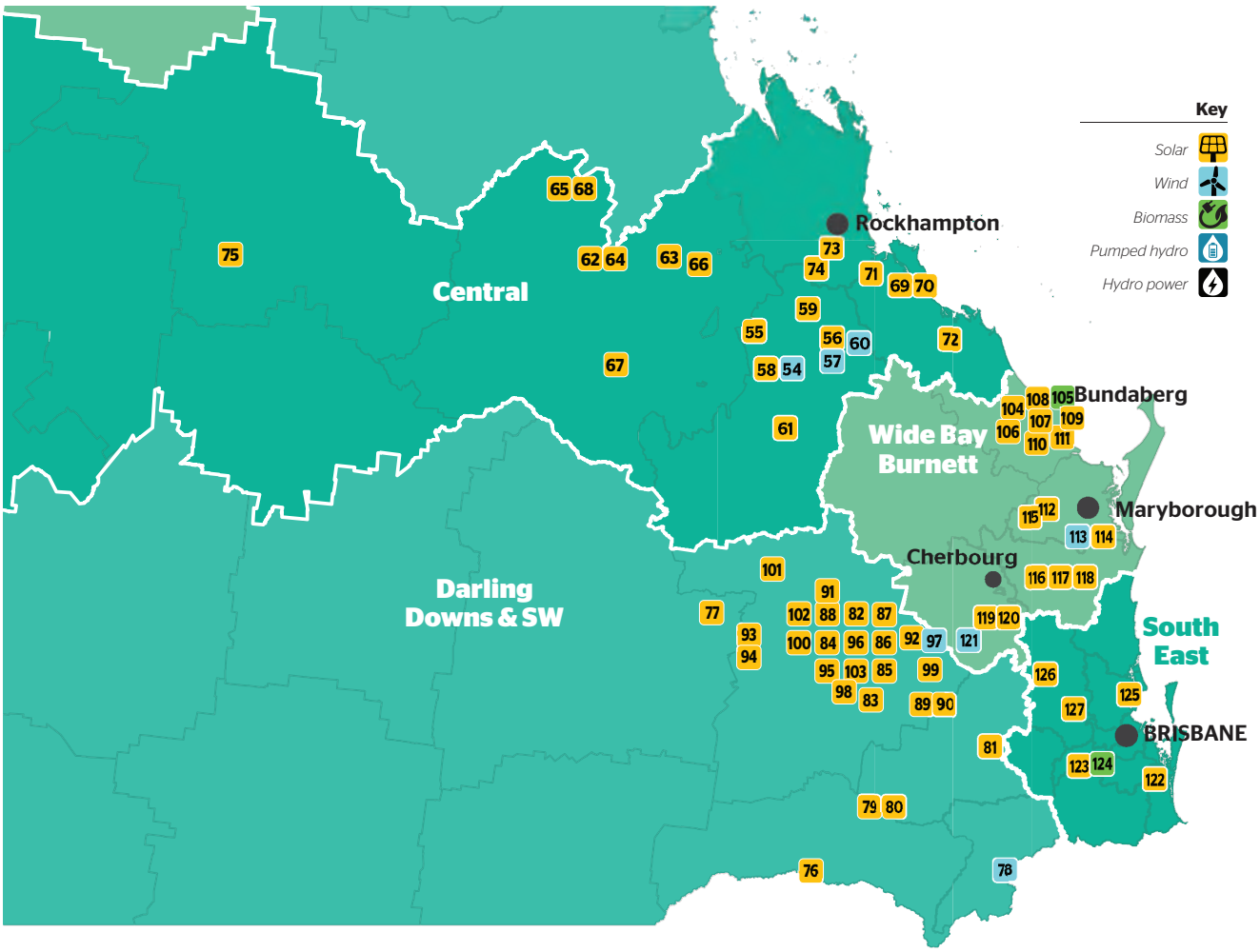
FAR NORTH & NORTH WEST

1. South Johnstone Mill (expansion): **32MW**
2. Cape York solar Farm: **55MW**
3. Lakeland solar farm stage 2: **17MW**
4. Forsayth Wind Farm (previously Qld Wind): **65MW**
5. Kennedy Energy Park Stage 2 & 3- Wind: **650MW**
6. Kidston Wind Farm: **150MW**
7. Stage 2 Kidston Pumped Storage Hydro and Integrated Solar PV Project: **270MW**
8. Chewko Solar Farm: **75MW**
9. Desailly Renewable Energy Park: **1000MW**
10. Mareeba Solar Farm: **60MW**
11. Atherton: **60MW**
12. Chalumbin Wind Farm: **300MW**
13. High Road Wind Farm: **60MW**
14. Kaban Green Power Hub: **130MW**
15. Weipa Solar Farm Stage 2: **5MW**
52. Cloncurry Solar Farm: **30MW**
53. Gregory Solar Farm: **215MW**

NORTH EAST

16. Burdekin Solar Farm (Cleangen): **140MW**
17. Clare Solar Farm 2: **45MW**
18. Haughton Solar Farm Stage 2: **400MW**
19. Koberinga Solar Farm: **55MW**
20. Majors Creek (Woodstock): **200MW**
21. Burdekin Hydro Power Station: **50MW**
22. Mount Leyshon pumped hydro: **20MW**
23. Pentland Bioenergy project: **16MW**
24. Blair Athol Solar Farm: **60MW**
25. Broadlea Solar Farm: **100MW**
26. Broadsound Solar Farm: **392MW**
27. Clarke Creek Solar Farm-Pac Hydro: **315MW**
28. Clarke Creek Wind-Solar Lacour Energy: **400MW**
29. Clarke Creek Wind-Solar Lacour Energy: **800MW**
30. Coppabella Wind Farm (QLD): **70MW**
31. Dyno Nobel Moranbah renewable hydrogen: **210MW**
32. Dysart 2 Solar Farm: **130MW**
33. Dysart solar farm: **100MW**
34. Fiery Creek Wind Farm: **70MW**
35. Lotus Creek Wind Farm: **250MW**
36. Nebo Solar Farm: **80MW**
37. North Creek Wind Project: **330MW**
38. Rugby Run Stage 2: **105MW**
39. Glenella Solar Farm: **30MW**
40. Mirani Solar Farm: **60MW**
41. Paget Solar Farm: **20.6MW**
42. Urannah Renewable Energy Hub: **1500MW**
43. Urannah Renewable Energy Hub: **1300MW**
44. Urannah Renewable Energy Hub: **800MW**
45. Bluewater Solar farm: **102MW**
46. Rollingstone Solar Farm: **110MW**
47. Yabulu Solar Farm: **40MW**
48. Collinsville North Solar: **100MW**
49. Collinsville Solar Stage 2: **36MW**
50. Gumlu Solar Farm: **60MW**
51. Kelsey Creek Solar Farm (North Queensland): **50MW**

Development pipeline for renewable energy projects proposed for Queensland (South QLD)



CENTRAL

54 Banana Range Wind Farm: **180MW**
55 Baralaba Solar Farm: **100MW**
56 Central Queensland Power Project-Solar: **1000MW**
57 Central Queensland Power Project-Wind: **1000MW**
58 Moura Solar Farm: **110MW**
59 Smoky Creek Solar Farm: **450MW**
60 Specimen Hill Wind Farm: **275MW**
61 Theodore Solar Farm: **70MW**
62 Blackwater Solar Farm: **150MW**
63 Bluff Solar Farm: **100MW**
64 Comet Solar Farm: **235MW**
65 Crinum Creek Solar Farm: **100MW**
66 Dingo Solar farm: **85MW**
67 Rolleston Solar Farm: **90MW**
68 Tieri Solar Farm: **96MW**
69 Aldoga Solar Farm: **250MW**
70 Gladstone Abattoir Solar Farm: **78MW**
71 Raglan Solar Farm: **350MW**
72 Rodds Bay Solar Farm: **300MW**
73 Bouldercombe Solar Farm: **280MW**
74 Razorback Wind Farm: **200MW**
75 Barcaldine Stage 2: **50MW**

DARLING DOWNS & SW

76 Gunsynd Solar Farm: **100MW**
77 Yuleba North Solar Farm: **310MW**
78 Rabbit Ridge: **- Dalveen: 13.6MW**
79 Bulli Creek Solar Farm Stage 1: **600MW**
80 Bulli Creek Solar Farm Stage 2: **600MW**
81 Charlton Solar Farm: **10MW**
82 Barunggam Solar Farm: **140MW**
83 Beelbee Solar Farm (Darling Downs II): **240MW**
84 Bluegrass Solar Farm (Cameby): **148MW**
85 Brigalow Solar Farm: **130MW**
86 Chances Plain (Oakdene): **100MW**
87 Chinchilla -First Solar: **100MW**
88 Columboola Solar Farm: **310MW**
89 Dalby Solar Farm: **30MW**
90 Dalby Solar Farm (RES): **22MW**
91 Daystar Energy Solar Farm: **100MW**
92 Diamondy Wind Far (Wambo): **500MW**
93 Dulacca Renewable Energy Project: **240MW**
94 Dulacca Solar Farm: **100MW**
95 Edenvale Solar Park: **280MW**
96 Everleigh Solar Park: **150MW**
97 Goomeri Wind Farm: **130MW**
98 Hopeland Solar Farm: **28MW**
99 Jimbour East Solar Farm: **200MW**
100 Miles Solar Farm: **409MW**
101 Wandoan South Solar Project: **1000MW**
102 Warhook Solar Farm: **200MW**
103 Western Downs Solar Farm: **250MW**

WIDE BAY BURNETT

104 Bucca Solar Farm: **108.8MW**
105 Bundaberg Biohub
106 Bundaberg Bullyard Solar Farm-EIWA: **93MW**
107 Bundaberg Solar Farm: **58MW**
108 Gooburrum Solar Farm: **4MW**
109 Innes Park: **25MW**
110 Kensington (Branyan/Childers) Solar Farm: **42MW**
111 Qunaba/Woongarra Solar Farm (Three Chain): **77MW**
112 Aramara Solar Farm: **130MW**
113 Forest Wind Farm: **1200MW**
114 Munna Creek Solar Farm: **120MW**
115 Teebar Solar Farm: **52.5MW**
116 Lower Wonga Solar Farm/ Gympie Regional Energy Hub: **350MW**
117 Woologa Energy Park: **185MW**
118 Woologa Solar Farms: **130MW**
119 Kingaroy Solar Farm: **40MW**
120 Kingaroy Solar Farm (REP): **60MW**
121 Kingaroy Wind Farm: **64MW**

SOUTH EAST

122 Gold Coast Solar Farm: **5MW**
123 Ebenezer Solar Project: **10MW**
124 Swanbank Waste-to-Energy plant: **50MW**
125 Beachmere Solar Farm (Ningi): **50MW**
126 Harlin Solar Farm: **1500MW**
127 Wivenhoe Regional Energy Hub - Bryden (SQ2 WREH): **1000MW**

Region **in focus**

Previous page. Gladstone Harbour Flyover. *Photo*. Greens MPs.

Gladstone and central Queensland

Gladstone is one of Australia's major industrial hubs, hosting Queensland's largest power station, alumina refineries, gas liquefaction plants, a cement kiln and an aluminium smelter, among several other industries.

Until now, renewable energy wouldn't have registered on the radar screen of employment opportunities for the region, but things are changing.

The region largely missed out on the first boom in large-scale renewable energy project construction from 2016 to 2019 when investment flowed mainly to north Queensland and the Darling Downs. However, Gladstone now has an impressive pipeline of proposed projects that, with a supportive market and government policy conditions, could proceed to construction and inject significant employment into the region.

Four significant solar farms are proposed within the Gladstone Council region which comprise a total of just under 1,000 MW and can be expected to produce power equivalent to the consumption of 380,000 Queensland households.

For over a decade, industrial land at Aldoga, 20 kms north-west of Gladstone, was unused after plans for an aluminium smelter at the site fell through. Now that land has been slated for a 250 MW solar farm that is being pursued by international construction company Acciona. This project is expected to create 240 construction jobs onsite.

Rodds Bay Solar Farm is a 300 MW project proposed near the township of Bororen, 50 kms south of Gladstone. This project is being pursued by a specialist renewable energy project developer called Renew Estate and the investment firm United Green. If it were to proceed it is expected to create 300 jobs on site over its construction period.

Raglan Solar Farm is a 350 MW project proposed by Eco Energy World nearby to the township of Raglan, 50 kms north-west of Gladstone which is expected to create 130 jobs on site over its construction period.

The fourth solar farm is part of a wider project to establish a major abattoir adjacent to the Gladstone Port. The 78 MW solar farm would help power the abattoir in conjunction with a hydrogen production plant and illustrates a growing trend where significant electricity consuming businesses are turning to renewable energy to provide lower cost power to run their business. Several abattoirs around the country now have solar power plants installed. At a larger scale, Townsville's Sun Metals built a 124 MW solar farm in 2017 to help power its zinc smelter and lower its energy costs.

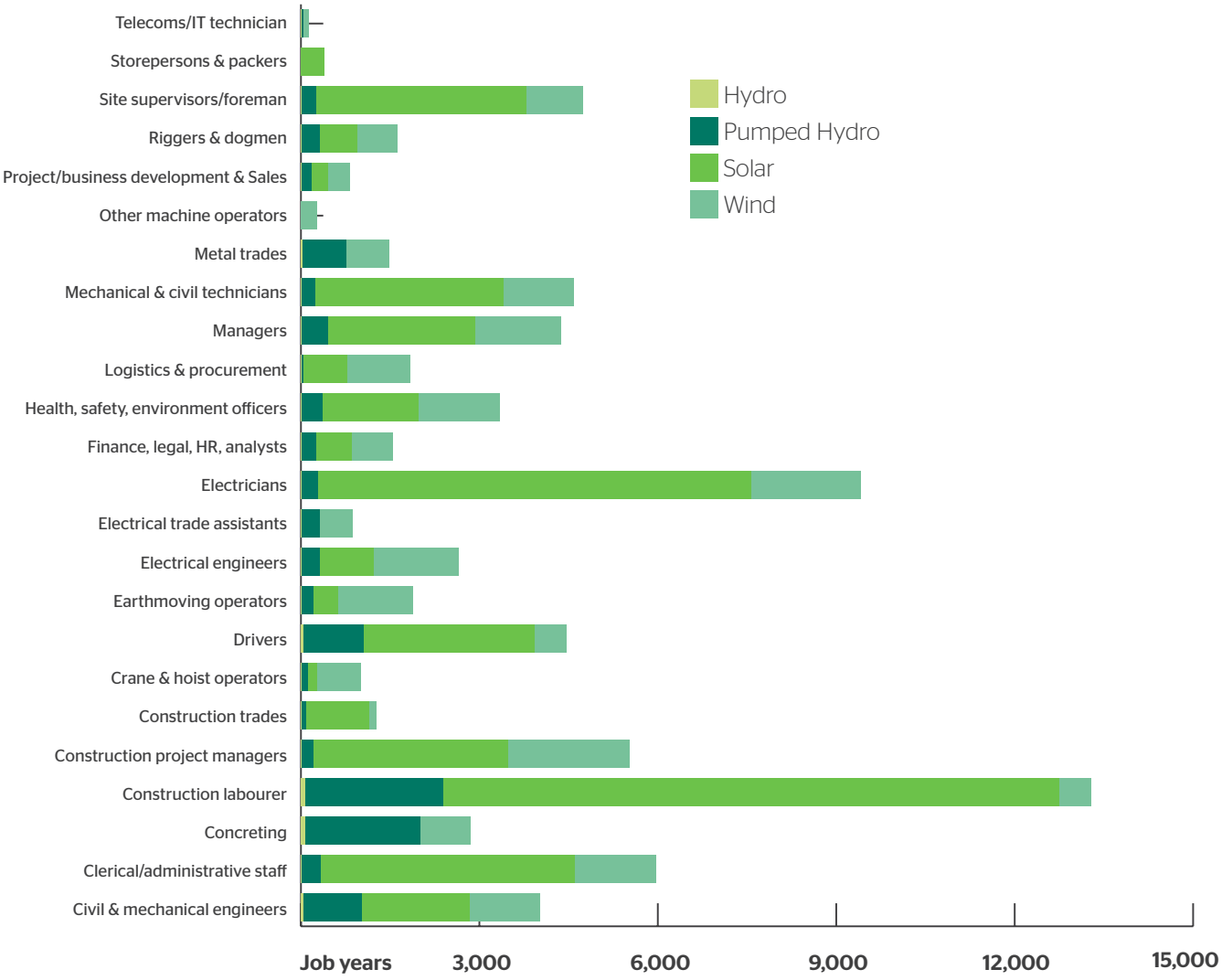
The potential for renewable energy to help lower industrial manufacturers' energy costs has also inspired a far more ambitious proposal in the wider Central Queensland region by experienced renewable energy project developers RES and Energy Estate. They plan to develop a 2,000 MW combination of wind, solar and energy storage projects around the Central Queensland region, that could collectively deliver reliable, competitive and low emission power to support Gladstone's heavy industry. If this project were to proceed it would create over 1,000 local jobs during construction.

Further north, another major hybrid renewable energy project is proposed for Clarke Creek, 150 kms north-west of Rockhampton, and being pursued by Goldwind and Lacour Energy. This project involves an 800 MW wind farm combined with a 200–400 MW solar farm and battery energy storage. This single project could generate power greater than the consumption of 600,000 Queensland households.

The types of construction jobs created by these projects are similar to what you would expect from a range of other major construction projects involving extensive electrical work. Employment opportunities are created for a diverse group of occupations with differing levels of experience and education, from engineers and finance professionals to truck drivers, electricians, mechanics, welders and labourers.

Figure 3.3 provides an estimate of the amount of employment created by occupation and trade if all the renewable energy projects currently proposed in Queensland were to proceed.

Figure 3.3 Employment by occupation and trade from construction of renewable energy projects in development but not yet committed



Source: *Green Energy Markets analysis with the distribution of employment by occupation derived from surveys undertaken by University of Technology Sydney and detailed in their publication – Renewable Energy Employment in Australia: Methodology – June 2020*

To realise its potential as a renewable powerhouse, **Queensland needs stronger political will,** better planning and policies to rejuvenate its energy system

Below. Victorian wind farm. *Photo*. Doug Gimesy.

Previous page. Cyclist and koala in Adelaide Hills. *Photo*. @bikebug

The need for new skills, infrastructure and government policy

It is important to recognise that, while these proposed projects offer great potential for employment, most will not manage to proceed to construction without better planning and policies to rejuvenate the energy system and phase out polluting sources of energy.

To increase the chances of success, regions will need investment in high-quality transmission infrastructure, supportive government policy that recognises the importance of tackling the threat of a changing climate, and a skilled and enthusiastic workforce.

Other state governments around Australia are eager to encourage renewable energy investment in their state, and Queensland faces significant competition for private sector investment dollars. The NSW Government is building substantial new transmission infrastructure to establish renewable energy zones in its New England region and the mid-west and south-west of the state, partly with the support of Federal Government funding.

Victoria is initiating new projects and is building up local industry through its renewable energy procurement auctions. It has also been pushing for new transmission to the north-west and mid-north, as well as extra battery storage capacity. South Australia is targeting 100% renewable energy and making investments in batteries and a new transmission interconnector with NSW to support this target. Meanwhile Tasmania has set a goal of 200% renewable energy meaning it will meet not just its own electricity needs from renewables but also export renewable power to the mainland. To support its goal, it has extracted promises from the Federal Government to help underwrite its Battery of the Nation transmission and new hydro projects.

At present the Queensland Government has a goal for the state to get 50% of its power from renewable energy by 2030. Yet policies announced to date will only get the state to a bit under 38% by 2030. Even if further policies are enacted to achieve the 50% target, it will only just scratch the surface of Queensland's potential.

To achieve 50% would require about 3,000 MW of new wind and solar projects, which would deliver around 8,000 job-years of construction employment. Spaced out over a 10-year construction period to 2030, this would equate to around 800 full-time construction jobs.

However, the full pipeline of projects currently proposed for Queensland could deliver 78,000 job-years of employment. If this was delivered as part of a 15-year program to achieve self-sufficiency in renewables and build an industry exporting renewable energy (for example via hydrogen, green steel or aluminium production), Queensland would provide permanent full-time employment for around 5,200 people in constructing these projects. It would also create employment for another 4,100 people in operating and maintaining the facilities. Further employment would also come from establishing hydrogen production or metal smelting facilities.

In addition, because solar and wind technology has been improving quite rapidly, there are strong incentives to repower these plants after around 20 years of operation with new panels or new turbines. This would create an ongoing cycle of construction activity and employment beyond the initial 15-year program outlined here.

Such a large program of construction activity would not be without its challenges. Indeed, a number of projects built recently in parts of northern Queensland have encountered problems where the transmission system has been inadequate to accommodate their full generation potential. Considerable effort needs to go into ensuring power system security and reliability can be maintained in a system fed by a large amount of wind and solar. Yet Australia's construction and engineering capability should be up to such a challenge. Critical to the success of such a program is our political leaders who must provide industry, investors and regulators with a clear plan of what we need to achieve and how.

Appendix A – the basis of employment estimates in this report

Employment estimates in this report have largely relied on detailed survey work undertaken by the Institute for Sustainable Futures at the University of Technology Sydney in 2019 and 2020. They surveyed a range of businesses engaged in constructing, developing and operating renewable energy projects in Australia to assess how many jobs and what types of jobs were created by the construction and then operation of various renewable energy technologies. The report which explains how they estimated employment creation is entitled Renewable Energy Employment in Australia: Methodology, and is available from:

https://www.uts.edu.au/research-and-teaching/our-research/institute-sustainable-futures/our-research/energy-futures/renewable-energy-employment-australia.

This research estimates construction employment on the basis of the amount of labour required to develop and construct a megawatt of capacity measured by job-years. A job-year is equal to one person being employed full-time for a single year. These estimates exclude the labour involved in manufacturing equipment used in constructing these power projects and represents employment confined to Australia. A large proportion of these construction jobs will be on-site at the location that the power plant is constructed but some will involve staff working in office locations in capital cities. The study estimates that between 59% to 78% of the jobs created will be in regional areas of Australia outside of capital cities.

Appendix B- A note on the selection of projects used in this study to estimate employment

The purpose of this analysis was to provide an illustration of the employment creation potential from exploiting Queensland renewable energy resources using real-world examples of projects that are currently under construction or recently constructed or are being currently pursued by power project developers. Because wind and solar technology have only recently reached a level of scale and cost competitiveness that rivals that of fossil fuels, many people are yet to appreciate just how significant a role these technologies could play in meeting our energy needs, generating employment and supporting our economy. In such circumstances tangible examples of actual projects being built or proposed by businesses can help to convey this better for many people than an explanation based on the engineering principles of these technologies and the available wind and solar resource. Such technology-based explanations can come across as abstract and theoretical to many members of the general public, even though the technological performance has been well demonstrated in the field and there are a wide range of locations that are suitable for renewable energy projects that are not currently being proposed for development.

However, ensuring we maintain a reliable and secure supply of energy will probably mean that the mix of projects and locations that are most economical will to be different to what is currently proposed by developers and which was used to inform this analysis. For example, the western parts of Queensland have a superb solar resource that is less susceptible to cloud cover and well suited to solar thermal with energy storage as well as solar PV. However, because of a lack of suitable transmission infrastructure and the immature nature of solar thermal technology, developers have focused on other options. Also there hasn't been a pressing need for extra pumped hydro and battery capacity because existing fossil fuel generators have little trouble flexing their output up and down around the variation in solar and wind power output experienced to date, and expected over the next few years. But as solar and wind's share of power supply becomes far more significant, then fast-response energy storage projects will become more useful and economically attractive. Also, while it is expected that hydrogen production technology will achieve substantial cost reductions over the next ten years, proposals will tend to remain modest until these cost reductions are realised.

If anything, we expect a more diverse mix of technologies will result in greater employment creation than what has been detailed in this report. This is because pumped hydro and solar thermal projects in particular usually require more labour to construct than wind and solar. Also energy storage projects will often complement rather than displace the need for wind and solar capacity.

With investment in high-quality transmission infrastructure, **supportive government policy,** and a skilled and enthusiastic workforce, **Queensland could be a world leader in renewable energy projects.**

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