

# A Plan to Justly Transition the Bowen Basin thermal coal industry into Queensland's new Renewable Energy Zones

**Submission to the House Standing Committee on the Environment and Energy in respect of the Climate Change (National Framework for Adaptation and Mitigation) Bill 2020 and Climate Change (National Framework for Adaptation & Mitigation) (Consequential & Transitional Provisions) Bill 2020**

**Dr Bill Laing**

**Climate scientist & former Geological Consultant to the international mining industry**

**4 December 2020**

**Support** I support the Climate Change Bill. It will reset Australia's agenda once-and-for-all, from fossil fuels to renewable energy. This is precisely the subject of this Submission.

**Personal statement** I make this submission, having worked as a Consultant to the international mining industry over a 50 year career, I want the Climate Bill to proceed, and I want our politicians to see and seize the opportunity of a Just Transition in the world's largest coal basin, the Bowen Basin of Central Queensland. This Submission shows how it can be achieved. This Submission was lodged with the Queensland Just Transition Group, Department of Employment, Small Business and Training, in July 2020, and with the Greens State MP for Maiwar. It was not to my knowledge referenced in any way during the Queensland State election in October 2020.

**Conscience vote:** I ask that the decision by Parliamentarians be a conscience vote, to allow MPs to represent the views and voices of Australians in their electorate. My Submission includes a substantial commitment to educating the Bowen Basin community as to why the transition from thermal coal to renewables (1) is inevitable, (2) will be much faster than they perceive, and (3) will be of enormous benefit - economically, socially, and climatically - to the Bowen Basin community itself. My own many interactions with this community (my daughter-in-law from Mackay is from a family diggedly sticking to the status quo - out of ignorance of the renewable energy industry) show that once educated on renewables, the Bowen Basin community will be free to choose their own destiny on credible, up-to-date information. The MP's of the Bowen Basin must represent the interests of their constituents, by being part of their enlightenment, not their mushrooming. The enormous carrot for constituents, and their MPs, is documented in this Submission.

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# A Plan to Justly Transition the Bowen Basin thermal coal industry into Queensland's new Renewable Energy Zones

## Key points:

- Queensland's Bowen Basin is the largest commercial coal-exporting region in the world.
- Coal-fired power is diminishing, globally and in Australia; at an accelerating rate.
- Queensland is Australia's leading renewable State under construction.
- The coalmining companies and the Queensland Government publicly recognise these realities.
- The Bowen Basin of central Queensland contains\*:
  - Circa 29 (partly) thermal coalmines; jobs circa 3300 dedicated to thermal coal (some already written down (2020))
  - 4 major coal-fired power stations; jobs 750; these are already being significantly written down (second-half 2020)
  - A pipeline of circa 60 renewable power stations, operating/planned; jobs 7200 construction, 2225 operational
  - 8 battery metal projects (6 mines, 2 smelters), operating/planned; jobs 3200 construction, 3320 operational
- The Bowen Basin's Just Transition will be a direct switch from one energy industry to another:
  - The new jobs in renewable energy require the same skillsets as the old thermal coal jobs
  - The new jobs in renewable energy are co-located with the old thermal coal jobs
  - There are more jobs in the new renewable energy industry than the current thermal coal industry\*. This jobs equation is decisively weighted toward strong and lasting future employment demand in renewable energy and related industries..
- A Bowen Basin Transition Authority will oversee the Just Transition, by curating a community-owned database of outgoing and incoming jobs and workers, and providing human resources to ensure that the transition is just and community-serving. The Bowen Basin community will be in charge of its own destiny, in collaboration with the companies and the Queensland Government.

\* The employment figures in this Report are in the process of updating to 2019 figures provided by Queensland's DNRm. The new 2019 figures do not change the fundamental equation in 2020. There are more jobs in renewable energy, focussed on Queensland's newly announced (September 2020) Central Queensland and Northern Queensland Renewable Energy Zones, and new "heavy" industries which reconfigure current heavy industry infrastructure (aluminium smelter as megabattery, green hydrogen, green steel) and use regionally-sourced renewable energy, than in thermal coal.

# A Plan to Justly Transition the Bowen Basin thermal coal industry into Queensland's new Renewable Energy Zones

This Submission addresses the following aspects of the Bill:

- |   |                                     |   |
|---|-------------------------------------|---|
| 1 | <input checked="" type="checkbox"/> | Objectives and long-term emissions reduction commitment                   |
| 2 | <input checked="" type="checkbox"/> | Why legislating Net Zero by 2050 and regular 5 year budgets is important  |
| 3 | <input checked="" type="checkbox"/> | Guiding principles to be applied  |
| 4 | <input checked="" type="checkbox"/> | Risk and adaptation assessments for all sectors                           |
| 5 | <input checked="" type="checkbox"/> | Technology readiness assessment   |
| 6 | <input type="checkbox"/>            | Independent climate change Commission and skills needed on the Commission |



# SAFE PASSAGE

## A Plan to justly transition the Central Queensland thermal coal industry into Queensland's renewable power industry

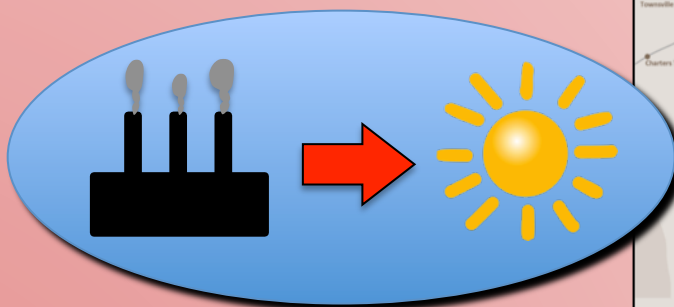
**Dr Bill Laing**

International Mining Analyst, Climate Scientist, Renewable Energy Advocate

*Central Queensland's Bowen Basin is the world's largest commercial coal basin.  
Queensland - the Sunshine State - is the world's largest solar energy state.  
Australia can Justly Transition the Bowen Basin, and deliver a model for the world*

Foreword by Professor Peter Sheldon, leading international advocate of Just Transition

Dedicated to Fred and Loma Thompson of Townsville  
for their lifetime of service to Queensland working communities and the union movement  
The title "Safe Passage" is gifted by their son, Roger Thompson of Townsville





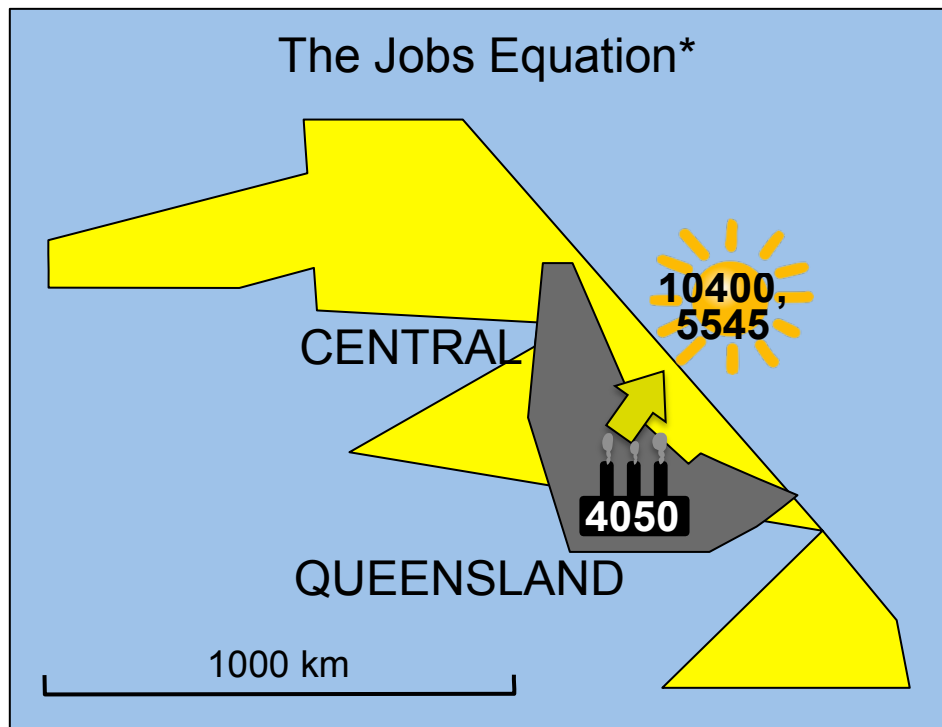
## FOREWORD

Dr Bill Laing has brought together his deep technical knowledge, passion for social justice and commitment to the well-being of the people, towns and environments of the Bowen Basin. Dr Laing's Report helps us understand how we might break free from impediments to Australia reaching its potential to address climate change and to develop a new high-skills economy with more good jobs. Crucial to this is a Just Transition: protecting and advancing the livelihoods and futures of the people and towns of thermal coal-producing areas, like the Bowen Basin. I see two elements to Dr Laing's report as crucial. The first is to distinguish thermal coal production and the power stations it feeds, from coking coal production (for metallurgical use). Australia's coal-fired energy sector is in clear and rapid decline. This makes closing it the easiest and most obvious path through which we can greatly reduce our emissions. The second is to explain how the Bowen Basin, a region now so important for thermal coal production and power generation, has all the resources and capabilities to host a major locally-based Just Transition. Dr Laing presents plausible suggestions as to how to accomplish this.

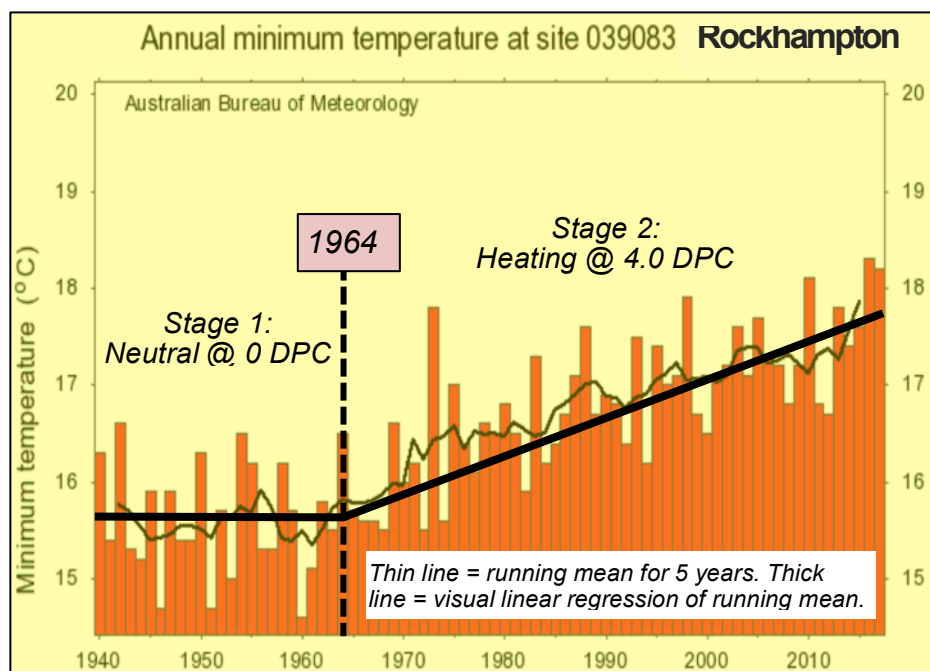
**Peter Sheldon**

Professor, School of Management  
Director, Industrial Relations Research Centre  
UNSW Business School  
University of New South Wales, Sydney

*22 July 2020*



\* The employment figures in this Report are in the process of updating to 2019 figures provided by Queensland's DNR. The new 2019 figures do not change the fundamental equation in 2020. There are more jobs in renewable energy, focussed on Queensland's new Central Queensland and Northern Queensland Renewable Energy Zones, and new heavy industry (aluminium smelter as megabattery, green hydrogen) than in thermal coal.



## WHAT IS THE PROPOSED JUST TRANSITION?

### Just Transition Phase 1: Assembly of stakeholders in the Transition

Identify, collaborate, and negotiate agreement to commence a Just Transition. In Phase 1 the process is paramount; the outcome awaits.

### Just Transition Phase 2: Community education for the Transition

Community Workshops    (1) Climate change & central Queensland's renewable Future  
    (2) A Just Transition for the Bowen Basin thermal coal industry

### Just Transition Phase 3: Energy assets redistribution and jobs transfer

This is the core activity, likely to be a decade-long process.

## THE KEY DRIVERS OF A JUST TRANSITION at July 2020

1. Global knowledge of climate change, and global response to that knowledge.
2. World economic fundamentals, particularly the commercial stability of oil, gas and thermal coal.
3. Community and business attitudes toward fossil fuel consumption and climate action, especially post-Covid-19.
4. The attitudes and policies of Bowen Basin stakeholders to a Just Transition.
5. Federal Government, and separately the Queensland Government, attitudes toward fossil fuels and renewable energy.
6. Government policy (Federal and Queensland) around AEMO's ISP and the future NEM.
7. Development of Queensland Government policies on a Just Transition, announced 2018 but largely non-actioned.
8. Evolution of the Renewable Project Completion Ratio (RPCR): it is evolving and decreasing, but in the wake of Covid-19 and current Federal Government announcements on Australia's post-Covid energy supply, and lack of announcements on NEM regulatory overhaul, the PCR might take an unexpected regression.
9. Copperstring will unlock \$680 billion mineral resources and deliver cheaper electricity.

## WHAT ARE THE FUTURES OF THE BOWEN BASIN?

Queensland's Bowen Basin is being inexorably driven to a future free of thermal coal. The drivers comprise every factor relevant to this future. The drivers are acknowledged by essentially all stakeholders, except with a degree of certainly the Bowen Basin community itself, who can respectfully but unfortunately be assumed to be knowledge-poor with respect to climate change and the renewable future, as is the Australian community generally. The reasons for this are touched on in the Proposal. The drivers toward a thermal coal-free future are:

- *Technical*
- *Economic*
- *Commercial*
- *Geopolitical (except not recognised by the current Governments of Australia and USA)*
- *Environmental*
- *Climate change (ditto)*
- *Health*
- *Safety*
- *Community ownership of the community's future*

The transition out of thermal coal into renewable energy for the Bowen Basin community can be unplanned and chaotic, or it can be planned; to generate a future with more employment, complete sustainability, and a happy permanent regional community. The Bowen Basin's present trajectory does not plan for the future. This Plan offers a vision and a strategy for a Just Transition. It is founded on a simple direct switch; from a Bowen Basin fossil fuel industry to a co-located Bowen Basin renewable energy industry. Current Bowen Basin macro-industries will remain and flourish, specifically electric power generation and aluminium, and renewable metals mining will become a major new and permanent industry. The Bowen Basin communities will remain and prosper in the towns they are in.

The drivers are accelerating and will not wait for outlying local factors. A Just Transition starts now. The global Covid-19 pandemic, a new driver, impels us also toward the renewable age.

## SUMMARY

Queensland's Bowen Basin is the largest commercial coal-exporting region in the world. Coal-fired power is diminishing, globally and in Australia; at an accelerating rate. Queensland is Australia's leading renewable State, under construction. The coalmining companies and the Queensland Government publicly recognise these realities.

The Bowen Basin of central Queensland contains:

- Circa **15 thermal coalmines**; jobs circa 3300 dedicated to thermal coal (estimated)
- **4 major coal-fired power stations**; jobs 750
- A pipeline of **89 renewable power stations**, operating/planned; jobs 7200 construction, 2225 operational
- **8 battery metal projects (6 mines, 2 smelters)**, operating/planned; jobs 3200 construction, 3320 operational

The Bowen Basin's Just Transition will be a direct switch from one energy industry to another:

- The new jobs in renewable energy require the same skillsets as the old thermal coal jobs
- The new jobs in renewable energy are co-located with the old thermal coal jobs
- There are more jobs in the new renewable energy industry than the current thermal coal industry. The jobs equation is decisively weighted toward strong and lasting future employment demand:

**4050 coal jobs**



**10400 construction jobs & 5545 operational jobs in renewables**

A Bowen Basin Transition Authority will oversee the Just Transition, by curating a community-owned database of outgoing and incoming jobs and workers, and providing human resources to ensure that the transition is just and community-serving. The Bowen Basin community will be in charge of its own destiny, in collaboration with the companies and the Queensland Government.

## What does the author bring to Safe Passage, and why?



I am a geologist born in Sydney, educated at Sydney University on Hunter Valley coal, and I have studied and explored for coal with the NSW Mines Department.

*Historic geological map of the Newcastle Coal Measures*

My family home for 5 decades has been a coal-fired miner's cottage on the beachside Wallarah Seam south of Newcastle. I've been underground at Wallarah Colliery, I've lived and played with coal families for decades.



*Laing family home 2020 built ca 1875*



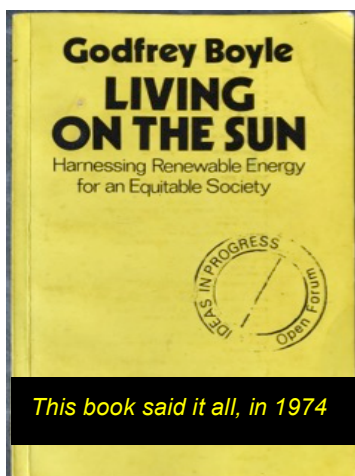
*Coal train at the beach 1875*



*Walarah Seam at the beach 2015. Two filled-in portals ca 1873.*

### THE BARRIER ENVIRONMENT GROUP

Concerned by the greenhouse effect, which was postulated by scientists but not yet confirmed by NASA, I founded the Barrier Environment Group 45 years ago (1975). BEG still operates in Broken Hill, the issues remain, and the world's future is now more dire.

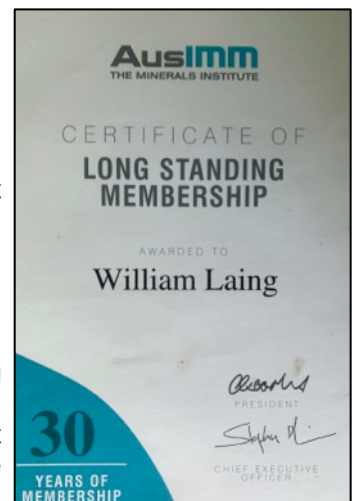


*This book said it all, in 1974*

Sun energy (solar, wind, hydro) is now fully commercialised. It is cheaper, more efficient, cleaner, healthier, zero-emitting, and more community-owned than coal. Its demonstrated benefits and its commerciality are in 2020 established to the point where we can offer coalworkers and their communities a just and Safe Passage out of coal into a renewable future.

I've been an international mining consultant for 50 years, and Fellow of the Australasian Institute of Mining & Metallurgy, the Australian Institute of Geoscientists, and the Society of Economic Geologists.

Our industry has prospered by mining indirect energy: coal, oil, and gas. We can now mine direct energy: the sun. This direct mining is considerably cheaper and more environmentally sustaining than fossil fuels.



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Archived; available on request

## THE GLOBAL CONTEXT

### Thermal coal and the globe's climate

The world's climate is changing and heating, and a host of other global environmental features are changing with the climate. The dominant driver of climate change, coalburning for 3 centuries, is acknowledged by the world scientific community and the world community.

Australia and the Bowen Basin have significantly climate-heated. This commenced between 1930 and 1970 and continues at a rate between 2 and 4 degrees per century, which is double the world heating rate. There is thus a dual imperative for the Bowen Basin to decarbonise: Bowen Basin thermal coal is a significant contributor to the world's climate change, and the Bowen Basin itself is heating from the burning of its own coal. We must decarbonise to save our own climate, and to save the world climate.

### The status of the world thermal coal industry

Thermal coal (thermal coal) is in worldwide terminal decline, to "End coal". The decline has three primary drivers: the increasing inefficiency and cost of coal versus oil and gas (including the ageing of coal power stations from "peak coal" installations in late C20), the uncompetitiveness of coal versus renewable power, and the Paris-mandated GHG emissions reductions. End coal is recognised globally by all stakeholders, via policy statements and actions: the coal companies, grid-power companies, investors particularly superannuation funds, national futures funds, central banks, and the banking industry; market analysts, energy market analysts, insurance, and national governments - including those strongly dependent on thermal coal. The stakeholders have adopted this position, in their role as energy policy *drivers* (the Intergovernmental Panel on Climate Change, UN bodies, national energy market regulators, national and state governments), and as energy policy *consumers* (the rest of those listed above). All policy consumers have endorsed End coal, and are committing increasing resources to renewable energy. Some thermal coal suppliers have completely withdrawn from supply, and committed 100% to renewables, while other withdrawers remain exposed to oil and/or gas energy. Other companies continue to deal in thermal coal. Australia's Energy Council has called new coal-fired power stations 'uninvestable' and said the industry has no plans to start building new coal-fired power stations, and Australia's "Big Three" power companies have declared as follows: AGL "We do not believe any private capital will invest in new coal plants." Origin "It is unlikely we would be an investor in new coal." Energy Australia "Coal-fired power is a legacy technology; it's a solution that my grandfather would have built"<sup>1</sup>.

Given the unanimous stakeholder agreement, the key issues are the *timeframe* for End coal, and the *programmed steps* by which End coal will occur in the Transition to new energy sources. The global end-point for the Transition is nominated as two to three decades hence, and it is being implemented in many different ways around the globe. The timeframe is quite uncertain, and is constrained by many factors on both supply and demand side. However the key factors are political not technical. Renewable power is fully embedded in our economic system, technically and commercially. The one quite clear and consistent feature is the shortening of the projected timeframe for End coal, as the last couple of years have progressed; an *acceleration* of the Transition to renewable energy. We know the end of thermal coal is in sight, and it is closer than most of us think.

Coal-fired power is becoming denormalised (Figure 3). As recently as 2018 the Australian community perceived coal-fired power stations as essential. In mid-2020 a majority of the Australian community sees 100% renewable power as the near future, and is receptive of the idea that coal-fired power stations are no longer required (references).

### The Australian thermal coal industry

Australia leads the world in thermal coal mining and exporting, and is also a strong user of coal for grid power. At the same time, the Australian thermal coal industry finds itself in an anomalous regressive position; a policy limbo by our national Government and our coal industry. The



Australian Government has no serious policy settings on the trajectory of carbon emissions, and on the future of thermal coal and other fossil fuels.

This contrasts markedly with most other thermal coal-producing (and consuming) nations, who have set clear carbon emissions reduction targets, and are developing clear strategies for decreasing their use of, and export of, thermal coal. A recent seminal Report on a Just Transition for Australia's thermal coal industry<sup>2</sup> analysed world-leading coal power industries, and classified their "structural adjustment" as follows: "*successful*": Singapore, Germany, Netherlands; "*marginally un/successful*" Newcastle steelworks, 1999; "*unsuccessful*" South Wales, Appalachia, Australian coal-fired power stations.

Most Australian thermal coal mining companies are multinational, and are well aware of the world thermal coal situation, but their mining communities and their social infrastructure (the towns, Local Governments, support industries who are "non-coal"), and their cultural norms and expectations, are arguably not up to speed with the events of the outside world. They may in particular not be aware of the Transition culture which has developed in some countries, which has already delivered the plan, the action, and the resilience which is taking those countries into the industrial future with confidence, and with a distinct market edge over those other countries who have not considered the Transition.

### **Transitions experienced in other leading thermal coal countries**

The UK, Germany, USA, South Africa and India have also been major thermal coal producers and users, and each has experienced a transition to renewable grid power. The European leaders have made successful transitions, while the US and South Africa have experienced major disruptions and negative impacts on their coal companies, coal workforce, and coal communities. India is included, because it is a major market for Australian thermal coal which is transitioning rapidly to renewable energy.

The world leader of the coal-powered Industrial Revolution, the UK, in 2019 continued its decadal trend by reducing coal generation by 60%<sup>3</sup>. In 2019 coal generated only 2% of UK electricity - less than solar, in that cool and cloudy country. 54% of UK electricity is now from low-carbon sources, including 37% from renewables and 20% from wind alone. UK CO<sub>2</sub> emissions have fallen 29% over the past decade, those from coal falling by 80%. In 2019 on 83 days the UK didn't use coal for power - 23% of the year - including a record 18-day stretch of coal-free power in early summer. The UK's remaining coal power plants will close in the next year, with just three operating ahead of the 2024 Government deadline. And in this decade of decarbonisation the UK's economy has grown by 20%.

This year Germany commissioned its world-leading Transition Plan (Energiewende - "Energy Path"). Once a world leader in coal production, Germany ended black coal mining in 2018, and in February 2020 the German Government, its coalmining states, and its major utilities, committed to a comprehensive timetable for shutting down the country's 84 coal plants by 2038, to compensation payments for operators, and to the closure of its remaining 6 nuclear power plants by 2022<sup>4,5</sup>. Shareholders were cheered by the news that coal power companies will receive up to US\$45 billion for closing their plants. Renewable energy sources will continue expanding, to 65% of Germany's power requirements by 2030, but Germany's power has already reached 61% renewable<sup>6</sup>.

The USA has had no overarching transition plan, despite their thermal coal industry being in serious decline. Coal mines have declined by 53% in the last decade<sup>7</sup> which together with automation, has reduced the coal industry workforce from 86,000 to 52,000 or 40%, between 2008 and 2018<sup>8</sup>. Only 69% of redundant workers have gained new employment. Between 1968 and 2014 an estimated 76,000 coalminers died of black lung disease<sup>9</sup>. Mining by mountaintop removal and valley fill has transformed the landscape of the huge Appalachian coal province even more than strip mining: tops of mountains removed, rivers and valleys filled with mine waste, and major pollution from the streamwater<sup>10</sup>. Coal corporations are filing bankruptcies, workers are unpaid, coal communities are left behind, and minesites are abandoned with no implemented clean-up. Congress has not yet passed bills to fund workforce benefits and cleanup projects.

The biggest US private coalminer Murray Energy was buying up mines in Appalachia in 2015-16, but in 2019 filed for bankruptthermal coaly, with over \$10 billion in debt including obligations to fund pension and benefit plans<sup>11</sup>. Other major companies Alpha, Arch Coal and Peabody Energy went bankrupt in 2015-2016. The Green New Deal tabled in 2019<sup>12</sup> calls on the US Government to create millions of high-wage union jobs through a federal jobs guarantee and a just transition for vulnerable communities. The US Government has rejected the proposal.

Another coalpower leader South Africa, in 2007 chose to remain with coal, and commissioned two mega power stations Medupi and Kusile to generate 9.6 GW for national power company Eskom, for completion by 2015 at a cost of US\$10 billion. In 2020 both remain uncompleted, will cost US\$28 billion, and both have given South Africa years of rolling blackouts and an economy in deep trouble<sup>13</sup>. The anticipated cost equals Eskom's entire current debt, an unsustainable burden which requires a three-year, US\$8 billion Government bailout to remain solvent. Eskom's consultants estimate that 35 new coal mines will be required to support the plants, and the University of Pretoria's Business Enterprises calculated that 30% of Kusile's externality cost directed into renewable energy would have generated 5 times Kusile's power<sup>14</sup>.

India is vigorously transitioning, via replacement of coal power with renewable power. in 2010 India had a thermal coal power pipeline exceeding 600 GW, but by June 2018 had shelved and cancelled projects totalling 582 GW - almost the complete pipeline<sup>15</sup>. At June 2018 coal power stood at 219 GW operating and 62 GW under construction or permitted; a total of 281 GW. The cancelled 582 GW is more than double the "currently required" 281 GW. At September 2019, India's renewable electricity capacity was 131 GW or 36% of the 366 GW installed generation, and India's 175 GW "interim renewable target" includes 102 GW under construction, bidding or planning<sup>16</sup>. Nearly 85% of power capacity added in India in Q1 2020 was solar and wind<sup>20</sup>. Thermal power sector witnessed a contraction in installed capacity, all due to coal contraction with more retirements than new additions. The share of total renewable energy capacity has increased from 21.6% to 23.5%. Around 38% of India's power generation capacity is now based on non-fossil fuel technology. The accelerating expansion of India's renewable energy is accelerating coalpower retirements and cancellations.

### **The commercial bottom line for thermal coal**

The levelised mean cost of energy (subsidies removed) in 2019 was<sup>17</sup> (US\$/MWh) solar (utility scale) \$37, wind \$49, coal \$109; while their mean capital cost was (US\$/KW) solar (utility scale) \$1000, wind \$1300, coal \$4625. In both cost categories, renewables are cheaper than coal by half an order of magnitude. It is now cheaper to build and operate a renewable power station than a fossil fuel power station, and dramatically cheaper than building and operating a coal power station: one fifth the build cost and one third the operating cost. It is also an omnipresent truth, that coal power in all its forms, in contrast to renewable energy:

- burns a costly, non-renewable, fuel
- this fuel requires transporting to the power station, sometimes halfway around the planet
- requires a complex feedstock infrastructure, on a regional to international scale
- has a footprint (kilometres<sup>2</sup> per MW - combining coal mines + power stations) much larger than renewable energy
- remains a major emitter of CO<sub>2</sub> and other noxious substances
- causes significant damage to community health
- requires continuous complex maintenance
- requires sophisticated human management 24/7/365
- requires a major cooling component
- generally requires a large amount of water
- is substantially more costly per MW, unsubsidised, both on a whole-of-life (construction included) basis and an operational basis (reference)

Coal has not been, and cannot be, commercially operated in any other fashion, and all attempts to operate otherwise have been spectacular failures. The continued operation of coal power stations

remains economically unsustainable wherever renewable energy using free power sources is being developed in the same market. Every market has a choice: to immediately commence an orderly transition from thermal coal, or incur mounting economic and social losses and billion-dollar stranded assets.

### **The parameters of the transition from thermal coal to renewable energy**

The transition is FROM: A diminishing *thermal coal industry*, whose future - death - is assured.

The transition is TO: a burgeoning *renewable power industry*

- which has already constructed circa 40 renewable power stations in the region
- which has another 50 in the planned pipeline
- which will generate 6 coal-fired power stations' worth of electricity
- whose electricity costs - capital and operating - are considerably less than coalpower
- which will give North Queensland a valued-added export industry larger than coal
- which emits zero carbon
- which is far less dangerous to its workforce; dangers immediate (workplace incidents) and long-term (health)
- which has a suite of critical (renewable) mineral deposits already being processed, mined, or awaiting final development

1. The transition does not involve coking coal. 70% of coal workers will retain their jobs into the renewable age. *Data available*

2. Precedents have already been set, for the two key tasks:

2a. World-leading exporters of fossil fuels have already transitioned their *economy* eg Norway 100% completed, Saudi Arabia well on the way. *Data available*

2b. World-leading exporters of fossil fuels have already transitioned their *workforce* eg Germany 80% completed. *Data available*

3. Renewable energy requires as many jobs as fossil fuelled energy (less direct jobs, more indirect jobs). *Data available*

4. Australians have already designed a blueprint for the transition<sup>2</sup>, and it protects and nurtures Australia's coal workforce.

## **CENTRAL QUEENSLAND IS IN THE BOX SEAT FOR A JUST TRANSITION**

### **The availability of critical minerals in Central Queensland**

The last 10 years worldwide has witnessed a significant trend towards renewable materials, driven by the ever-increasing demand for renewable energy, electric vehicles, and energy storage. The basis of these new technologies is a series of minerals known under the general term "critical minerals"<sup>21</sup>. The term "critical" is used to define their importance for new and renewable technologies and also issues related to supply and demand. The list of critical minerals includes, but is not limited to: REEs, PGE, Ga, In, Nb, Li, Ta, Te, Cr, Mn, Co, Ni, Sc, Mg, Cu, Mo, Sb, W, and V. Major economies, such as USA, EU, Japan, South Korea and Australia have established national strategies to deal with supply and demand, and to encourage exploration for the minerals critical to these renewable materials. Central Queensland contains mineral deposits and processing plants in the last 9 of these 19 critical minerals: Co, Ni, Sc, Mg, Cu, Mo, Sb, W, and V.

### **Australia is in the box seat for a Just Transition**

Australia's population is only 25 million; 42% of South Africa, 37% of the UK, 30% of Germany, 8% of the US, and 2% of India. Australia has a much smaller domestic market, and a far lower domestic/export thermal coal ratio than most transitioning countries. Hence a Just Transition for Australia's thermal coal mining industry can be more flexible, and cheaper to all stakeholders. Australia owns natural assets of solar and wind substantially superior to those of Europe, North America, South Africa, and much of Asia.

## A Just Transition for Australia's thermal coal industry

The Just Transition model proposed by Sheldon et al<sup>2</sup> is a generic, whole-of-nation model. It looks to redirect the coal workforce (and physical infrastructure where possible) of any of Australia's thermal coal provinces, into Australia's generic value-adding infrastructure: universities, technical colleges, research institutes, technology parks and startup hubs. The Sheldon Report's recommendations are at a generic national level, and do not consider specific regions. The difference between the Sheldon Report on a Just Transition for Australia, and this Report on a Just Transition for the Bowen Basin - generic versus specific - is shown in Figure .

## A Just Transition for the Bowen Basin

The Bowen Basin possesses five prime socioeconomic positives:

- 1 It lies within Australia's principal industrial belt, the east coast.
- 2 It is in the centre of a thousand-kilometre long zone in central Queensland containing 89 utility-scale renewable power stations, many operating and the rest planned and funded.
- 3 Its infrastructure includes the national power grid network, the national highway, the national railway, and major international ports.
- 4 It is centred on four large coal power stations, with a total output of 4650 MW and a mean age of 29 years. These power stations provide most of Queensland's fossil-fuelled regional power, but their shelf life looms large in their future.
- 5 Its thermal coal in most thermal mines is complemented by a coking resource, which would permit a transition to 100% coking extraction with relatively limited curtailment and reorganisation of the mine.

The Bowen Basin's thermal coal industry is Australia's *coal-fired energy powerhouse*. A Just Transition Region for the Bowen Basin thermal coal industry is readily identifiable, based on three co-located mega-assets:

- an established fossil fuel power industry (integrated feedstock-transport-generator-consumer, generating 4.7 GW)
- a burgeoning renewable power industry, with 89 power stations generating 3 GW (now), rising to an exportable 11 GW by 2025
- a host State with a population of 5.1 million, more decentralised than any other State. The Bowen Basin Transition Region (BBTR) would extend from Townsville in the north to Bundaberg in the south, with a population of approximately 0.5 million.

The Bowen Basin's "Big Four" coalpower stations are in a state of declining health. They are aged between 19 and 41 years. Gladstone is producing only 35% of capacity due to competition from renewable power stations (reference - website). Callide A closed following a trial of carbon capture (without sequestration) which showed the terminal uncompetitiveness of CCS (reference - website).

## A key role in the Just Transition for the Gladstone aluminium smelter

The Bowen Basin's aluminium smelter at Boyne Island Gladstone has been a cornerstone asset for 37 years. However the changing fundamental cost structures of fossil fuel versus renewable energy newly threatens aluminium melters globally, to the point where world aluminium leaders are linking their smelters to co-located renewable mega-power sources (reference). Gladstone's smelter can be reinstated from vulnerable to future-assured by this new power option of firmed variable renewable energy [VRE]. More excitingly, Gladstone's smelter may be further transformed and reinvented into a Bowen Basin mega-asset, by converting it into a reverse battery (reference) which would underwrite a significant proportion of future Bowen Basin industry power demand and growth. A still-further asset enhancement would be enlargement of the Gladstone smelter and concomitant enlargement of its capacity as a mega-battery.

## BLUEPRINT FOR THE JUST TRANSITION IN CENTRAL QUEENSLAND

### Safe Passage

The Just Transition is modelled in Figures 1a to 1m.

Safe Passage proposes a Just Transition for the Bowen Basin via this obvious opportunity. Safe Passage *can immediately transform the Bowen Basin's coal powerhouse into its spatially contiguous renewable energy equivalent: the Central Queensland Renewable Powerhouse*. The meat of Safe Passage is the simple transfer of human and physical assets between a waning energy industry and a waxing energy industry. Safe Passage does not explore - may not need to explore - the Sheldon Report's detailed recommendations "*Economic development for communities and labour demand*". The Sheldon Report recommendations are vital for Australia's thermal coal industry, but Safe Passage in the Bowen Basin circumvents their necessarily comprehensive complexity, by identifying a simple co-located workforce transmutation. Safe Passage comprises a "subset" Just Transition, entirely within the ambit of the Sheldon Plan (Figure 7). Safe Passage may not work in other Australian thermal coal provinces, which will require the comprehensiveness of the Sheldon Report.

Safe Passage will be implemented in three phases:

Phase 1: Education for the Transition

Phase 2: Assets redistribution and jobs transfer

### Just Transition Phase 1: Assembly of stakeholders in the Transition

### Just Transition Phase 2: Community education for the Transition

The Transition will only operate effectively when its social justice is honoured in the jobs transfer of Phase 2. The importance of social justice in successful cases was especially emphasised by Sheldon et al<sup>2</sup>. Equally, the Transition will only be agreed to in the first place when its stakeholders are all honoured in an initial consultation phase: Phase 1 Education for the Transition.

The stakeholders are as follows:

- The Queensland Government and its Just Transition Group
- The Central-North Queensland community, centred on the Bowen Basin (Mackay-Rockhampton are the major cities)
- The coalminers - CFMMEU
- Coal industry contractors
- Thermal coalmining companies (approximately 12)
- The traditional owners of the coalfields and of the NQ renewable energy hub

The stakeholders will be educated around the two key issues:

Why is a Just Transition needed?

What will a Just Transition consist of?

The community education will be via a grassroots campaign, delivered to the Bowen Basin stakeholders via a set of community meetings at community centres, by invitation from the Bowen Basin community. The meetings will comprise a Workshop in two consecutive parts: (1) Climate change and central Queensland's renewable Future (2) A Just Transition for the Bowen Basin thermal coal industry. Each Workshop will be chaired by a member of the community and will include a comprehensive interactive Q&A session.

The lead presenters could be a developer of the Just Transition Dr Bill Laing or Professor Peter Sheldon, or their nominee(s). Collaborating presenters may include a representative of each of the stakeholder groups above.

The education campaign will require the approval (at least in principle) and preferably the active collaboration of

- the traditional owners
- the CFMMEU and other relevant unions
- the thermal coalmining companies
- the Local Governments of the region.

### **Just Transition Phase 3: Energy assets redistribution and jobs transfer**

The assets of the two industries are comprehensively mapped in Figures 1a-1m. The statistics for company workforce in thermal coal are from published sources. Contractors in thermal coal are estimated indicatively, as 50% of the company workforce.

The jobs transformation will be governed by a schedule of decommissioning of thermal coal mining and coal-fired power stations, which will be determined by the Queensland Government. This schedule will be designed by collaboration between the Government and a set of advisory bodies and stakeholders, which will include the thermal coalmining companies.

The timeframe available for the direct jobs transformation is also governed by the number of built versus unbuilt renewable power stations, which ratio is changing and increasing. Currently (mid-2020) the ratio is circa 35 built versus 54 unbuilt = 40%. Given that a small number of power stations will not be built (through financial attrition and Covid-19 factors), we assume a built/unbuilt ratio of 50%. This ratio underpins any Just Transition Plan, and will change (increase) each year. The ratio is termed the Project Completion Ratio. Jobs available in 2020 = 50% of construction (PS yet to be built) and 50% of operational (operating PS already have workforce in place).

The proposed direct transmutation of Bowen Basin human assets from thermal coal to renewable power is termed the “Bilateral Job to Job” transition (BJJ). BJJ has key attributes:

- 1 Two originally separate jobs become linked, in a bilateral transaction BJJ between two originally separate employer companies. Job “a” closes concomitantly with Job “b” opening.
- 2 BJJ deals with both single jobs and “team” jobs. BJJ1 transmutes single jobs, and BJJ2 transmutes multiple jobs.
- 3 The job marketers are the two companies, not the individual employee. They are united in a commitment to transmuting Job “a” into Job “x” : Company A closes Job “a” simultaneously with Company X opening Job “x”. Completion of the transaction will deliver a win for each company and a win for the employee: Win-win-win. Individual employees and contractors are also accommodated in BJJ.
- 4 Each company has a stake in the job transaction which is greater than the job itself. In particular, multiple job transfer (BJJ2) of teams of employees carries strategic weight in each company’s transition program. BJJ permits optimisation of each company’s transition program.
- 5 The Bowen Basin Transition Authority (BBTA) will be established as the agent of jobs transfer in a just manner. The BBTA will manage the jobs transfer with two core goals: the optimisation of its (1) technical-commercial, and (2) socially just aspects. The BBTA will possess a small staff to execute these goals. The BBTA will possess a database of industry jobs and skills linked to both employees and companies, within a Bowen Basin-wide schedule of job closures and job openings. The BBTA will not possess powers over the job transfers; these will be retained by the job marketers, the company and the employee. The BBTA will simply possess and manage the database. The BBTA will have a vital role as conciliator between the marketers, but without powers of arbitration. The BBTA will be based in the appropriate regional centre, and may have small (one-person) offices distributed throughout the region.
- 6 The prioritised delivery of “full-team” transfers by the BBTA, as well as individual worker transfers, will permit workers to remain together. This will strengthen community cohesion,

at a time when cohesion is otherwise threatened, in perception if not reality, by the Transition process.

## **BBTA Function 1 - Technical-commercial Optimisation of Jobs Transfer**

### **The Register of Displaced Coal Workers**

The BBTA will establish a Register of Displaced Coal Workers. The Register will be administered by the BBTA, with job transactions being developed and closed by the parties themselves: the displaced workers and the companies.

The Register will be voluntary. It will be securely managed by the stakeholders to restrict registration to legitimate Bowen Basin coal workers. This will be defined to include rather than exclude individuals, and the definition will be agreed by all stakeholders in the Transition Plan. Any company (donor or recipient) may be included in the register. The Register will contain as much (broad to detailed) information on its individual registrants as they permit, with the aim of optimising their opportunities for just employment in a new environment.

The Register will be populated by the coal companies, and by individuals and contractors outside the companies, by providing staffing information to the Authority on a confidential basis. The Authority will then insert into the Register, all nominated individuals (company- and self-nominated) after confirming their employment within the Bowen Basin coal industry. Workers may terminate or modify their registration at any time. Their entry in the Register is totally under their control.

### **The Jobskill Managers**

The BBTA will employ a set of Jobskill Managers. Their role is to assess, where appropriate or requested, the skills of the displaced worker(s) and the required job positions, and advise both parties on the technical match between workers and positions. The Jobskill Managers might comprise, for example:

#### In Coalmining:

- Underground mining
- Surface mining
- Downstream mining
- Administration/management

#### In Coal-fired power stations:

(Insert appropriate list) .....

#### In Renewable Power Stations:

- Site management
- Construction
- Ongoing operations

## **BBTA Function 2 - Socially just Jobs Transfer**

The BBTA will possess staff dedicated to ensuring a just transfer of jobs. This will include legislative and legal advice to parties on request, representatives of Governments to provide advice on Government regulations and assistance, and advice on community groups who can assist in the jobs transfer.

## **BBTA Function 3 - Facilitator of development, Gladstone aluminium smelter transformation**

The BBTA will facilitate research into the feasibility of transforming Gladstone aluminium smelter into a mega-battery, which would optimise electricity generation and useage across the region [References].

## KEY ISSUES AND OPPORTUNITIES

### An example of the renewable power industry growing in the BBTR

Australia's largest solar power station, the \$650 million Wandoan PS<sup>18</sup> will lie within the BBTR (Figure 1). It will be built by Vena Energy starting this year, in several stages: (1) stage 1 of the 1000 MW power station by 2021, (2) 150 MWh "giant" battery built by AGL also by end 2021, (3) next stages, to 1000 MW and up to 450 MW of storage, at a later date. Wandoan's initial 150 MWh battery will be one of the biggest in Australia, and its final 450 MW battery will be the biggest. Wandoan stages 1 and 2 will precede the BBTR, unless events in 2020 hasten the closure(s) of thermal coal mines and/or coal power stations, in which case the Wandoan workforce could transition from the closing facilities. The Wandoan battery is a core element of Australian "Big Three" power company AGL's transition to renewables: currently 2.6 GW of renewables and growing, which equals its largest coal power station Bayswater. Wandoan's capacity of 1.8 GW hours per year is equivalent to the annual needs of 255,000 homes, or 640,000 people (ABS 2018). With the BBTR population of circa 0.5 million, Wandoan by itself will generate electricity for a population 28% larger than the BBTR.

### Co-opportunities in the Just Transition: EV transformation of central Qld

Cars - workers + companies + contractors  
 Commercial vehicles - companies + contractors  
 Prototype(s) - testbed  
 Prototype(s) - commercialisation

via Charging station (eg Qld companies) & onsite marketing campaign

### The future of Bowen Basin coking coal: it will also require a Just Transition

The Bowen Basin coking coal asset may, like its thermal coal asset, become stranded earlier than foreshadowed - by green steel (Figure 15) (reference <https://reneweconomy.com.au/world-first-fossil-free-steel-manufacturing-plant-completed-in-sweden-36577/>)

- The world's first fossil-free steel plant, Sweden's HYBRIT built 2018-2019 in 2 years, will produce one tonne of steel per hour
- Traditional steel is highly dependent on coal, both for high temperature heat, and for carbon necessary in the steel process
- Steel is responsible for an estimated 7% of global emissions: HYBRIT will cut Sweden's greenhouse gas emission by up to 10%
- Steel is a challenging sector to decarbonise due to the need for high temperature heat: HYBRIT may be the gateway
- SSAB is one of the world's largest steelmakers: Sweden will be the first nation to market fossil-free steel, as early as 2026
- HYBRIT integrates raw material, steel processing & energy into a single project
- Supported by Swedish Government, with financial support from the Swedish Energy Agency
- Aims to lead transition to a completely emissions-free steel sector in Sweden within the next 20 years
- The UN has asked Sweden to lead the Leadership Group for Industry Transition, which will reverberate around the world
- Fossil-free electricity and its conversion to hydrogen are crucial: for the steelmaking, and because its hydrogen storage can balance an electricity system, delivering more weather-dependent power and increased capacity
- Major implications for the Australian steel and coal industries: (1) a first step away from using coal as an input in steelmaking, (2) as an example of countries taking advantage of generous wind and solar resources to produce zero emissions materials.



## **Just Transition will involve mine closure and rehabilitation**

Corinne Unger is the AusIMM representative on the ISO TC 82 (Mining) Subcommittee 7 (Mine Closure and Reclamation Management) on three Working Groups, WG1 Vocabulary, WG2 MC&RM planning, and WG3 Abandoned/Legacy Mine Management.

[https://ausimm.com/news/webinar-a-family-of-iso-standards-on-mine-closure-and-reclamation-management/?utm\\_medium=email&utm\\_campaign=Webinar%20A%20Family%20of%20ISO%20standards%20on%20Mine%20Closure%20and%20Reclamation%20Management&utm\\_content=Webinar%20A%20Family%20of%20ISO%20Standards%20on%20Mine%20Closure%20and%20Reclamation%20Management+CID\\_7418c88255a036df5b8251898a18cfe9&utm\\_source=EDM&utm\\_term=Webinar%20A%20Family%20of%20ISO%20Standards%20on%20Mine%20Closure%20and%20Reclamation%20Management](https://ausimm.com/news/webinar-a-family-of-iso-standards-on-mine-closure-and-reclamation-management/?utm_medium=email&utm_campaign=Webinar%20A%20Family%20of%20ISO%20standards%20on%20Mine%20Closure%20and%20Reclamation%20Management&utm_content=Webinar%20A%20Family%20of%20ISO%20Standards%20on%20Mine%20Closure%20and%20Reclamation%20Management+CID_7418c88255a036df5b8251898a18cfe9&utm_source=EDM&utm_term=Webinar%20A%20Family%20of%20ISO%20Standards%20on%20Mine%20Closure%20and%20Reclamation%20Management)

## **THE TRANSFORMING ROLE OF THE GLADSTONE ALUMINIUM SMELTER**

### **Re-energising the Bowen Basin by transforming Gladstone aluminium smelter into a mega-battery**

#### **Wind and solar could play key role in future of Australia's aluminium industry**

<https://reneweconomy.com.au/wind-and-solar-could-play-key-role-in-future-of-australias-aluminium-industry-87495/>

Gladstone is one of four aluminium refineries in Australia. Equalling Tomago in NSW, Gladstone is the largest, youngest, most energy-efficient, highest electricity-consuming, and highest-employing refinery in Australia ..... Energy required for Gladstone, for Tomago, and even for old Portland, could come from firmed variable renewable energy [VRE] ..... As the electricity system is reconfigured aluminium's role is being re-examined. The answers don't necessarily change but different questions can be asked. Firstly, it's clear that if aluminium production closes down there will be a >10% reduction in electricity demand. Unless there are new sources of demand, such as electric vehicles or, more distantly, hydrogen production, there will be an excess of generation and more power stations will close. Yallourn, Vales Point and Gladstone power stations are the most vulnerable.

#### **Greens call for aluminium smelter to be upgraded to serve as "reverse battery"**

<https://reneweconomy.com.au/greens-call-for-aluminium-smelter-to-be-upgraded-to-serve-as-reverse-battery-15275/>

Australia is already host to the world's biggest lithium-ion battery - the 100/129MWh Tesla big battery at Hornsdale in South Australia. And they are about to get bigger: Twin batteries to upgrade Hornsdale's main link to Victoria, a 600MW big battery near Geelong for a similar purpose by Hornsdale owner Neoen, and the massive 30GWh battery co-located with the world's biggest solar farm in the Northern Territory by the Sun Cable consortium.

But perhaps the biggest, and cheapest, battery in Australia right now are the ones that we already have, and don't quite know it – the huge aluminium smelters that account for 10% or more of state demand in Queensland (Gladstone, owned by Rio Tinto Alcan), NSW (Tomago), Victoria (Portland) and Tasmania (Bell Bay). Until now these smelters have relied on usually heavily subsidised supply of power from a fleet of coal generators with gas units in support.

Some companies in the mining industry now are designing their new new projects around the principle of "base-cost" renewables: using energy when it is abundant, and scheduling downtime when it's not. Now the big on-grid users are being invited to also think differently about energy, both in its supply, and in its use. They can act as "giant batteries", by modifying their behaviour and choosing times to suck most power from the grid according to supply equations, pricing, and what else is happening in the network, and being paid to reduce demand at other times. "It is worth re-imagining a smelter as a giant virtual battery, one that also produces aluminium," says Clark Butler (Report for the Institute for Energy Economics and Financial Analysis). This already happens overseas, such as at Rio's Kitimat smelter in Canada and a Hydro Norsk smelter in Norway, where smelters with "captive" hydro power sources have integrated electricity and smelting to manage

both aluminium and electricity price volatility. "They can make an objective, value-maximising choice between ramping up aluminium production (and using more electricity) when aluminium prices are attractive and curtailing production (and selling surplus electricity) when that provides a better return," Butler says. "Smelters without captive generation can be configured to modulate energy use up or down to optimise its productivity, including those in Australia, such as Portland and Tomago" (and Gladstone).

**ME: AGL Energy dumps rescue plan for Alcoa aluminium smelter at Portland Victoria** [\*The Australian\*, 23 September 2020](#)

THE POLICY

## Smelt-down

"Despite the efforts of AGL and some other market participants, and a constructive engagement with the ACCC, we did not proceed with the original plan. The reasons for this included lack of industry participation and the conditions required for a successful consortium."

THE AUSTRALIAN

AGL Energy confirms that it has dumped a rescue plan for Alcoa's aluminium smelter in Portland, Victoria, raising fears that the plant – with a 500-strong workforce – could close as early as next year.

## References

- <sup>1</sup> *Hansard 26 June 2018, M. Butler MP, 14:24*
- <sup>2</sup> *Sheldon, P., Junankar, R., De Rosa Pontello, A., University of NSW Business School, Industrial Relations Research Centre, 2018*
- <sup>3</sup> <https://reneweconomy.com.au/uks-co2-emissions-have-fallen-29-over-the-past-decade-41446/>
- <sup>4</sup> <https://reneweconomy.com.au/german-government-mining-states-and-utilities-fix-path-for-coal-exit-69069/>
- <sup>5</sup> <https://oilprice.com/Alternative-Energy/Nuclear-Power/Germany-Aims-To-Close-All-Nuclear-Plants-By-2022.html>
- <sup>6</sup> <https://cleantechnica.com/2020/03/06/wind-energy-leads-germany-to-renewable-energy-record-in-february/>
- <sup>7</sup> <https://www.greenbiz.com/article/coal-industry-shrinking-heres-what-miners-need-just-transition>
- <sup>8</sup> <https://www.theguardian.com/environment/2019/aug/12/west-virginia-appalachia-miners-green-new-deal>
- <sup>9</sup> <https://www.theguardian.com/business/2020/jan/24/us-coalminers-black-lung-disease-dying>
- <sup>10</sup> <https://www.eia.gov/energyexplained/coal/coal-and-the-environment.php>
- <sup>11</sup> <https://www.washingtonpost.com/business/2019/10/29/coal-giant-murray-energy-files-bankruptthermal-coal-coals-role-us-power-dwindles/>
- <sup>12</sup> <https://www.congress.gov/bill/116th-congress/house-resolution/109/text>
- <sup>13</sup> <https://www.bloomberg.com/news/articles/2019-10-09/two-mammoth-power-plants-are-sinking-eskom-and-south-africa>
- <sup>14</sup> <https://www.greenpeace.org/africa/en/publications/1750/the-true-cost-of-coal/>
- <sup>15</sup> <https://reneweconomy.com.au/india-coal-project-cancellations-snowballing-77501/>
- <sup>16</sup> [https://en.wikipedia.org/wiki/Renewable\\_energy\\_in\\_India](https://en.wikipedia.org/wiki/Renewable_energy_in_India)
- <sup>17</sup> <https://www.lazard.com/perspective/lcoe2019>
- <sup>18</sup> <https://reneweconomy.com.au/agl-signs-up-for-giant-battery-in-queensland-paving-way-for-1000mw-solar-plant-12232/>
- <sup>19</sup> [https://www.themonthly.com.au/today/paddy-manning/2020/11/2020/1589175817/thanksjackmunday?utm\\_medium=email&utm\\_campaign=The%20Monthly%20Today%20-%20Monday%2011%20May%202020&utm\\_content=The%20Monthly%20Today%20-%20Monday%2011%20May%202020+CID\\_d0d6ea9e11b2a83fa60eb2e73a3e8abf&utm\\_source=EDM&utm\\_term=ThanksJackMunday](https://www.themonthly.com.au/today/paddy-manning/2020/11/2020/1589175817/thanksjackmunday?utm_medium=email&utm_campaign=The%20Monthly%20Today%20-%20Monday%2011%20May%202020&utm_content=The%20Monthly%20Today%20-%20Monday%2011%20May%202020+CID_d0d6ea9e11b2a83fa60eb2e73a3e8abf&utm_source=EDM&utm_term=ThanksJackMunday)
- <sup>20</sup> <https://cleantechnica.com/2020/05/23/nearly-85-of-power-capacity-added-in-india-in-q1-2020-was-from-solar-wind/>
- <sup>21</sup> <https://www.jcu.edu.au/economic-geology-research-centre/egru-news/egru-seminars-2020>

### **The Sheldon Report** (*verbatim quotes in italics, with some editing by the writer*)

In commissioning the Sheldon Report, the Australian Construction, Forestry, Maritime, Mining and Energy Union (CFMMEU) sought a description of what would constitute a “best practice” structural adjustment program for coal power regions that would:

- *minimise and preferably eliminate forced redundancies*
- *enable voluntary redundancies and early retirement to be spread across power stations and dependent mines in a region, or across the country*
- *provide successful transfer of workers to alternative quality jobs*
- *provide alternative economic development for the regions that would maintain or improve the situation of the regional community*

### **Just Transition - Sheldon Report: Summary by CFMMEU National President Tony Maher 2018**

*In Germany's Ruhr region, a major reshaping of the regional economy with no forced job losses was achieved by forward planning, investment in industry diversification, staggered mine closures and a comprehensive package of Just Transition measures. Central to this outhermal coalome is the presence of a national, coordinated response. In the Australian energy debate to date, the impact of the transition on workers and communities has been almost completely ignored. This is an omission we can't afford. After all, the costs of investing in a Just Transition need to be balanced against the costs of doing nothing and abandoning whole communities to a bleak future. While global trends suggest that Australian export coal for steelmaking and energy production will be in demand for decades, coal-fired power generation in Australia is winding down.*

### **Sheldon Report: Concrete Proposals**

*Recommendation: Establishment of a national, independent statutory authority to plan, coordinate and manage a Just Transition for Australia's coal power workers and their communities.*

#### *Economic development for communities and labour demand*

##### *1. Cluster policy*

*Promote clusters for particular industries or linked service activities for new, high tech industries and services, eg universities, technical colleges, research institutes, technology parks, startup hubs. Government funding: applied research, infrastructure, marketing initiatives to attract inbound investment and highly skilled workers.*

##### *2. Strengthening local factors to boost development*

*Existing local strengths (or apparent weaknesses): local forms of economic specialisation, knowledge and skills, local institutions, and recent experiences. Crucial in the early stages is public sector investment in:*

- a. Education & training; immediate jobs in building and other on-site works, ongoing jobs across many different types.*
- b. Fostering private sector innovation and entrepreneurship to rebuild sectors and areas.*
- c. Investment in transport and communications infrastructure.*

##### *3. Funding labour-intensive regional projects*

*Eg site rehabilitation, using the same skills as power stations and mines; may last a decade. A very useful employment bridge for less (formally) skilled workers leaving power stations & mines and nearing retirement. Rehabilitation of damaged environments improves local health and makes the area more attractive to (a) other forms of investment, particularly service industries (tourism, health precincts, retirement villages) (b) those joining universities, technology parks & clusters.*

#### *Supporting individual workers and improving labour supply*

##### *4. Labour pooling among nearby power stations or mines*

*Requires well-planned & staged closures. Workers, particularly older or more senior, can move to still-operating facilities.*

##### *5. Early retirements*

*Requires additional funding to allow these workers to retire with dignity.*

##### *6. Retraining*

*Focus: provided ahead of retrenchments, job experience in the new industry, individualised approach to skills recognition and older workers.*

##### *7. Income maintenance and support*

*Focus: bridging financial support, higher than unemployment benefits, mortgage and rent support for a defined period.*

##### *8. Relocation and travel assistance*

*Where new employment is some distance away (complete relocation or long commuting).*

#### *Culture and decision-making processes*

*Starting point: the need for a Just Transition for the workers and their communities: (a) both top-down and bottom-up approaches, (b) equal prioritisation of labour demand and supply questions. The proposals require economic and industrial relations cultures conducive to a vision of Just Transition for individual workers & their communities; built on tripartite engagement, socially-acceptable outhermal coalomes, community participation, and corporate social responsibility. The western European tradition of “social partnership”, with a prominent role for unions and collective agreements, was very successful in Germany, Netherlands, Singapore, as was broad stakeholder consultation and engagement. Critical is finding consensus through the changes, via workplace consultation and upward feedback and pressure.*

## Union Attitudes

### **CFMMEU National President Tony Maher 2018 - Foreword to Sheldon et al Report, October 2018**

*In Germany's Ruhr region, a major reshaping of the regional economy with no forced job losses was achieved by forward planning, investment in industry diversification, staggered mine closures and a comprehensive package of Just Transition measures. Central to this outhermal coalome is the presence of a national, coordinated response. In the Australian energy debate to date, the impact of the transition on workers and communities has been almost completely ignored. This is an omission we can't afford. After all, the costs of investing in a Just Transition need to be balanced against the costs of doing nothing and abandoning whole communities to a bleak future. While global trends suggest that Australian export coal for steelmaking and energy production will be in demand for decades, coal-fired power generation in Australia is winding down.*

*Sheldon, P., Junankar, R., De Rosa Pontello, A., University of NSW Business School, Industrial Relations Research Centre, 2018*

### **ETU state organiser Jason Young - RenewEconomy, 11 October 2019**

*ETU state organiser Jason Young said the union is focused on the "just transition" but was not convinced the Government had a clear plan. "With the whole world screaming for action on climate change this Queensland Government has a real chance to highlight how, when done collaboratively and in conjunction with a proper Just transition plan, we can transition to renewable forms of energy and it can be done with minimal impacts on regional jobs and towns." (Young) said the union wanted the Government to "put a halt on all planned and proposed large scale renewable energy projects until the Just Transition Authority has the funding, mandate and resources to ensure workers and communities are future-proofed." And he wanted CleanCo to identify the scale and scope of investment required "to provide a responsible, diversified public-owned renewable energy sector that provides jobs and job security where they are needed. We will not allow our members and their communities to be left in the dark when it comes to their jobs and the future of their towns. One thing is for sure, if nothing is done now there will not be a reliable, relatively cheap power network in Queensland within five years."*

*<https://reneweconomy.com.au/union-demands-halt-to-new-wind-and-solar-projects-in-queensland-but-its-already-happened-14943/>*

## **APPENDIX 1**

### **Safe Passage in a post-Covid world**

# Post-Covid19 - status of Australian wind & solar projects

## **Covid-19 could stop new Australia wind and solar projects** *RenewEconomy, 29 March 2020*

The global Covid-19 pandemic is expected to hit planned wind and solar projects in Australia and other countries particularly hard, and wipe out any anticipated growth in renewables deployment in 2020, according to a new study by Norway-based Rystad Energy. "The full extent of the impact of Covid-19 on the renewable energy market is just beginning to reveal itself," it says in a new report by Senior Vice President Gero Farruggio. They say they had expected global solar additions to grow 15% to 140 GW in 2020, and wind additions to grow 6% to around 75 GW. But it now expects this growth to be eliminated, and its forecasts for 2021 have also been cut by around 10%. Rystad suggests a bigger impact could be felt in countries where the currency has declined sharply against the US dollar, and this will have a particular impact on Australia, where capital costs could rise by more than one third.

Companies typically procure key renewable energy project components in US \$ despite reaping revenue in local currency. Given this, projected returns on developments under procurement are already plummeting as unfavorable exchange rates result in soaring equipment prices. Utility wind is most at risk, as the percentage of wind development capex procured in US dollars is 25% higher than that of a utility solar PV." Farruggio says Australia will be one of the worst hit because its currency has fallen dramatically in recent weeks to a 17-year low. "Developers already appear to have cooled on orders that were otherwise imminent," he says. Much of the 2 GW utility PV solar expected to begin production 2020 in Australia is already built and going through the commissioning phase, which in many cases has been become long and complex, and in some instances heavily delayed. "Work will continue on these projects. However, the key determiner of success will be the process of grid connection," he notes. **But the outlook is not good for projects seeking financial close, and that will mean that the country will likely miss its expected installation of around 1.8 GW of utility scale PV in 2021. Wind, because of its longer lead times, is still expected to deliver 4.5 GW of finished wind turbine capacity between 2020 and 2021, but the 1.5 GW worth of approved projects scheduled for 2022 are at risk of delay. "We feel it is now unlikely that Australia will see a standalone wind farm reaching financial close in 2020."**

<https://reneweconomy.com.au/covid-19-could-stop-new-australia-wind-and-solar-projects-wipe-out-global-growth-49742/>

## **Coronavirus impact lays bare inflexibility of German power generation & demand** *RenewEconomy, 11 May 2020*

While power demand fell during the pandemic because much of the German economy lay idle, sunny and windy weather led to strong renewable power production, prompting wholesale power prices to repeatedly fall deep into negative territory. Then electricity producers paid wholesale customers to use the power they generated rather than turn off plants because it was cheaper, revealing the inflexibility of the country's electricity generation and demand. Hanns Koenig of consultancy Aurora Energy Research: "Power prices turned negative because it was not possible or profitable for thermal plants to turn off, and because a lot of renewables that are in the system currently have no incentive to turn down when power prices turn negative." "There are still 2 to 3 GW of lignite plants that won't turn off, no matter how negative prices are, and Germany's grid would be more flexible with them closed." Energy transition think tank Agora Energiewende\* argues priority must be given to making demand much more responsive to prices, and also to throttling down fossil power generation, before thinking about making renewables more flexible.

<https://reneweconomy.com.au/coronavirus-impact-lays-bare-inflexibility-of-german-power-generation-and-demand-76398/>

# How Covid-19 will impact the Bowen Basin Transition

- Covid-19 has slashed our GDP and economic indices, to the point where rational Federal and State Governments will apply rigorous cost-benefit analysis to all infrastructure and especially energy infrastructure. There will be no fiscal room for ideologues, coal-lovers or fossil fuel fossils. **In post-Covid economic realism, coal-fired power will rapidly become untenable.**
- **In Post-Covid economic realism the Big Four Bowen Basin coalpower stations will become stranded assets sooner than expected. There will probably be uncertainty around the stranding timeframe. This scenario will incentivise Bowen Basin thermal coal companies to Transition faster.** The Big Four coalpower stations' uncompetitiveness with the renewable power infrastructure enveloping them, will push the Queensland Government, their owners and major shareholders, to replace them sooner than currently planned.
- The deferred installation of renewable power stations in Covid 2020 will provide a year downstream of extra construction. **The coal workforce will have a year's extra renewable jobs in the Transition.**



**Update Thermal Coal Mines**

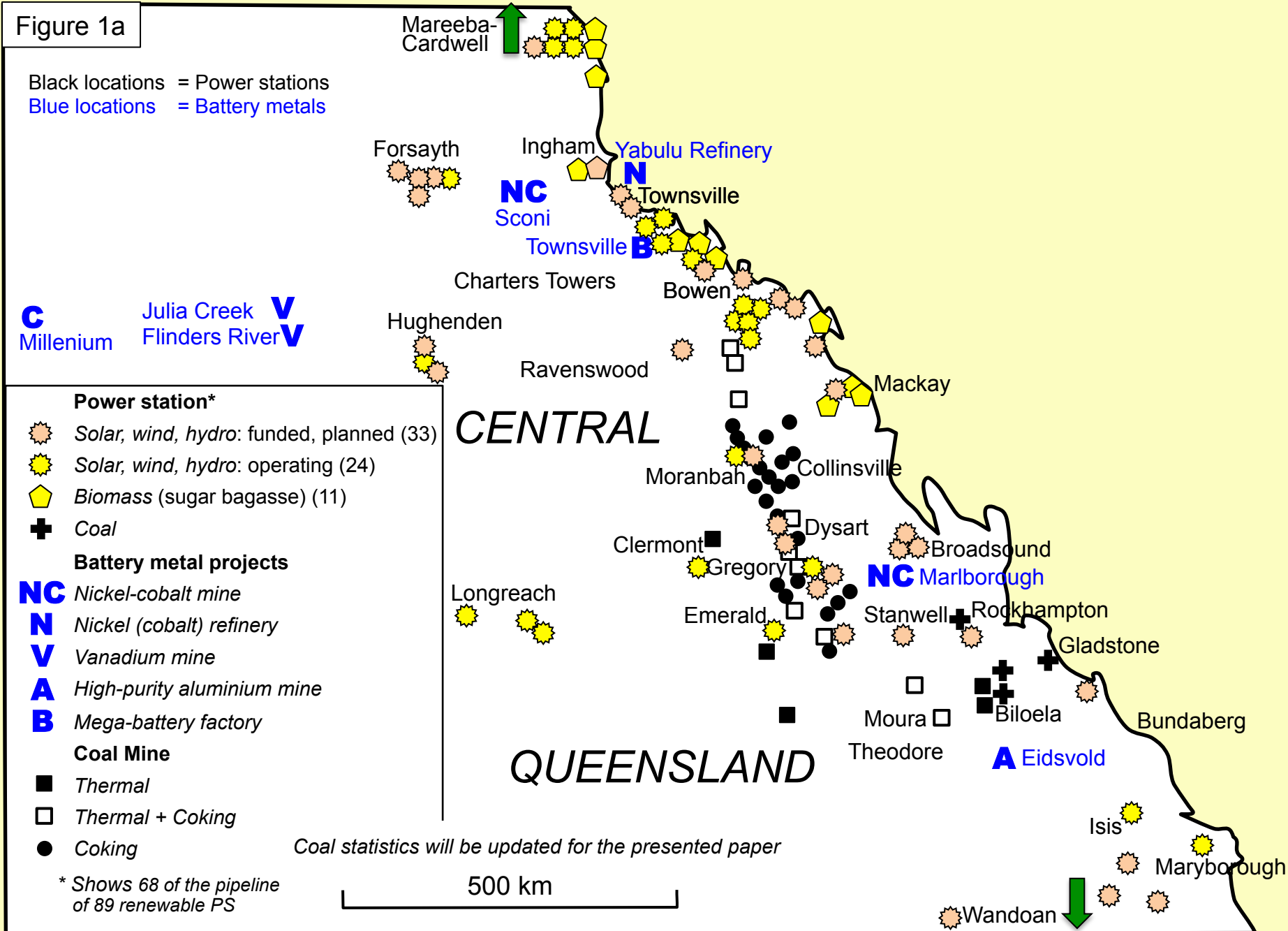
## **APPENDIX 2**

**The industry Transition and jobs transfer, in maps**

**Figures 1a to 1m**

# Bowen Basin Transition: Regional assets: Now & future

Figure 1a



## Bowen Basin Transition: Regional assets: Now & future

### Figure 1b

Black locations = Power stations  
Blue locations = Battery metals

## NQ BATTERY METAL MINING

8 developing projects

**NQ RENEWABLE ENERGY  
HUB  
43 PS ca 5 GW**

**C** Millenium Julia Creek V  
Flinders River V





**CQ RENEWABLE  
ENERGY HUB  
19 PS ca 2 GW**

**ROCKHAMPTON  
POWER STATIONS  
4 PS 4.7 GW**

**BOWEN BASIN  
COAL PROVINCE**  
37 coal mines  
15 of them thermal

**SEQ RENEWABLE  
ENERGY HUB  
27 PS ca 4 GW**

- ## Power station\*

-  *Solar, wind, hydro*: funded, planned (33)
-  *Solar, wind, hydro*: operating (24)
-  *Biomass* (sugar bagasse) (11)
-  *Coal*

- ## Battery metal projects

- NC** *Nickel-cobalt mine*  
**N** *Nickel (cobalt) refinery*  
**V** *Vanadium mine*  
**A** *High-purity aluminium mine*  
**B** *Mega-battery factory*

- ## Coal Mine

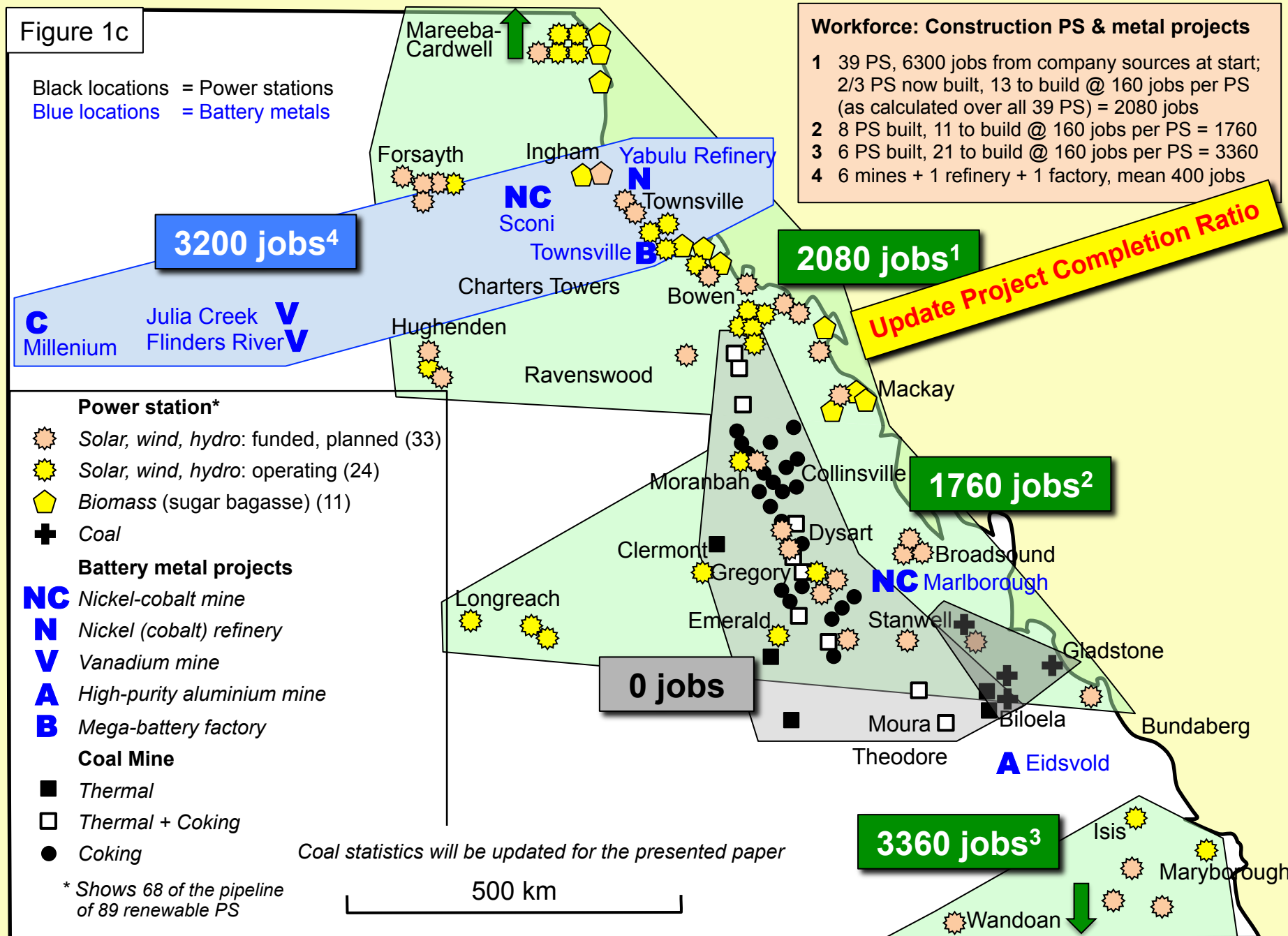
- *Thermal*
- *Thermal + Coking*
- *Coking*

\* Shows 68 of the pipeline of 89 renewable PS

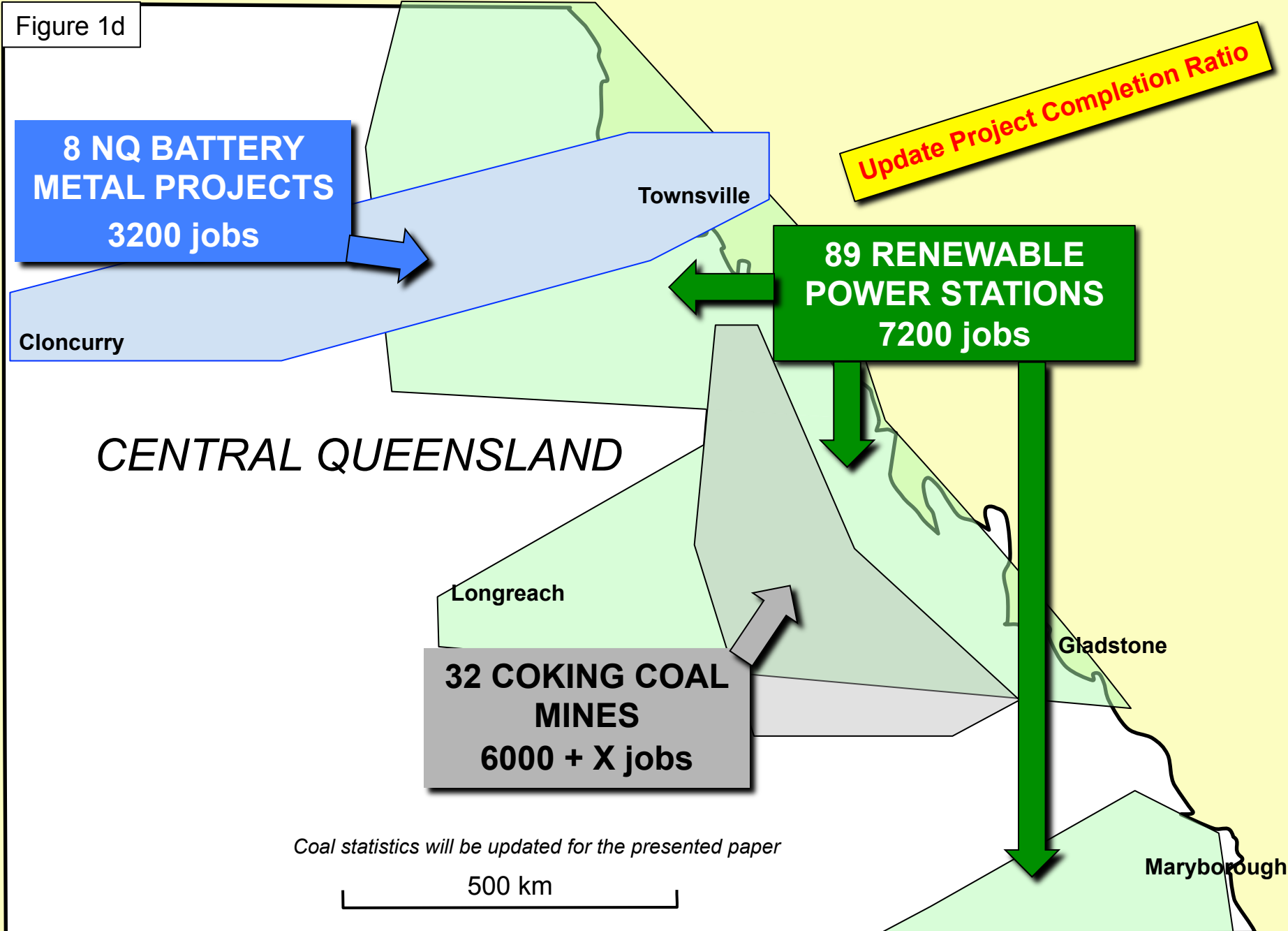
*Coal statistics will be updated for the presentation*

500 km

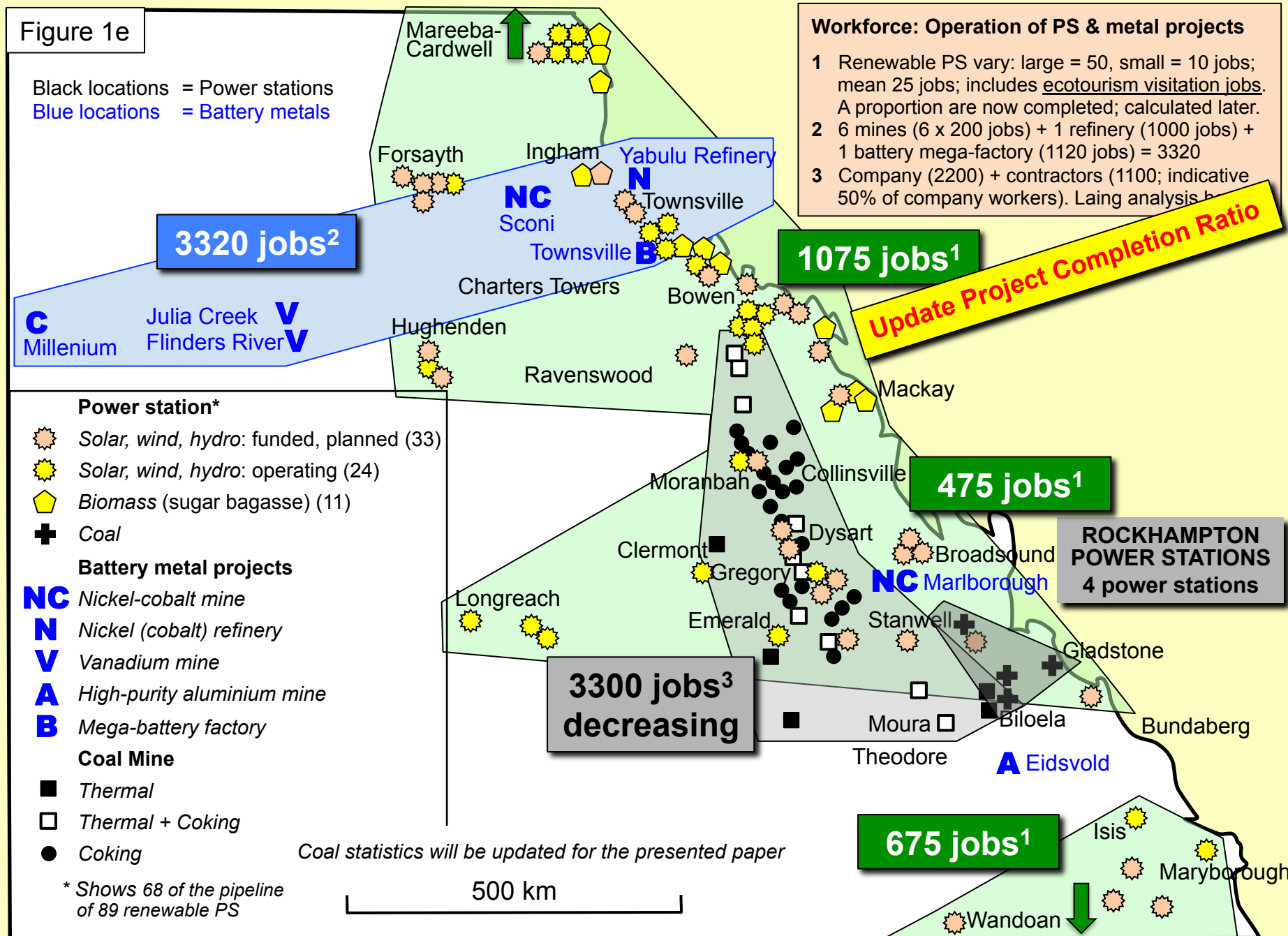
# Bowen Basin Transition: Workforce: Future construction



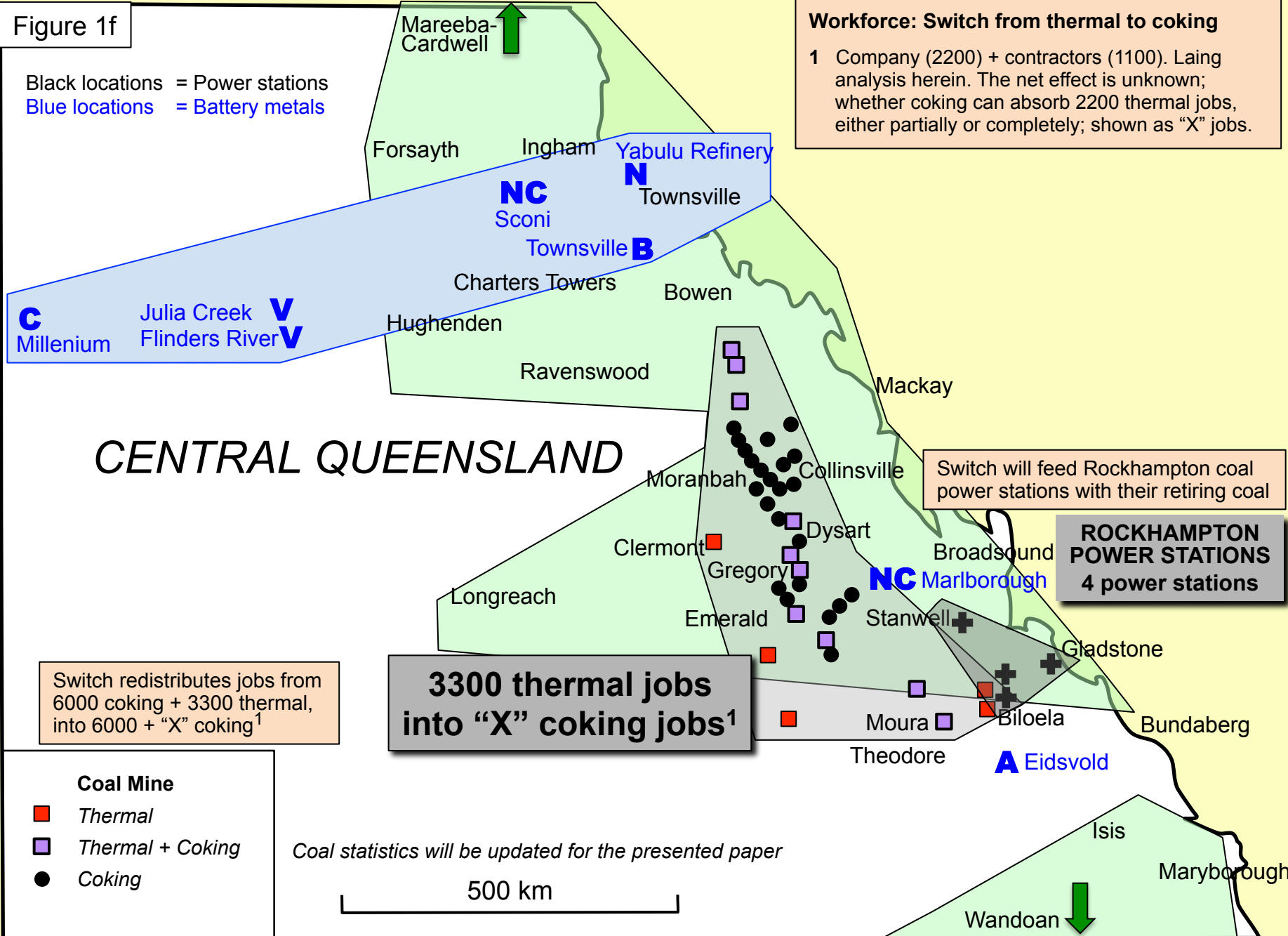
# Bowen Basin Transition: Workforce: Future construction



# Bowen Basin Transition: Workforce: Future operational

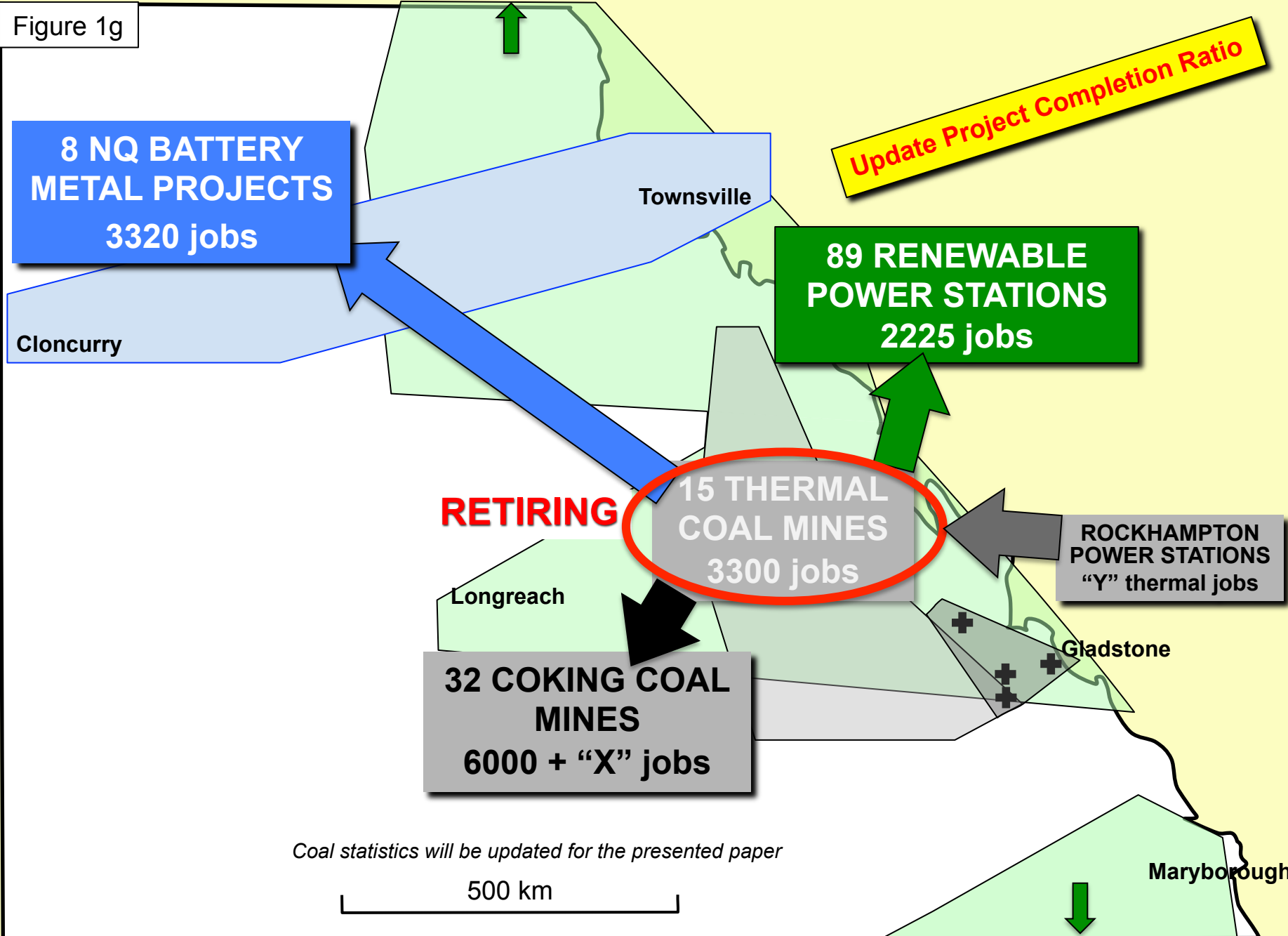


# Bowen Basin Transition: Workforce: Future coal switch



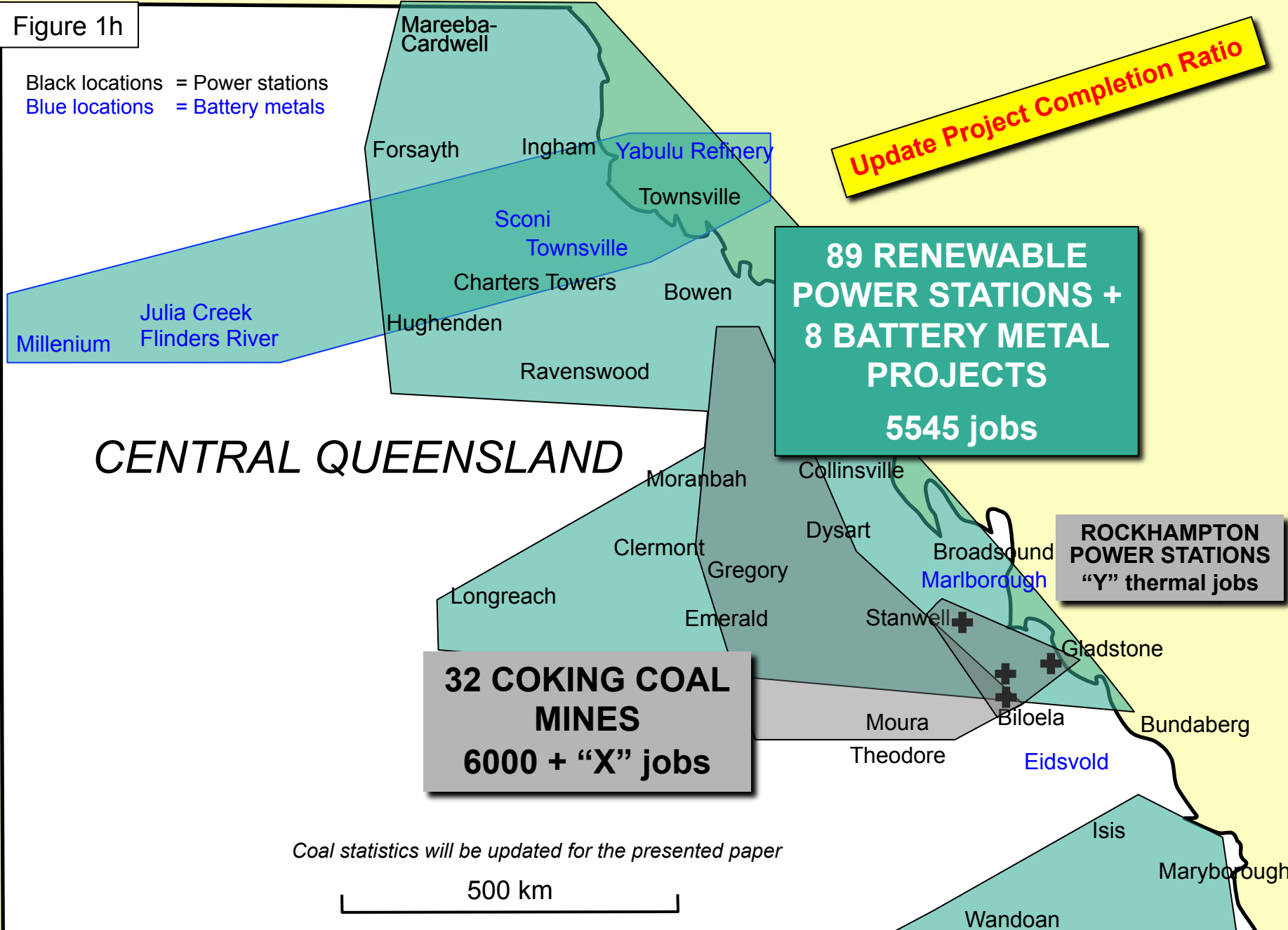
# Bowen Basin post-Transition: Operational workforce

Figure 1g



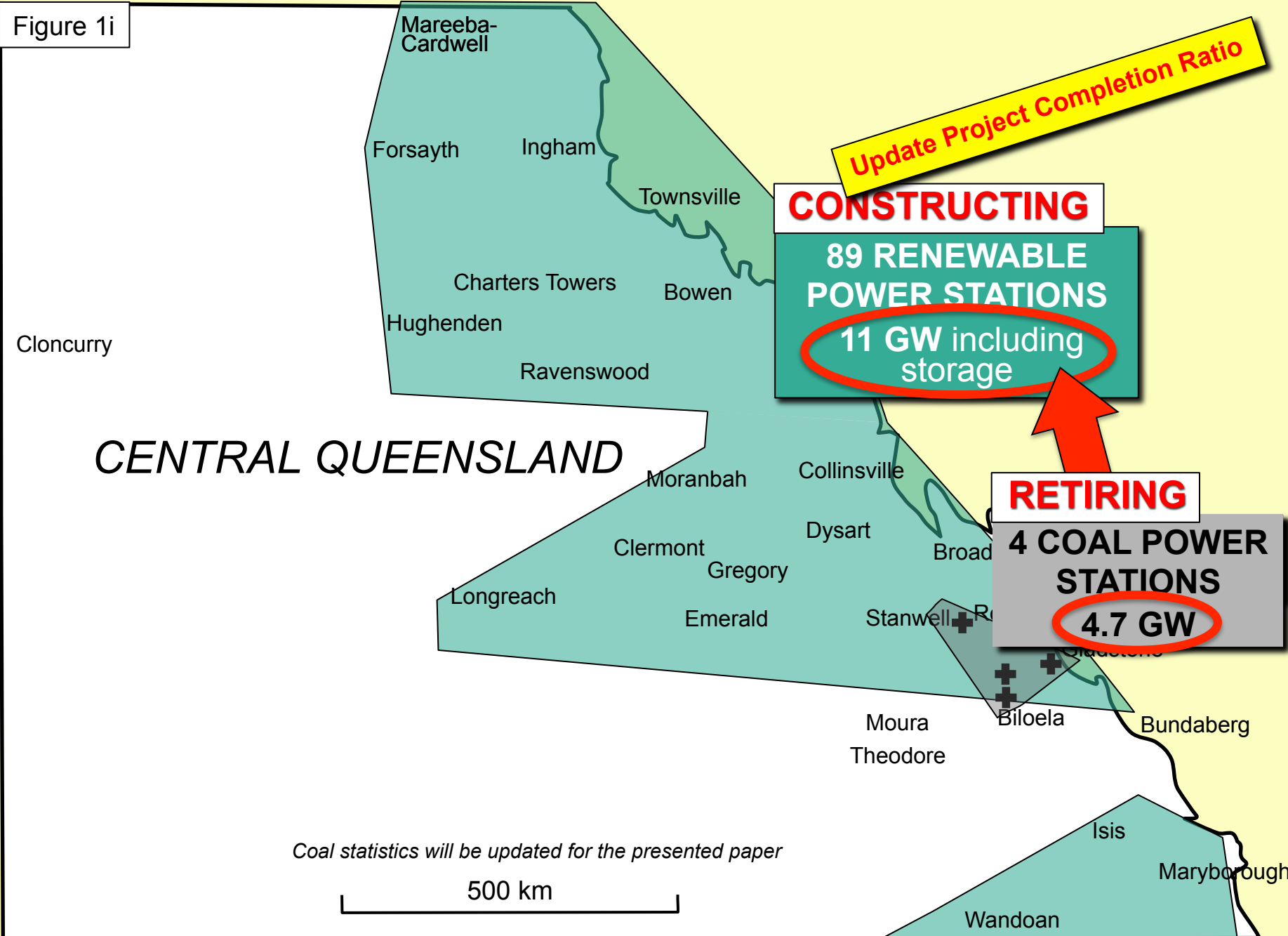


# Bowen Basin post-Transition: Operational workforce



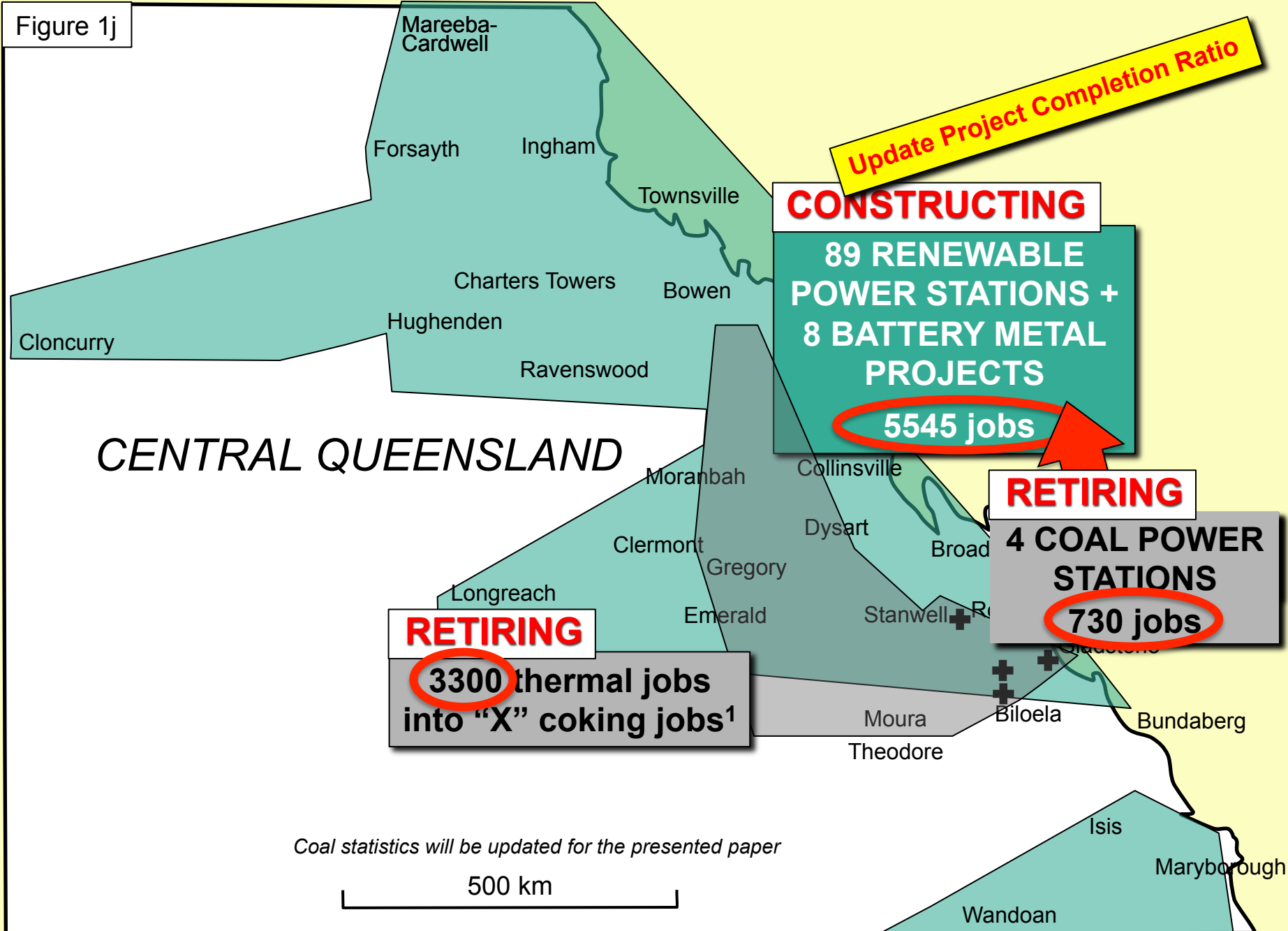
# Bowen Basin post-Transition: Energy transformation

Figure 1i

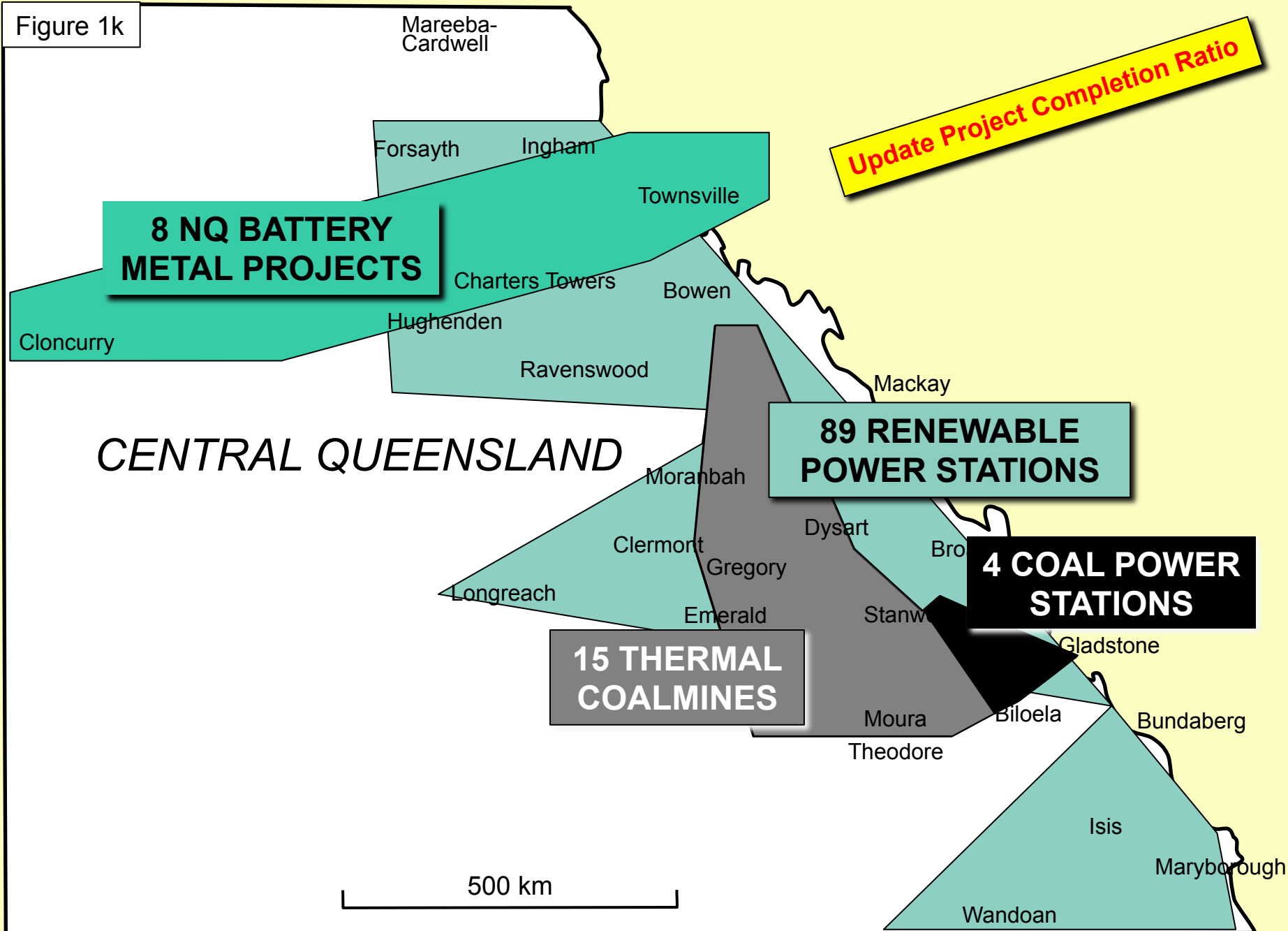


# Bowen Basin post-Transition: Workforce transformation

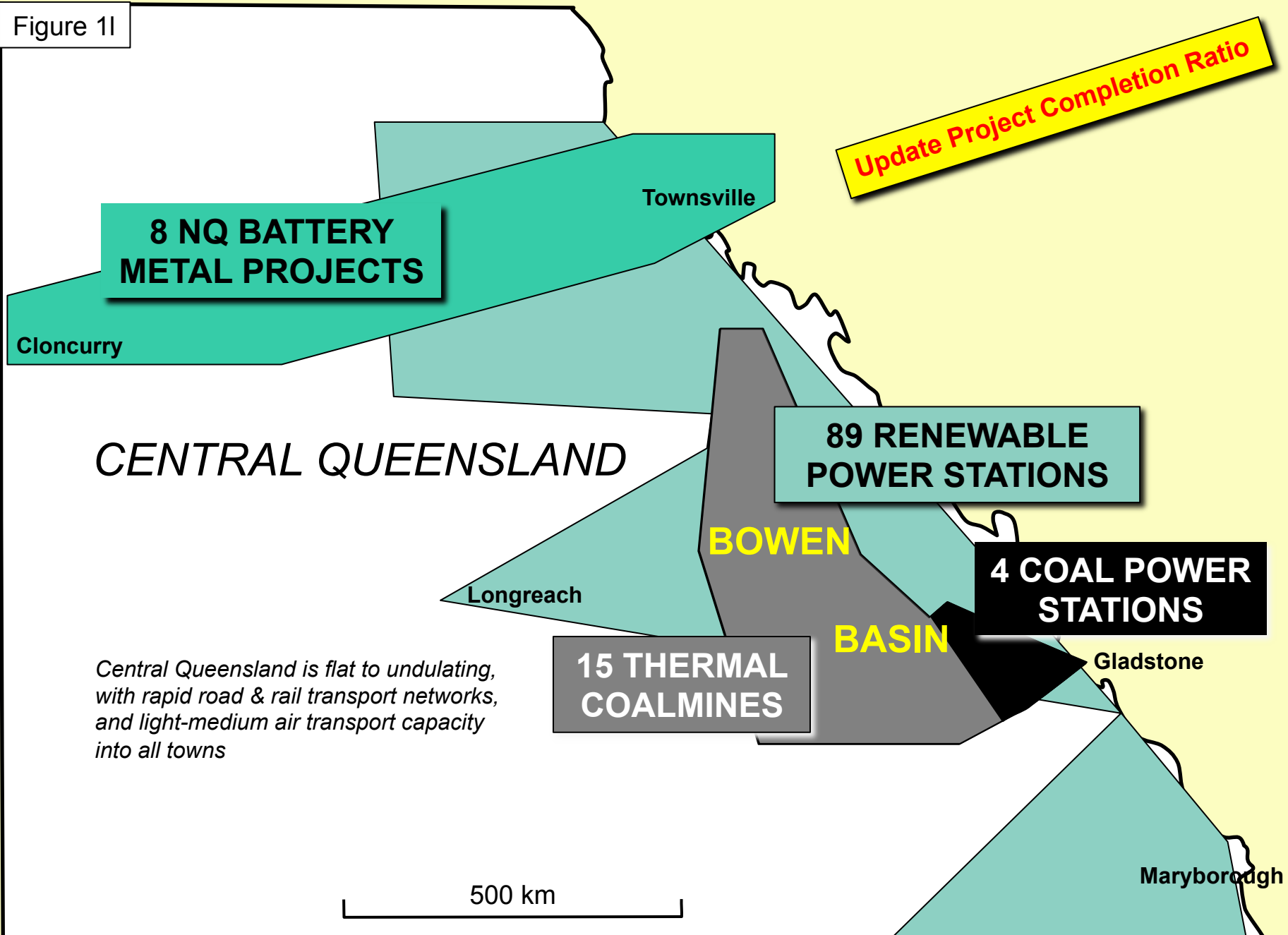
Figure 1j



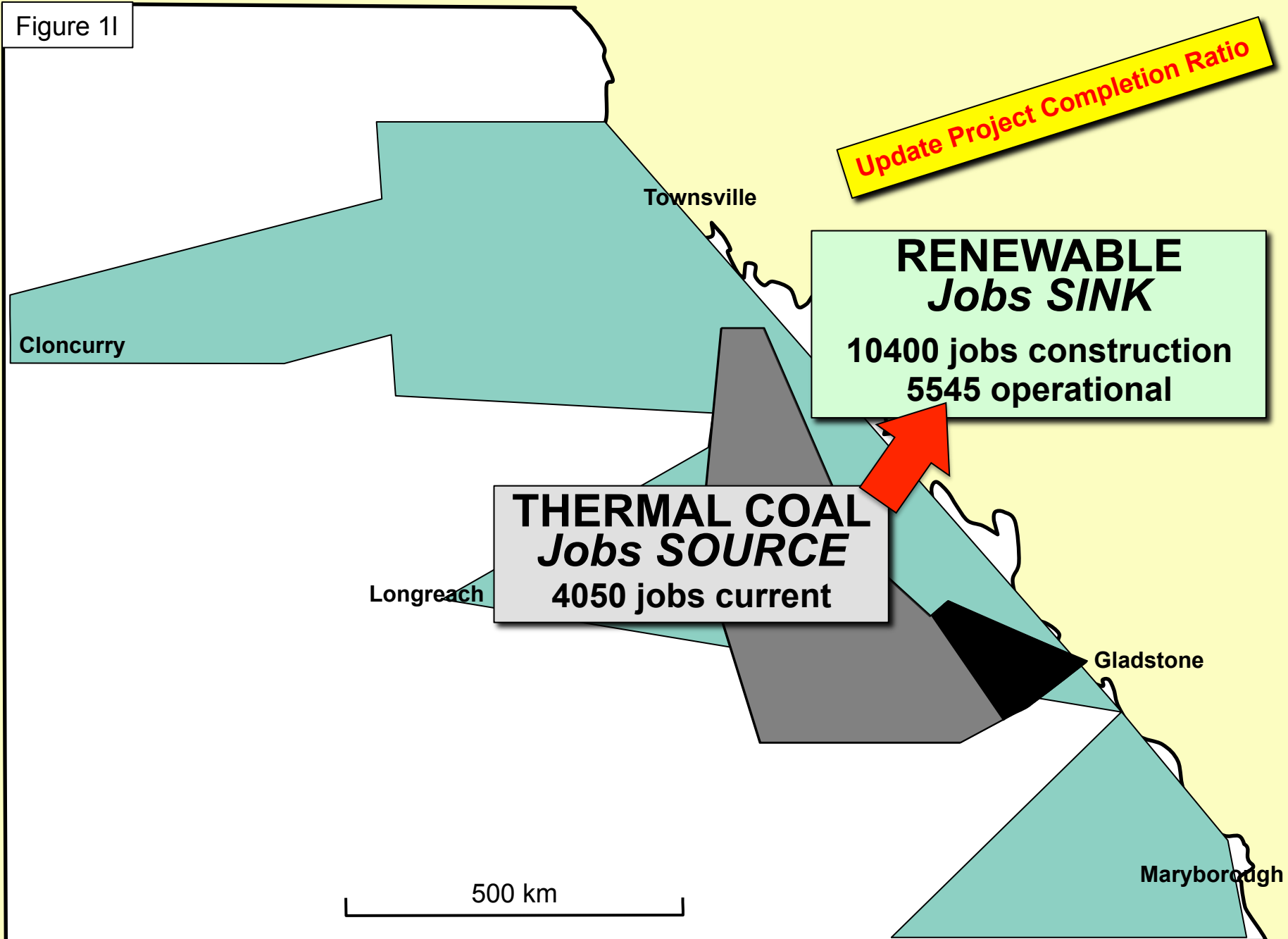
# Bowen Basin post-Transition: Workforce transformation



# Bowen Basin post-Transition: Workforce transformation

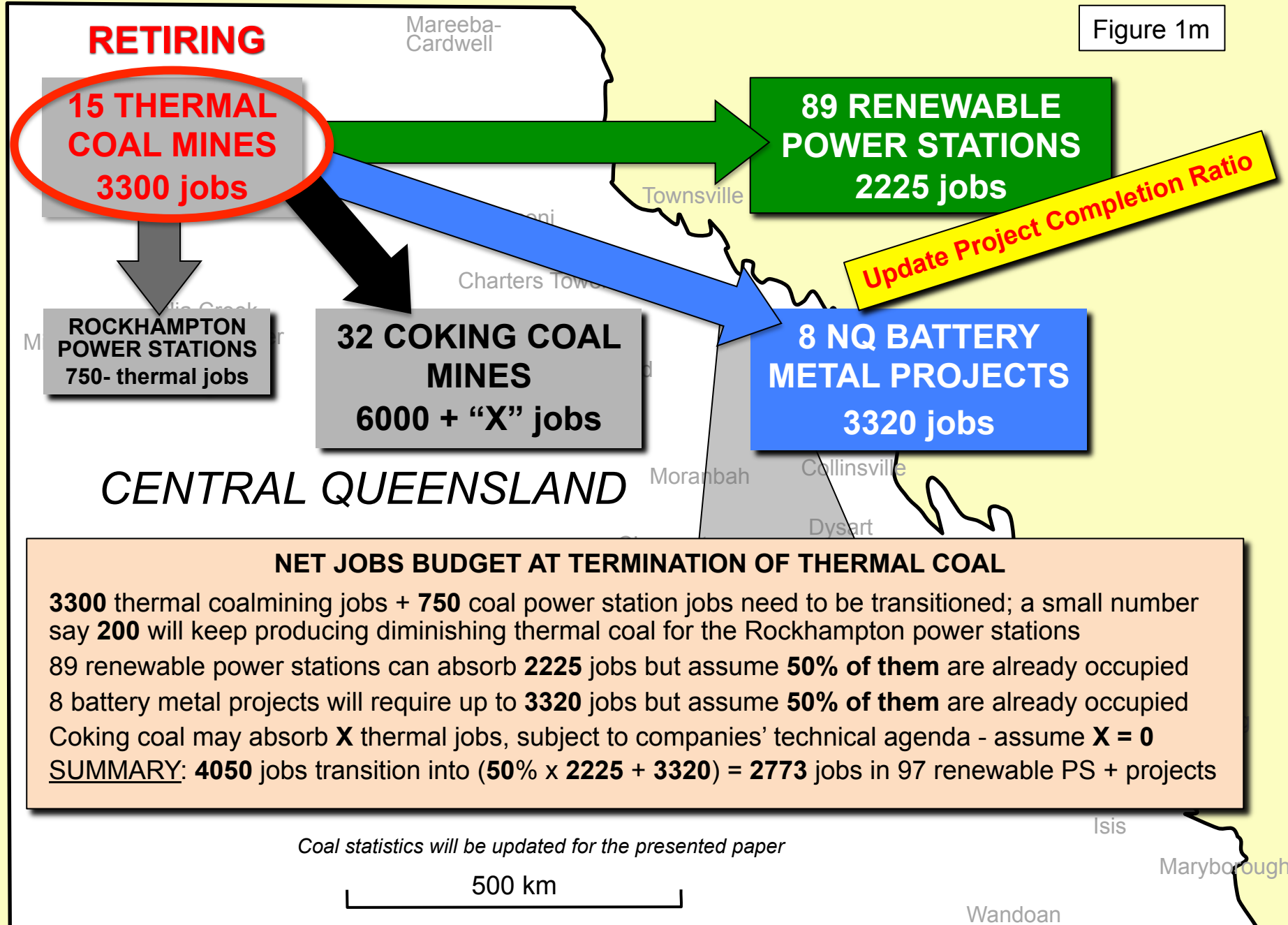


# Bowen Basin post-Transition: Workforce transformation



# Bowen Basin Transition: Workforce: Total jobs budget

Figure 1m



**Update Thermal Coal Mines**

# **APPENDIX 3**

## **Figures 2 to 11**



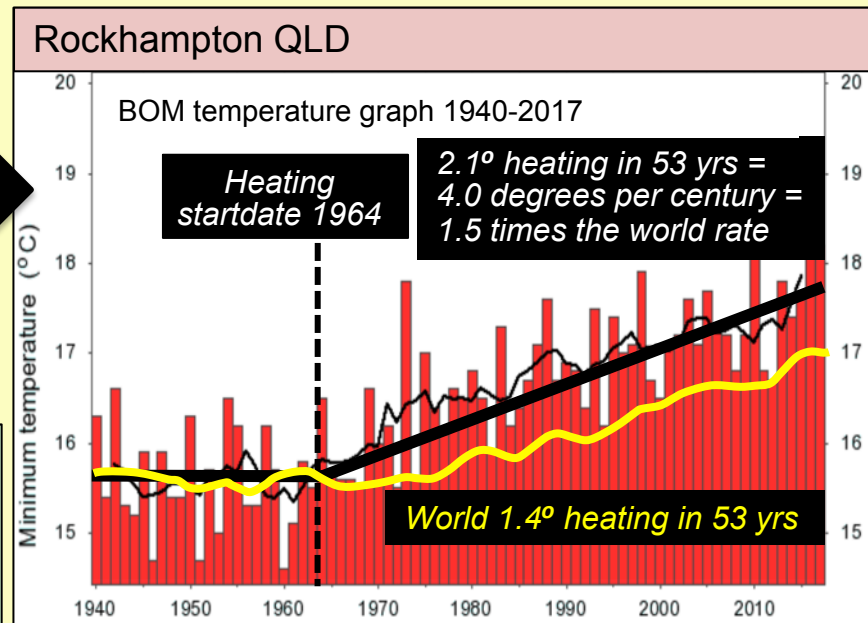
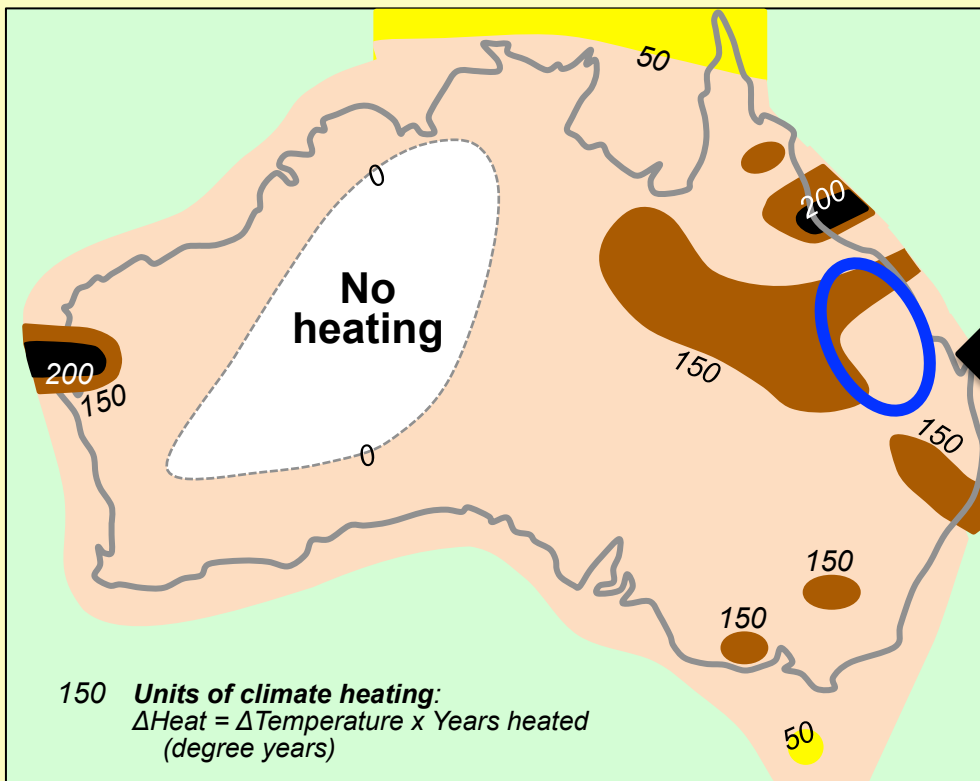
# The Bowen Basin is heating at 2 times the world rate

## Your town is heating at a similar anomalous rate

ROCKHAMPTON's climate heating rate, 4.0 degrees per century, is the fifth highest in Australia.

The city is heating at 1.5 times the average world rate.

[https://www.ncdc.noaa.gov/cag/global/time-series/globe/land/ytd/12/1910-2019?trend=true&trend\\_base=10&begtrendyear=1910&endtrendyear=2020&filter=true&filterType=binomial](https://www.ncdc.noaa.gov/cag/global/time-series/globe/land/ytd/12/1910-2019?trend=true&trend_base=10&begtrendyear=1910&endtrendyear=2020&filter=true&filterType=binomial)



The BOWEN BASIN lies astride the strongest climate heating region of Australia (dark brown-black).

The Bowen Basin is heating at 1.5 to 2 times the average world rate.

Figure 2

# Coal is becoming denormalised

RenewEconomy 12 May 2020

## **Energy Insiders Podcast: How to integrate 75 per cent wind and solar into Australia's main grid**

[Giles Parkinson & David Leitch](#)

AEMO's Alex Wonhas joins Energy Insiders to discuss the operator's Renewables Integration Study and how to integrate world-leading 75 per cent wind and solar into Australia's main grid.

## **Queensland urged to unlock \$36bn renewable investment boom in lead-up to election**

[Michael Mazengarb](#)

Solar Citizens calls on Queensland government to embrace wind and solar to unlock more than 50,000 new jobs and take the state past 90% renewables.

## **Coal power falls to lowest levels in 43 years in US, after biggest annual drop in 2019**

[Giles Parkinson](#)

Coal generation slumps to 43 year low as the number of generators declines and those that are left are little used. And that's with the support of Donald Trump.

## **UK enjoys a month without coal power for first time for 138 years**

[Giles Parkinson](#)

UK enjoys first month since 1882 without coal-fired generation as its grid operator celebrates dramatic cut in emissions and plans for carbon free operations by 2025.

Figure 3

# Safe Passage: What is the transition from, what is it to?

**From THIS**



**To THIS**



Figure 4

# Safe Passage: A Just Transition plan for the Bowen Basin

There are two types of Just Transition: Global and national, and Regional.

Global and national Just Transition Plans provide a comprehensive set of principles, strategies and guidelines which define a Just Transition in any situation; they cross national, cultural, and industrial boundaries. The principles are global, the strategies may be global or local, and the guidelines assist in the construction of a regional Just Transition where the situation is outside the specifics of the global-national Plan.

A regional Just Transition plan has the same structure as the global-national plan, but it delineates specific aims, strategies and desired outcomes for the selected region. It is a recipe for immediate, holistic action by all stakeholders: the workforce, the companies, the Governments, and the community.

In a Venn diagram:

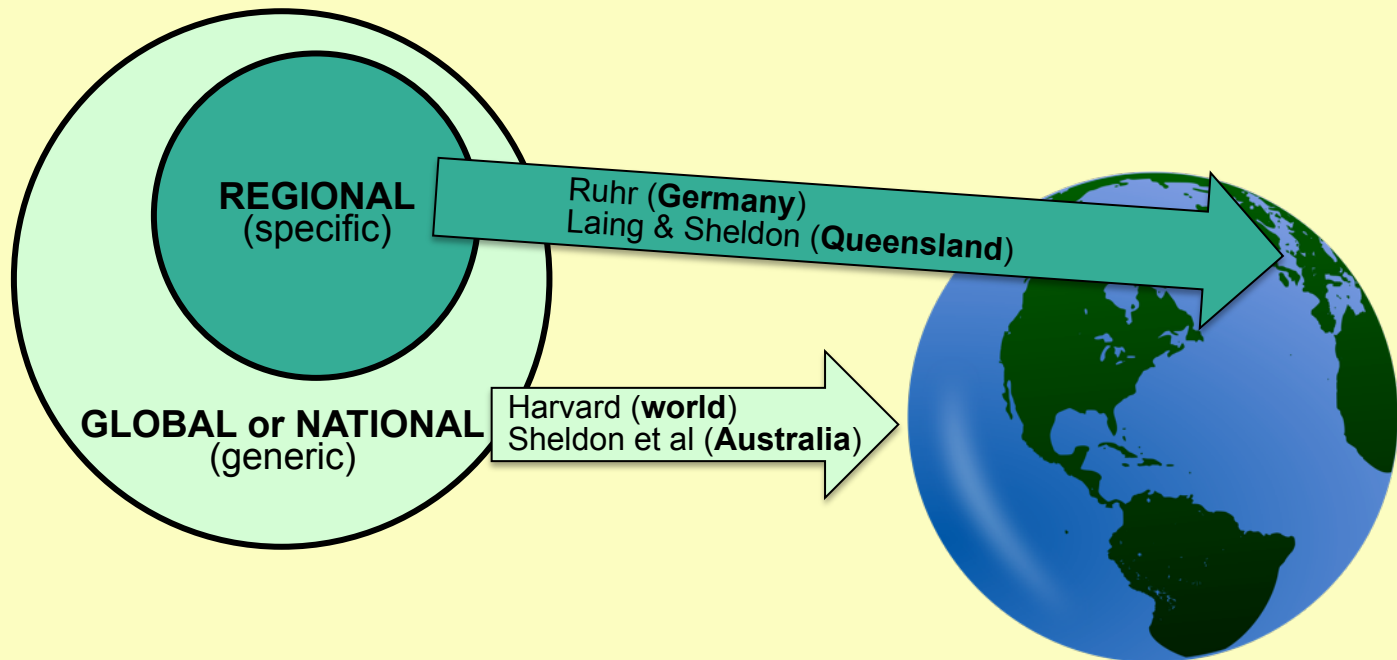


Figure 5

# Bowen Basin coal power is not a 100% commercial success

- Gladstone power station has been operating at 35% capacity (since 2016) due to commercial undercutting by Queensland renewable power stations.
- Callide A was the site of the Callide Oxyfuel Project, which was decommissioned in 2016 following a “successful” two-year demonstration of carbon capture technology. In 2017, Martin Moore, chief executive officer of project proponent CS Energy said of the Callide project:

**“We proved that technologically it’s possible to retrofit [CCS carbon capture and sequestration\*] to existing coal-fired plants, but commercially, the numbers don’t stack up ... It’s unlikely there will be [a commercial operation for CCS in Australia], I think that technology may well be bypassed ... simply because of the economics. ... If you could decarbonise coal by capturing and sequestering the emissions, then you’d have clean coal. It sounds easy if you say it fast enough, but it’s not that simple.” \*The CS experiment incorporated carbon capture but not carbon sequestration.**
- The Callide CCS Project was a commercial failure. CCS is nowhere in commercial operation. CCS has been ruled out as a coalpower option by the coal industry itself.



# Safe Passage: Schedule for coal-fired power stations

No decision has been made to close any of our plant and the final decision regarding the actual closure of Callide B, and in fact any of CS Energy's power stations, will be made by our shareholder the Queensland Government. CS Energy recently informed the Australian Energy Market Operator (AEMO) that its forecast closure date for Callide B Power Station is 2028, in accordance with new reporting requirements for large generators to provide advance notice of plant closures. It is important to note that 2028 is a forecast closure date due to the technical life of Callide B. 2028 has always been the forecast closure date for Callide B, not 2038 as recently reported in the media. AEMO has confirmed that CS Energy did not change the retirement date of Callide B and that the plant has a design life of 40 years. In a statement on their website, AEMO has acknowledged that their 2018 Integrated System Plan, published in mid-2018, used a generic NEM-wide coal-fired generation fleet assumed operating life of 50 years. **CS Energy is committed to working with its employees and other key stakeholders to ensure a smooth transition when Callide B is closed.**

<https://www.csenergy.com.au/news/statement-on-the-future-of-callide-b-power-station>

**Employees: 222**

Callide Power Station uses coal-fired power generation to supply baseload electricity to the national grid via its two sites: Callide B and Callide C. Callide C was the first supercritical coal-fired power station in Australia. CS Energy owns Callide C in a 50/50 joint venture with [InterGen](#). CS Energy also owns the Callide A Power Station, which was originally constructed in 1965. **Callide A was the site of the Callide Oxyfuel Project, which was decommissioned in FY2016 following a successful two-year demonstration of carbon capture technology.**

Table 1 Australia's operating coal fired power stations at 31 December 2016  
(Senate Committee, 2017; 5)

Coal Fired Power Stations (Operating)						
State	Power station	Primary fuel type	Year of commissioning	Announced year of decommissioning	Age (years)	Capacity (MW)
NSW	Eraring	Black coal	1982-84		32-34	2,880.0
NSW	Bayswater	Black coal	1982-84	2035	32-34	2,640.0
NSW	Liddell	Black coal	1971-73	2022	43-45	2,000.0
NSW	Mt Piper	Black coal	1993		23	1,400.0
NSW	Vales Point B	Black coal	1978		38	1,320.0
VIC	Loy Yang A	Brown coal	1984-87	2048	29-32	2,210.0
VIC	Hazelwood	Brown coal	1964-71	March 2017	45-52	1,760.0
VIC	Yallourn W	Brown coal	1975, 1982		34-41	1,480.0
VIC	Loy Yang B	Brown coal	1993-96		20-23	1,026.0
QLD	Gladstone	Black coal	1976-82		34-40	1,680.0
QLD	Tarong	Black coal	1984-86		30-32	1,400.0
QLD	Stanwell	Black coal	1993-96		20-23	1,460.0
QLD	Callide C	Black coal	2001		15	810.0
QLD	Millmerran	Black coal	2002		14	851.0
QLD	Kogan Creek	Black coal	2007		9	750.0
QLD	Callide B	Black coal	1989		27	700.0
QLD	Tarong North	Black coal	2002		14	443.0
QLD	Yabulu (Coal)	Black coal	1974		42	37.5
QLD	Gladstone QAL	Black coal	1973		43	25.0
WA	Muja	Black coal	1981, 1986		30-35	1,070.0
WA	Collie	Black coal	1999		17	340.0
WA	Blueswaters 1	Black coal	2009		7	208.0
WA	Blueswaters 2	Black coal	2010		6	208.0
WA	Worsley (Alumina)	Black coal	1982-00		16-34	135.0

## BOWEN BASIN COAL POWER STATIONS

Station	Startdate mean	Age mean yrs	MW
<b>Gladstone</b>	1979	41	<b>1680</b>
<b>Stanwell</b>	1995	25	<b>1460</b>
<b>Callide C</b>	2001	19	<b>810</b>
<b>Callide B</b>	1989	31	<b>700</b>
<b>Total</b>		29	<b>4650</b>

Gladstone since 2016 has operated at 35% capacity due to competition from renewable power stations

Figure 7

# Safe Passage: Example of the Transition schedule

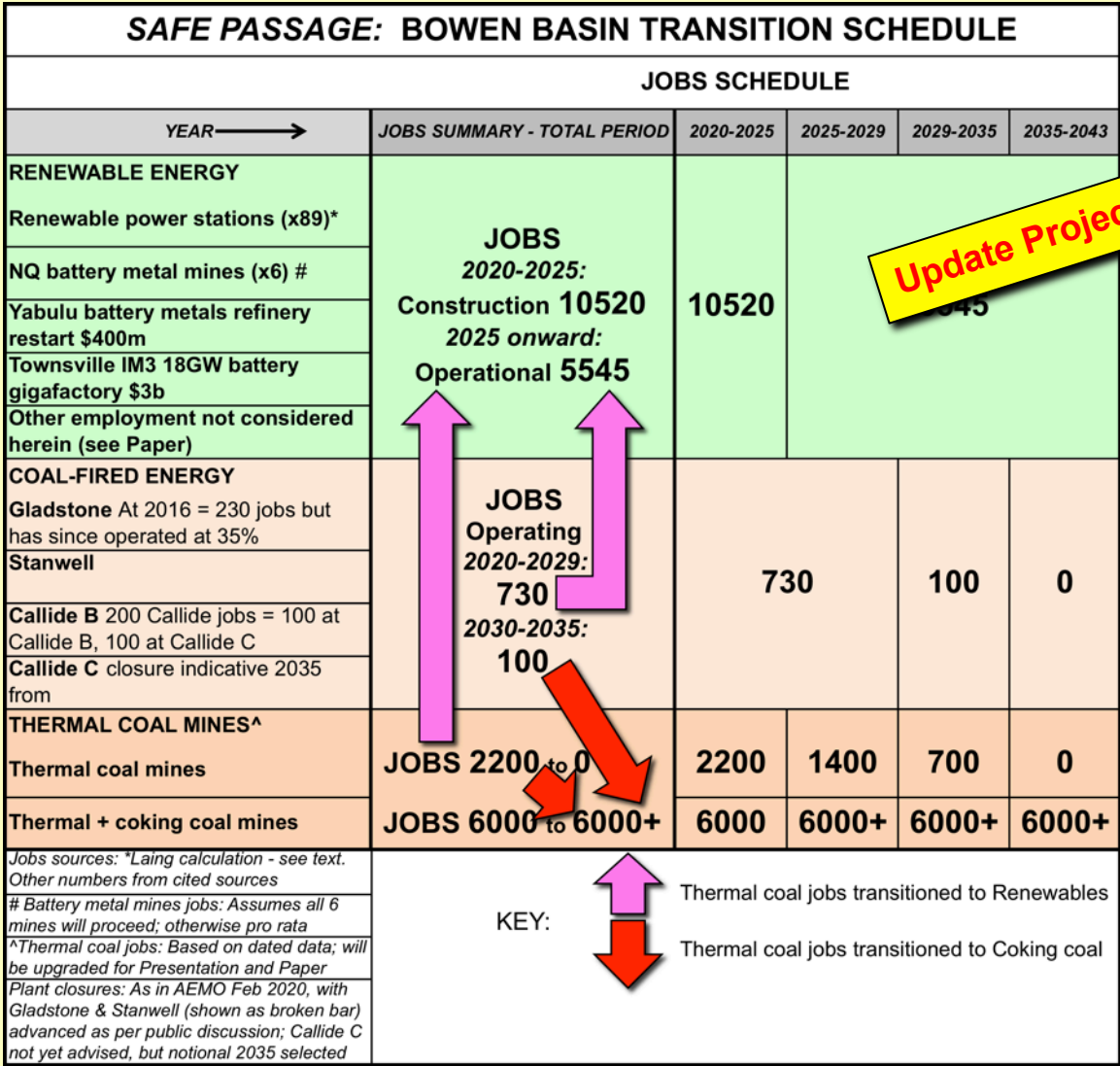


Figure 8

# Safe Passage: Example of the Transition schedule

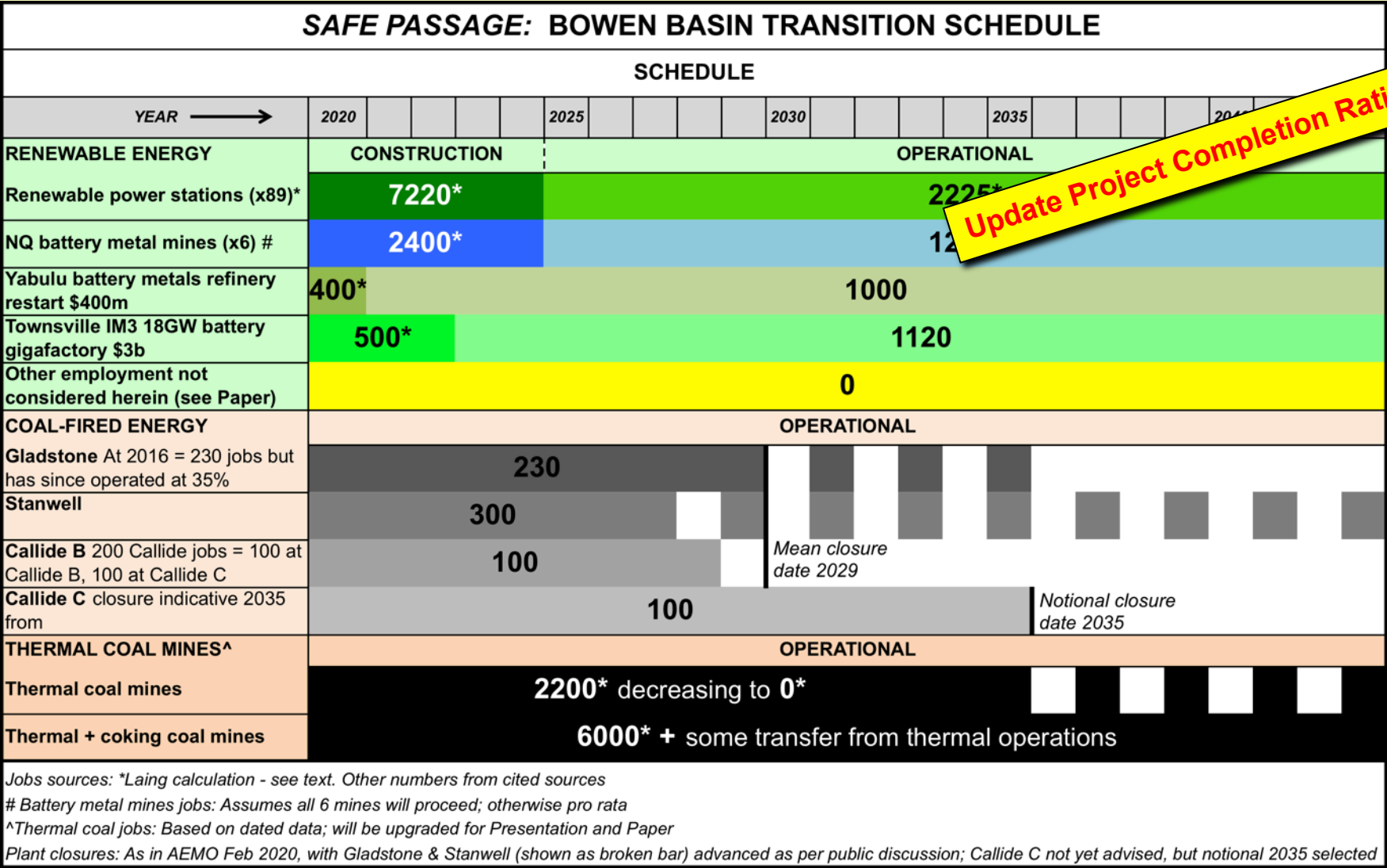


Figure 9



# Safe Passage: Example of the Register of Displaced Workers

See text for explanation.

REGISTER OF DISPLACED COALWORKERS Example							
Transfer Type*	Name	Donor Company	Staff No	Position	(Multiple columns of personal information, workdates, skills)	Recipient Company	Success
No	Robert Smith	Glencore	13252	Surveyor	.....		
BJJ1	James Patterson	Curragh	7632	Lab Technician	.....	Origin Energy	√
BJJ2	Angelo Tizio	BMA	1856	Miner	.....	Macarthur	√
BJJ2	William Callister	BMA	5463	Electrician	.....	Macarthur	√
BJJ2	Kurt Schweizer	BMA	2236	Miner	.....	Macarthur	√
BJJ2	Frank Green	BMA	1897	Plant operator	.....	Macarthur	√
* BJJ1 = Bilateral Job to Job - Single worker                      BJJ2 = Bilateral Job to Job - Multiple workers							

Figure 10

# The Bowen Basin *coking coal* asset may also become stranded earlier than foreshadowed - by *green steel*



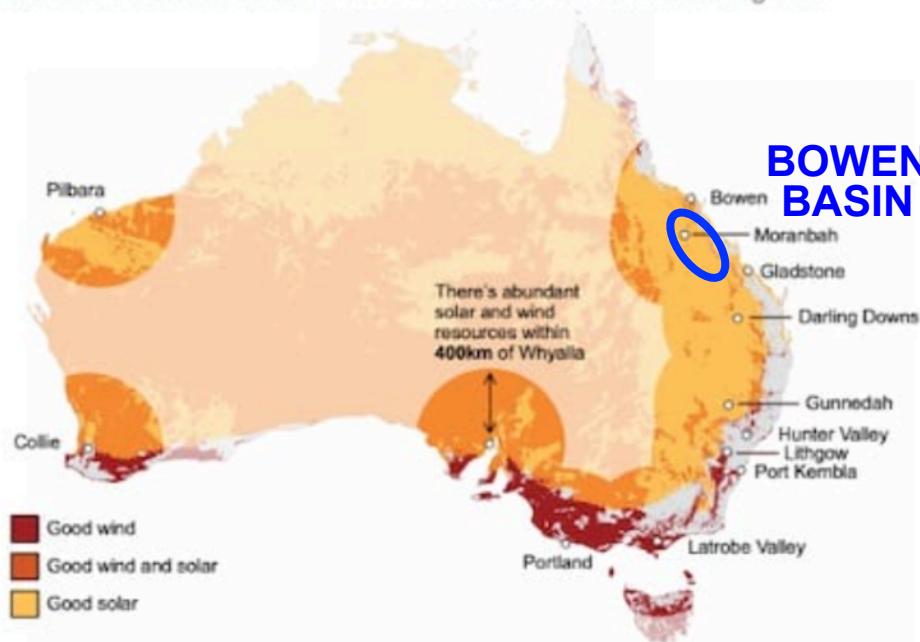
## How “green steel” could replace Australia’s coal industry – and end climate wars

Sophie Vorrath

Grattan Institute says Australian green steel manufacture and export industry could generate around \$65bn a year in today’s dollars, and resolve nation’s great climate conundrum.

<https://reneweconomy.com.au/how-green-steel-could-replace-australias-coal-industry-and-end-climate-wars-50875/>

Figure 3.1: Carbon regions are close to high-quality renewable resources  
Wind and solar resources within 400km of carbon-intensive regions



Notes: High-quality resources are defined to be areas with average wind power-density of at least  $450 \text{ W/m}^2$  and average daily solar photovoltaic potential of at least  $4.5 \text{ kWh/kWp}$ . Offshore wind potential is not shown.

Sources: Grattan analysis of Global Wind Atlas (2020) and Global Solar Atlas (2020).

**APPENDIX 4**

**The AEMO Integrated System Plan 2020**

**Figures 12 to 17**

# AEMO ISP (new Integrated System Plan): January 2020



## Draft 2020 Integrated System Plan

12 December 2019

For the National Electricity Market

In its **Integrated System Plan**, the proposed 20-year blueprint for the future of Australia's electricity grid, the Australian Energy Market Operator spells it out clearly in four alternative scenarios, each indicating Australia's proportion of the main grid supplied by renewable energy:

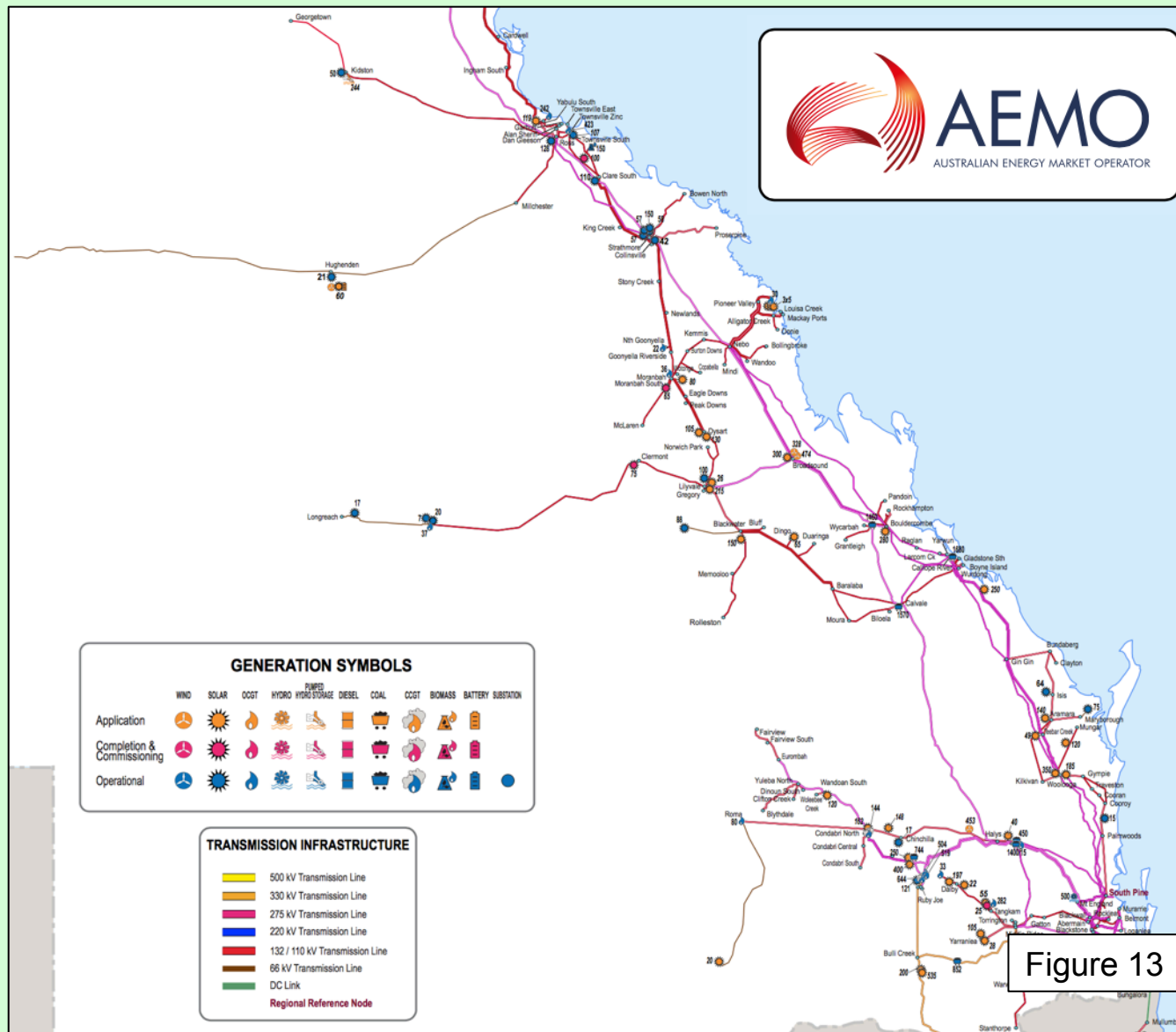
By 2041/42:

- (1) “**Central**” scenario of current policies, Australia's main grid: **73%**
- (2) “**High DER**” scenario, where households and businesses embrace rooftop solar, battery storage, electric vehicles and VPPs at a faster rate than expected: **74%**
- (3) “**Technology-led**” scenario, featuring a greater fall in wind and solar costs than expected: **79%**
- (4) “**Step change**” scenario, where policy makers make a conscious effort to take the advice of the experts and scientists and seek to do their share of trying to limit average global warming to 1.5°C,: **89%**

[https://www.aemo.com.au/-/media/files/electricity/nem/planning\\_and\\_forecasting/isp/2019/draft-2020-integrated-system-plan.pdf?la=en](https://www.aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/isp/2019/draft-2020-integrated-system-plan.pdf?la=en)

# AEMO current infrastructure: Power stations - Queensland

[https://www.aemo.com.au/-/media/files/electricity/nem/network\\_connections/maps/qld-generation-v2019-02.pdf?la=en&hash=072AB754552500F8704265BB2A0478FD](https://www.aemo.com.au/-/media/files/electricity/nem/network_connections/maps/qld-generation-v2019-02.pdf?la=en&hash=072AB754552500F8704265BB2A0478FD)



# NEM current infrastructure: Transmission - Queensland

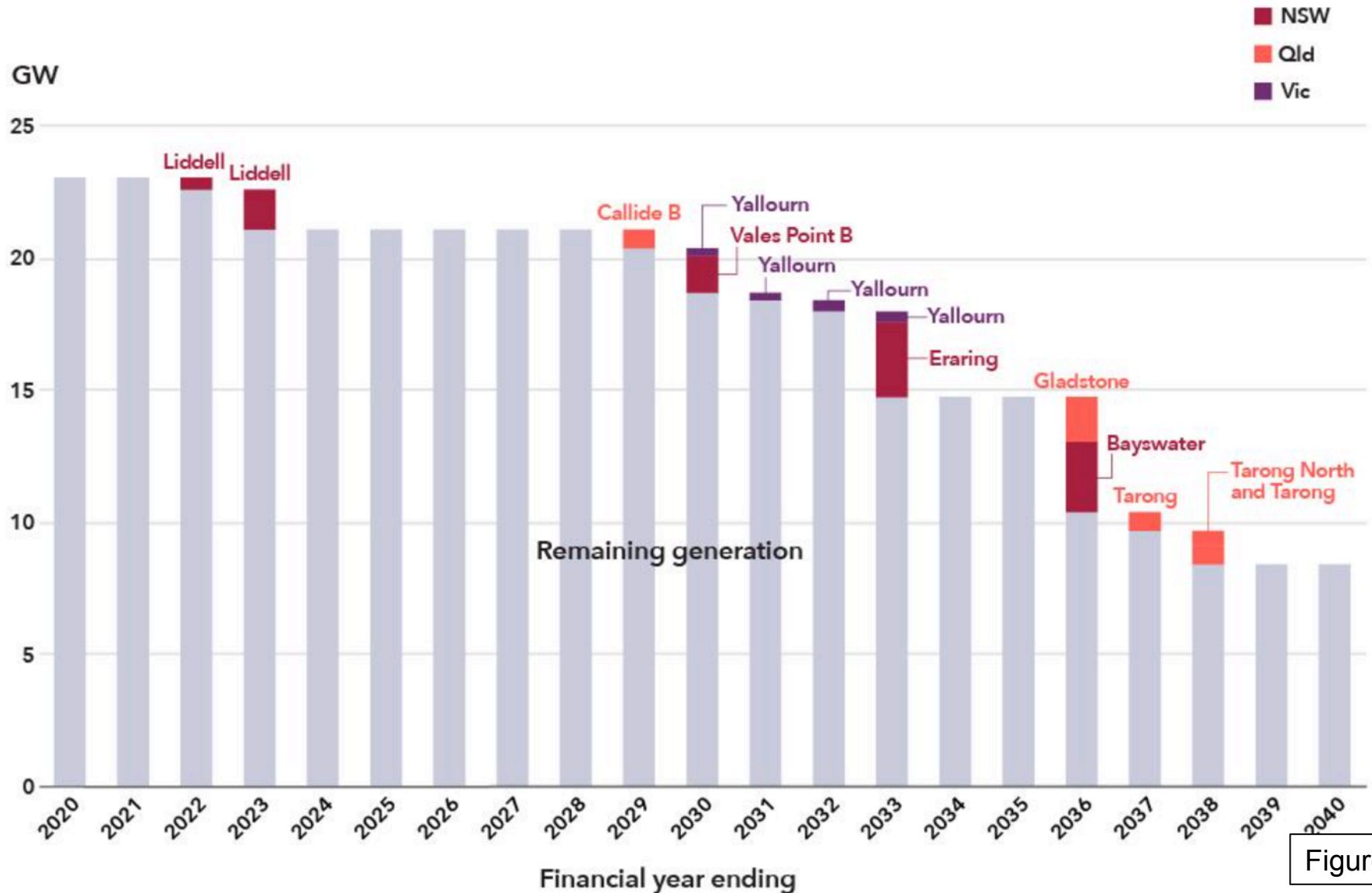
<https://www.aer.gov.au/system/files/State%20of%20the%20Energy%20market%202012%20-%20Complete%20report%20%28A4%29.pdf>

A high-voltage network, rated at 220 kV or higher, connects most consumers and producers of electricity in Queensland, New South Wales (NSW), the Australian Capital Territory (ACT), Victoria, South Australia, and (via the undersea Basslink cable) Tasmania (Figure 19.2). This power system operates within the NEM and it incorporates the longest interconnected AC network in the world, stretching 4500 km.<sup>3</sup>



# AEMO future power: Australian coal-fired station retirements

Figure 9 Coal-fired generation remaining as power stations retire\*





# AEMO future power: renewable energy zones

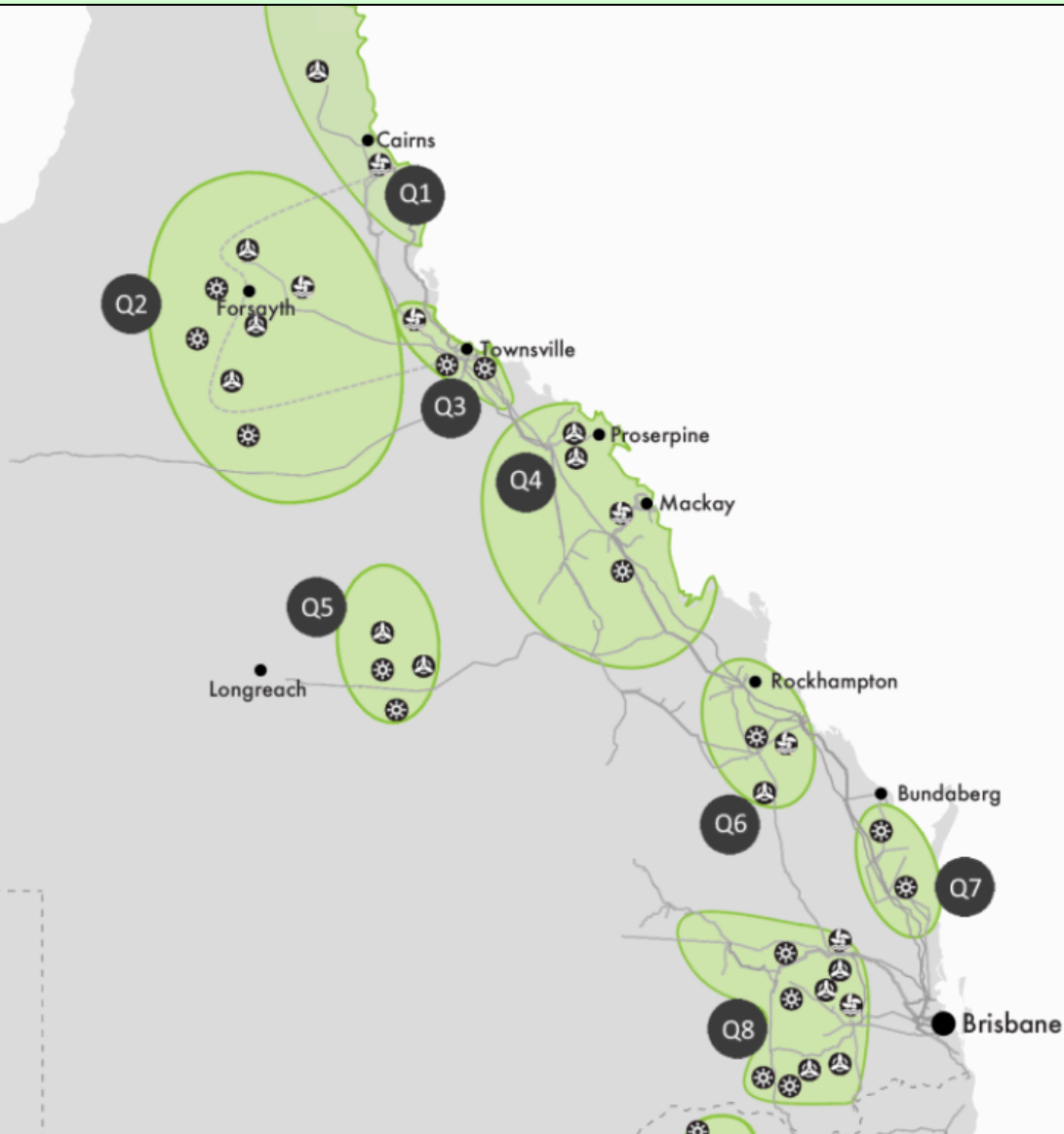


Figure 15 Identified potential Renewable Energy Zones (REZs) across the NEM

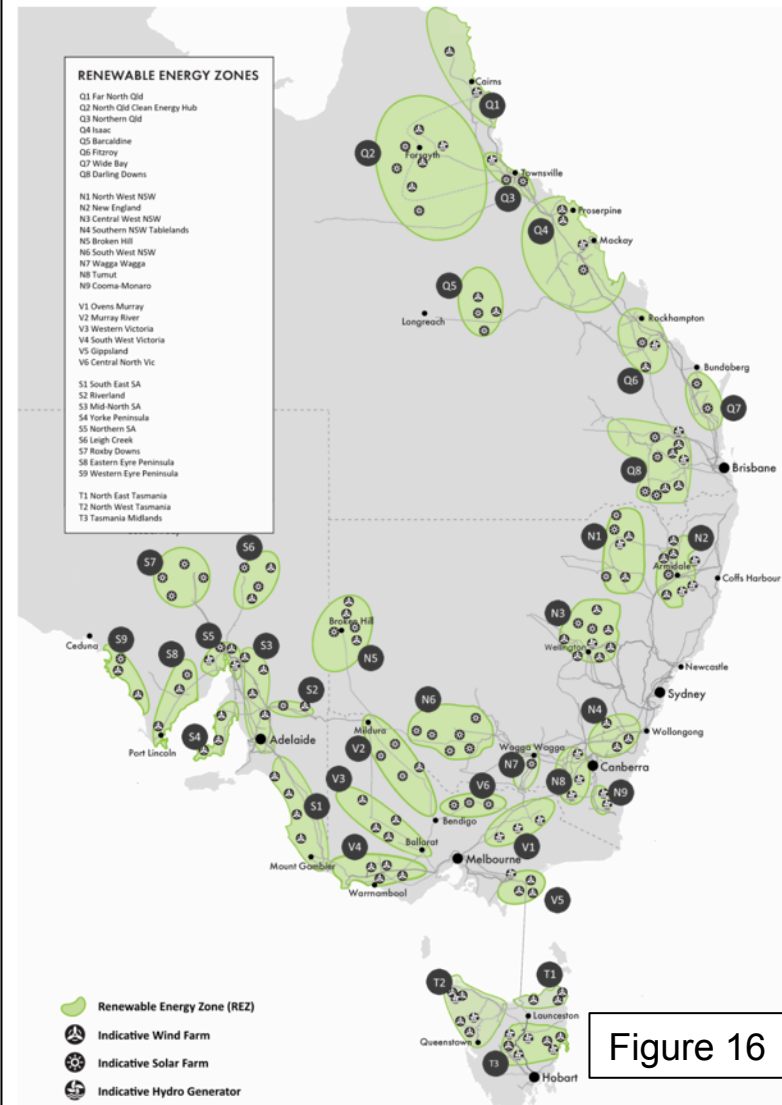


Figure 16



## AEMO future power: planned development

**Figure 1** The development paths for the NEM in the Draft 2020 ISP<sup>17</sup>

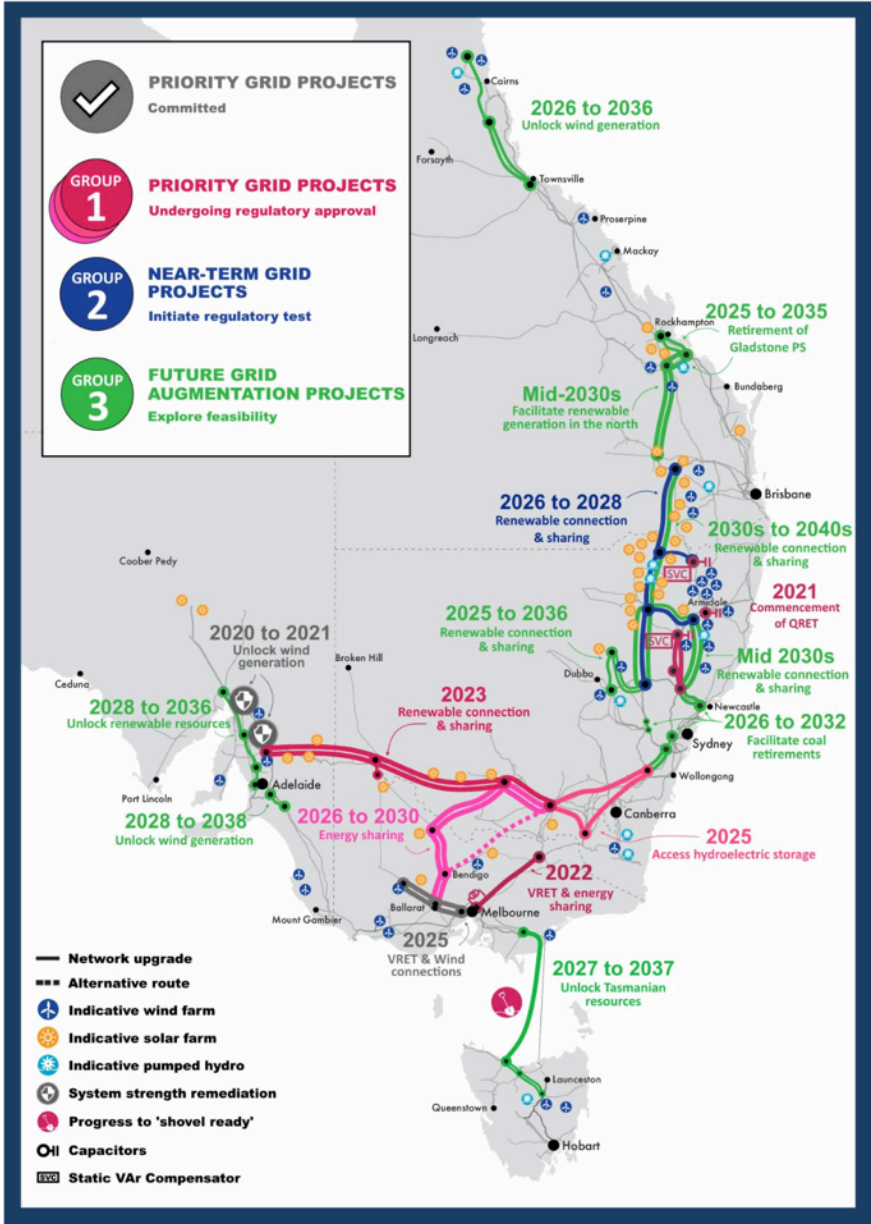


Figure 17

# AEMO future power: power generation changes 2019-2040

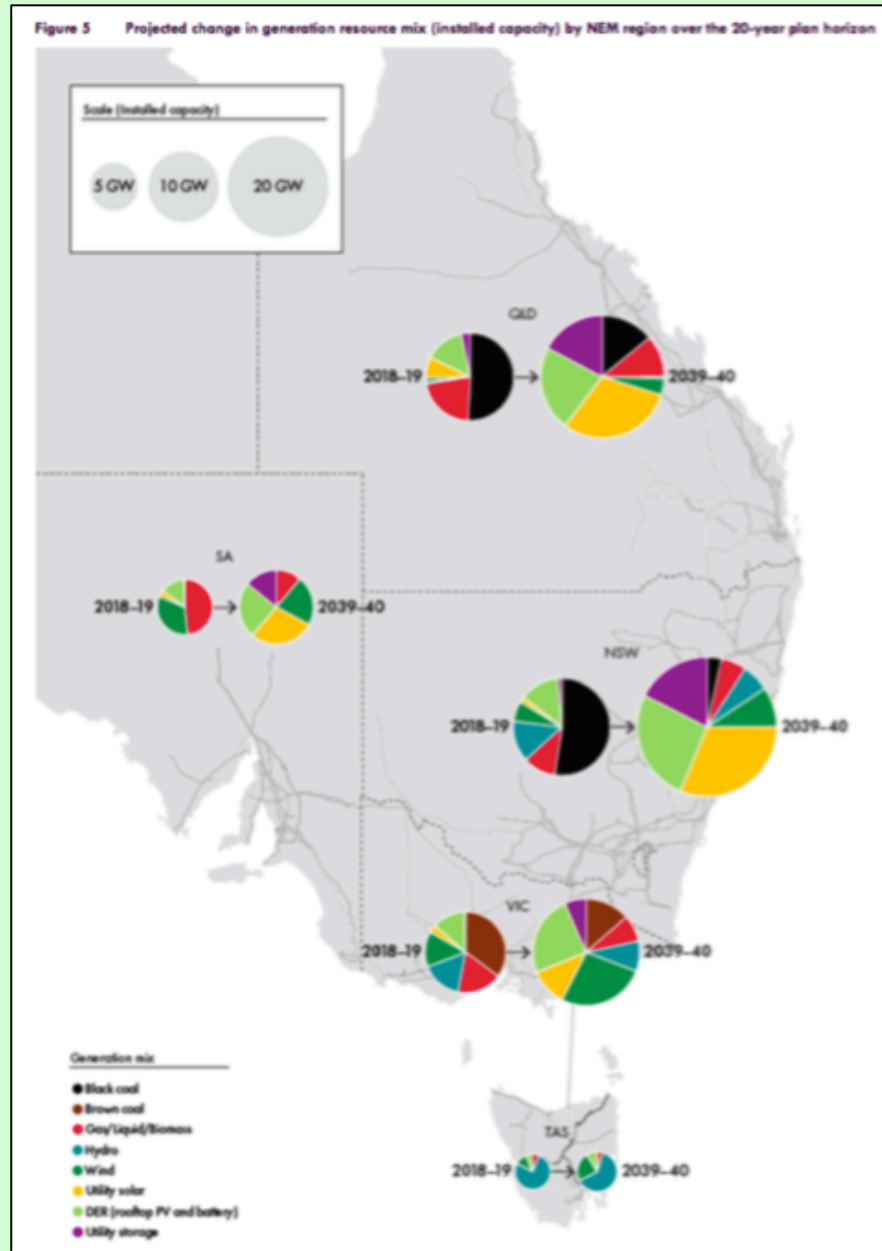


Figure 18