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ENERGY MODELLING EXPERTISE

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Report (TVE00007) to

Energy development opportunities in North Queensland - Summary Report

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VERSION HISTORY

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EXECUTIVE SUMMARY

Key findings

1. Development in renewable energy will be economically very favourable under the expanded Renewable Energy Target, and the Carbon Pollution Reduction Scheme.
2. Early movers will have a significant advantage under the Renewable Energy Target scheme.
3. North Queensland has substantial renewable energy resources.
4. North Queensland has very high marginal loss factors. This is very favourable to generation developers.
5. Renewable energy development in North Queensland will help to prevent continual rise in marginal loss factors in North Queensland, which will be to the significant benefit of loads in the region, ensuring continued economic development.
6. Load growth and transmission strength in North Queensland make it a very attractive development location for renewable energy.
7. For these reasons, North Queensland is a superior location for renewable energy development.
8. Development in renewable energy is economically competitive, and has long term benefits in comparison with development in fossil fuel technologies

Recommendations

There are immediate opportunities for development in substantial renewable energy in North Queensland. In order to capture the benefits of renewable energy for Queensland, there should be an immediate focus on identification and development of resources in:

1. Wind energy
2. Sugar cane bagasse (biomass) energy
3. Solar thermal energy

The factors inhibiting development in renewable energy are typically not economic or technical in nature. To address these barriers, it is recommended that:

1. ***The process for approval of renewable projects in North Queensland is streamlined.*** This can be very effective in encouraging increased renewable development. The Victorian government is currently undertaking this process, and it is recommended that Queensland do the same.
2. ***High quality information regarding renewable energy resources and transmission availability*** is made publicly available to potential developers. This will help development occur at the best possible locations, through the most streamlined process. This should include integrated and detailed mapping of wind resources, transmission resources, solar resources, and identification of promising biomass opportunities.
3. ***Extensive consultation with sugar cane facilities with potential for bagasse generation*** is conducted. It is important to identify the non-economic and non-technical barriers they face, and to address them for effective utilisation of this resource.

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1) CONTEXT – RENEWABLE ENERGY IN NORTH QUEENSLAND

Key messages

1. Development in renewable energy will be economically very favourable under the expanded Renewable Energy Target, and the Carbon Pollution Reduction Scheme.
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3. North Queensland has substantial renewable energy resources.
4. North Queensland has very high marginal loss factors. This is very favourable to generation developers.
5. Renewable energy development in North Queensland will help to prevent continual rise in marginal loss factors in North Queensland, which will be to the significant benefit of loads in the region, ensuring continued economic development.
6. Load growth and transmission strength in North Queensland make it a very attractive development location for renewable energy.
7. For these reasons, North Queensland is a superior location for renewable energy development.
8. Development in renewable energy is economically competitive, and has long term benefits in comparison withdevelopment in fossil fuel technologies

Renewable Energy Target – Opportunities

The expanded Federal Renewable Energy Target (RET) of 20% by 2020 creates significant opportunities for development of renewable energy in Australia. Combined with the Carbon Pollution Reduction Scheme, The RET will ensure that a large volume of renewable energy projects of established technologies will be economically profitable.

Early movers advantage

Early movers will have a significant advantage under the RET (which begins on 1st July 2009). Unlimited banking of renewable energy certificates is permitted, which ensures that a possible oversupply of certificates in early years will not lower the certificate price. The earliest renewable projects will be able to create certificates for the entire life of the scheme, making the maximum possible profit from their sale. Certificate prices are also forecast to be significantly higher in the early parts of the scheme, increasing the early movers advantage.

Excellent renewable energy resources in North Queensland

North Queensland has substantial renewable energy resources. There is large potential for immediate, economically viable development of:

- Wind energy
- Sugar cane bagasse (biomass)

- Solar thermal energy

Wind opportunities

Although the quality of the wind resource in Queensland is not as high as in the southern states, transmission limitations in the south will push wind development to other states, including Queensland. There are substantial pockets of high quality wind resource in North Queensland that are competitive with the resource in the south of Australia.

In addition, wind patterns in Queensland tend to be uncorrelated with those in the south of Australia. This means that Queensland could be a significant provider of wind energy exports when it is windy in Queensland, and not in the south.

Sugar cane bagasse opportunities

North Queensland has substantial renewable energy resources in sugar cane bagasse. This is cost effective, and schedulable, providing reliable renewable electricity. The technology uptake has thus-far been inhibited by non-economic and non-technical factors, including risk averse mill owners (whose primary business is not in electricity production). With measures to assist with risk management, and sourcing of capital, sugar cane bagasse development could secure a substantial proportion of the Renewable Energy Target for North Queensland.

Solar thermal opportunities

Queensland has solar resources that are far superior to those in the southern states. The difference is very significant, and will make solar thermal projects in North Queensland far more profitable than those in the southern states.

In particular, the solar resource in the west of Queensland (around Mt Isa) is very substantial, and could be utilised in the main network (the National Electricity Market) if the proposed transmission augmentation to connect Mt Isa to the grid goes forward.

The solar thermal technology is currently at the pilot stage, and projects are likely to be eligible for capital funding under the Renewable Energy Fund, and other research initiatives.

Marginal loss factors are high

Marginal loss factors (MLFs) give a measure of the transmission losses inherent in supplying electricity to or from a particular location. They are a number around 1 that is directly multiplied by the price that a generator is paid, or that a load pays for electricity. High factors (eg. 1.1) benefit generators and encourage generation development, whereas low factors (eg. 0.9) benefit loads and encourage load development.

North Queensland has very high marginal loss factors. This is very favourable to generation developers. By locating renewable energy in North Queensland, developers

can take advantage of the high marginal loss factors (giving almost a 10% increase in revenue). There is the potential to develop up to 1000 MW of renewable energy in North Queensland before these benefits will reduce.

Marginal loss factors are also applied to the creation of Renewable Energy Certificates, giving renewable generators a two-fold benefit.

Generation development will prevent MLFs from getting higher

Due to continual gradual increases in the load in North Queensland, which is not matched by generation development, the marginal loss factors in the region continue to rise. For example, Townsville MLFs in 2008/09 were ~1.01, but rose to ~1.08 in 2009/10, and are expected to continue to rise. This is very unfavourable for loads in the region, and will inhibit economic development (dependent upon sourcing inexpensive electricity) in the region.

Development of renewable generation in North Queensland will be very effective in preventing MLFs from getting higher, and if sufficient renewable generation is installed, will reduce the MLFs to much more favourable levels for economic development.

Transmission and load growth

Transmission limitations are a significant limiting factor in renewable development in other states of Australia (particularly in South Australia). By contrast, North Queensland has a strong transmission grid, and will benefit from the four 275kV lines to Townsville (two currently under construction), and two 275kV lines north of Townsville to Cairns. Those under construction will strengthen the grid further, and provide an even stronger case for renewable energy development in North Queensland.

The proposed linking of Mt Isa to the main grid through a significant transmission augmentation, either to Bowen or Townsville, will create even more appealing opportunities for extensive renewable energy development in North Queensland, to meet the additional major load and prevent extremely high marginal loss factors from occurring in the region.

The load at Bowen is also likely to increase with the development of the Alumina refinery. This will provide the same benefits to renewable energy developers in the region.

Development in renewable energy instead of fossil fuels

Supported by the Renewable Energy Target and the Carbon Pollution Reduction Scheme, renewable projects are economically competitive with fossil fuel projects. They also have additional benefits including:

1. Major development benefits in terms of construction an ongoing operating expenditure to locations that are suitable for renewable energy
2. Long term energy security (not dependent upon gas supply)
3. High public support

4. Very low running costs (not dependent upon gas supply at rapidly rising costs)
5. Not dependent upon pipeline infrastructure (likely to be constrained for gas supply in future)
6. Low pollution levels (air, water and sound)
7. High long term prospects in a carbon constrained future, regardless of emissions targets (removing uncertainty)

A number of distributed renewable energy projects will have the same benefits in alleviating electricity imports from central Queensland as a large fossil fuel plant.

In addition, renewable projects are equally good at curbing price rises in North Queensland as fossil fuel plants, since these price rises result from insufficient generation of any type.

2) ATTRACTIVE RENEWABLE ENERGY PROJECTS

2.1) WIND

ROAM has conducted a high level analysis to identify locations in North Queensland which:

- Have high mean wind speeds, above 7m/s, over a significant area, based on 3km resolution data at hub height (80m)
- Are near to existing transmission lines

The assessment of an individual site for its wind potential is a significant task which requires detailed study of local geography/topography, environmental concerns and actual wind speed on the ground. Therefore, ROAM is not suggesting that these sites will all be ideal for wind farm construction, but rather that they are deserving of further analysis.

Far North

A 12 MW wind farm is operating at Windy Hill, owned by Transfield Services. A 13 MW upgrade has been proposed, bringing the total to 25 MW.

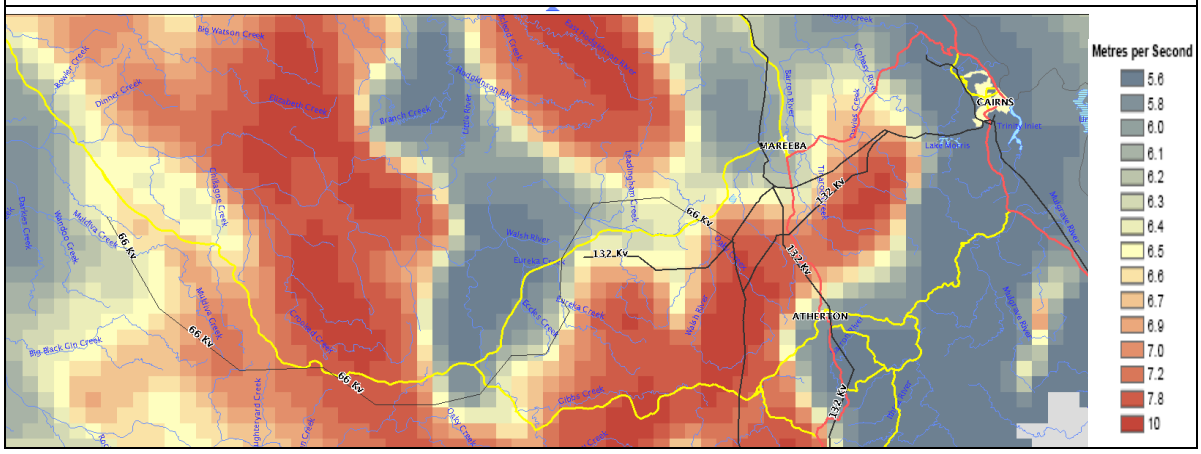
Wind Power Queensland and IFE Engineering have proposed[1] a wind farm at Archer Point, consisting of 60 turbines for a total of 120 MW. A Stage II upgrade of an additional 60 MW has also been proposed. Other locations inland but nearby also appear to have significant resources.

In general, there are significant wind resources in Far North Queensland, in addition to the sites already mentioned. Strong winds exist north-west of Atherton, and also along the 132 kV line between Atherton and Cairns, as shown in Figure 2.1. No proposals have so far been made for specific wind farms in this region, however ROAM expects there to be potential for up to 300 MW of additional installed capacity in the Far North region.

[1] http://www.news.com.au/couriermail/story/0,23739,23673370-3122,00.html

Further transmission infrastructure may be required to take full advantage of the resources in this area, but given the wind resource, this can potentially be justified.

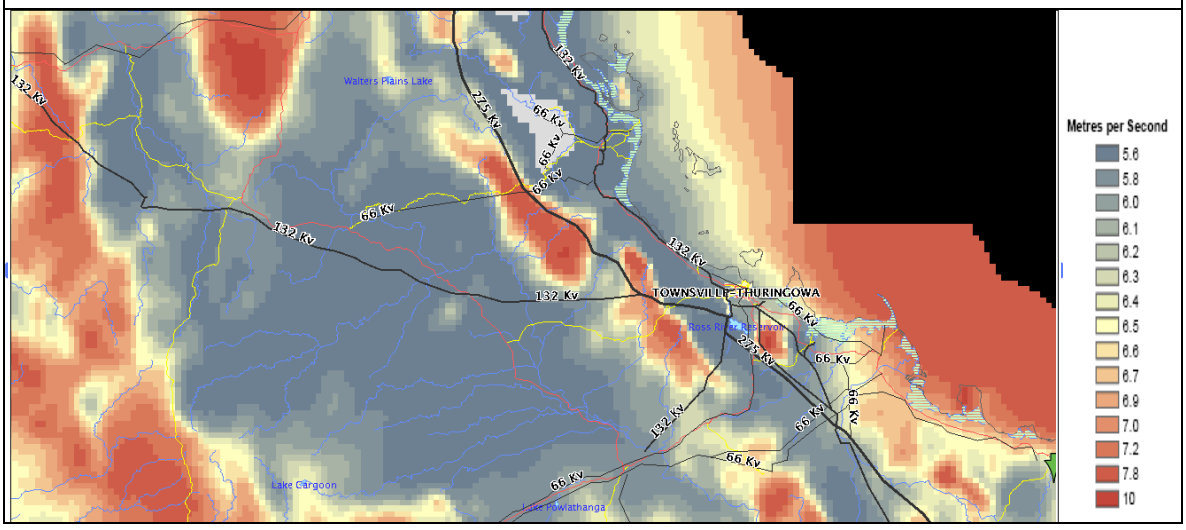
Figure 2.1 – Map of wind speeds North/West of Atherton



Ross Node

ROAM notes that there are pockets with significant wind resources in the region around Townsville. Although the higher population centres in the region may pose competition for land use, it seems likely that at least 100 MW of total capacity could be installed. The proximity to both load centres and significant transmission makes this a promising region for development.

Figure 2.2 – Map of wind speeds near Townsville

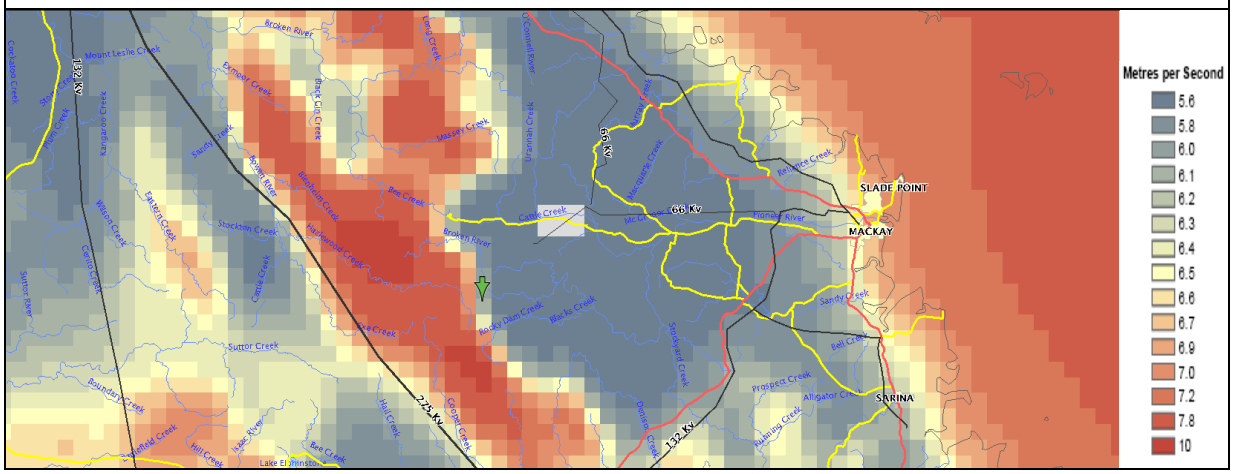


North Node

Transfield Services is undergoing a feasibility study for a 100 MW wind farm near Bowen[2]. Although wind resources aren't as strong as in other Queensland locations, there may be other sites along the coastline with useful resources. Transfield Services are also performing monitoring of wind speeds near Crediton, where excellent wind resources run parallel to the 275 kV transmission line. Transfield Services propose a 40 MW wind farm, however it seems likely that further capacity could be installed in the region, or north west near Collinsville.

Given the proximity of these high wind locations to transmission, ROAM believes these sites warrant detailed study for their potential as top tier wind farms.

Figure 2.3 – Map of wind speeds near Crediton



2.2) BAGASSE

Over 300 MW of bagasse generation is currently installed in Queensland, but in most cases mills only generate sufficient electricity for their own needs (the majority of the bagasse is burnt inefficiently, or disposed of). With an upgrade to efficient cogeneration, bagasse generation could produce a significant portion of the 2020 renewables target.

2.2.1) Development opportunities

In the first instance, the development of one mill in each sugar growing region would allow mills to pool resources and maximise capacity factors (and hence profitability). ROAM has identified the following projects as being the most promising.

Victoria Mill (Ingham)

Owned by CSR sugar, it is one of the largest sugar mills in Australia. An upgrade has been proposed to export 70 MW of electricity to the grid. Additional bagasse could be sourced from the nearby Macknade Mill, to increase its capacity factor and profitability.

[2] http://www.windfarms.net.au/html/development_portfolio/development_portfolio.html

Racecourse Mill (Mackay)

Owned by Mackay Sugar Cooperative. Proposal for a 27 MW cogen upgrade to provide year round electricity supply, with high capacity factor, to an adjacent refinery. Can receive additional bagasse from Farleigh and Marian Mills, also owned by Mackay Sugar, as required.

Proserpine Mill (Proserpine)

Owned by Proserpine Cooperative Sugar Milling Association. Located north of Mackay, they have a significant crop yield and are receptive to "value adding" projects. Up 70 MW of cogeneration is possible. Additional bagasse could be sourced from Mackay mills to boost capacity.

Tully Mill (Innisfail)

Owned by local cane suppliers. Situated 150km north of Cairns, it would be an ideal location for a cogen upgrade, processing bagasse from Tully mill and, potentially, surrounding mills. Up 70 MW of cogeneration is possible.

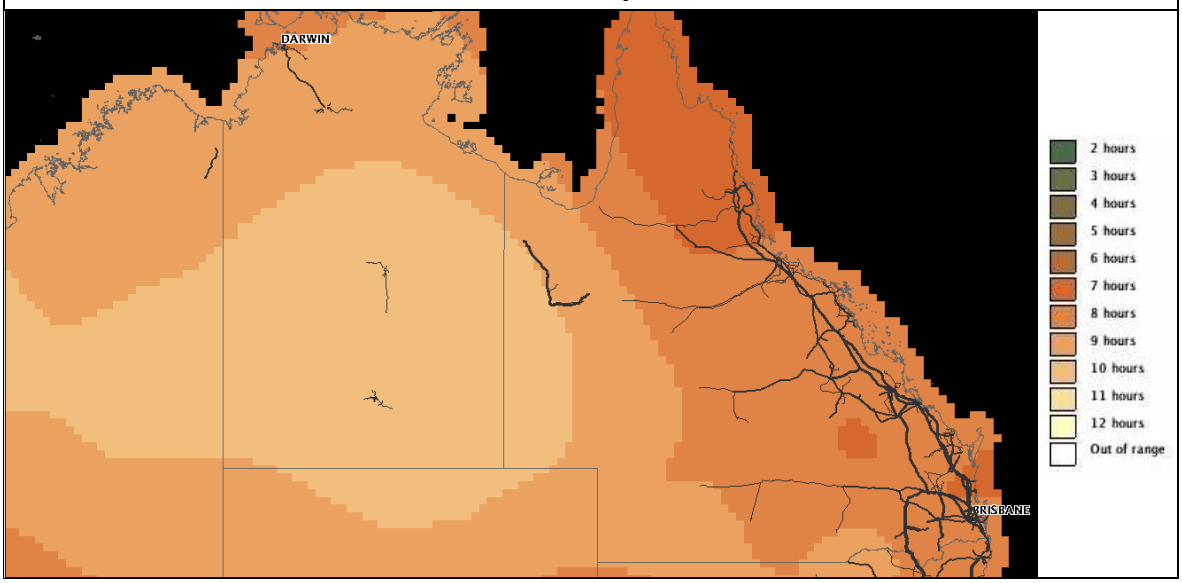
Other opportunities

The above projects represent the most likely options for bagasse cogeneration in the short term. Further options for consideration include Plane Creek Mill in Mackay which is owned by CSR Sugar and would be an ideal candidate for a second Mackay mill upgrade. Macknade Mill in Ingham also has a large cane throughput, and could be upgraded independently of Victoria. A second mill could potentially be constructed in the Ingham area acting as a central receiver for Mossman, Mulgrave Central, Tableland and Babinda mills.

2.3) SOLAR THERMAL

North Queensland has a world class solar resource, and solar thermal technology shows great promise. Daily solar exposures in North Queensland are up to 50% higher than southern states which has a significant impact on the output and hence long run marginal costs of solar electricity. Figure 2.4 shows the mean annual hours of sunshine per day, with transmission lines overlayed in black (thicker lines indicate higher capacity).

Figure 2.4 – Mean annual hours of sunshine per day (transmissions lines marked in black)



Worley-Parsons, representing a conglomerate of industry bodies, has proposed the construction of thirty-four 200 MW solar thermal power stations in Australia by 2020. Additionally, US-based company Ausra has expressed interest in the Australian market.

North Queensland has a strong business case to host pilot solar thermal projects:

- Viability of solar projects are improved high annual solar exposure (increasing the capacity factor) and more hours of sunshine during the day (reducing the need for storage). NQ has world class resources.
- High quality resources are available in North Queensland without the need for significant transmission upgrades, in particular west of Townsville.
- Generators would also be able to take advantage of the currently high marginal loss factors in NQ, increasing revenue

Sites inland of Townsville should be seriously considered for solar thermal projects, and would be ideal locations for pilot projects supported by capital grants.

In the event that the CuString or IsaLink transmission lines are built to Mt Isa, solar thermal plants could be constructed west of Mt Isa to take advantage of the exceptional resources on inland Australia. The construction of solar thermal generation equal to twice the local load (approximately 400 MW) would allow maximum utilisation of the link, exporting to NQ/CQ during daytime and importing at night.

3) RECOMMENDATIONS

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The factors inhibiting development in renewable energy are typically not economic or technical in nature. To address these barriers, it is recommended that:

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