Submission No 221

SUSTAINABILITY OF ENERGY SUPPLY AND RESOURCES IN NSW

Organisation: Pelena Energy

Date Received: 16 September 2019

Dear Committee for the Inquiry into the Sustainability of Energy Supply and Resources in NSW,

I write as the Managing Director of a company based in NSW that manufactures and exports renewable energy products. We were established in 1998 and for the past 13 years we have been based in rural NSW at the town of Dorrigo. I also write as a professional Engineer with experience in a variety of renewable energy technologies over 30 years including solar thermal (high and low temp), solar PV, biomass, wind, and biofuels. Our main technology, and the purpose of this submission, relates to small scale run-of-river (RoR) hydroelectricity opportunities for NSW.

Some relevant information specifically related to NSW:

1. I assume you are aware that hydroelectricity requires rainfall and mountains.

2. I also assume you are aware that the mountain range, the Great Dividing Range (GDR), runs down the east coast of NSW. (Only 17% of the land area is on the coastal side.)

3. I also assume you are aware that it is 'wetter' on the coastal side of the GDR. (Historically, on average, 42% of the total rain *volume* is on the relatively narrow coastal strip.)

However, given the above three points, it is interesting that 92% of NSW's hydroelectric energy generation is from water falling on the western, 'dry' side of the GDR. That is, only 8% of NSW's hydroelectricity is generated from the region that would be typically recognised as *more* suitable for hydroelectricity.

I understand this 'back-the-front' situation (hydros in dry areas) is as a result of storage dams (reservoirs) being built on the 'dry side' to mitigate drought through, primarily, irrigation networks. All dam structures in NSW with hydroelectric capacity were primarily built for water storage, not hydroelectric generation. All associated hydroelectric systems are used to regulate the flowrate of water to the downstream rivers depending on water demand.

As a result, there is a conflict between the dam owners that want to reserve the water for dry times and the hydroelectric owners that want to release the water to generate electricity. As a result, hydro operators usually have small capacity factors to be able to maximise the electricity generation when water is released. The Snowy hydro, for example, operates on average only 14.6% of its 'nameplate' power rating.

Whilst there are a number of considerations for selecting the location of a dam, in principle, the main aim is to have the dam as 'low' down the valley as possible to maximise rainfall catchment area, but high enough to be able to gravity feed the necessary consumers. Pumping water is expensive, primarily as water is heavy. The opposite of pumping is hydroelectricity, which is a 'dense' energy technology because of the weight of water.

Run-of-River (RoR) hydroelectricity uses the natural flow of water down a stream, converting some of the falling water into electricity then returning it to the stream; all without dams. We see significant opportunities on the east coast of NSW for this technology.

Furthermore, because the technology is 24/7 there is significant 'off-peak' opportunities to use the energy to pump water to *very high off-stream reservoirs* increasing water security. This water, then stored at height, could be later used for 'peak' hydroelectricity generation or for irrigation. Dams could be built in the upper reaches of catchments, significantly minimising the environmental impact of traditional storage dams 'lower down' yet provide the benefit of water storage *and*

energy. Water could be extracted from downstream areas at more environmentally responsible flowrates. (Here in Dorrigo, when it gets 'dry', all the irrigators start their pumps at the same time, placing significant stress on the rivers as well as the local electricity grid.)

What about water? Aren't we presently in a drought?

One of the opportunities of RoR Hydro in NSW is that we have significant historic streamflow data allowing for good planning. Furthermore, rivers on the east coast don't dry-up overnight. In dry times flowrates slowly decline. This would allow forward planning and a 'buffer' of weeks, months etc to bring other generation online. This is a significant benefit of RoR Hydro over wind or solar where predicting future generation can be restricted to hours, minutes, or seconds.

In 2016 the NSW Office of Environment and Heritage gave a grant to the Dorrigo Chamber of Commerce Inc. to investigate the RoR Hydro potential of the Dorrigo Plateau. Pelena Energy was the lead consultant for this investigation. Using historic (NSW Gov't) streamflow data, topographical maps, and 35 site inspections, "962kW (kilowatts) of Run-of-River hydro-electric capacity was identified on the Dorrigo Plateau with an expected annual energy generation of 7.2GWh1. This results in a potential annual greenhouse gas emission saving of 6,186 tonnes of carbon dioxide. The total RoR Hydroelectric capacity of the Dorrigo Plateau has not been assessed but is expected to be in the order of 3MW." This is close to the capacity of the local electricity grid. Flow Duration Curves were developed and only flowrates exceeding 90% were used in calculating energy and power potential. That is, only stream flowrates that exceeded 90% of the time were used. When it's 'wetter', more power could be generated, and likewise, when it is dryer, less will be generated.

We estimated that utilising only a small proportion of the east-coast RoR hydro potential (100m drop above 500mASL in 50% efficient systems) would generate 158% of the Snowy Hydro's average annual electricity energy generation.

Over more than two decades we have attempted to engage with various government agencies at a state and federal level. The 2016 grant for a study was a terrific step, but the reality is that there has been little progress. As a private business, we are restricted from demonstrating this technology due to multiple levels of 'red tape' which are mainly unknown to the various agencies.

My private business is regularly put under financial stress trying to promote this technology to various government agencies in Australia. We survive through exporting 100% of our products to countries that appreciate what we have to offer.

I therefore make the following recommendation:

The NSW government directly fund the establishment of three RoR hydroelectric projects on the Dorrigo Plateau through the following:

1. Directly engage Pelena Energy, the local RoR hydro experts (This may be viewed as a conflict of interest, but our specialisation is frequently dismissed jeopardising opportunities for growth. Other consultants do not have the experience and often look for problems, not solutions, increasing their fees and further jeopardising opportunities for NSW)
2. Fund NSW DPI (Fisheries & Water) to establish a RoR research project in conjunction with the three proposed hydros to develop a "Non-Extractive water licence" for RoR Hydro. (Some other states in Australia have such guidelines, but not NSW)
3. Support the establishment of the Dorrigo Energy Centre to be a hub for RoR hydro training and development and education centre for the public and policy makers.

4. Support projects in association with local farmers for on-farm, off-stream water storage at height
5. Support projects in association with the local electricity utility to investigate embedded small-scale hydro for opportunities such as voltage stabilisation
6. Fund the local council to establish planning guidelines to minimise the burden on potential developers due to the lack of specialist knowledge in this area by development staff.
7. Work with federal government agencies such as ARENA to convince them of the potential for RoR Hydro on the eastern watershed of NSW
8. Work with federal government to increase the allowable STC's for hydro. Presently the maximum is 6.4kW with adeeming period of only 5 years, whereas for solar it is 100kW with a deeming period of up to 12 years. This is unfair.
9. Promote and support actual generation of renewable energy (kWh), not promises such as has been developed through the STC's 'deeming period'.

I thank you for your consideration.

Yours sincerely,

Peter

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