

Zero Carbon Bill: Submission by Dr A.G. Barnett

Introductory Statement

I have elected not to use the standard submission form because I wish to restrict my submission to areas where I have specialist technical qualifications. AGB 19/7/2018

I am a civil engineer with over fifty years of experience of computational studies of water flows in proposed or existing engineering projects in over twenty countries. As well as undertaking numerical model studies in harbours, hydropower channels, and drainage networks, I have set up many field monitoring programmes for model calibration and validation. I have developed a series of software packages for hydraulic analysis. The latest, *AULOS*, is used for real-time hydropower flow routing as well as urban drainage and tsunami inundation studies.

With the New Zealand Ministry of Works and Development from 1961-86, after graduation I began as local manager of the road construction breakthrough at Haast. This completed the opening of the first highway over that mountain pass, frequently subjected to extreme rainfall and flooding.

Then followed my Ph.D and three years of post-doctoral studies in leading hydraulic institutes in The Netherlands, France and Denmark, funded by the New Zealand National Research Advisory Council. On my return to New Zealand I worked with the MWD Power Division making computational predictions of the propagation of tsunami-like waves in response to control gate operations. During commissioning tests on the 26 km Tekapo canal, these predictions were later verified as highly accurate at full scale. The canal was designed to carry flows in both directions between Lake Tekapo and Lake Pukaki in case of a later need for pumped storage, and this capability was confirmed as part of the commissioning.

My later career included specialist consulting commissions for water flow studies in several countries. For the New Zealand Government I designed Te Papa in 1989 against the combined projected hazards of Climate Change and tsunami at its exposed coastal site. Other Government clients included the Governments of Australia (dam break flood hazards for the Australian Parliament in Canberra), Malaysia (a range of flood studies), Singapore (urban drainage) and Hong Kong (siting the main sewage outfall in Hong Kong harbour).

International clients for coastal flood hazard studies included the World Bank (storm surges at Chittagong in the Bay of Bengal), the Asian Development Bank (sea level rise, reef sewage outfalls and coastal erosion in Kiribati) and the European Investment Bank (tsunami hazards at the Port of Suva, Fiji), plus private sector multinationals such as Dames and Moore, Shell and Bechtel. Also tidal current predictions were accurately computed over the course for the successful defence of the America's Cup by Team New Zealand in 2000.

Meanwhile the world flood engineering body (the IAHR) responded to widespread concerns about lack of validation in the design of many commercial and government flood modelling packages by setting up a new Flood Risk Management Technical Committee. They began by setting up accuracy benchmarks for assessing whether flood software actually worked. The initial prototype benchmark (Urban Stream Floods), based on a dataset from Auckland City, went live on the IAHR Beijing web site in October 2016. This resulted in my election as a full member of the world Committee.

Focus of this Submission:

This submission relates to two of the proposed questions:

Q10. *What are the most important issues for the Government to consider in setting plans to meet budgets?* I am concerned about the lack of evaluation of pumped storage in current reports on options to shut down thermal generation. This is in stark contrast to advice to the Australian government, which has just announced pumped hydro storage will be their central strategy!

Q3. *How should New Zealand meet its targets?* Neither of the options offered refer to our small Pacific neighbours. While we cannot dictate the internal policies of independent countries, we should be mindful that our legislation will be widely interpreted as a template for a Pacific attitude to their adaptation, or in some cases their very survival. We must acknowledge this responsibility.

Pumped Storage

The Transpower submission to the Productivity Commission dated 2 October 2017

<https://www.productivity.govt.nz/sites/default/files/sub-low-emissions-81-transpower-new-zealand-852KB.pdf> discussed the renewable alternative to continued thermal generation as follows:

Use more renewables – in theory a renewables-only solution may be attainable if the system provides an over-supply in a normal year. This requires additional investment in generation plant such that the system spills excess energy (or leaves some plant idle) most years. Additionally, some resource consents provide for lakes to be lowered below their normal operating range under extreme hydro shortfall conditions;

There was no reference here to the pumped storage alternative, even though this has been chosen by the Australian government in a recent announcement <http://www.abc.net.au/news/2018-06-07/how-does-pumped-hydro-power-work/9843804>. Furthermore, to provide the pumped storage linking conduit, the Australians have to commission a new 27km tunnel whereas (as explained above) our equivalent 26km canal was already commissioned and ready for pumped storage use 40 years ago! With pumped storage, instead of spilling excess energy or leaving some plant idle, excess energy most years can be put to use restoring the energy reserves in the upper reservoir.

To ensure that even the driest years can be covered, thermal-free energy options can be tested using the same modelling software that was developed for the original canal design. Therefore the only thing blocking zero carbon electricity generation seems to be an unwillingness to consider using hydropower technology if it was developed by the former Ministry of Works!

Pacific Island Adaptation

One Pacific island which is totally subject to New Zealand legislation is Chatham Island. The main settlements are as threatened there by sea level rise as elsewhere in the Pacific, yet it is unlikely that the option of “domestic emissions reduction” in Q3 included any thought of our own Pacific Island, which is still largely dependent on thermal generation. How can we then advise our independent neighbours without being seen as hypocritical?

This is especially true as a recommended 100% hydro solution based in the Cascade gorge has been treated as none of Government business now for several years. If Government cannot be bothered to deal with thermal power generation at Pacific Islands scale, then our neighbours will have to look elsewhere for advice and support.

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