

Emissions free electricity: the dream and the reality

The Government's mind-boggling announcement of its intent to eliminate carbon dioxide emissions from electricity generation directly contradicts its own official advisers and would increase residential power prices by 300%. The excellent report from the Interim Committee on Climate Change (ICCC) warned the Government of the colossal technical and economic problems such a policy would inflict on New Zealand.

The policy would shut down coal and gas-fired generation and geothermal generation would also bite the dust because it also gives off CO₂. As a result, nearly 3000 MW of existing cheap and reliable generation would be abandoned. The resulting electricity shortfall would be exacerbated by the government's policies on electric transport that could easily add 1000 MW to New Zealand electricity demand.

The government appears to believe that solar or wind power can reliably supply the needed 4000 MW even though they produce much less energy per MW of capacity and they must be supported by massive storage facilities because the wind doesn't blow all the time and the sun doesn't shine at night.

A detail analysis that takes into account the costs and problems associated with storage by batteries or by hydro pumped storage revealed that the all in cost of the solar power option would be 60¢/kWh – more than four times the current wholesale price – and the wind power option would cost 52¢/kW. Because of the way our electricity market works, residential power prices would be three times higher and the hydro generators would make enormous windfall profits.

The pumped storage option would be opposed by environmentalists and, anyway, is not feasible because of the lack of suitable sites. The solar power option would cover six times the urban area of Auckland with solar cells and the environmental effects are anyone's guess.

The reality is that the government's ambitions for emissions free power generation are technically, economically and environmentally fraught and would inevitably lead to skyrocketing prices and regular blackouts. Industry and commerce would be forced to resort to diesel generators to maintain operations at an acceptable price. New Zealand would soon become a third world country.

As we are frequently told that wind and solar are cheaper than conventional generation the background to the assumptions used to derive the cost of supplying 4000 MW of demand from wind or solar power is provided below.

Because a 1000 W solar cell has an average output of only 150 W, 17,500 MW (nearly twice the current NZ installed capacity) of solar power is needed to supply all the energy required by the 4000 MW load and to compensate for the 25% losses in the energy storage system.

In practice a solar cell rated at 1000 W seldom produces more than 800 W so the effective maximum output of 17,500 MW of solar is 14,000 MW. As the power system can only absorb 4000 MW the storage system must be able to absorb as much as 10,000 MW of surplus energy. The conclusion is that about 27,500 MW of solar plus storage capacity is needed to supply the 4000 MW demand! If batteries are used for storage the total cost is in the region of \$100 billion and, inevitably, leads to the very high cost of providing a reliable supply from solar power.

Wind power that has an average output of 35% of its installed capacity is a bit better but does not lead to a large reduction in price because the battery cost dominates.

Hydro pumped storage is cheaper. Based on costs derived for pumped storage in Australia, the cost drops to 37¢/kWh. In reality, it is impractical because it would need several sites with large upper and lower lakes not far from each other with an elevation difference of at least 200 m. If they could be found there would be, quite justifiably, major environmental objections. Anyway, it would take at least 10 years to get through the environmental process and build the schemes.

If the government really wants to eliminate emissions of carbon dioxide from power generation it would do well to consider safe and reliable nuclear power with or without hydropower. Even then, the problem of dry hydro years that drop hydro output by 15% or more still remains. The IPCC said it could only be met by burning gas or coal.

The government is left with only two realistic options: accept the conclusions of the IPCC report and abandon its dream of emissions free electricity or decide to adopt nuclear power supplemented by hydropower.

The technical report and spreadsheet are available on my website www.bryanleyland.co.nz

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