Commentary on Transpower's "Energy Futures"

Bryan Leyland MSc, DistFEngNZ, FIMechE, FIEE(rtd), MRSNZ.

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Summary and conclusions
Transpower's paper assumes that it is inevitable that New Zealand will pursue a policy aimed at driving down carbon dioxide emissions. This leads it to conclude that of fossil fuel stations must be shut down, we must switch to electric transport and switch fossil fuel industrial heat to electric heat. it envisages that, by 2050, electricity demand will have doubled to about 14,000 MW and 80 GWh. It then goes on to postulate a number of scenarios.

The paper is replete with heroic assumptions with little or no evidence to back them up. It admits that its scenarios will need about 12,000 GWh of dry year storage and it has no idea where this could come from. To me, this casts doubt on the validity of the whole paper.

The paper fails to mention the effect that the scenarios will have on the cost of electricity. Given that each scenario predicts that most of the 40 GWh of additional demand that, it is assumed, must be met, is postulated to come from intermittent, unpredictable and expensive wind and solar power and that expensive batteries will be relied upon for storage, it could easily double or triple the cost of electricity.

Given that China, India, and many other countries will, under the Paris agreement, build more than 450,000 MW of coal fired power stations, New Zealand's efforts will make no difference to the world's climate. Therefore there will be no compensating benefits to offset the huge damage that high electricity prices and unreliable supply will impose on the New Zealand economy.

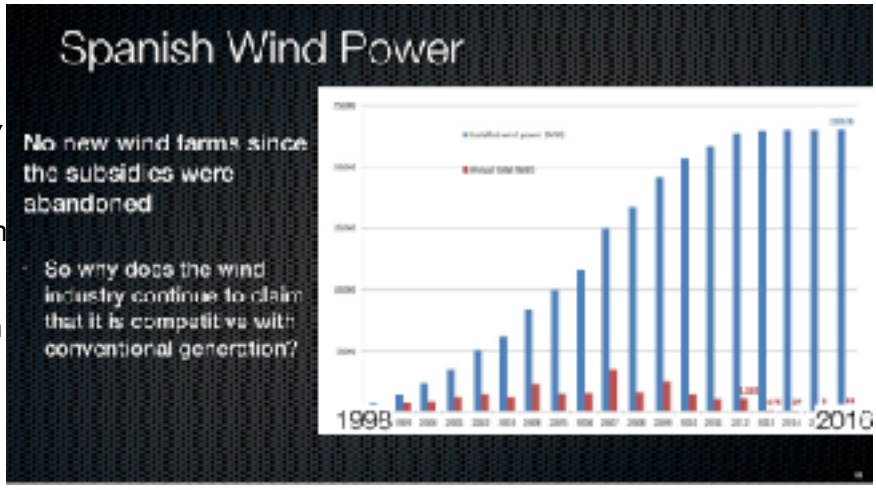
The paper lacks in-depth analysis and provides no information on costs. It promotes scenarios that cannot provide a reliable and economic supply, would compromise system stability and so expensive that it would seriously damage New Zealand 's economy.

A wide-ranging discussion on the long-term and short-term future of electricity supply is urgently needed. But it must be based on the real world, not on dreams unsupported by evidence or analysis.

Rather than shedding light on the situation, Transpower's paper simply adds misinformation that, inevitably, will lead to confusion and bad decision-making.

It should be withdrawn and replaced by a new study based on credible scenarios and detailed power system modelling.

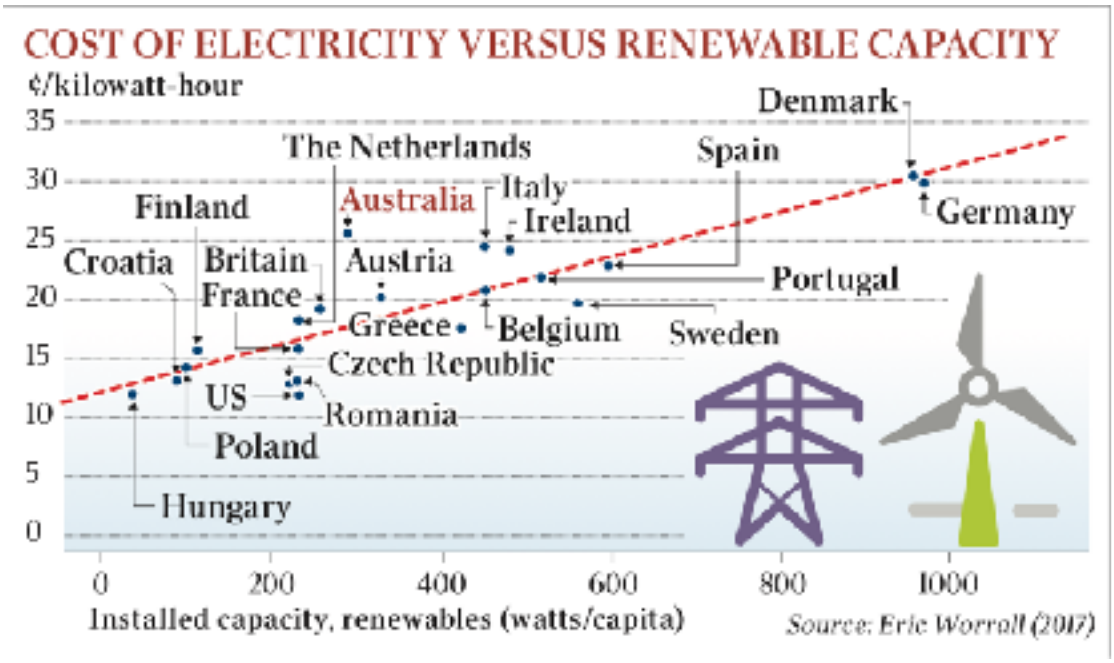
Assumptions
Directly or indirectly, the assumptions that underlie this report include:



- ***Wind and solar power are now competitive with conventional generation.***
  This is simply not true. The claim is often made based on the convenient assumption that direct and indirect subsidies can be ignored and that consumers, not the generators, carry the cost of the backup power needed to keep the lights on

when the wind is not blowing or the sun is not shining. When these are taken into account the cost of onshore wind and solar power in sunny regions is in the region of 15 to 20¢/kWh. This is confirmed by the fact that, where ever subsidies have been abandoned, solar and wind power development effectively stops. (Note that the average spot price in New Zealand is about 8¢/kWh.)

The chart below shows the correlation between the cost of electricity and renewable energy capacity.



- ***New Zealand, acting on its own, can affect the world's climate*.**
  The paper implies that if New Zealand does nothing, climatic disaster is inevitable and if it takes action climatic disaster will be averted. This is nonsense. Nothing that New Zealand does will make the slightest difference to the world's climate. Anyway, according to the IPCC climate models if every country lives by its Paris promises until the end of the century, the world would be cooler than predicted by 0.17°C - an amount that cannot even be measured!

- ***The transport future is electric***
  The paper assumes that there will be an ever increasing market for electric vehicles and, by 2030, they will reach 40% market share in New Zealand. By 2050, the market share will be 85%.

  The problem is, that, unlike the Model T Ford and the iPhone and many other technological success stories, an electric vehicle does not offer huge advantages over current technology. The major difference between a conventional car and an electric car is that a conventional car can be refuelled at about 400 km/minute and an electric car at about 10 km/minute. Many electric cars sales are at the top end of the market where they are purchased by rich people who want to show off their green credentials. There are a limited number of these people. At the bottom end of the market, the Tesla Model 3 will cost at least $US40,000 once the subsidies terminate – which will happen very soon – while an equivalent conventional car costs $US25,000. Why buy something that is less convenient and more expensive?

  The big problem with electric vehicles will eventually come down to finding people who want to buy them.

  Another problem is that fast charging stations cost about $35,000 each and because of the 30 minute charging time and the need to recharge every two - three days, each would probably service less than 100 vehicles. They are likely to have 20 times the footprint of an equivalent conventional petrol station and they will need a very substantial and expensive power supply.

Who is going to pay? The electric car owner or the hapless taxpayer or electricity consumer?

Most electric cars are sold in countries like Norway, USA and China that heavily subsidise their purchase and provide privileges such as no road tax, the ability to drive in bus lanes and even free parking. These are based on a belief that electric cars are a cheap and effective way of reducing CO2 emissions. They are not. Therefore, there is no guarantee that these subsidies will continue indefinitely. When subsidies were abandoned in Denmark sales crashed from's 1100 in 2016 to 698 in 2017.

It must always be remembered that the cheapest large-scale technologies for reducing emissions of CO2 are converting from coal to gas and adopting nuclear power.

- ***Car batteries can be used to meet peak demands***
  The paper assumes that many of the batteries in electric cars will be connected to the grid and supply extra energy during periods of peak demand. There are three problems with this: the first is that, by shortening the battery's life its value would decrease by about $0.30 for every kWh it delivers; the second is that during critical periods, the batteries will have to be recharged using high-priced electricity from the spot market and the third is that extra power needs to come from batteries that will be substantially discharged from daily use. Another potential problem is that, on a very cold night, when the system operator's options are rotating blackouts or running all the batteries flat, what will he do? How will the car owner react next morning?

- ***A renewable future is the most affordable***
  A claim as bold as this must be supported by evidence of the cost of both conventional and renewable generation. No such evidence is provided.

  There is ample evidence that the cost of wind, solar and batteries will need to decrease by a huge amount to make them competitive with conventional generation. The lower limit is the cost of the raw materials plus the cost of installation. The cost of solar cells is about one third of the installed cost so solar power would be only 30% cheaper if they cost nothing. A solar/battery installation in New Zealand delivers power for about $0.50/kWh. If it cost a fifth of that, it might be getting close to competitive with conventional generation.

  Completely new and revolutionary wind, solar and battery technologies are needed to reduce costs by the amount assumed by Transpower. No such technologies exist or are on the horizon.

- ***Nuclear power is not an option for New Zealand***
  Given that wind and solar power are expensive and intermittent, storage hydropower is deemed to be unacceptable to the government for environmental reasons, gas and coal are banned and geothermal is limited, the only practical and economic option left is nuclear power. Long before 2050, small modular nuclear producing power at a price competitive with conventional generation will be available. The paper dismisses safe, environmentally friendly and cheap nuclear power. Why? (Note that New Zealand's anti-nuclear legislation does not ban nuclear power.)

Discussion

The Electricity Authority has developed a publicly available Generation Expansion Model for comparing and optimisation power generation scenarios. Had this been used, it would have produced a credible, costed system expansion plan. It would have made accurate comparisons of various options and could also have given a realistic indication of exactly how much New Zealanders would need to pay for a reduction in carbon dioxide that could not affect world climates.

I have attempted to reverse engineer Transpower's predictions and, it seems, to meet a 14,000 MW and 80 GWh load in 2050.

Transpower indicate that we need something like 30,000 MW of installed capacity, plus more than 5000 MW of batteries to provide 80 GWh pa. This includes 12,000 MW of rooftop solar power. If 50% of this is on house roofs, the 6000 MW will be feeding a daytime load of less than 1000 MW

and trying to export the remaining 5,000 MW into a distribution system that could not carry it. In the middle of summer on a good day all the generators would be wanting to provide 20,000 MW to supply a demand of less than 10,000 MW. During peak demand periods the 30,000 MW would provide a reliable generating capacity of only 9000 MW – 5000 MW short of what is needed.

Based on the best of current technology, domestic solar power plus batteries costs $0.45/kWh, using an electric car battery to store energy costs about $0.40 – and the big unknown is the cost of purchasing the power to recharge the battery. Cost reductions by a factor of five – or even 10 – are needed before they can compete with conventional generation.

The cheapest and most effective way of reducing carbon dioxide emissions from burning coal in the South Island, is to encourage offshore gas exploration or exploit the onshore shale gas resource in the South Island.

The paper also seems to have ignored the fact that power systems must have a fairly large proportion of conventional rotating generators connected to the system to provide system stability and to restart the system in the event of a blackout. With current technology, these vital services cannot be provided by wind, batteries and solar power.

Note. I can provide references backing up every claim I have made. Please do not hesitate to ask.
bryanleyland@mac.com 021 978 996