Nathan Turner is the Country Manager for BlueFloat Energy New Zealand where he is responsible for overseeing a partnership with New Plymouth based Elemental Group to build up to 3GW of new generation offshore wind capacity. The partnership has already announced plans to build offshore wind farms in South Taranaki and West Waikato.

CAN NEW ZEALAND AFFORD OFFSHORE WIND ENERGY? WE CAN'T AFFORD TO IGNORE IT

In mid-September 2023, the New Zealand Wind Energy Association held its annual summit in Wellington. Over the course of the two-day event, I was pleased to observe the frequency with which people stated that it was no longer a matter of whether offshore wind energy would come to New Zealand, but when. However, despite the growing acceptance of offshore wind as a critical part of New Zealand's energy future, some sceptics remain. Isn't offshore wind too expensive? Aren't offshore wind projects too big for our electricity market? These questions are often posed in a rhetorical fashion, with the asker rarely paying attention to the response. Despite this, they are important questions and New Zealanders should be paying attention to the answers. Without offshore wind in the mix, our net zero targets look pretty hard to achieve and we can all expect higher power bills in the future.

We have a mountain to climb

Over the course of the last few years, a number of credible reports have been published which outline forecasts for New Zealand electricity system growth between now and 2050. Whether you look at the BCG Report[1], Transpower's Whakamana i Te Mauri Hiko[2], or the Climate Change Commission's demonstration path[3], the numbers look reasonably similar; New Zealand needs between 400-500MW of new renewable generation to be installed every year between now and 2050. This demand growth is driven mostly by the electrification of some transport and industrial process heat, along with a sprinkling of population growth. Put in context, this is like bringing online a new Clyde Dam every year.

Now, that's no easy task, but it's also becoming clearer that this is only part of the story. Earlier this year, MBIE released its Interim Hydrogen Roadmap which included forecasts from an accompanying report prepared by Ernst & Young[4]. MBIE acknowledges that electrification is capable of delivering about 70% of our decarbonisation needs. However, the remaining 30% of emissions, which come from hard to decarbonise sectors such as heavy transport, heavy industry and high-temperature process heat will need another technological solution. In a similar vein, Transpower estimated that its base case for electrification in Whakamana i Te Mauri Hiko (ie 400-500MW of new renewables every year) would deliver less than 40% of our emissions reduction targets by 2050. (see figure 1 on next page.)

This is likely to require the production of "green molecules" such as hydrogen, ammonia or methanol. As it transpires, production of these green molecules also requires vast amounts of renewable energy – a requirement that is not included in the 400-500MW of annual generation growth previously forecasted.

In order to see the full picture, we therefore need to combine the electricity demand growth from both electrification and from green molecules. When you combine the base case for electrification in the BCG Report with the base case for green molecules in the Interim Hydrogen Roadmap, the result is that total electricity demand is forecast to grow from 42TWh to 111TWh by 2050 – a staggering 164% increase. This is the lowest scenario for domestic hydrogen demand in the Interim Hydrogen Roadmap.

How much new generation capacity do we need to meet that demand growth? The answer depends on the mix of

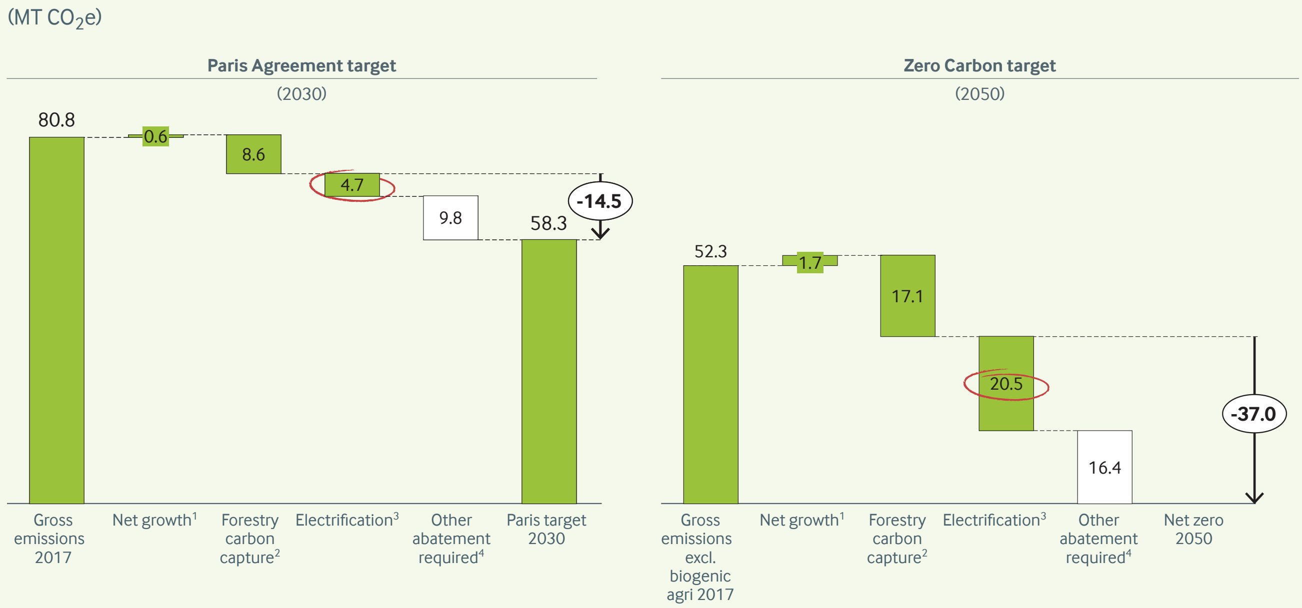
1 Boston Consulting Group, The Future is Electric: https://web-assets.bcg.com/b3/79/19665b7f40c8ba52d5b372cf7e6c/the-future-is-electric-full-report-october-2022.pdf

2 Transpower, Whakama I Te Mauri Hiko: https://static.transpower.co.nz/public/publications/resources/TP%20Whakamana%20i%20Te%20Mauri%20Hiko.pdf?VersionId=FljQmfxCk6MZ9mIvpNws63xFEBXwhX7f

3 Climate Change Commission, Ināia tonu nei: https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa.pdf

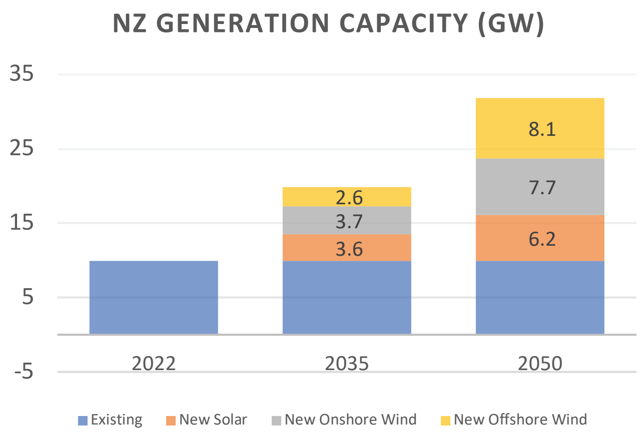
4 Ernst & Young, Hydrogen Economic Modelling Results: https://www.mbie.govt.nz/dmsdocument/27220-hydrogen-economic-modelling-results-pdf

Figure 1: **Contribution to emissions targets**



1 Net growth is composed of additional energy requirements in transport and process heat combined with efficiency gains from delivering those energy requirements with improving fossil fuel technologies;
2 MfE forecast of forestry carbon sequestration recognised under Paris Agreement in 2030 extended to 2050 based on planting an estimated 0.6m additional forestry hectares;
3 Emissions reduction from electrification estimated in Whakamana i Te Mauri Hiko base case;
4 Abatement required from other sources required to achieve each target.

technology you assume, due to the difference in capacity factors[5]. In any event, the answer is plenty! In the graph below, you can see one scenario of generation build-out to meet this new demand. If you take a simplistic approach and assume that new geothermal generation will replace existing power stations due to retire, then more than 20GW of new wind and solar will need to be connected to the grid before 2050 to meet new demand.



In this scenario, New Zealand can build a new 900MW offshore wind farm every two years from 2032 to 2049 and offshore wind would still only amount to 37% of all new renewable generation developed over that time horizon.[6]

Today, New Zealand has peak electricity demand of about 7GW. In that context, it's easy to understand why the idea of a new 900MW offshore wind farm can be difficult to grasp. However, we are not developing these projects for the electricity system of today – we are developing them for the electricity system of the future, which will be much larger than the system we have now.

Onshore renewables will play a critical role in supporting New Zealand's energy transition and we need to support the development of these important projects. However, we also believe that onshore renewables won't be able to deliver the energy transition on their own. Relying solely on onshore wind and solar projects to meet growing demand could require Transpower to connect about 13 new utility scale generation projects every year[7]. Until recently, Transpower was only receiving 3-5 new connection enquiries each year (including demand side connections) and this increase would place significant pressure on the limited skills and resources that we have in this country, at a time when it is already common to wait >12 months for a new grid connection to proceed. Our solution to navigating the energy transition must be deliverable. If we fall behind in developing new generation, power prices will rise and system reliability

5 Capacity factor represents the average output of a generation plant compared to its peak capacity.

6 Assumes the following capacity factors: Offshore wind 50%, onshore wind 35%, solar 18%.

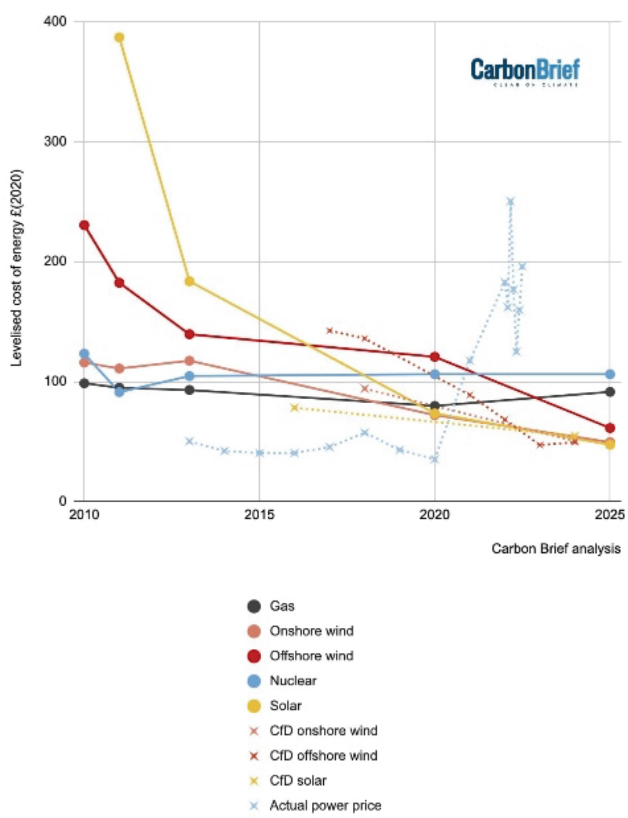
7 Assuming average solar project capacity of 80MW and onshore wind project of 150MW. Demand growth assumed to be met 50% by each of solar and onshore wind. Same capacity factor assumptions as above.

will fall resulting in bad outcomes for consumers and headwinds for decarbonisation. We need an affordable, sustainable and reliable electricity system to encourage electrification if we are to realistically achieve our climate change goals in an equitable manner.

Ok, but tell me about the cost

Offshore wind projects have now been operating for over 30 years in Northern Europe. In the early days of the industry, the technology was new and supply chains were immature. As a result, Governments were required to provide significant subsidies to bring projects to market. In 2017 when the UK Government began running regular CFD[8] auctions for renewables, offshore wind projects required prices of around £150/MWh when wholesale power prices were closer to £50/MWh.

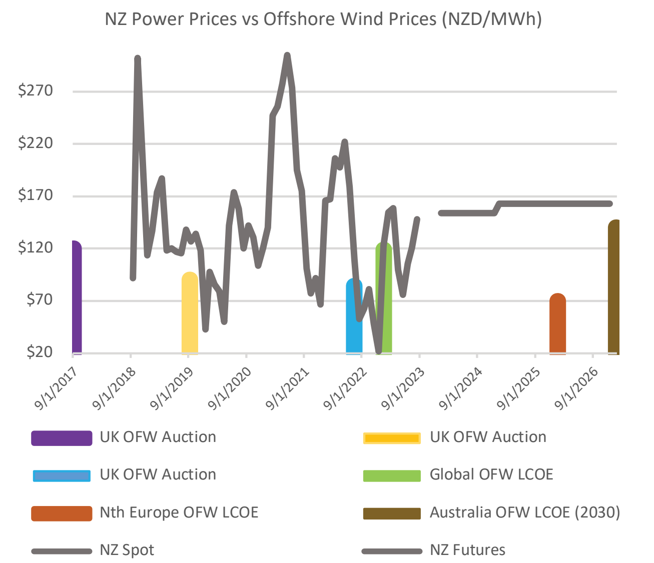
CfD auction results and actual power price (dashed lines) vs govt cost estimates (solid lines)



Because of this history, it is natural for many people to hold the view that offshore wind is expensive technology that depends on government subsidies. However, the industry is changing.

When the UK ran a multi-technology CFD auction round in 2022 (AR4), offshore wind was the lowest cost of all renewable energy types at a price of just £37/MWh[9] – cheaper than solar and cheaper than onshore wind. This significant cost reduction was the result of larger turbines and more industrialised supply chains. When combined with the fact that UK wholesale power prices had risen to well over £100/MWh, offshore wind CFDs were set to become a significant revenue source for the UK Government.

To avoid the confusion that often comes when working with multiple currencies, we have taken a look at how offshore wind price benchmarks compare to power prices back here in New Zealand, on an NZD basis. On the graph below, you can see actual New Zealand wholesale power prices for the last 5 years in addition to the futures price for the 2024-2026 calendar years[10]. The graph also shows a variety of international offshore wind reference prices, including actual CFD auction outcomes in the UK (2017, 2019, 2022) and a number of published LCOE forecasts[11].



8 CFD stands for Contract for Difference, a financial contract to hedge power price volatility by providing a stable price to a generator or customer.

9 Bid prices were expressed in 2012 dollars.

10 NZ Spot represents North Island demand weighted price, NZ Futures represents ASX OTA price as at 20/09/2023,

11 UK OFW Auction prices represent AR2, 3, 4 bid outcomes converted to NZD inflation adjusted to year of bid outcome, Global OFW LCOE as published by BNEF 1H 2023, Nth Europe LCOE as published by Aegir, Australia LCOE as published in CSIRO GenCost (mid-point of range)

The graph shows that offshore wind projects in the UK are contracting their power generation at prices (NZD84/MWh in 2022) well below the futures price for power in New Zealand (NZD154/MWh in 2024, NZD163/MWh in 2026). Even the forecast cost of offshore wind in an emerging market like Australia (NZD140/MWh in 2030) is below New Zealand's wholesale price expectations in the coming years.

Yes, project costs have been rising in the last 12 months due to supply chain constraints, commodity prices and interest rates resulting in a recent failed UK auction round for offshore wind. Yes, the UK is a very mature market and delivering projects at the same cost in New Zealand is unlikely in the short term. However, New Zealand projects are not expected to come online until next decade and costs are widely expected to continue their downward trend in the long-term. Further, offshore wind doesn't need to achieve UK level costs to be competitive – even a 50% premium on the 2022 UK auction round outcomes would result in prices well below the futures price in New Zealand (NZD126/MWh vs NZD154-162/MWh).

If offshore wind is already economic, why does the industry need CFDs?

Building large scale renewable energy projects is a capital-intensive exercise and project financing has made a significant contribution to the lowering of project costs in recent decades. To unlock the significant capital required, projects must be "bankable", meaning that the overall risk profile of the project must be attractive to equity investors and financiers.

One of the key risks for projects is power offtake. If a project developer is not able to demonstrate a stable, long-term revenue stream with a credit-worthy counterparty (i.e. a long-term power sale contract with a credible buyer), they are unlikely to attract capital. By decreasing the risk of your project, you can gain access to more pools of capital at a lower cost. The lower your cost of capital, the lower your ultimate power cost to consumers, whether industrial or domestic.

CFDs have become common tools for helping to de-risk renewable energy projects. They operate as a hedging instrument, protecting project developers against the volatility of wholesale spot prices. Without an instrument like a CFD, a project developer would need to go into the market and find credit-worthy commercial customers who would be willing to sign long-term, fixed-price power purchase agreements to provide a similar degree of commercial de-risking.

New Zealand's electricity market has very few customers who could meet these requirements. As a result, New Zealand has >2.5GW of renewable energy projects[12] which are consented yet have not moved to construction – despite the futures price far exceeding renewable LCOEs (ie the cost of new generation). A lack of offtake or customer commitments is contributing to this delay in projects coming to market.

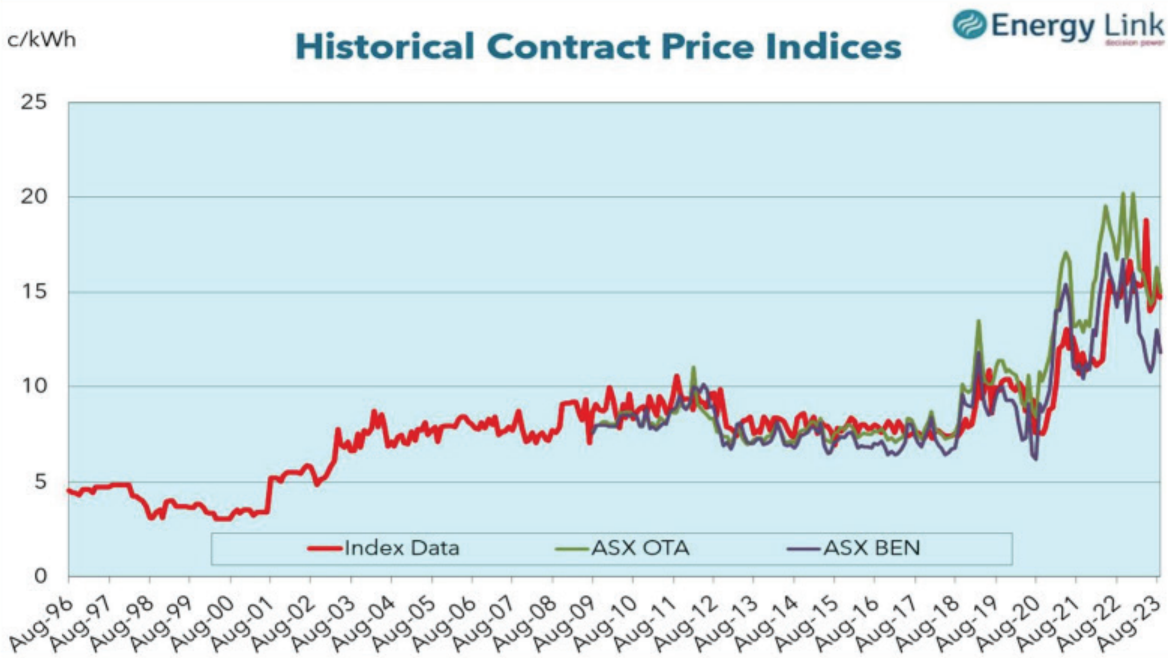
We recently undertook an exercise to model the anticipated output from a potential New Zealand offshore wind project, based on 20 years of hindcast wind data[13]. We then overlaid this generation profile against actual wholesale power prices in the four years from 2018 to 2021. If a 900MW South Taranaki offshore wind farm had been operating through this period with a CFD at a strike price of NZD105/MWh, the government would have earned revenue of NZD153 million. With onshore renewable LCOEs claimed to be well under NZD100/MWh, one must wonder why government isn't already using a tool like this to encourage new generation investments whilst also providing a potential revenue stream for government.

Now, we appreciate that wholesale prices would have been entirely different at the Stratford node in this period if a 900MW offshore wind project had been in operation in addition to exiting generation. However, the exercise demonstrates that CFDs shouldn't automatically be associated with subsidies. Rather, CFDs should be seen as a price stabilisation tool, unlocking the important amounts of cheap capital needed to build these projects.

New Zealand needs to start building and connecting new generation at a rate far greater than we are doing today. Power prices have already risen significantly, impacting business cases for electrification or green industrial expansion projects. Only by delivering more generation to keep up with growing electricity demand will we achieve affordable power pricing through the energy transition to ensure that decarbonisation doesn't mean deindustrialisation.

12 https://www.mbie.govt.nz/dmsdocument/26447-consultation-document-edgs-2023-pdf

13 https://static1.squarespace.com/static/634c93e9c297a25f06938ba4/t/650a19206671f33b4ff435de/1695160620953/OffshoreWindNZ+%281%29.pdf



So, what next then?

MBIE is currently consulting on a regulatory framework which would allow offshore wind projects to move to the next stage of feasibility investigations and design. This legislation is expected to be in place by the end of 2024 so that permits can be granted in 2025. Sticking to this timetable is critical to maintain investor confidence and to secure New Zealand's place in global supply chains. And, whilst a regulatory framework for permits is important, we are calling on the Government to pursue a few key actions to ensure that New Zealand can take advantage of offshore wind technology to support the energy transition:

1. Set stable, long-term targets for new renewable generation to support investment;
2. Implement the enabling regulatory framework and streamline consenting;
3. Support route to market for new projects through a CFD auction scheme;
4. Enable timely infrastructure development to de-risk generation investments; and
5. Put in place a workforce and supply chain development strategy.

Here at the BlueFloat Energy and Elemental Group team, we're passionate about the role that offshore wind can play in New Zealand's energy future. Not only can these projects accelerate the decarbonisation of New Zealand's economy, they can unlock broader economic growth by increasing the affordability, reliability and sustainability of our energy mix to encourage new investment. In the past, New Zealand has attracted large industrial investors with domestic hydropower and natural gas resources. To ensure economic prosperity into the future, we will need to do so with our abundant wind and solar resources. Tackling climate change whilst creating exciting new economic opportunities for future generations – hard to argue with that.