

Offshore Wind – what if it had been around in the winter of 2024?

2024 Backcasting Exercise

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2025 New Zealand Wind Energy Summit

Introduction to NZOWL

- A wholly owned subsidiary of Elemental Group established in 2019
- Deeply engaged in development of the offshore renewable energy regulatory framework
- Working closely with local stakeholders to build social license and economic opportunities
- Partnership with BlueFloat Energy until their exit in 2024
- Owner and recipient of all IP created as part of the Elemental / BlueFloat Joint Venture



What happened in the winter of 2024?

Tiwai Point smelter agrees to further cut in energy use

Tiwai Point aluminium smelter to cut back its power use

Methanex move spurs calls for quick fix to energy crisis

Human cost of energy crisis mounts as jobs slashed

Electricity supply crisis: What you need to know

Hundreds... and many face layoffs, due to factory close downs, blamed on high energy prices. (File photo)

Kiwis urged to reduce electricity amid 'potential tightness' in supply

Methanex NZ will idle its Motunui facility for the next three months and sell the gas it would usually turn into methanol to Contact Energy and Genesis Energy. (File photo)

Study Scope

NZOWL engaged Energy Link to model theoretical outcomes for calendar year 2024 electricity supply and pricing if Offshore Wind supply was available

Scope

- NZOWL will apply for feasibility permits for two offshore wind projects in the North Island, Aotearoa NZ:
 - South Taranaki: 900 MW development.
 - Waikato: 810 MW development.
- Energy Link was engaged to undertake a back casting exercise to determine the impact that 3 offshore wind development scenarios might have on the electricity market:
 - 500 MW development in South Taranaki.
 - 500 MW development in Waikato.
 - 1,000 MW development (both South Taranaki & Waikato).
- The modelling approximated the generation mix, water values, and nodal spot prices for the 2024 electricity market from which a market analogue, or “base case” was developed.
- The 3 development scenarios were run and compared against the base case.

Development Overview

NZOWL is proposing two offshore wind developments. Each can potentially generate more than 800 MW of renewable electricity at world class capacity factors



South Taranaki

- Generation Capacity: 900 MW
- Net Capacity Factor: 54%
- # of Turbines: 60
- Turbine Capacity: 15 MW
- Water Depth: 40 – 65 metres
- Commencement Date: 2035



Waikato

- Generation Capacity: 810 MW
- Net Capacity Factor: 43%
- # of Turbines: 54
- Turbine Capacity: 15 MW
- Water Depth: 55 – 70 metres
- Commencement Date: 2035



Study Assumptions & Limitations

Back casting is inherently complicated due to difficulties in predicting / modelling the counterfactual. Modelling results nevertheless provide an indicative, guided, set of results

Demand

- Recorded market data from the modelled period, published by Transpower. Including Tiwai's reduction in demand.

Offers

- Hydro, thermal, wind & other generation offers have been modelled using market data
- Observed hydrological inflows for the back-casting period were used. Inflow data was collected and compiled from a range of publicly available river flow data.

Offshore Wind

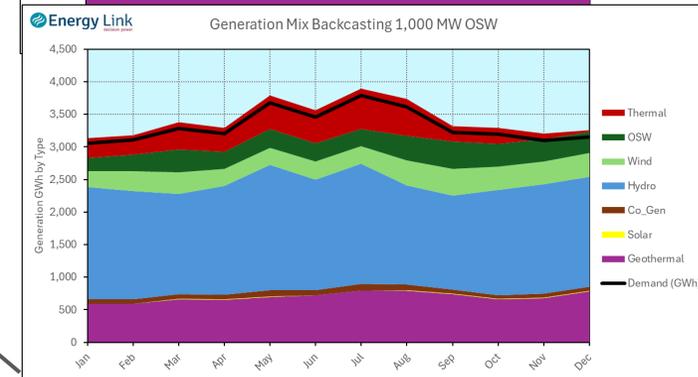
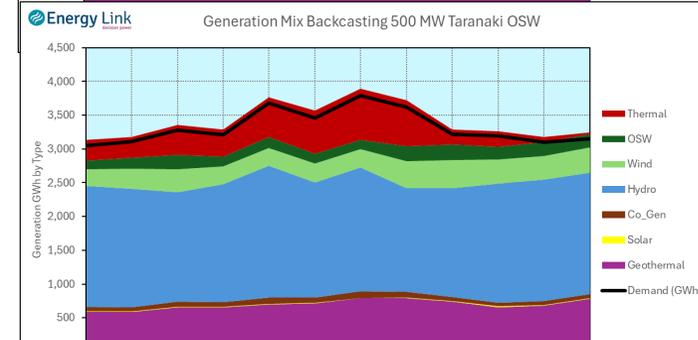
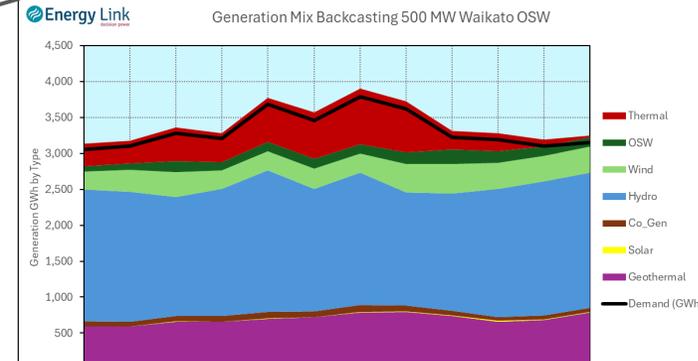
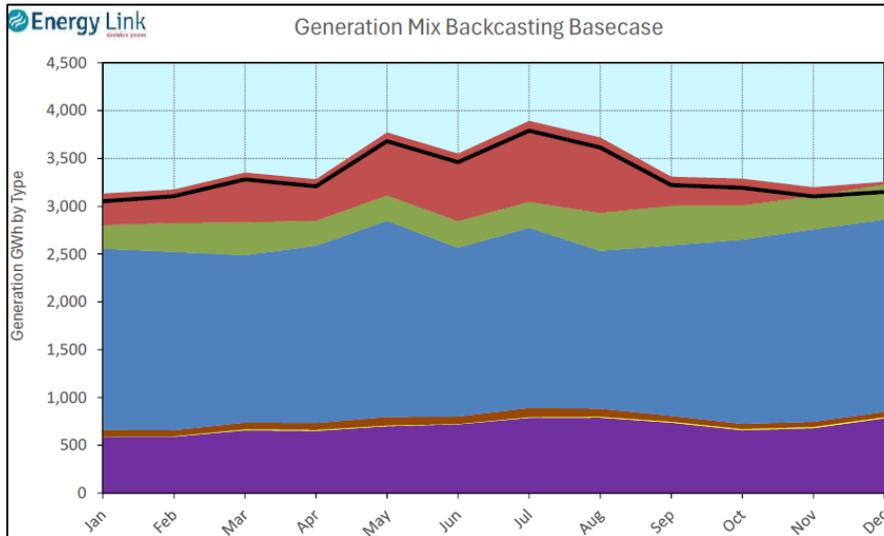
- OSW projects are modelled such that their output is correlated with existing onshore windfarms near the project area.
- OSW generation profile is approximately in line with the *onshore* wind patterns in the area at that time.
- Capacity factors of 0.44 were used for the Waikato project and 0.52 for the Taranaki project.

Limitations

- Modelling water values and thermal offers in a back casting exercise is complex and will likely misinterpret actual behaviour and underpredict offer prices.

Results 1

Generation Mix Outcomes



Generation Profile

- Increasing the OSW size increases the overall renewable generation profile from 84.9% to:

- 86% : 500 MW Waikato
- 86.5%: 500 MW Taranaki
- 87.7%: 1,000 MW Combined

Results 2

Change in contributions by source

Scenario	Thermal	Hydro	Wind (incl. OSW)	Geothermal, Solar, Co-Gen
500 MW Waikato	-9%	-5%	+42%	0%
500 MW Taranaki	-13%	-7%	+55%	0%
1,000 MW Combined	-21%	-11%	+95%	0%

Summary of results

- Meaningful reduction in hydro and thermal generation.
- Contribution from OSW is 5.8%, 7.8% & 13.2%.
- Contribution from wind (total) almost doubles in the 1,000 MW case.
- The additional OSW energy significantly reduces the amount of thermal and hydro generation required.
- This would likely result in higher levels of water storage and reduced pressure on gas prices.

Results 2

Pricing

Modelling Outcomes

- A reduction in average Haywards pricing across the period.
 - 500 MW Taranaki -48%
 - 500 MW Waikato -44%
 - 1,000 MW Combined -88%
- Higher capacity factor for Taranaki results in additional generation and hence lower prices.
- Results are highly skewed due to the unusual nature of the electricity market in 2024:
 - Curtailment at Tiwai Point.
 - Diversion/sale of Methanex gas to two gentailers.
 - Use of large volumes of coal for thermal baseload generation.

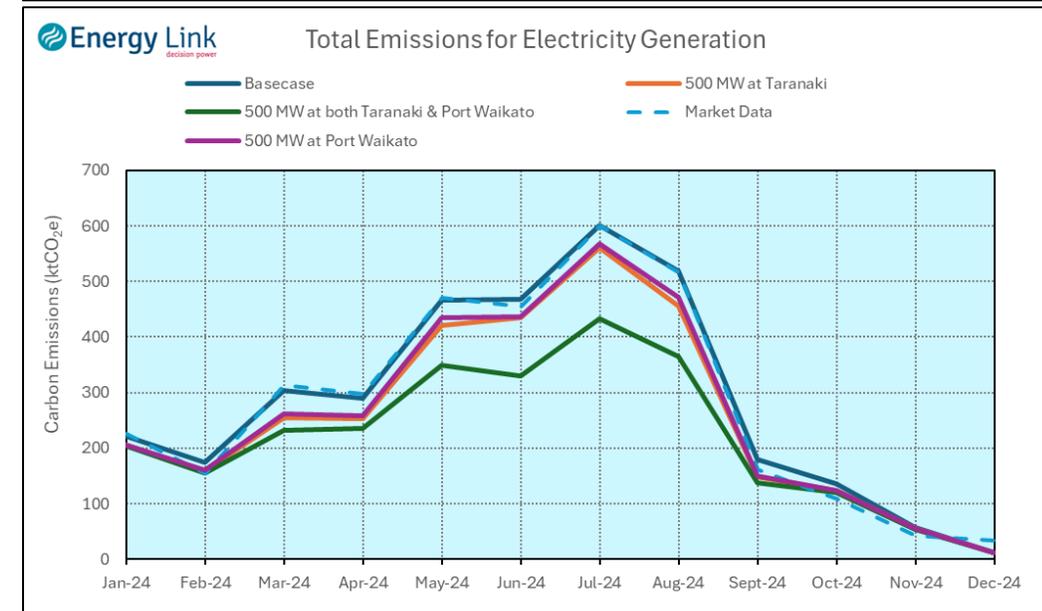
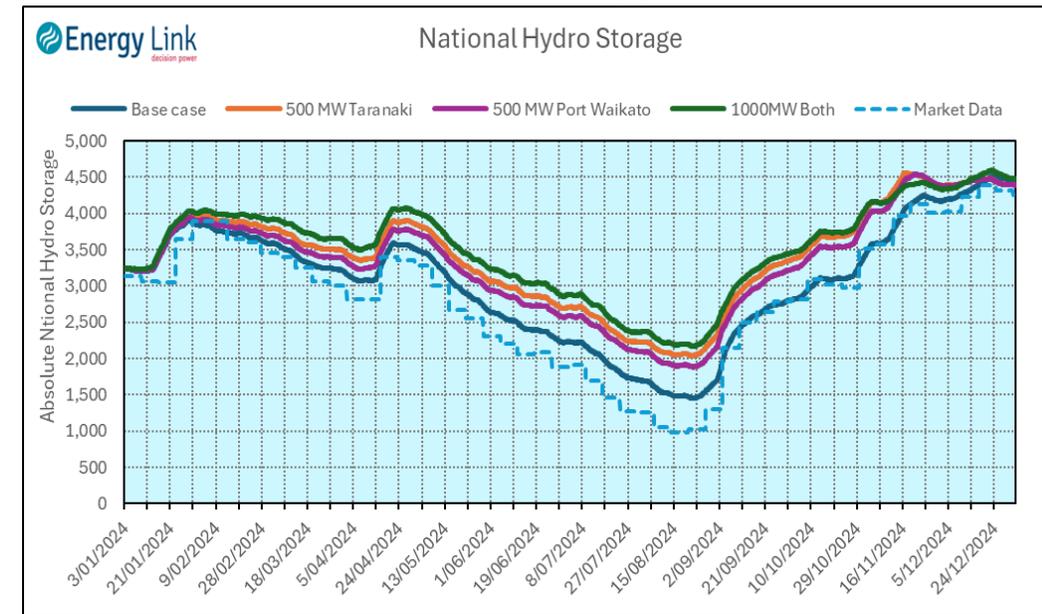


Results 3

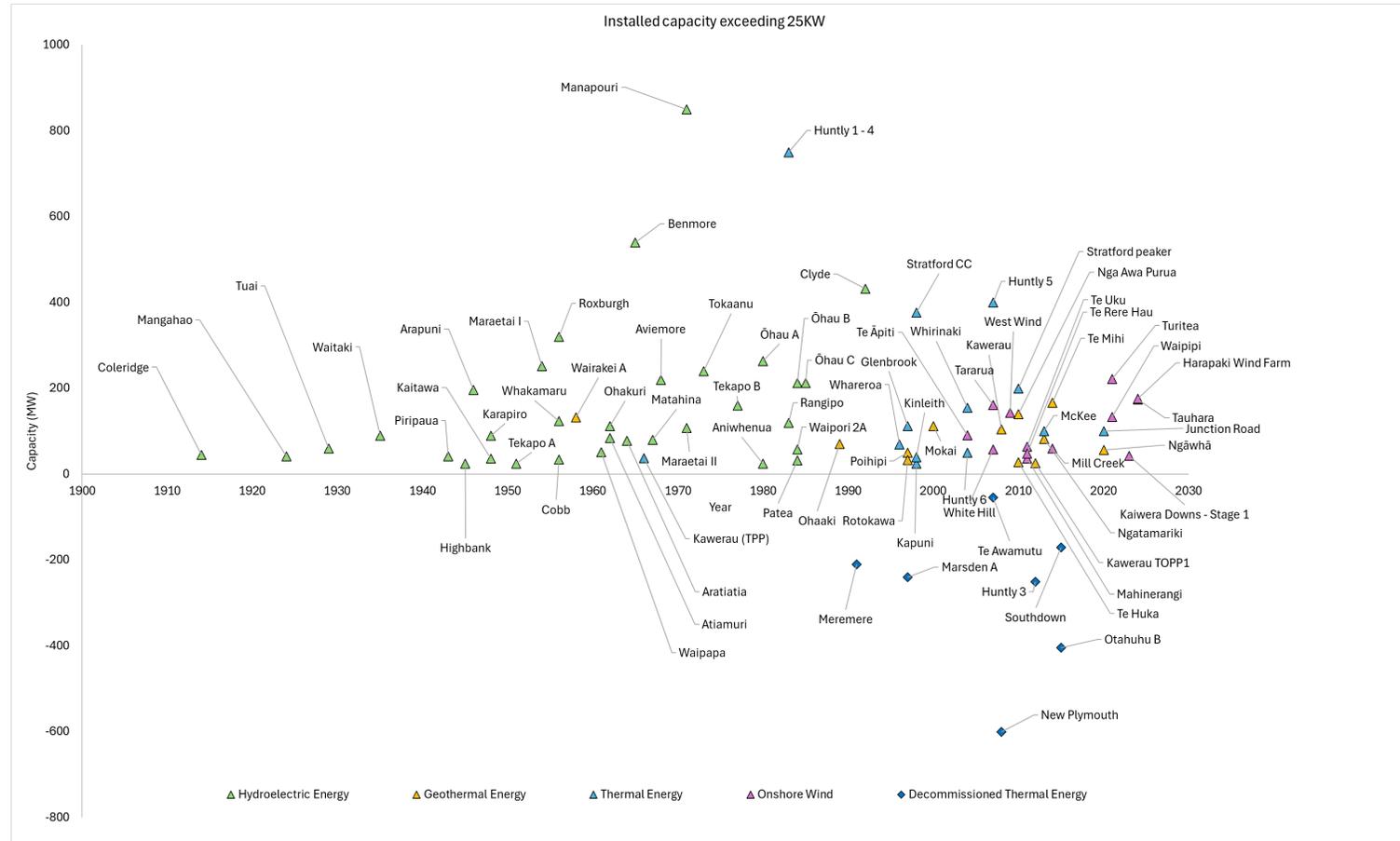
Hydro Storage & Emissions

Modelling Outcomes

- The additional generation from OSW means that less hydro generation is required, leading to increased storage.
- Deviation of the base case from the real market data is due to modelling limitations.
- Thermal generations emissions are modelled to have reduced as follows:
 - 500 MW Taranaki -9%
 - 500 MW Waikato -8%
 - 1,000 MW Combined -16%
 - Large reduction in emissions during June, July, and August when very low inflows and lake levels prompted a significant amount of thermal generation to be dispatched into the market in the base case.



Placeholder for Kymber

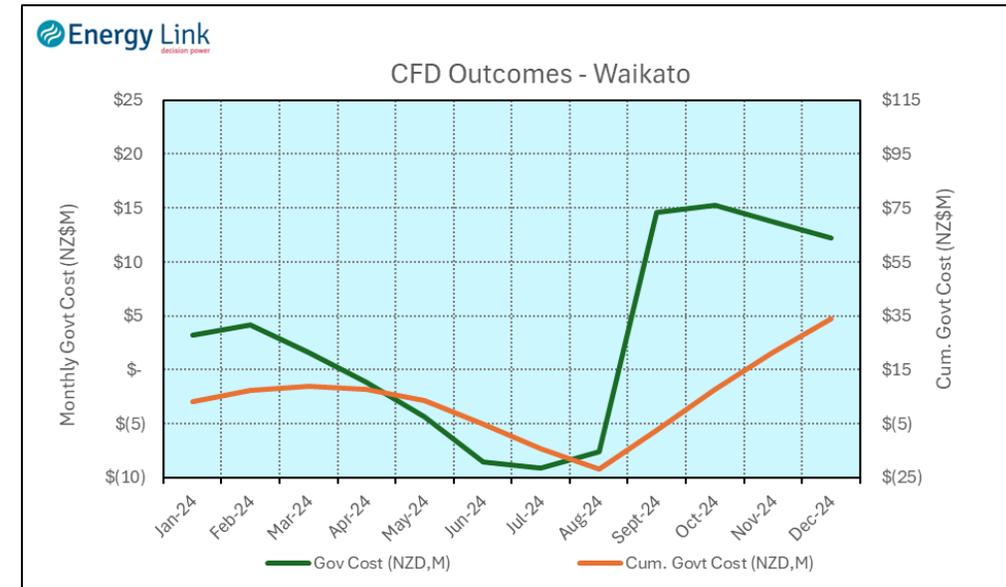
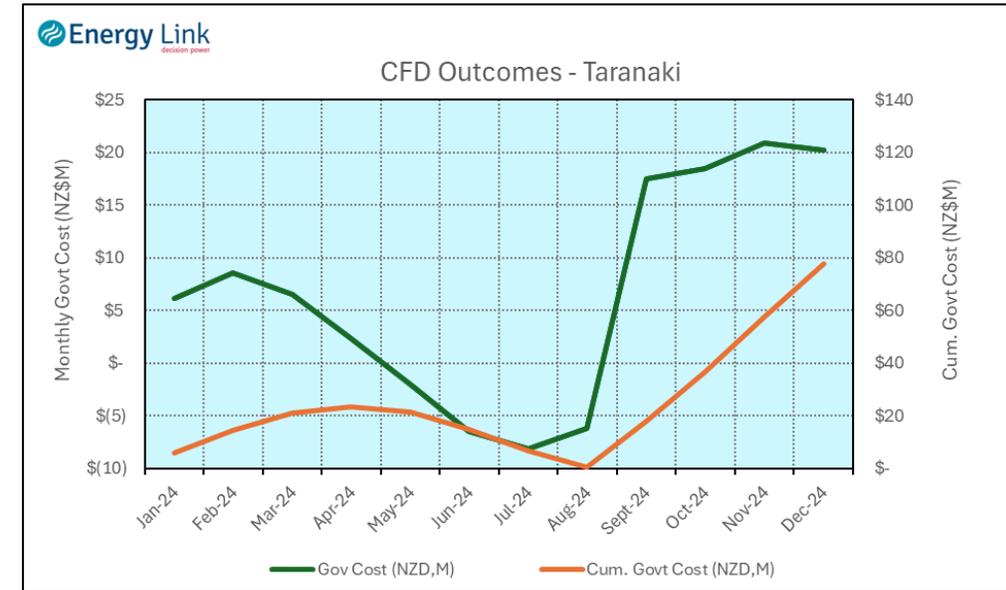


Price Support Mechanisms

Economic outcomes if a notional CfD were in place

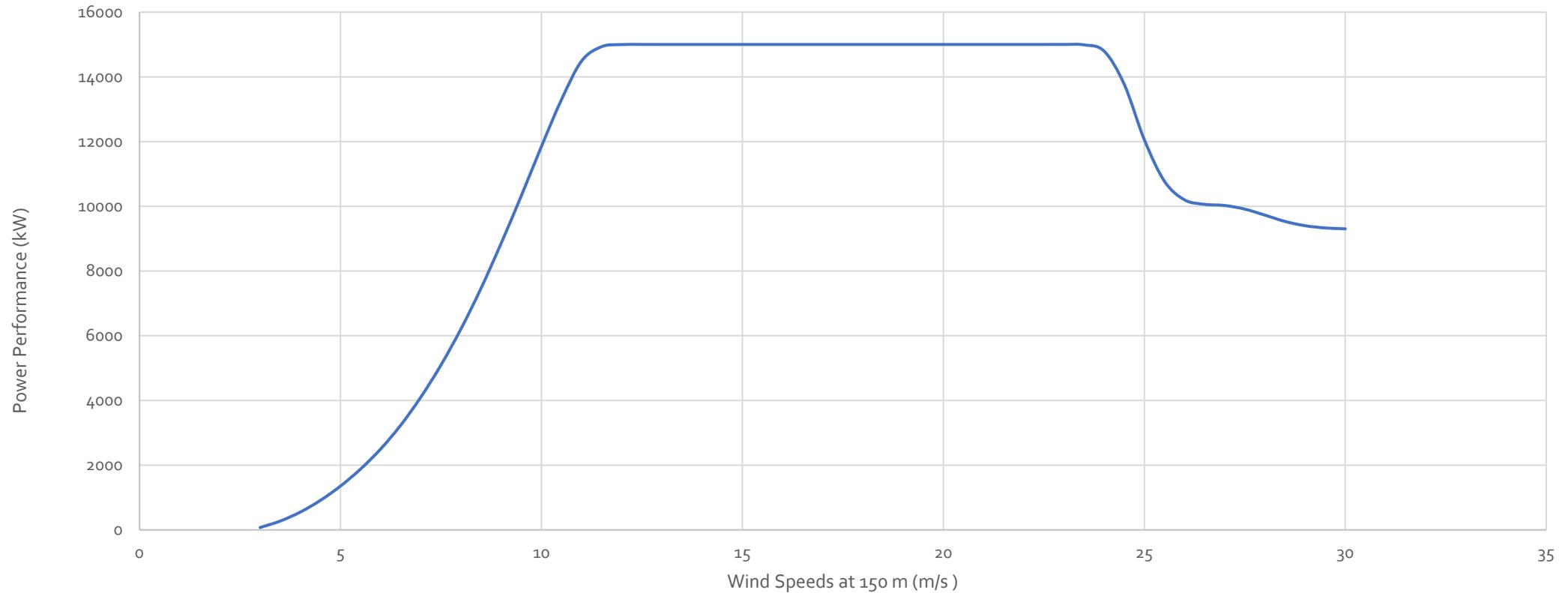
Price Support Modelling Outcomes

- A notional \$110 / MWh price support (CfD) was modelled for the period, for:
 - 500 MW Taranaki OSW
 - 500 MW Waikato OSW
- For the period to August price support outcomes were:
 - Taranaki OSW – Cost neutral
 - Waikato OSW - \$22 million to the CfD underwriter
- For the full 12-month period to December, and following significant market dynamics, the outcomes were:
 - Taranaki OSW – \$78 million to the CfD beneficiary
 - Waikato OSW – \$34 million to the CfD beneficiary
- The full year results need to be considered in the context of significantly unusual market dynamics:
 - Curtailment at Tiwai Point smelter
 - Methanex sale of gas to gentailers
 - Curtailment of industrial consumers during the period



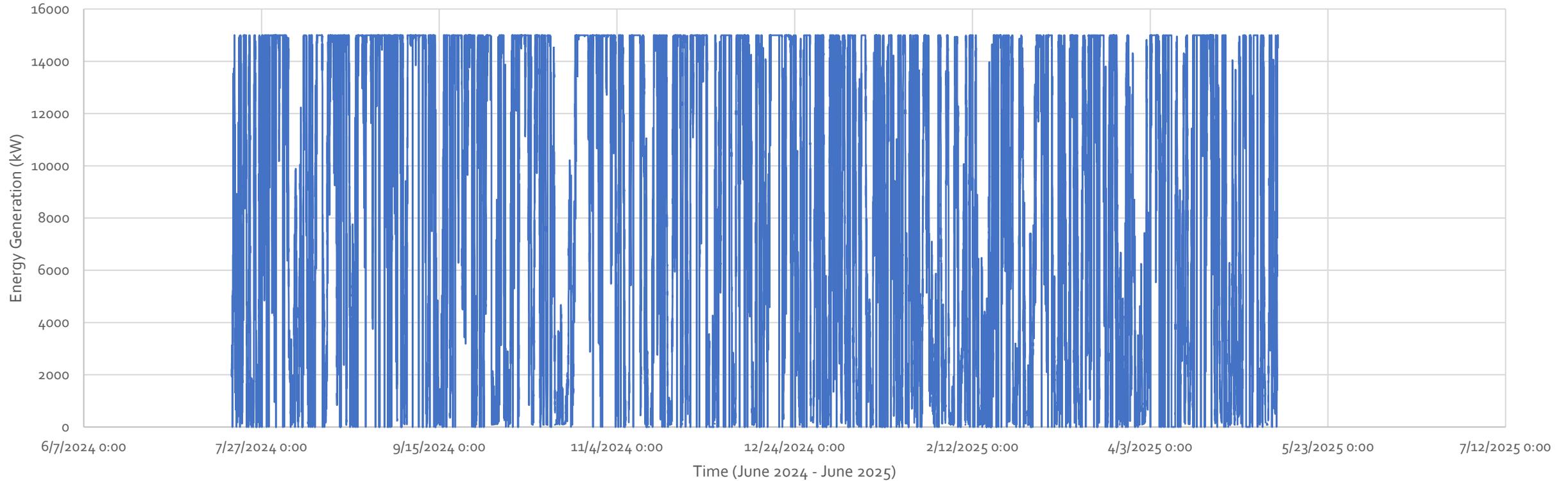
Kupe Vestas Turbine Power Curve

Vestas V236-15.0MW Turbine Power Curve (at 1.225kg/m³ density)



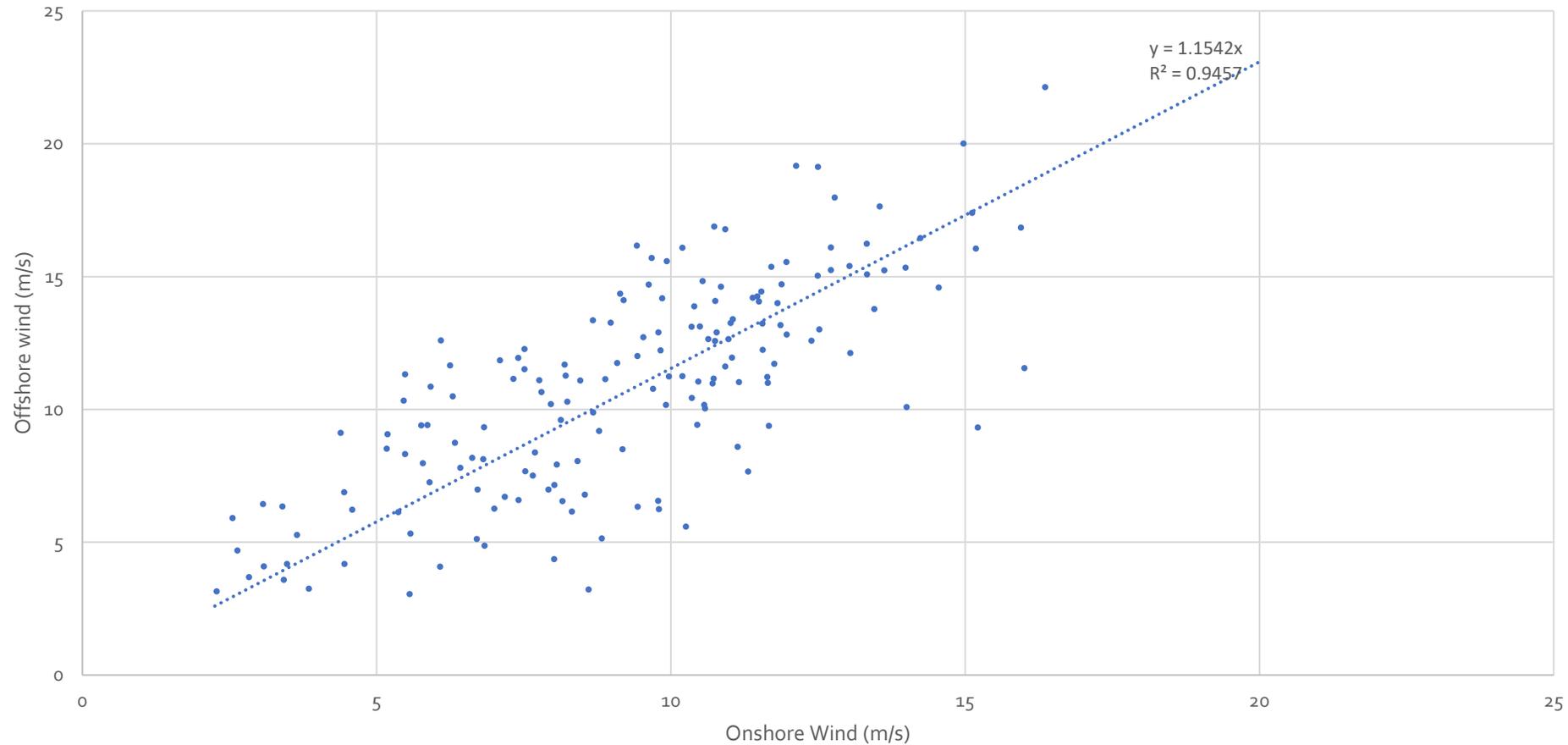
Offshore LiDAR Data

Predicted Generation from Recorded Wind Speeds (kW)



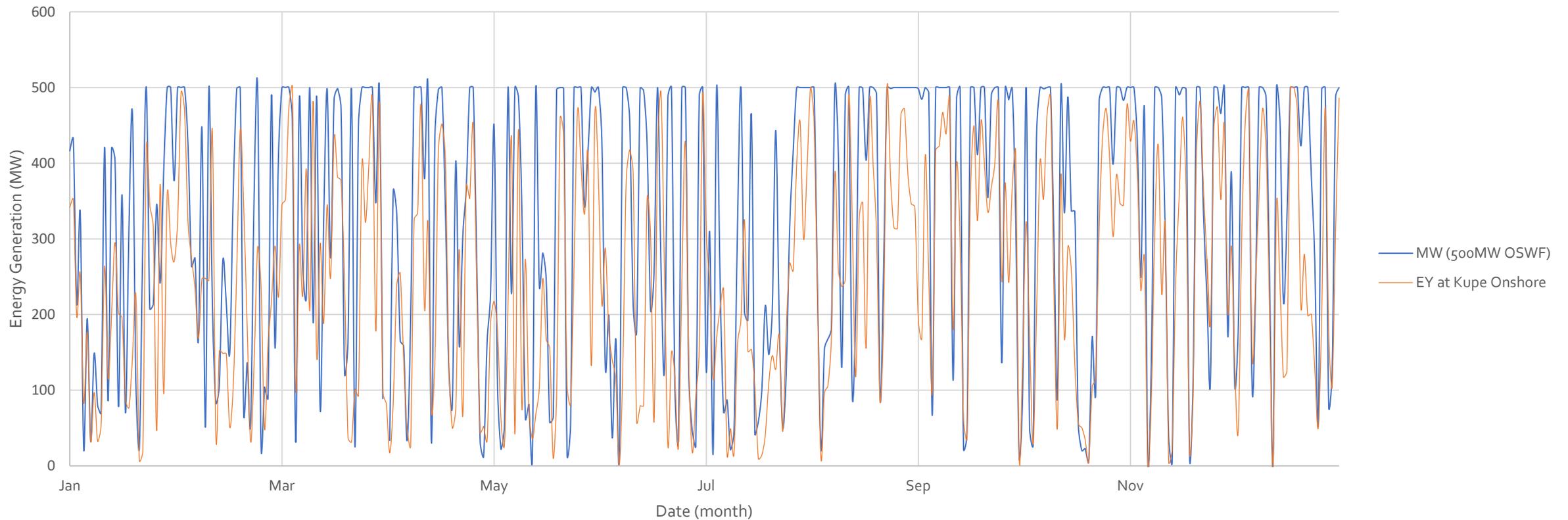
Finding a Correlation with what we have

Daily Correlation 2024 between Offshore and Onshore Data

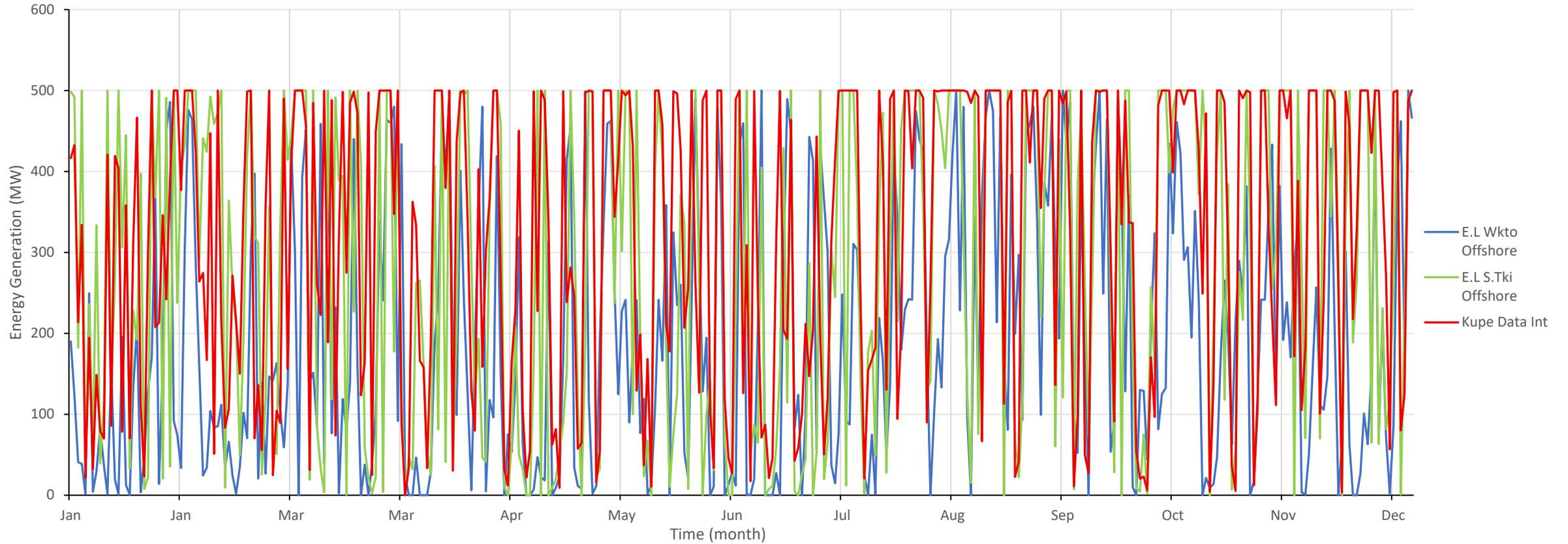


Estimated Energy Generation for Offshore Wind Farm

500MW OSWF: 2024 Gross Production Hindcast



Estimated Energy Generation for Offshore Wind Farm



Conclusions / Observations

All OSW scenarios showed reductions in price, moderate emissions reductions and an increase in storage by the end of the modelling period.

Summary of Results & Conclusions

- All OSW scenarios showed large reductions in price, moderate emissions reductions and an increase in storage by the end of the modelling period.
- Due to modelling limitations, there would likely have been different outcomes in the real world.
 - Spot prices would be expected to be higher, emissions and storage would be lower with the addition of OSW due to different thermal operations and offer prices.
- If a \$110 CfD had been in place, this arrangement would have 'broken even' from January through August.
- The CfD underwriter (NZ govt. in this case) would have been liable for between \$34 – \$77 million over the full year period, noting:
- Tiwai likely wouldn't have needed to curtail – the 330 GWh quoted would have been more than provided by OSW.
- Methanex likely wouldn't have sold 7 PJ of gas to two gentailers and the electricity price may not have been negatively affected by the excess thermal generation potential.
- Less coal would have likely been burnt due to security of supply – better for emissions
- Potentially fewer domestic industries would have curtailed production as there would have been less uncertainty around future electricity prices
- Lakes levels would have remained higher over the entire year – improved energy security.

Thank you

