WESTPOWER LTD PROPOSED WAITAHA HYDRO SCHEME

ASSESSMENT OF ENVIRONMENTAL EFFECTS

REGIONAL RESILIENCE AND NEW ZEALAND'S ELECTRICITY DEMAND AND SUPPLY SCENARIOS AND ELCTRICTY GENERATION INVESTMENT

Report prepared for Westpower Ltd

Report prepared by: Erik Westergaard

12 November 2024

Statement confirming compliance with the Environment Court's Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2023

As an expert witness or peer reviewer, I have read, and I am familiar with the Environment Court's Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2023.

I have prepared my, or provided input into, an assessment of effects for the Waitaha Hydro Scheme in compliance with the Code of Conduct and will continue to comply with it in this Fast-track Approvals Act process. In particular:

- my overriding duty is to assist the decision-maker impartially on matters within my expertise;
- unless I state otherwise, my assessment is within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express; and
- I have not, and will not behave as, an advocate for the Applicants.

Contents

Introduction and scope of report

1 Westpower Ltd (**Westpower**) proposes a run-of-the-river hydro-electric power scheme (the **Scheme**) for the Waitaha River, approximately 60km south of Hokitika[1] on the West Coast of the South Island, New Zealand.

2 The Scheme would be run-of-river with no instream storage (i.e. dam). The proposed Headworks include a low weir and intake structure situated at the top of Morgan Gorge that will divert water into a tunnel and pressurised desander. A pressurised tunnel will convey the diverted water down to a Power Station below Morgan Gorge. Having passed through the turbines the diverted water will be returned via tailrace discharging to the Waitaha mainstem in the vicinity of the confluence of Alpha Creek. The Scheme is to divert up to a proposed maximum of 23 cumecs, whilst maintaining a minimum residual flow of 3.5 cumecs immediately downstream of the intake. The abstraction reach would include approximately 2,500 metres of the Waitaha River, including Morgan Gorge. Construction access to the Headworks above Morgan Gorge would initially be via helicopter and / or on foot and then via an access tunnel (once completed), while an access road and transmission line corridor would be required from the Waitaha Valley Road to the Power Station Site to enable a connection to the existing network. As part of this work, the existing transmission corridor, extending from the State Highway to the southern part of Waitaha Road would also be upgraded.

3 Westpower has commissioned an independent expert opinion on the need for regional resilience in the electricity sector and the reality of the electricity demand / supply scenarios in New Zealand, and what New Zealand needs to do if we are to meet electricity targets. In this report, the report author (Erik Westergaard) discusses how proposed projects such as the Waitaha Scheme will assist in meeting these needs.

4 The report author is an energy industry and regulation specialist with the qualifications and experience relevant to this report provided in **Appendix A**.

5 The purpose of this report is to:

(a) discuss why it is critical that renewable electricity generation (**REG**) schemes such as the Waitaha proceed if we are to meet the Government's regional resilience goals, thus ensuring the impacts of climate change on electricity consumers is minimised.

(b) discuss the current and projected demand for electricity in New Zealand and the West Coast.

[1] Measured using local roads and tracks to the Power Station.

(c) explain the Government's commitments to decarbonisation of the New Zealand economy, and other energy sector objectives and the implications on projected energy demand.

(d) explain the role of REG in meeting those targets and objectives.

(e) discuss the existing supply base and the potential sources of new electricity in New Zealand and explain whether there will be sufficient capacity to meet the projected demand.

(f) discuss the significance of the energy supply shortfall and the importance of hydro generation, including the Scheme, in fulfilling this demand.

Waitaha Scheme’s role in providing resilience to the local power supply

6 Modern power systems face many threats and hazards, and modern economies rely increasingly on reliable and resilient power systems. The scope of these threats and hazards includes physical events such as windstorms, bushfires, earthquakes, sea level rise, and flooding, and man-made events like human error, physical attacks and cyber-attacks.

7 These events can and do have impacts a long distance from where they occur. This is certainly the case facing Westpower who are reliant on almost 550 kilometres of transmission to provide supply from Benmore. To put this into perspective, that is the same as having all of Auckland’s power supplied by stations in Wellington. Consequently, Westpower’s electricity supply is at risk from a failure at any point on the 550 kilometres of the transmission corridor.

8 Manifestation of any of these threats and hazards will have local impacts that vary depending on the local economy. Consequently, greater attention is being placed on how to increase the reliability of the power system.

Traits of distributed generation contributing to regional resilience

9 To evaluate the ability of generation to provide resilience to local power systems, the United States National Association of Regulatory Utility Commissioners (**NARUC**) identified the following several traits of distributed energy resources (**DERS**), most of which the Scheme meets:

> *“Dispatchability: Resilient DERs can respond to a disruption at any time with little to no advance warning.*
>
> *"Islanding Capability: Resilient DERs have the ability to isolate from the grid and serve load during a broader outage."*

Sitting at Critical Loads/Locations: Resilient DERs reside at critical loads or at critical points on the grid (e.g., areas of high residential density).

Fuel Security: Resilient DERs do not rely on the availability of a limited physical fuel to provide power.

Quick Ramping: Resilient DERs are capable of changing output quickly to match rapidly changing load.

Grid Services: Resilient DERs can provide voltage support, frequency response, and other grid services that contribute to stabilization during disruptions.

Decentralisation: Resilient DERs are sized and sited to support a load in the distribution system

Flexibility: Resilient DERs can be deployed quickly and at relatively low cost, when compared to centralized generation, transmission, and/or distribution, at locations and times where resources are needed."[2]

10 The Waitaha Scheme meets most of these attributes, although Dispatchability and Quick Ramping are only partial – the output can always be reduced. As a run-of-river station, the Scheme would normally operate at the maximum output that river conditions will allow, so cannot increase output. Sitting at Critical Loads/Locations does not apply, although it is in a critical location for supplying a remote region of New Zealand.

11 As a run-of-river hydro scheme embedded within the Westpower network, the Scheme is dispatchable by Westpower control room staff. It can operate islanded if the network is cut off from the transmission system. It is sited close to the largest single load on the network (Westland Milk Products) and the second largest centre of population (Hokitika).

12 As a run-of-river scheme, it has security of fuel supply. No known instance of the Waitaha River flow stopping has been recorded, and rather, due to the heavy rainfall and snow and ice melt the Waitaha River floods regularly throughout the year. Being a hydro generator, the Scheme is inherently able to decrease production extremely quickly. Being embedded in the distribution network, the Scheme is decentralised in accordance with the above definition. Further, subject to receiving all required approvals, the Waitaha Scheme will be operational quicker and at a lower cost than many large grid connected generation projects.

---

[2] https://pubs.naruc.org/pub/D3D1CE12-155D-0A36-3130-1E8E4E51F582

Providing resilience after an Alpine Fault earthquake

13 The West Coast is facing a high probability of a large earthquake on the Alpine Fault. When this occurs, it will almost certainly cause an extended period power outage. There may be multiple locations where damage to the transmission system is sustained along its 550km route into the West Coast.

14 Partial mitigation of this risk is currently provided by diesel generators. This will likely be inadequate due to limited fuel storage in the region. Providing additional fuel storage will not help as these may rupture and spill fuel, contaminating the ground and possibly waterways. As roads will likely be closed for an extended period, importing additional fuel into the region will be problematic. While shipping fuel supplies on barges or in small tankers may provide some relief, the absence of sheltered harbours may make this option difficult, especially if weather conditions are inclement for crossing sandbars at the river mouths. Further, transfer of fuel from ship to shore is fraught with risk ordinarily, without having to operate from severely damaged facilities.

15 In the absence of any experience with an event of this type, the prospect of the Scheme continuing to operate after the earthquake is unknown, but not inconceivable. It is entirely possible that it could be brought back into service relatively quickly if the transmission lines feeding it can be restored and there is no major damage to civil structures. While there can be no guarantees, a well-designed Waitaha run-of-river hydro scheme could continue to make a significant contribution to the provision of a limited power supply in the region and minimise the need for using diesel generation.

16 The power supplied by the Scheme will be essential in meeting the electricity requirements of critical facilities such as hospitals and other medical facilities, police and fire service stations, disaster relief coordination centres, emergency accommodation, and essential infrastructure such as water and wastewater treatment plants. Furthermore, it will also support the provision of a limited electricity supply to meet the basic requirements of consumers, excluding large commercial and industrial sites.

The value of local generation

17 The value of local generation was recently highlighted following the collapse of the Transpower transmission tower supplying the Northland Region in June 2024. In the report prepared by the

Electricity Authority, the cost to consumers in Northland was estimated at $37.5 million.[3] The report noted that estimates by other parties were much higher – up to $80 million.

18 The cost to the Northland Region could have been much worse. Even with a partial restoration of supply, without regional generation from Ngāwhā geothermal station, Lodestone Energy's Kohirā solar farm and diesel generators, the cost would have been much higher. The Electricity Authority estimated that local generation saved Northland consumers approximately $26 million.[4] This is the direct benefit of local generation over the period from when a limited power supply was initially restored, to full supply being restored nearly 75 hours later.

19 The value of local generation would have been even higher if it was able to operate in an islanded mode and operate when there was no transmission. As discussed above, the Waitaha Scheme can operate in an islanded mode.

20 Islanded generation refers to the ability of a generator to continue to operate when it is disconnected from the transmission grid. Islanded generation can continue to supply local consumers in a specific region without the need for connection to the transmission grid.

21 If there is a loss of transmission to Westpower's network – either full or partial – and customer load is curtailed, the Electricity Industry Participant Code (the **Code**) specifies a value of $20,000 MWh to that lost load (**VoLL**).[5] Based on prior research, and given the nature of industry connected to the Westpower network, the actual value of lost load on the Westpower network is likely to be significantly higher.[6]

22 A review of past transmission outages resulting in a loss of supply to consumers connected to Westpower's network at the Hokitika GXP, shows a total of 30 supply interruptions between 1999 and 2024.

23 Unfortunately, records of the energy lost is not available at this time. However, using average metered half hourly consumption data from the Electricity Authority's EMI website[7] for the same time period in the days immediately prior and following the loss of supply event, metered data allows a proxy of unserved energy to be calculated.

24 Over the past 10 years there have been 7 outages at Hokitika. An estimated 154.8 MWhs of unserved energy was caused by these outages and with VoLL at $20,000/MWh, the cost to consumers was approximately $3.1 million. The benefit of the Waitaha Scheme to consumers

---

[3] Electricity Authority Report Northland tower collapse 20 June 2024 (ea.govt.nz)

[4] Tower Collapse Report

[5] Electricity Industry Participation Code 2010 | Electricity Authority (ea.govt.nz), 4.1 Schedule 12.2 Grid reliability standards

[6] The author of this report has undertaken prior research into VoLL in NZ and internationally and has found values significantly higher than $20,000 for businesses similar to those that dominate load on the Westpower network. These values are confidential and commercially sensitive.

[7] Electricity Authority - EMI (market statistics and tools) (ea.govt.nz)

during a future transmission outage will be approximately $300,000 per hour based on the Scheme operating at the expected capacity factor. Obviously, this may be higher or lower depending on the actual output of the plant and the amount of load lost.

Government renewable electricity generation targets

25 In 2019, the Government passed the Climate Change Response (Zero Carbon) Amendment Act 2019 (**Zero Carbon Act**), committing New Zealand to several climate change targets. The key target is set out in at Part 1B Emission reduction, Subpart 1—2050 target. Section 5Q, of the Zero Carbon Act is to:

> *"…net accounting emissions of greenhouse gases in a calendar year, other than biogenic methane, are zero by the calendar year beginning on 1 January 2050 and for each subsequent calendar year;"*[8]

26 In terms of REG specific objectives, the Interim Climate Change Commission recommended to the Government that it should set a target of having 100% of New Zealand's electricity supply from REG by 2035. The then Government accepted this target but set an aspirational goal of reaching 100% REG by 2030. To deliver on this, the previous Government established several funding streams and other initiatives to support the achievement of this goal.

27 This included the State Sector Decarbonisation Fund and the Government Investment in Decarbonising Industry (**GIDI**) Fund. These provided funding for decarbonisation projects to the Government and private sectors respectively. They also established the Clean Car Discount Scheme which was aimed at helping to reduce light vehicle fleet emissions through offering rebates for zero and low emission vehicles. These funds were closed in 2023.

28 A change in government at the 2023 general election saw a change in focus. The current Government has adopted a supply-side approach to the issue. In its policy statement, the National Party announced that:

> *"National will unleash investment in new renewable energy generation, transmission, and local electricity lines by slashing red tape and speeding up the planning process. Electrify NZ will help double renewable generation to accelerate New Zealand's transition to a low-emissions, high-growth economy and get this country on track to achieve its climate change targets."*[9]

29 This policy position was set out in the Government Policy Statement to the Electricity Authority, under section 17 of the Electricity Industry Act 2010. The document noted that REG is expected

[8] Climate Change Response (Zero Carbon) Amendment Act 2019 No 61, Public Act Contents – New Zealand Legislation
[9] Electrify_NZ.pdf (nationbuilder.com)

to double. It made clear that the investment required must be *"efficient to deliver reliable supply at lowest possible cost to consumers."*[10]

30 In the press release for the publication of the Government Policy Statement on Electricity (October 2024), the Minister of Energy Simeon Brown commented:

> *"The GPS outlines our expectation that the Electricity Authority will drive a more competitive, fuel agnostic, electricity sector…This will shift demand from imported fuels towards domestically produced electricity,* ***and see more distributed electricity generation brought online to bolster regional resilience.***[11] *[Emphasis added]*

31 Development of the Waitaha Scheme is considered to be entirely consistent with the expectation expressed by the Minster on the release of the Government Policy Statement.

Electricity demand

32 In talking about the demand for electricity, care needs to be taken in distinguishing between peak demand measured in Megawatts (**MWs**) – the demand at a point in time (typically a half hour trading period or instantaneous in New Zealand) – and the energy consumed over a period and measured in Megawatt hours (**MWhs**). In this section both are discussed.

Current demand for energy

33 Recent demand for electricity in New Zealand has been flat for several years. **Figure 1** below provides details of annual electricity generation and renewable generation between 1997 – 2023, the period New Zealand's wholesale electricity market has been operating.

34 We have used electricity generation rather than electricity consumption to represent demand. This is because electricity losses in transporting energy from where it is produced to where it is consumed must be captured in analysis. Losses typically amount to approximately 7.2% of electricity generated in New Zealand, greater than that produced by the Benmore power station, the second largest renewable power station in New Zealand.

[10] Government Policy Statement on Electricity - October 2024.pdf (beehive.govt.nz)

[11] Government releases plan for affordable electricity | Beehive.govt.nz

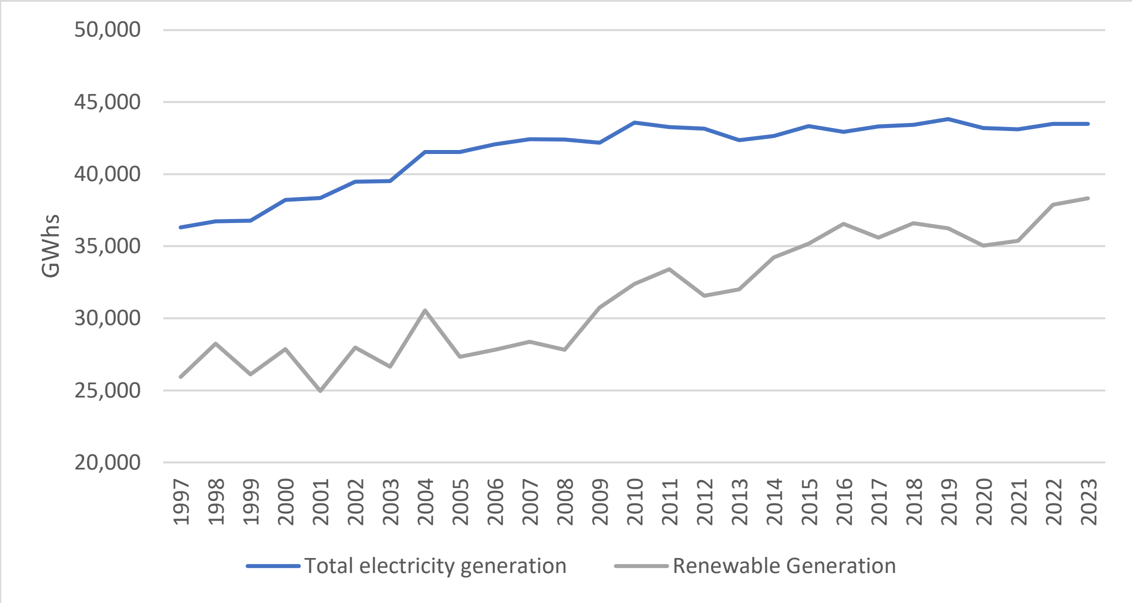

Figure 1 – Annual Electricity Production 1997 – 2023[12]

35 Average growth over the period is slightly below 0.5% per year. The proportion of generation from renewable sources ranges from a low of 65% in 2001, a year of low inflows to hydro lakes, to a maximum of 88% in 2023.

36 With the Government's policy goal of doubling New Zealand's renewable generation, this equates to an additional 38,000 GWhs of energy over and above the generation achieved in 2023.

37 Details of generation by fuel type are set out in **Figure 2** below.

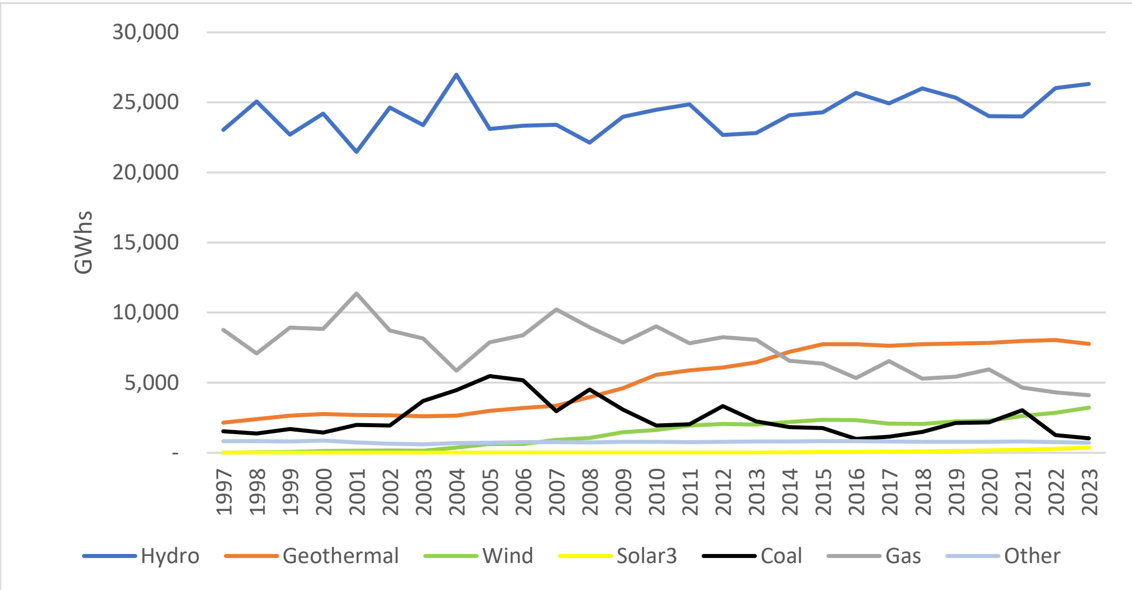

Figure 2 – Sources of generation by fuel type

12 electricity.xlsx (live.com)

38 **Figure 3** below shows the change in fuel mix further. The contribution of gas and coal has been declining steadily since 2008, with the peak contribution in 2001 at 34.8% of energy produced, dropping to 11.8% in 2023.

39 This has been offset by an increasing contribution to energy supply by geothermal, wind and solar. These sources reached a combined 25.6% of energy production in 2023. Their contribution will have increased further in 2024 with the commissioning of new geothermal, wind and solar generation.

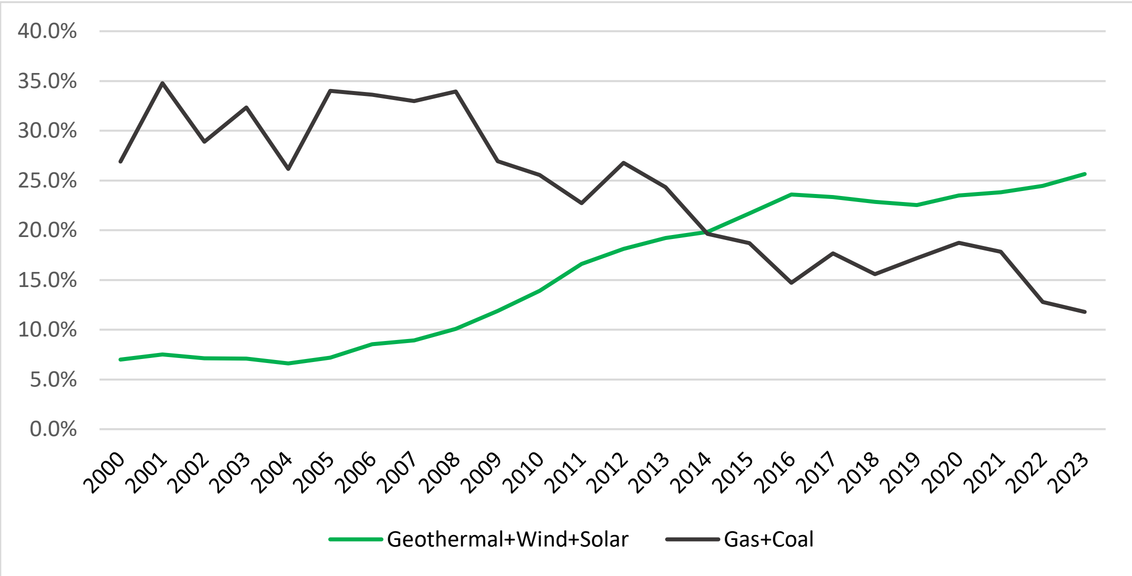

Figure 3 – Comparison of the contribution to energy requirements of gas+coal and geothermal+wind+solar[13]

Capacity requirement

40 Peak demand is a matter of growing importance as evidenced by the grid emergency declared on 9 August 2021. On that evening, there was not enough generating capacity to meet the demand for energy from customers (a new record) resulting in several thousand customers having their power disconnected. This shortfall arose in part because of the absence of key thermal generating units (fuelled by gas and coal) from the market, and the inherent variability of renewable energy – wind generation suddenly declined due to a lack of wind and a hydro plant could not operate because of blocked water intakes.

41 In addition to this grid emergency, there have also been 22 Customer Advisory Notices issued since May 2022 due to a shortage of generation being offered into the market – specifically less than 200 MW of residual generation.

[13] electricity.xlsx (live.com)

42 Peak demand has been relatively flat for an extended period. This changed in August 2021 with a then record peak of 7279 MWs, a figure subsequently exceeded on 2 August 2023 with a new peak of 7304 MWs. This is highlighted in **Figure 4** below.

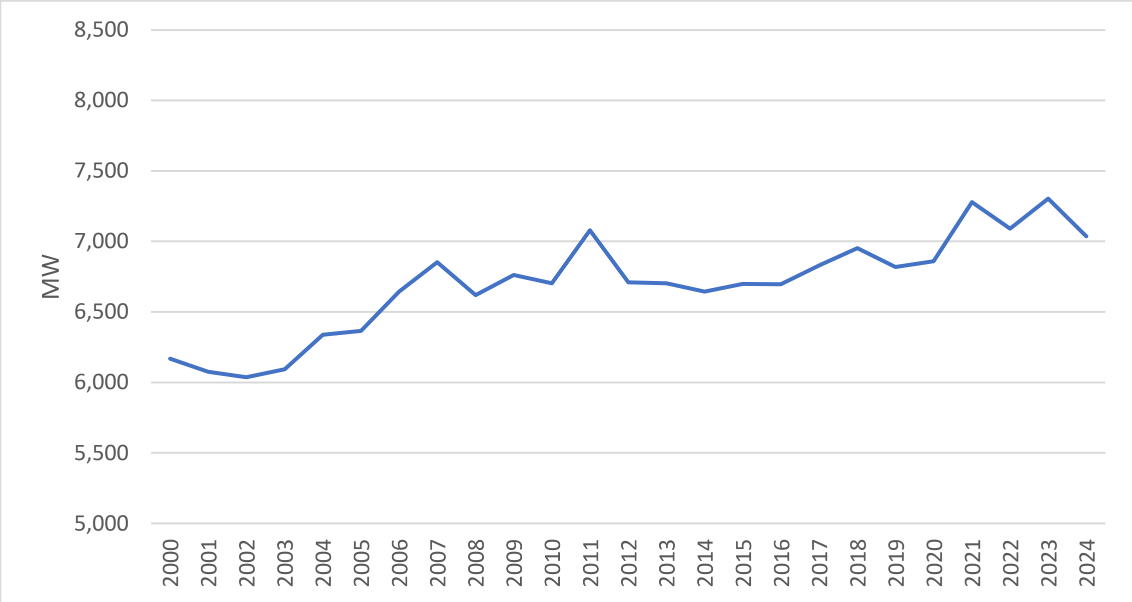

Figure 4 – Annual Peak demand 2000 - 2024[14]

43 It is interesting to note that in both 2021 and 2023, the peak recorded demand exceeded the highest forecast set out in Transpower's Net Zero Grid Pathways[15] document released in 2021. In 2021 by 308 MWs and by 92 MWs in 2023.

Forecast demand for electricity

44 Projected demand for electricity in New Zealand is a matter of considerable uncertainty. The two authoritative sources of electricity demand forecasts are provided by MBIE and Transpower.

45 MBIE prepares Electricity Demand and Generation Scenarios (**EDGS**) which sets out the possible electricity demand through to 2050, and the incremental generation needing to be built to meet this forecast demand. The purpose of the EDGS is to provide the Commerce Commission with independent information to allow it to consider major capital project applications by Transpower under the Transpower Capital Expenditure Input Methodologies. These are transmission expansion projects Transpower reasonably believes will be required to meet the future demand for electricity in New Zealand.

---

[14] *Transpower Annual Reports, New Zealand Energy Dashboard*

[15] Transpower_NZGP_Scenarios Update_Dec2021.pdf

46 The most recent version of the EDGS report was released in July 2024[16]. As this is the most recent demand forecast, we use these forecasts for the discussion below.

47 An alternative dataset is prepared by Transpower. In response to New Zealand's target to be net zero carbon by 2050, Transpower commenced a project - Net Zero Grid Pathways (**NZGP**). This project is based on the reasonable assumption that to achieve net zero status by 2050 significant electrification of the New Zealand economy will be required.

48 NZGP seeks to identify grid investments necessary to ensure that the transmission system is not a barrier to achievement of this goal. To identify these projects, the NZGP prepares load forecasts out to 2050 based on modified 2019 EDGS scenarios.

49 We compared the NZGP forecast with the 2024 EDGS to ensure that our selection of the 2024 EDGS was an appropriate choice. See **Figure 5** and **Figure 6** below.

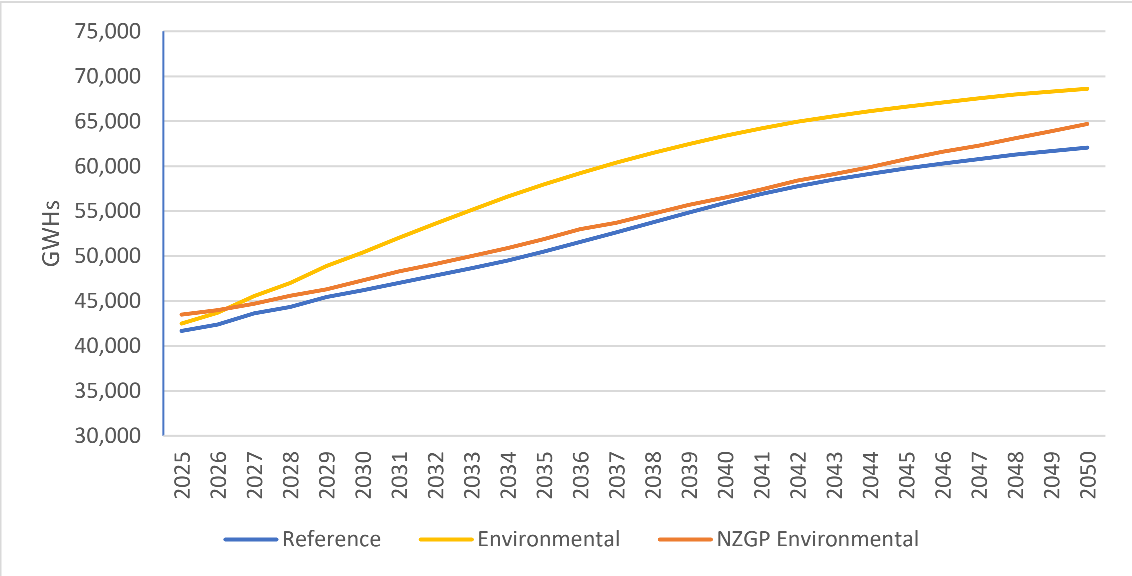

Figure 5 – Comparison of EDGS scenarios with NZGP Environmental Scenario (high growth) – energy production

50 Over the period 2025 – 2050, the difference in energy requirements between the two Environmental scenarios is approximately 120,000 GWhs. The maximum annual difference is in 2040 where the EDGS environmental scenario is 6881 GWhs higher than the comparable NZGP scenario. This is equivalent to 850 MW of baseload geothermal generation or 1960 MWs of onshore wind.

51 The maximum difference in annual capacity required is approximately 2000 MWs in 2050.

[16] Electricity Demand and Generation Scenarios: Results summary July 2024 (mbie.govt.nz)

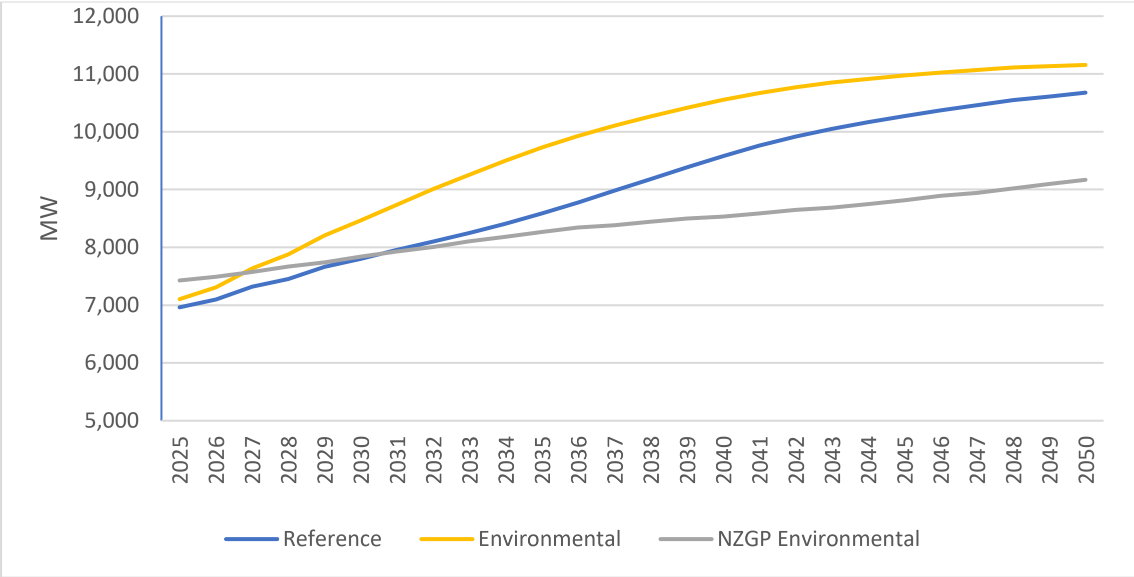

Figure 6 – Comparison of EDGS scenarios with NZGP Environmental Scenario (high growth) – maximum demand

52 Reinforcing our comfort with the choice of the EDGS scenarios is that the 2021 NZGP capacity forecasts were exceeded in both 2021 and 2023 by the actual maximum demand recorded.

Tiwai Point Smelter

53 The potential closure of the smelter from 2024 has hung over the electricity sector for several years and has been a suggested cause for a failure to build new generation capacity.

54 In July 2024, NZAS announced that they had reached agreement with Meridian Energy, Contact Energy, and Mercury NZ on terms for a new long-term contract for the supply of electricity to the Tiwai Point smelter. The term of this contract runs through to 2044.

55 The smelter consumes approximately 5,000 GWhs of energy annually (13% of New Zealand's current electricity demand) and 570 MWs of form capacity.

56 With the smelter remaining open, New Zealand requires additional generation equivalent to approximately 1,500 MWs of new wind generation – based on new wind generation plant operating a load factor of 40% over a scenario where the smelter closed. Alternatively, approximately 600 MWs of geothermal generation operating at 95% load factor is required.

57 We note that Transpower in the role of System Operator uses a load factor of 20% for wind when calculating the New Zealand Generation Balance (**NZGB**). The purpose of the NZGB is to:

"…NZGB forecasts whether there will be enough generation capacity to meet potential peak demand on the power system over the next 200 days. It also helps industry participants coordinate outages and assess the impact of their outages on potential generation balance."[17]

58 Using the NZGB load factor of 20%, a doubling of new wind capacity to 3,000 MWs would be required to ensure the ability to generate the energy necessary to supply the smelter under low wind conditions.

Sources of future load growth

59 When looking at future load forecasts, consideration also needs to be given to where and when load increases might occur. When considering decarbonisation of the New Zealand economy, three areas have special importance: process heat, transportation, and space heating/cooling. Although a fourth, the impact of datacentres and artificial intelligence on future load growth is also an area for future focus.

Process heat

60 Decarbonisation of process heat will see a switching from coal, natural gas, LPG, and diesel to either electricity, or because of the existing pipeline network, green hydrogen in the North Island. However, because of the energy lost in the production of green hydrogen from renewable energy, it is not obvious why this fuel would be taken up in the process heat sector, except for a small number of niche applications.

61 While some attention has been placed on biomass as an alternative fuel, it remains unclear whether sufficient resources are available to make a meaningful contribution to meeting energy demand.

62 Energy Efficiency and Conservation Authority's (**EECA**) Regional Heat Demand Database[18] provides detailed process heat data for New Zealand. They estimate that electrification of process heat will require an additional 5980 MWs of capacity and 28,140 GWhs of energy. The estimate for the West Coast Region is approximately 89 MW of capacity and 237 GWhs of energy.

63 Most of this West Coast process heat load relates to food processing, in particular in the dairy and meat processing industries. The predominant need for this new energy falls over the late

[17] Customer Portal - NZGB (transpower.co.nz)
[18] Regional Heat Demand Database | EECA

spring through the autumn processing period. The dairy sector alone, is estimated to require approximately 65 MW of process heat capacity.[19]

64 The EDGS make a range of assumptions about the rate and timing of fuel switching. The Environmental and Innovation scenarios assume earlier switching, which brings forward the need for new generation capacity. None of the EDGS scenarios assume 100% electrification, with the Environmental and Innovation scenarios only assuming a 50% switch for high temperature process heat and 95% switch for low temperature heat. [20]

Transportation

65 Regarding transportation, the primary source of load growth in the near term relates to electric vehicles. **Table 1** below summarises registrations of EVs over the period January 2019 to September 2024.

[19] Regional Heat Demand Database | EECA

[20] Electricity Demand and Generation Scenarios: Results summary July 2024 (mbie.govt.nz)

Import status	Vehicle type	Registrations
New	Bus	463
	Campervan	6
	Car	50606
	Motorcycle	2973
	Truck	209
	Utility	266
	Van	852
Total New		55,375
Used	Campervan	2
	Car	17805
	Motorcycle	32
	Truck	5
	Utility	1
	Van	334
Total Used		18,179
Grand Total		73,554

Table 1 – Electric Vehicle Registrations by type – 2019 - 2024[21]

[21] [Fleet statistics | Ministry of Transport]

66 Hidden within this data is the impact of EV rebates on buyer behaviour. In December 2023 immediately prior to the elimination of rebates, weekly EV purchases peaked at 1212 new cars being registered. Following elimination of the rebates in early January 2024, the number dropped to just 30.

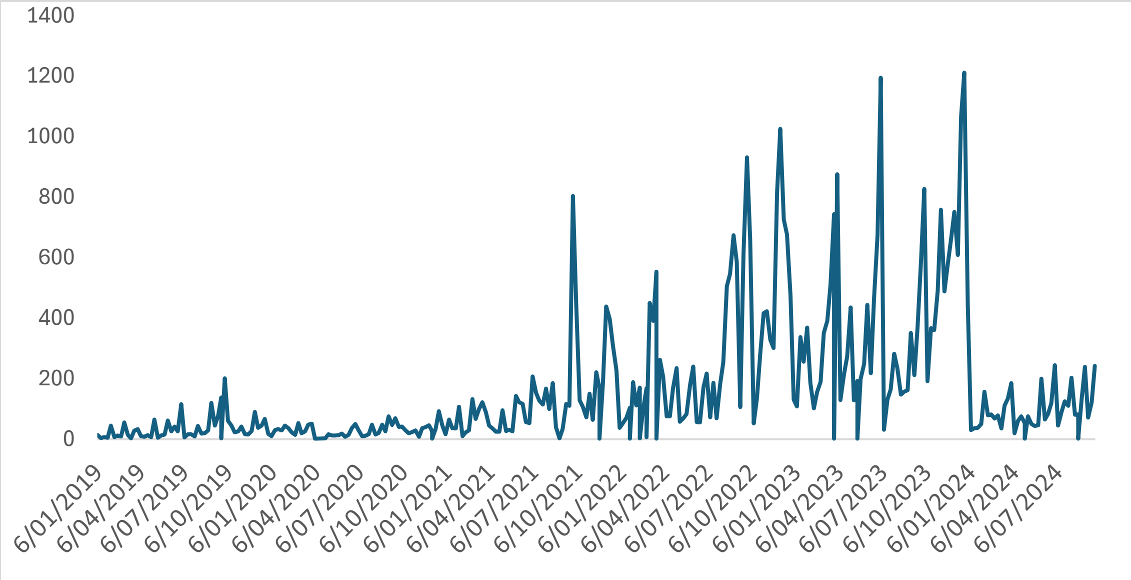

Figure 7 – Weekly New EV Registrations - cars

67 Load forecasts generally assume that in-home EV charger load growth will be accommodated within normal load growth. However, this assumption is based on the typical trickle charging rate of 1.8 kW, which is used by approximately 61% of electric vehicles in New Zealand.[22]

68 Since January 2021, approximately 200 MWs of home EV charging capacity has been added to distribution networks. With 72% of that new load coming from smart chargers, charging at 7.2 kWs or above.

69 As part of their policy announcements prior to the 2023 election, the Government announced that they would install 10,000 public EV chargers. As EV technology improves, so too does the ability for vehicles to utilise much higher charging rates. This is suggestive of more higher capacity chargers. Accordingly, the number of installed ultra-fast chargers rated at 150 kW and above is increasing.

70 When and where these will be installed is a matter of conjecture. However, assuming that all of these are installed, and they have an average capacity of 50 kW, this would add 500 MWs of potential demand to the power system. However, as they would not all be used at the same time, and their peak use is unlikely to coincide with the early evening peak demand periods,

[22] Electric Vehicle Charging Survey | EECA

their impact on peak demand is unlikely to be significant. Although, it may have an impact on certain regions such as holiday destinations during peak periods.

71 At present, Westpower has 425 kW of installed EV charging station capacity connected to their network.[23]

72 One concern with increasing penetration of home EV charging with higher capacity chargers, is when those chargers will be used. This is important because as the number of EVs increases, there is a risk that EV chargers may cause a secondary peak on the power system.

73 To test this, data was provided on a confidential basis by a party who monitors EV home charging use. The data shows that EV charging is very closely linked to retailer tariff structures. Owners of EVs respond to the price signal in their tariff and there is a very steep step up around 9:00pm as charging commences, with a gradual decline to approximately 7:00am.

74 This highlights the importance that the design of future retail and distribution pricing tariffs will play in electrification. While a supply-side response is required, careful attention will need to be paid to demand-side signals.

Space heating and cooling

75 A third area driving growth is electrical space heating and cooling. While there has already been widespread electrification through the adoption of heat pumps for space heating, there is significant potential for further uptake.

76 Globally, we are seeing increasing temperatures, including both maximum daily temperatures and minimum overnight temperatures. In countries with temperate climates like New Zealand, this has resulted in both an increased use of heat pumps for summer cooling and greater electrification with heat pumps replacing existing heating systems.

77 From a Westpower network context, initial heat pump uptake will largely replace solid fuels – wood and coal. No publicly available information is held on the number of heat pumps currently installed on the Westpower network or the age of solid fuel heaters which are potentially subject to replacement with heat pump technology. Therefore, it is difficult to forecast the potential load impact of replacement of solid fuel heating.

Datacentres and artificial intelligence

78 A new trend in load growth is the increasing demand for electricity from datacentres and artificial intelligence (**AI**). A recent report from Goldman Sachs indicates that demand in the

[23] Public EV Charger Dashboard | EECA

United States from AI comprised approximately 3% of total electricity use in 2022 and they are forecasting that this will increase to 8% in 2030.[24]

79 In Ireland, datacentres consumed 21% of electricity in the country in 2023, surpassing the consumption from all urban households in towns and cities in Ireland.[25] This was a 20% increase on the previous year.

80 The EDGS do allow for growth of datacentres and AI. They assume that by 2050, 583 MWs of capacity will be required to support the load requirement from datacentres and AI. This equates to 4.6% of load.

81 Should datacentre and AI load reach 15% of New Zealand's demand by 2050, this would require approximately 1870 MWs of generation or an additional 1290 MWs of firm capacity over the 583 MWs already assumed in the EDGS. If this is supplied by intermittent wind, at a 40% load factor a further 3225 MW of capacity would need to be built.

Westpower load forecast

82 Westpower has had an extended period of declining load, both energy and peak, although in the past year load has started to increase. The declining peak load is set out in **Figure 8** below.

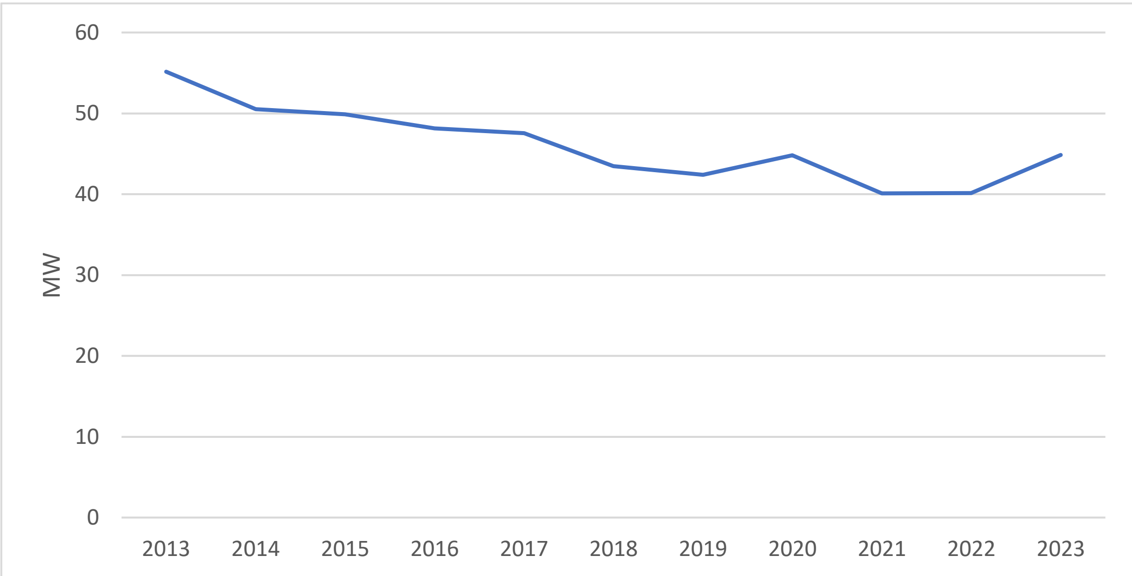

Figure 8 – Westpower peak demand 2013 – 2023[26]

83 For example, funding from the GIDI Fund (although now redundant) has already facilitated initial electrification of process heat on the Westpower network. ANZCO's Kokiri Processing Plant has

[24] Generational Growth AI, data centers and the coming US power demand surge (goldmansachs.com) (April 2024)
[25] Ireland's datacentres overtake electricity use of all urban homes combined | Ireland | The Guardian
[26] Data supplied by Westpower

installed a 1MW high temperature heat pump and a 1.5MW electric hot water boiler.[27] This investment replaces the existing coal boiler.

84 The GIDI fund has also helped Westland Milk Products initiate projects required in anticipation of decarbonisation. As noted below, Westland Milk Products is proposing to convert currently coal fired process heat to electrical load within the next 10 years.

85 New load from mining activity, decarbonisation and electrification at existing major load sites will cause both peak demand and the demand for energy to increase significantly. This is captured in the forecast peak load set out in **Figure 9** below.

86 What is uncertain however, is the timing for the replacement of Government owned facility coal boilers on the West Coast. Limited replacement of these boilers is assumed in the forecast load growth.

87 Given currently confirmed projects and underlying growth, an upturn in electricity demand is expected over the next ten-year period. This is set out in **Figure 9** below.

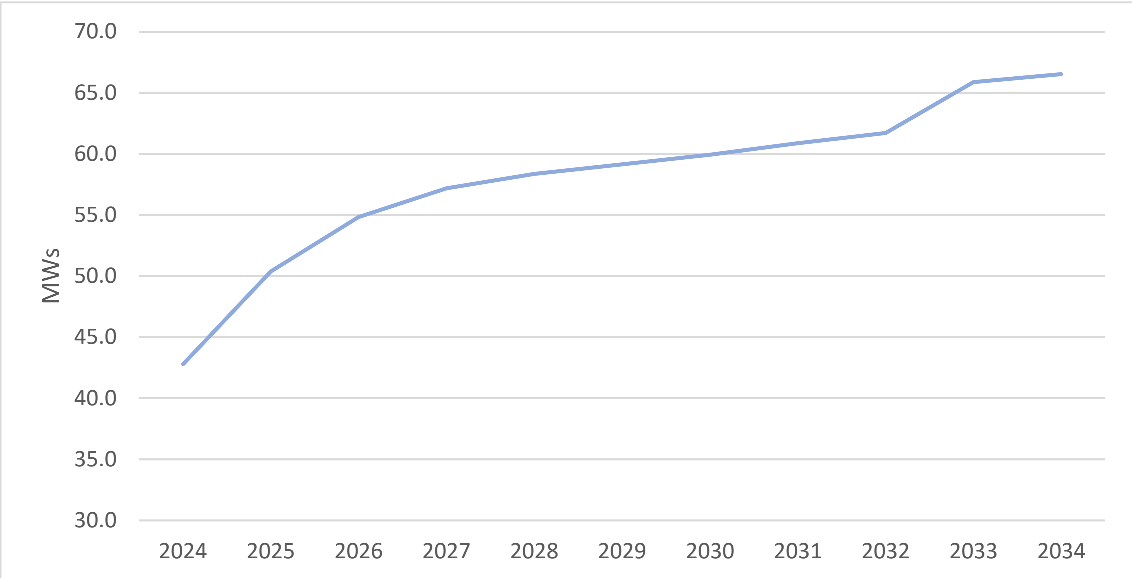

Figure 9 – Westpower Forecast Peak Load 2024 - 2034[28]

88 Peak load is forecast to grow by 15 percent in 2025. The majority of this comes from new load (6 MW) at the Federation Mining - Snowy River goldmine near Reefton. Additional load (1.6 MW) will also come from a new lactoferrin plant at Westland Milk Products in Hokitika. In 2026, new load will come from electrification of process heat and a proposed new mineral sand mine. Further mineral sand development at Barrytown is slated for 2027.

[27] Approved GIDI projects | EECA

[28] Source – Westpower supplied

89 In 2033, there is a forecast jump in load arising from Westland Milk Products converting a boiler from coal as part of the plant's decarbonisation project. The timing of this is uncertain and may be brought forward.

90 In total, Westpower is forecasting a 55% increase in peak demand on their network over the next 10 years. This is an increase of 23.7 MW, slightly greater than the 23 MW maximum capacity of the Waitaha Scheme.

Generation to meet forecast load

91 New Zealand is heavily dependent on the production of electricity from hydro-electric power stations. This generation requires a regular supply of fuel – water either from inflows or stored water in lakes. As shown in **Figure 10** there is also a growing proportion of generation provided by both geothermal and wind resources.

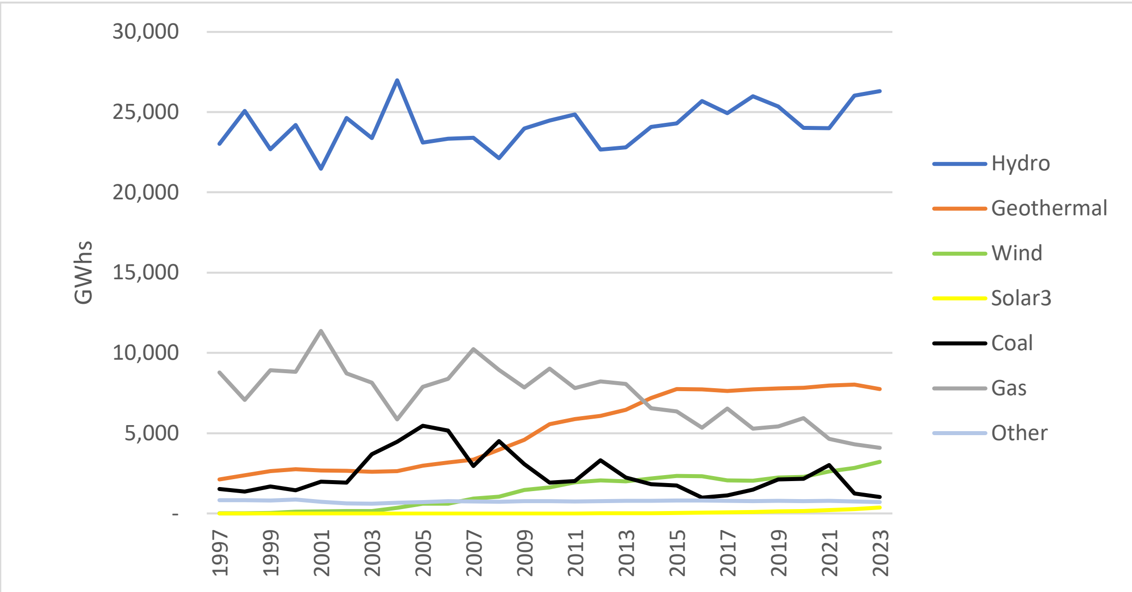

Figure 10 – Generation by plant type – 1997 - 2023[29]

92 Under normal conditions, the New Zealand electricity market is considered to be energy constrained. That means that, over time, there may not be enough energy to meet demand. This manifests from time-to-time in what are referred to as dry years, or years in which there are extended periods when water flows are insufficient to maintain storage levels in hydro lakes. The current year, 2024, is a prime example of this.

93 Annual hydro generation in these years declines and is replaced with increased coal and/or gas generation.

---

[29] Electricity statistics | Ministry of Business, Innovation & Employment (mbie.govt.nz)

Generation plant closures

94 If the target was 100% renewable generation, a significant number of plants would have to close, and significant investment in new replacement generation would be critical.

95 Starting with the replacement of existing thermal generation plant, 2,160 MWs of generation could be decommissioned. This total may be reduced if 241 MWs of co-generation remains operational to provide process heat or converts to an alternative such as biomass (woodchips). Details of plants facing closure are set out in **Appendix B**.

96 The thermal closures most likely to occur soon, are Contact Energy's (**Contact**) Taranaki Combined Cycle (**TCC**) plant and one of Genesis Energy's (**Genesis**) Huntly Rankine units.

97 Contact initially indicated that TCC would close at the end of 2024. However, with the need for TCC over the 2024 winter, Contact have confirmed that it will be recallable on a five-day notice period through 2025 to support Contact's Stratford Peaker Units in the event of an unplanned outage and provide further backup to thermal units in the market. In their announcement, Contact indicated that the plant had approximately 3000 hours of additional running, following completion of a technical assessment of the safe continuing operation of the plant.[30]

98 The closure of one of the three Rankine units is also possible. However, Genesis has announced that[31] *"in response to the market conditions during winter 2024 … Genesis Energy, Mercury, Meridian, and Contact have entered into a non-binding heads of agreement to investigate the potential for Huntly Power Station Rankine Units."* Genesis further indicated that the term of any agreement could be for upwards of 10 years.

99 Compounding the thermal plant retirement issue is the future availability of natural gas. Over the years, there have been many instances of parties proclaiming that there has been a shortage of gas. In general, the key gas fields have performed in accordance with operator forecasts. But, to achieve this, operators have had to invest in additional drilling programs to offset a decline in production.

100 However, since 2018, there has been a more persistent decline in production. Unless this decline can be turned around, contract volumes of gas necessary to fuel thermal stations may not be available or may not be available at prices that justify continued operation of some generation plants.

101 This problem has been made clear in 2024, where a gas shortage contributed to very high spot electricity prices and led to a significant shutdown of industrial gas use, notably at the Methanex plant.

---

[30] https://contact.co.nz/-/media/contact/mediacentre/2024/contact-to-keep-tcc-available-in-2025.ashx?la=en

[31] Exploring options for Huntly Power Station to support energy security | Genesis NZ

102 It is also probable that some older wind and geothermal plants may close before 2030. Although, assuming the existing activities are re-consented, any closed plant will likely be replaced with the modern equivalent plant at the same site.

103 This has materialised with New Zealand Windfarms and Meridian Energy forming a 50-50 joint venture to repower the Te Rere Hau windfarm. Repowering with modern wind turbines will increase the site's current capacity of 45 MW to a proposed capacity of 170 MW.[32]

What new plant will be built?

104 Decisions to build new generation in New Zealand will be a commercial decision for investors. It can be expected that the plants built will have the lowest levelized cost of energy (**LCOE**).

105 LCOE provides the present value of energy from a generation project. It is a measure of the lifetime cost of the project divided by its energy production. It provides a simple manner to compare different generation technologies (wind, solar, hydro etc). These technologies have different capital and operating costs, different expected lives, different capacity factors, and different costs of capital for their investors.

106 The International Renewable Energy Agency (**IRENA**) publishes annual data on the LCOE for commissioned plant and the expected capacity factor for that technology.[33] The most recent data for 2022 is set out below. Average capacity factors for New Zealand plant for 2023[34] are also shown.

107 The IRENA report also notes that the average LCOE for all solar and onshore projects is below the cost of the cheapest fossil fuel generation option. The average LCOE of solar was 29% lower and onshore wind was 52% lower.[35]

[32] NZ Windfarms eyes two new wind developments | Energy News

[33] Renewable Power Generation Costs in 2022 (irena.org); August 2023

[34] Electricity statistics | Ministry of Business, Innovation & Employment electricity.xlsx (live.com)

[35] Renewable Power Generation Costs in 2022

Plant Type	Average LCOE $/MWh[36]	Average Capacity Factor	NZ Generation Plant Capacity Factor[37]
Hydro	$98	46%	55%
Onshore Wind	$53	37%	37%
Offshore Wind	$129	42%	
Solar	$78	16%	13%
Geothermal	$90	83%	84%

Table 2 – IRENA - Levelized Cost of Energy for Renewable Generation

108 The IRENA report, quoted above, provides a 2021 LCOE for New Zealand onshore wind of $55/MWh.

109 By way of reference, the Amethyst Hydro LCOE at the time of construction was $63 per MWh and the Waitaha Scheme is currently conservatively estimated to be about $110 per MWh, although this will drop to a LCOE of approximately $94/MWh if its capacity factor, once commissioned is similar to the 78% of Amethyst.

110 Based on these LCOE figures, it would be expected that New Zealand will continue to see investment in onshore wind and solar, with investment in geothermal continuing to provide baseload generation.

111 The Electricity Authority has published a Generation Investment Dashboard that provides information on new generation projects proposed for New Zealand - see **Table 3** below. Committed projects are those where an unconditional final investment decision has been made. Actively pursued projects are those where a site has been identified and the developer has started actively considering at least one of: finance, connection, consents, etc.[38]

[36] Dollar figures are NZ$ converted from US$ at average exchange rate 2022 – 2024: NZ$1 = US$0.6239

[37] Electricity Statistics

[38] New Zealand progressing at pace towards a highly renewable electric future | Electricity Authority

Generation Type	Committed (MW)	Actively Pursued (MW	Other (MW)	Total (MW)
Hydro	30	64	0	94
Geothermal	147	267	85	499
Solar PV	872	7,377	1,097	9,346
Onshore Wind	155	2,603	1,305	4,063
Offshore Wind	0	6,270	3,125	9,395
Gas Peaker	0	0	350	350
Battery Storage	235	200	1000	1435
Total	1439	16,781	6,962	25,182

Table 3 – MW of Proposed Generation

How much capacity will there be in 2030?

112 While the Generation Investment Dashboard provides a useful summary of proposed projects, it also highlights a problem with the development of new generation projects, specifically the need for the delivery of projects.

113 Of the projects listed in the generation investment dashboard, 515 MWs of new capacity were scheduled for 2024 as the earliest commissioning year – 16 projects. To date, only two projects totalling 208 MWs of capacity have been commissioned in 2024.

114 A further 362 MWs (8 projects) of generation is committed and has 2025 as the earliest commissioning year. These projects are almost exclusively from solar sources (95%). Furthermore, a further 2540 MWs (27 projects) of capacity are either actively being pursued or have been announced. For 2026, only 3% of the capacity for proposed projects has been committed.

115 While details of the progress for projects with an expected 2025 completion and being actively pursued is not available, it is unlikely that all of these will be commissioned before 2026. Similarly, there must be a degree of caution in respect of the number of projects likely to achieve 2026 commissioning, given almost all of them are still in the actively pursued phase.

116 In addition to new generation, 1435 MWs of battery storage is also proposed – 235 MW committed, 200 MW being actively pursued, and 1000 MW in other. Given the contribution solar and onshore wind can reliably contribute to meeting peak demand, this battery storage will play a key role in meeting future peak demand periods.

117 Further compounding the capacity situation is that much of the proposed new capacity is either solar or onshore wind. New Zealand remains a winter peaking power system,[39] with the peak demand almost exclusively falling in the evening peak period between 6:00 – 7:30pm. This means that the contribution that committed solar might make to meeting peak demand is likely zero.

118 In preparing the NZGB, the System Operator discounts expected onshore wind capacity to 20% of rated capacity. Accordingly, we believe it is appropriate to use this figure when assessing available capacity in the future.

119 Removing new solar and discounting onshore wind from the committed project capacity, provides the following estimates of the capacity requirement out to 2030.

EDGS Scenario	Forecast Capacity Increase (MW)	Thermal Plant Closure (MW)[40]	Committed Capacity (MW)[41]	Capacity Shortfall (MW)
Base Case	764	630	443.4	-950.6
Innovation	1666	630	443.4	-1852.6
Environmental	1429	630	443.4	-1615.6

Table 4 – EDGS New Generation Capacity Requirement to 2030 – Committed projects (MWs)

120 As **Table 4** above shows, there is potential for a significant capacity shortfall when committed projects are mapped to EDGS scenarios. This table also assumes that all committed projects get commissioned and on time. While we assume that some existing thermal capacity is retired, even if the plant remained online, there would still be a substantial capacity shortfall.

121 If datacentre and AI load growth occurs faster than that assumed in the EDGS, another 400 MWs might need to be added to this shortfall in 2030 if datacentres and AI reached 5% of load.

122 To address this shortfall, we also consider the situation where actively pursued generation projects are brought online by 2030.

[39] We do note that EDBs in some regions are summer peaking – typically due to high irrigation loads.
[40] TCC and one Huntly Rankine unit.
[41] Includes BESS

EDGS Scenario	Forecast Capacity Increase (MW)	Thermal Plant Closures (MW)	Committed + Actively Pursued (MW)	Capacity Shortfall (MW)
Base Case	764	630	1472	78
Innovation	1666	630	1472	-824
Environmental	1429	630	1472	-587

Table 5 - EDGS New Generation Capacity Requirement to 2030 – Committed and Actively Pursued projects (MWs)

123 In **Table 5** above, we once again ignored solar and discount onshore wind to 20% of rated capacity. In addition, we also ignored offshore wind projects. We did this because the timetable for the construction of offshore wind is typically estimated at 7 – 11 years. This puts the earliest commissioning of offshore wind outside the period covered. Another reason for not considering offshore wind is that there is currently no capacity in New Zealand to support development of this type of project.

124 Given the constraints that exist in delivering infrastructure projects in New Zealand and globally, there remains a real risk that the capacity shortfall cannot be addressed in time. This means that either security of supply is put at risk or some of the existing thermal plants will need to remain operating at higher capacity factors than those recently observed, beyond 2030.

Will there be enough energy in 2030?

125 Using the same Generation Investment Dashboard and the EDGS datasets, we can also assess whether sufficient new generation will be built in time to meet the increasing demand for energy (GWhs) in 2030. But, as discussed in earlier sections of this report, there remain some caveats on the amount of energy required in the future.

126 Based on projected Committed and Actively Pursued generation projects, there appears to be sufficient investment in the pipeline to meet forecast energy requirements in the EDGS.

Innovation Scenario.

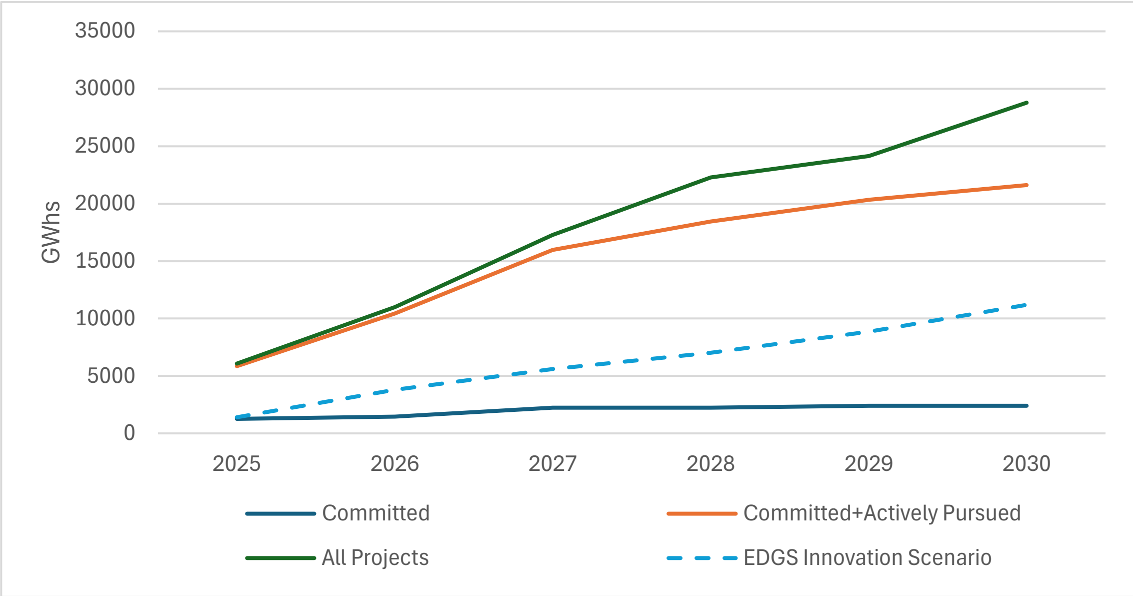

Figure 11 – Projected incremental energy to 2030

127 However, this assumes all currently Actively Pursued projects getting constructed within their currently estimated commission timeframe. History suggests that some of these projects may be delayed or not progressed at all.

128 The earlier projects can be moved from Actively Pursued to Committed (and under construction), the more confidence stakeholders can have that the energy risk is reduced. This increase in energy may also reduce the "dry year" problem New Zealand faces in years such as 2024.

Waitaha Scheme role in providing cheaper electricity for Westpower region consumers

129 The New Zealand wholesale electricity market creates the price at each location at which wholesale electricity is produced and consumed. There are about 280 of these locations across New Zealand. The pricing model optimises the dispatch of generation so that price and transmission losses are minimised. Simultaneously, several security aspects are considered, such as ensuring there is sufficient generation reserve, and optimising its supply. The development of prices at each location is referred to as nodal pricing.

130 Nodal pricing works such that the price at one of the 280 different locations represents both:

(a) the marginal cost of energy supply (based on generator price-quantity offers); and

(b) the marginal cost of transmission to the location of supply.

131 In this context, the marginal cost of transmission at a location refers to the additional losses that are incurred by supplying the extra demand at the location. Since losses are, in simple terms,

related to the square of the power flowing on the line, and the length and size of the line, then marginal losses are proportional to the length of the line and the power flow along it.[42] Put simply, the longer the transmission line, and the more power that flows along it, the higher the price will be at the end of it.

Transmission losses

132 In the previous sub-section, I discussed the relationship between transmission losses and nodal electricity prices, showing that prices increase relative to distance of transmission with increasing transmission losses. In this section, the energy savings that would result from reduced transmission losses by locating new generation facilities in the West Coast Region are discussed.

133 Higher transmission losses are experienced for electricity transmitted into the West Coast Region. Analysis based on average location factors (explained below) indicate that, for electricity transmitted into the West Coast Region, marginal transmission losses of approximately 11.4% have been recorded since the electricity market was formed. High electricity prices on the Westpower network reflect those high transmission losses.

134 If the Waitaha Scheme is constructed, there will be a decrease in transmission losses for the West Coast Region and across the whole upper South Island. Evidence of this is provided by the reduction in location factors following the commissioning of the Amethyst power station by Westpower in 2013.

135 Location factors prior to the Amethyst commissioning averaged 1.142, but they have dropped to 1.092 since it started operating. This represents a significant reduction in location factors and a further significant drop can be expected following commissioning of the Waitaha Scheme.

Westpower region nodal prices

136 The increase in losses with line length and power flow identified above is highly relevant in the case of the Westpower region and the upper South Island in general, since the transmission system to these locations is long and there is very little generation in these regions. The combination of the long transmission system, little generation in the regions, and increasing electricity demand, leads to higher prices which, in the absence of any significant new local generation capacity, will increase over time.

137 The West Coast region typically has some of the highest spot electricity prices in New Zealand. This flows through to high retail electricity prices, paid by consumers. These higher prices make

[42] This is a highly simplified analysis that does not consider the complexities of AC power flow. However, it is directly analogous to the New Zealand market pricing model and my intention is to illustrate the relationship between line length, power flow, and losses, and therefore price.

it a prime area for generation investment when there is a suitable fuel source. This will be particularly so in the case of Waitaha Scheme, which will run almost continuously when there are sufficient inflows into its catchment.

138 Locating generation in the West Coast Region will serve to lower the wholesale spot price on the Westpower network and should result in lower retail prices. Lowering of the wholesale spot price should have a beneficial effect on industry and consumers in the region. Importantly, lower prices may encourage greater electrification in the region, reducing CO_2 emissions.

Summary of benefits of the Waitaha Scheme

139 The Scheme is expected to provide a range of significant regional benefits for the West Coast and New Zealand more broadly. These benefits include:

(a) Resilience benefits

(b) Electricity markets benefits

(c) Climate change benefits

Resilience benefits

140 The Waitaha Scheme meets most of the attributes set by NARUC to determine the ability of distributed energy resources to provide resilience to local power systems. It fully meets most, but only partially meets dispatchability and ramping requirements owing to it being a run-of-river generator.

141 In the event of a natural disaster causing a loss of supply to the West Coast, the Scheme can make a significant contribution to the provision of a limited power supply in the region. This power supply will be essential in meeting the electricity requirement of critical facilities such as hospitals and other medical facilities, police and fire service stations, disaster relief coordination centres, emergency accommodation, and essential infrastructure such as water and wastewater treatment plants.

142 In the event of a transmission outage resulting in loss of load on the Westpower network, the Waitaha Scheme will provide a significant economic benefit to local consumers. The actual economic benefit, based on the VoLL set out in the Code, will depend on available water. Given an expected capacity factor of 67%, the value is estimated to be in the order of $300,000 per hour.

Electricity market benefits

143 The Scheme is proposed as a 23 MW run-of-river scheme. It is expected to generate between 120 and 140 GWhs of energy, based on a conservatively estimated average capacity factor of

approximately 67%. This contrasts with the near to 80% capacity factor of Westpower's Amethyst power scheme[43],which is also run of river, over its first ten years of operation.

144 The New Zealand electricity market requires generators to make price quantity offers to the System Operator. This allows the System Operator to create a merit order of generation which ranks generators by their offers, allowing the dispatch of the lowest cost generation to meet demand. Much of the generation in New Zealand has a zero-offer price ($0/MWh) or close to it. This reflects the fact that they provide renewable generation that must be produced or lost – either because it cannot be stored, or in the case of hydro generation, minimum water flows must be maintained.

145 As the Scheme is a run-of-river plant, it will typically be offered into the market at $0/MWh. As a result, it will be dispatched ahead of more expensive generation which, in the current market is either thermal generation or hydro generation with storage. If thermal generation is displaced, CO_2 emissions will be reduced. If hydro is displaced, energy security is improved because hydro storage increases. And as hydro storage increases, hydro generation will eventually displace thermal generation as the value of water in storage will in due course fall below the cost of thermal generation.

146 Because the Scheme will operate ahead of more expensive generation, it will, along with other new renewables, contribute to a reduction in spot electricity prices.

147 Located on the West Coast, weather patterns affecting inflows differ from those faced by the Waitaki River system, the primary location of hydro storage in New Zealand. Prior work done for West Coast hydro projects has identified that the generation from a scheme such as Waitaha will be average or above average in years when inflows and production on the Waitaki River are lower.

Climate change benefits

148 There are two potential climate change benefits arising from construction of the Waitaha Scheme. The key benefit is that it will help displace thermal generation in New Zealand – which was approximately 5,000 GWhs in 2023.The Genesis Energy Huntly plants emit approximately one tonne of CO_2 for each MWh of electricity produced.[44]Assuming Waitaha Scheme's production of 130 GWhs (130,000 MWhs) displaces thermal generation, this is equivalent to a reduction in CO_2 emissions of 130,000 tonnes from electricity production annually. This is comparable to removing approximately 69,500 internal combustion cars from NZ roads.

---

[43] Communication from Westpower

[44] Calculated based on publicly available information in the Genesis Energy Annual Report and Electricity Authority statistics.

149 As electricity generation using fossil fuel is captured by the New Zealand Emission Trading Scheme, at a NZU CO_2 price of $60/tonne, this is equivalent to a benefit of $7.8 million per annum to electricity consumers. However, given the complexity of wholesale electricity market pricing, the actual benefit may be less. This occurs because increasing intermittent renewables may increase price volatility, negating some of the benefits of reducing thermal generation.

150 The second benefit is that because the Waitaha Scheme reduces the price differential between the Benmore generation hub and the West Coast, and improves regional security of supply, it may encourage greater electrification in the region. This may be from the greater uptake of electric vehicles, an increase in the use of electricity for space heating, or greater and quicker electrification of process heat. These will lead to further reductions in CO_2 emissions.

Erik Westergaard

23 May 2025

APPENDIX A: Qualifications and experience

My name is Erik Cameron Westergaard. I am an independent consulting regulatory economist and electricity market expert.

I am currently a Board member of the Electricity Authority, Te Mana Hiko, appointed in January 2023 for a five-year term.

I graduated with a Bachelor of Commerce (Honours) Degree with majors in Accounting and Economics from Otago University.

I have more than thirty years' experience working in the electricity industry as both an employee of companies operating in the industry and as a management consultant providing services to governments, regulators, and corporations advising in many countries including Australia, Canada, Malaysia, New Zealand, South Africa, and the United States.

My relevant work experience includes:

(a) Preparing Energy Policy for Governments.

(b) Assisting with the design and operation of electricity markets.

(c) Addressing short-term and long-term issues impacting on security and reliability of supply.

(d) Developing financial transmission rights to manage risk associated with transmission congestion.

(e) Assisting utility companies assess and develop mitigation strategies for the risks facing their business.

(f) Investigating the potential for run-of-river hydro developments for international and New Zealand domiciled generation firms.

116. Recent projects include:

(a) Representing the Authority Board, member of the team investigating the 20 June 2024 Transmission tower collapse. The investigation was requested by the Minister of Energy under section 18 of the Electricity Industry Act 2010.

(b) Acting as the technical expert on a review commissioned by the Minister of Energy and Resources to investigate the causes of power supply interruptions on the evening of 9 August 2021, to identify and recommend improvements to ensure similar circumstances are better managed in future.

(c) Supporting a New Zealand distribution business evaluate options to meet rapidly growing electricity growth arising in large part from electrification of process heat on their network.

This project evaluated a range of options including both distributed generation and transmission solutions.

(d) Undertaking a project to calculate the value of lost load faced by customers of a New Zealand distribution business following power outages. The results of the project will support further investment in the network and generation options embedded in the local distribution network to minimise the need for customers to use diesel generation to meet electricity requirements following outages.

(e) Undertaking an investigation into options for reducing carbon emissions associated with the commissioning of new ferries for KiwiRail. The project demonstrated that partial electrification of ferries through the adoption of battery storage was a viable but not a complete solution.

APPENDIX B: Thermal plant closures to meet 100% renewables[45]

Plant	Location	Capacity (MW)
Auckland Hospital	Auckland (Waitemata)	3.6
Bream Bay	Northland	9
Edgecumbe	BoP	10
Huntly (3 units)	Waikato	750
Huntly 5 - E3P	Waikato	400
Huntly 6	Waikato	50
Junction Road	Taranaki	100
Kapuni	South Taranaki	25
Kawerau (TPP)	BoP	37
Kinleith	South Waikato	40
Mangahewa	New Plymouth	9
McKee (recip)	New Plymouth	2
McKee (turbine)	New Plymouth	100
QE2 Park	Christchurch	4
Stratford CC	Taranaki	385
Stratford peaker	Taranaki	200
Te Rapa	Waikato	44
Wellington Hospital	Wellington	8
Whareroa	South Taranaki	69.6
Whirinaki	Hawkes Bay	155
Total Thermal Capacity		2401
Co-generation plant		241

[45] List of power stations in New Zealand - Wikipedia