TRANSPOWER

Northpower

TOP ENERGY
TePuna Hihiko

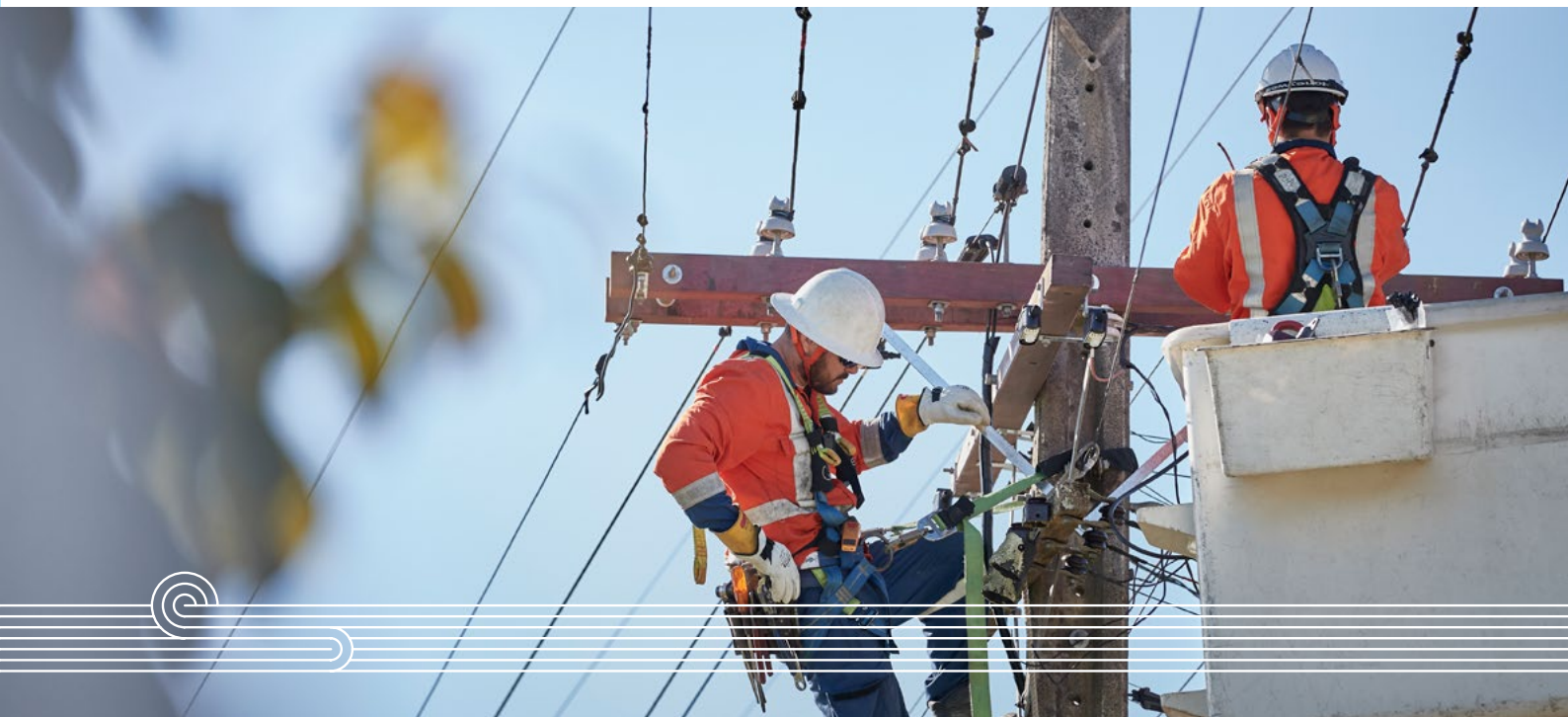
Renewable Energy Zones

Northland Pilot Concept

2022

Are Renewable Energy Zones right for Northland?

Contents



1.0 Purpose of this consultation document

1.1 We are seeking your feedback

Transpower, Northpower and Top Energy are working together to investigate the potential of a pilot Renewable Energy Zone (REZ) in the Northland region. This investigation is part of Transpower's national consultation programme for REZs in New Zealand.

This consultation document provides an overview of our initial work and seeks your feedback on a Northland pilot REZ.

It should be read alongside Transpower's *Renewable Energy Zones National Consultation 2022*, which gives further information about, and seeks feedback on, REZs in the wider New Zealand context.

Context

High demand from developers to build more renewable generation to connect to the electricity network currently outstrips available network capacity in the Northland region. Large volumes of renewable generation could be enabled if investment was made in the electricity networks in the region, such as upgrading existing assets.

While we have a preliminary view of the work that could be required, the types of network upgrades and investment needed will depend on the feedback gained during this consultation and any subsequent Expression of Interest (EOI) and Request for Tender (RFT) phases.

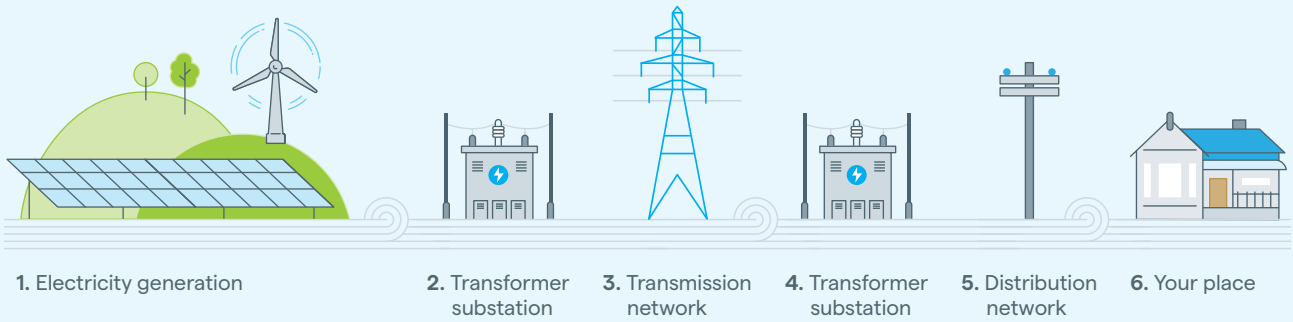


Figure 1: Illustration of electricity network infrastructure

Electricity transmission and distribution

In New Zealand, there are two types of electricity networks that play a role in transporting electricity from where it is generated to where it is used.

The transmission network, also known as the national grid, is owned and operated by Transpower. The national grid is a high voltage network (up to 220,000 volts) that transmits electricity over 12,000 kilometres of transmission lines and through 170 substations around New Zealand.

From local substations, distribution companies — like Top Energy and Northpower — bring the power across their networks directly to their customers' property boundaries. Some generation can connect directly and feed electricity into the distribution network.

Figure 2 shows the areas that Top Energy and Northpower service and the high voltage lines owned by Transpower, Top Energy and Northpower.

Figure 2: Transmission and distribution network ownership in Northland

1.2 What is a Renewable Energy Zone?

A Renewable Energy Zone (REZ) is a location of investment at the edges of an interconnected electricity network to enable renewable electricity to power more homes, communities and businesses.

In a REZ, multiple generators or major electricity users agree together to co-locate in an area to enable cost-effective investments in electricity infrastructure. The investment cost is recovered from these generators and/or large electricity users and not local consumers.

The purpose of these investments in any one zone can be:

- to bring new renewable generation onto the distribution or the transmission electricity network,
- to help large industrial energy users connect into the distribution or transmission network and electrify their operations or,
- a combination of the above.

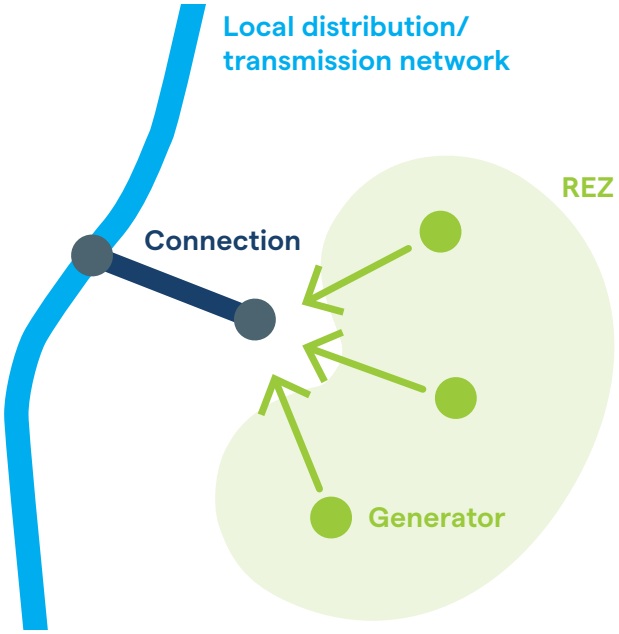


Figure 3: Simple Renewable Energy Zone

Other potential models:

'Industrial clusters', where several large geographically clustered electricity users (such as electrified process heat, manufacturing or data centres) connect to the network via a shared connection

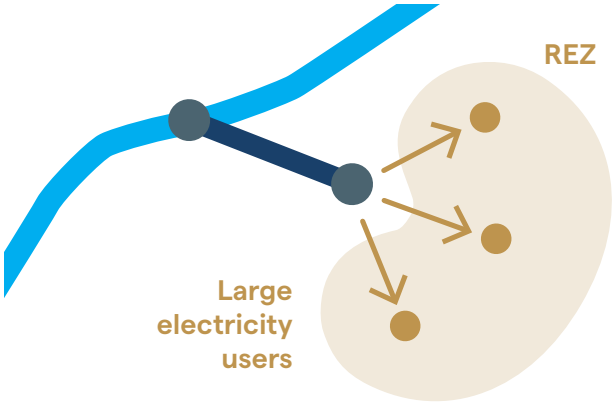


Figure 4: Industrial cluster

'Renewable energy industrial clusters', where electricity users are co-located with renewable generation. This enables the electricity users to take advatage of lower cost electricity due to decreased transmission costs.

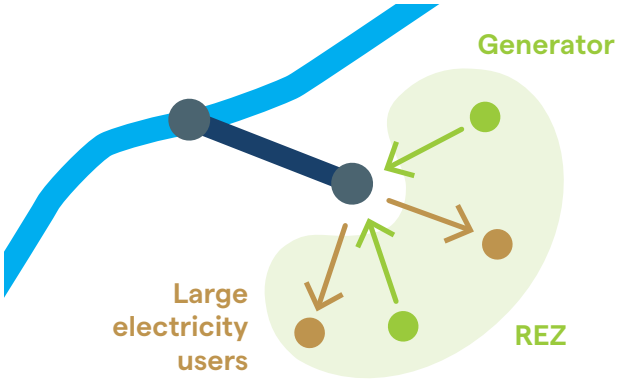


Figure 5: Renewable energy industrial cluster

1.3 Why are Renewable Energy Zones being considered?

Transpower through its Net Zero Grid Pathways programme, is exploring ways in which it can respond to electricity generation or electricity demand developers that are seeking to connect to the transmission network (or via distribution networks) but are inhibited by the first mover disadvantage (i.e. having to pay for the entire upgrade themselves while others may benefit) or very high connection costs.

These are typically the developers wanting to connect to parts of the transmission network that currently have limited available capacity. Transpower and a number of electricity distribution companies across New Zealand are receiving large volumes of connection enquiries of this nature from developers.

REZs, a model used overseas, have emerged as a potential mechanism to help to enable this generation.

To better understand the characteristics and the broader concept of REZs in New Zealand, please refer to Transpower's consultation document *Renewable Energy Zones National Consultation 2022*.

The national consultation is open until 8 April 2022, and seeks feedback on the following topics:

- Whether there is an appetite for developing REZs in New Zealand
- How regions might be selected for a REZ
- What the process for developing REZs should be and what parties should be involved
- How generation or electricity load projects might be selected to participate in a REZ and the commercial contracts that may be required and
- What potential commercial and/or regulatory challenges might be encountered and how they might be navigated.

For more information see www.transpower.co.nz/REZ.

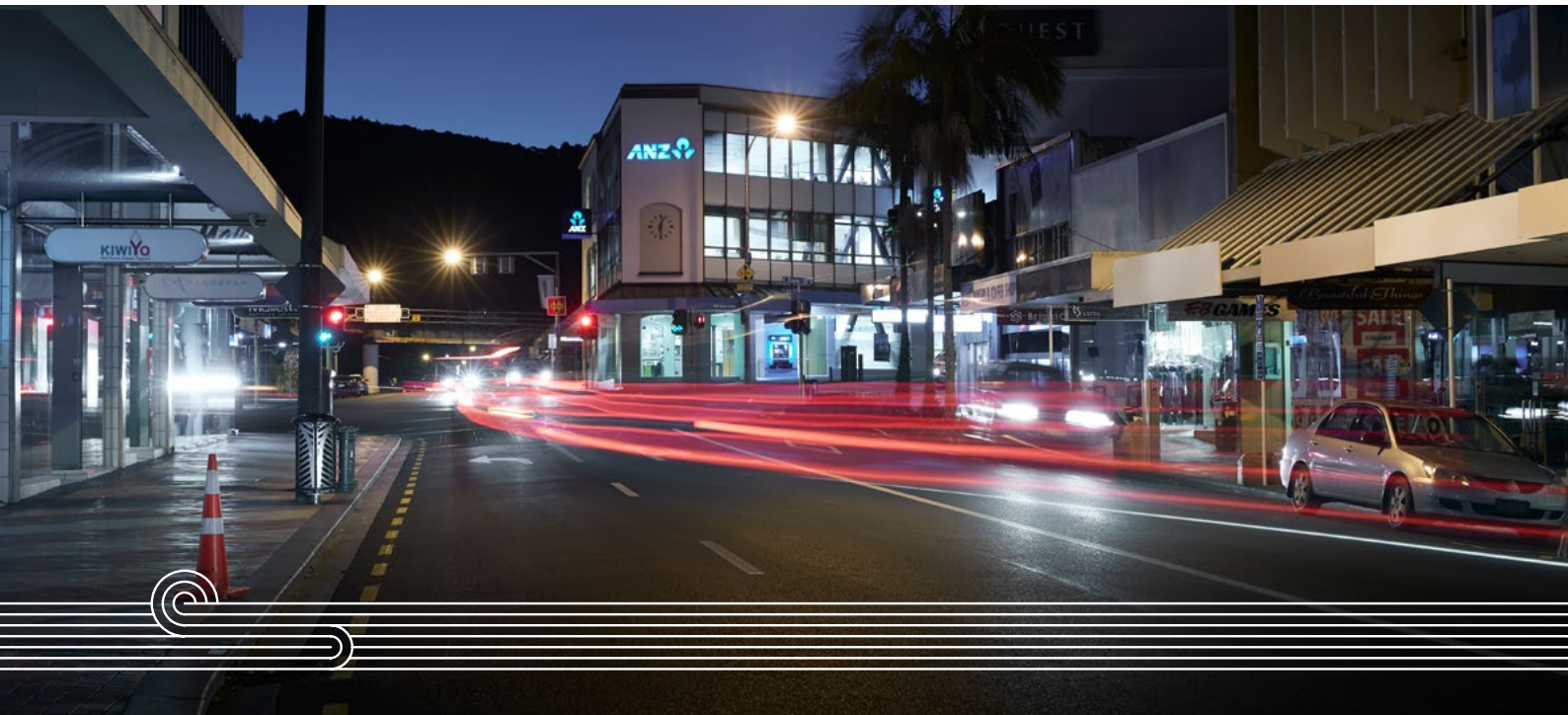
2.0 Pilot project: Northland

Northland has emerged as a potential region for New Zealand's first pilot REZ. This is due to the high levels of electricity generation developer interest and current or imminent constraints on the fringes of the transmission and distribution networks in the region, but with significant capacity available on the grid backbone from Marsden back to Auckland.

Northland is a region with abundant sun, wind and geothermal resources, where large volumes of new renewable generation could be enabled with incremental network investments, primarily through upgrading existing assets.

> Several generation developers have made enquiries and/or applications to Transpower, Top Energy and Northpower equating to roughly 2GW of new renewable generation, enough to power almost half the North Island during peak electricity use periods, or cater to the energy needs of 375,000 homes[1].

1. Northland ClimateWEB.pdf (niwa.co.nz)



There are areas in each network that are reaching full capacity with limited ability to connect new generation investment. Transpower, Northpower and Top Energy are considering how the three networks could enable new renewable generation investment in Northland.

The three companies have identified that a REZ could be a potential solution. We have started thinking about the preliminary upgrades that may be required across all networks, including potential commercial dynamics and possible challenges within the transmission and distribution regulatory frameworks.

This consultation paper brings together our thinking on the potential of a Northland pilot REZ. We are seeking feedback from iwi, generation developers, industry, local and central government, local interest groups and communities.

We hope to understand the level of support for a Northland pilot REZ and gain insight into the potential benefits and/or costs to communities at an economic, social, cultural and environmental level. We want to ensure that a REZ would add value to electricity networks across the region.

Your feedback on a Northland pilot REZ is important to us. Together with feedback from the national REZ consultation, it will help guide our next steps including whether we commence an EOI phase for the Northland pilot.

If there is sufficient support, **we plan to seek expressions of interest from generation developers in Q3/4 of 2022.** This process will help to inform the demand for a Northland REZ, and whether to proceed further with a REZ development, as well as the likely location, configuration and the extent of network upgrades and investment required.

2.1 The case for a Northland Renewable Energy Zone

There are many reasons why the Northland region is a strong candidate for a pilot REZ.

High-quality renewable resource to accelerate decarbonisation

Northland has an abundance of wind and solar resource, with most parts of the region receiving about 2000 hours of sunshine per year[2], and strong wind sites along the west coast. If generation developers in Northland were able to supply 1.5GW of new renewable generation, the region would have the potential to supply 5-10% of New Zealand's electricity through renewables. This could contribute towards the 100% renewable electricity target.

Transpower's Net Zero Grid Pathways Generation Consultation identified the potential for 600MW of grid scale solar generation and 900MW of wind generation across the Northland region. This is on top of the potential for widescale adoption of embedded rooftop solar, which can take advantage of Northland's sunlight hours (Figure 6).

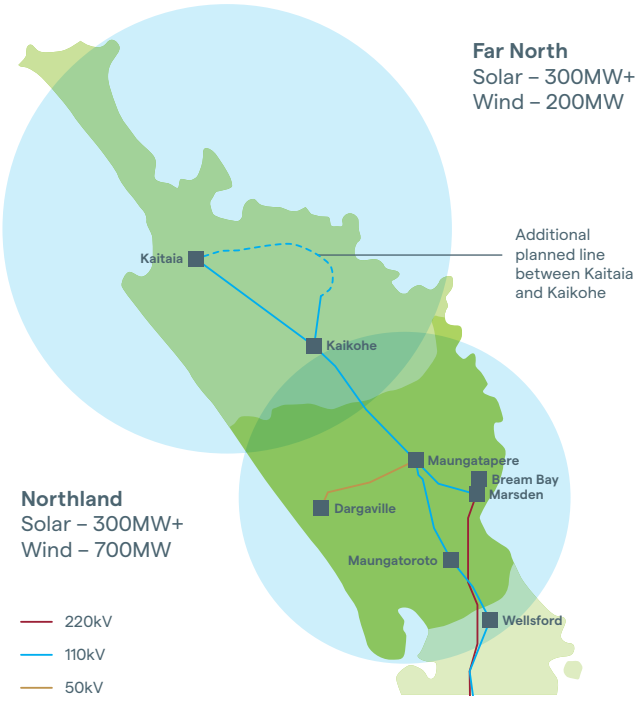


Figure 6: Estimated grid scale wind and solar resource availability

Source: Transpower NZGP generation consultation

2. Northland ClimateWEB.pdf (niwa.co.nz)

High demand from generation developers

Enquiries from developers to Transpower, Northpower and Top Energy are roughly equivalent to 20 times the existing spare capacity on the local networks.

These constraints create a barrier to investment in renewable generation.

Figure 7 shows the aggregated volume of generation enquiries received by Transpower, Northpower and Top Energy across the Northland region. At this stage, this represents close to 2GW of potential new generation across over 30 projects, predominantly made up of wind and solar developments. We have included all enquiries in these numbers, from early enquiries and investigations that may not eventuate, to well-developed projects that have progressed to detailed engineering studies and are likely to result in new renewable generation.

Transmission backbone capacity

The existing 220kV grid backbone interconnection lines from Auckland to Marsden, which form part of the transmission backbone, are significantly underutilised (Figure 7).

The lines can export around 300MW of electricity even during times of interruption and asset outages and potentially a further approximately 600MW of electricity when all transmission assets are fully in service south to Auckland. This is enough to power between approximately 56,000 – 160,000 households. A Northland REZ could enable new renewable generation in the region and utilise existing capacity in the transmission network to get that energy to where it is needed. It would also strengthen the region's ability to be a net exporter of electricity. Additional generation in Northland would provide additional resilience of supply into Auckland.

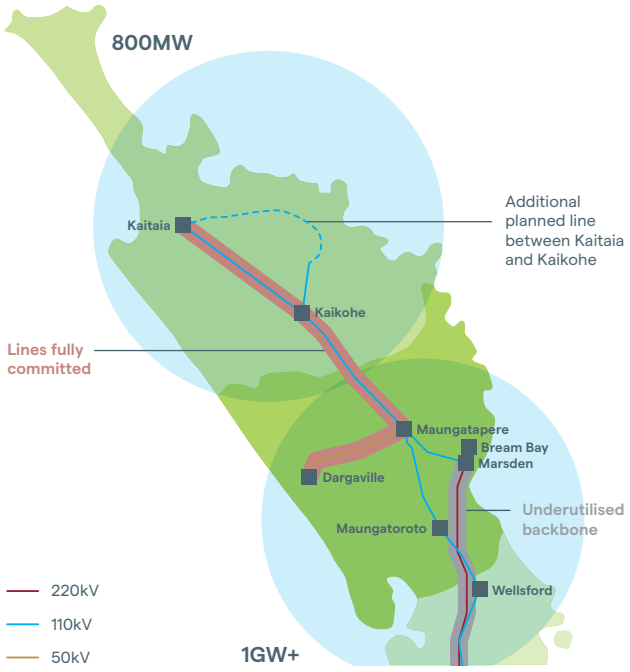


Figure 7: Generation interest in Northland region and lines reaching capacity limit

Source: Transpower, Northpower and Top Energy

Network capacity limits

Between the transmission backbone and locations with strong levels of renewable resource, there are areas in each network that are reaching full capacity and have limited ability to connect new generation investment. This is shown in Figure 7.

For example, Northpower's western region from Dargaville to Maungatapere is fully committed to planned projects but has significant potential for further wind and solar generation.

Similarly, Transpower's line from Maungatapere to Kaikohe is fully committed in terms of available capacity.

Likewise, Top Energy's network from Kaikohe to Kaitaia is fully committed and there are enquiries for a further 300MW of solar and two significant wind farms on the northern west coast around Kaitaia.

Existing network export capacity

The network as it is can export up to 325MW of electricity, if the distribution of generator connections is weighted more towards the 220 kV connections at Bream Bay and there are limited number of connections in the Far North and at Dargaville.

Figure 8: Illustration of existing network export capacity

Incremental upgrades

New generation capacity could be possible with incremental network investments, primarily through upgrading existing assets. This could be a cost efficient way of unlocking substantial new renewable electricity.

2.2 Potential benefits to Northland

A Northland pilot REZ could substantially benefit local communities in the following ways.

- **Stimulating the local economy** – through investment in construction of new generation and network infrastructure, including job creation and workforce training.
- **Ongoing employment opportunities** – post construction in maintenance and operations.
- **Potentially lowering regional electricity prices** – through a combination of reduced transmission losses and lower wholesale electricity costs. This will benefit existing industrial customers and could be the catalyst to attract new industrial energy users, driving economic growth and job creation.
- **Seeking to reduce energy hardship** – Northland has the highest delivered electricity cost of all regions in New Zealand. The REZ will lead in part to reducing the cost of electricity for those in Northland who live in areas with high socio-economic deprivation and high residential electricity prices.

More work is required to better understand the nature of these benefits and how they could be realised through a Northland REZ, including further engagement with central and regional stakeholders.

Questions

Q1.

Do you support the development of a pilot REZ in Northland? Please provide your reasons as to why or why not.

Q2.

What potential benefits of a REZ are important to you? Consider economic, social, cultural and environmental factors.

Q3.

What potential costs of a REZ are important to you? Consider economic, social, cultural and environmental factors.

2.3 Potential generation enabled and network upgrades

A range of scenarios to enable a Northland REZ are possible. Depending on consultation feedback, more detailed scenarios will be made available in the EOI phase, including potential incremental network upgrade combinations to enable renewable generation.

Based on the current volume of generation enquiries, the EOI scenarios could range from 410 MW to 700 MW of renewable generation enabled, with high-level investments ranging from $0.05M/MW to $0.56M/MW (based on estimated upgrade costs ranging from approximately $20-$400 million.)

Your feedback will help shape our thinking and guide the EOI phase including informing the likely network upgrades and investments, and their associated costs. Ultimately, the network upgrades and investments required for a Northland pilot REZ will be determined by the location and size of committed renewable generation developments in the Northland region.

Transpower, Northpower and Top Energy have looked into the current state of the combined networks to build a preliminary view of the range of asset upgrades and investments that may be required.

At a high level, these upgrades and investments would ensure that we make the most of our existing assets to enable a significant volume of new generation in the Northland region. This approach would also be more efficient than if we built new lines and substations. These may be required if there is significant new generation coming on stream, but it is generally more cost effective to first enhance or upgrade existing assets within the distribution and transmission networks.

At this stage we have only considered the Transpower, Northpower and Top Energy shared lines, substations and other equipment that would likely be used in a Northland pilot REZ.

Figure 9 shows a preliminary view of the range of network upgrades that may be required and could be considered basic building blocks for a Northland pilot REZ. We have not considered individual connections from potential generation plants to network connection points, which are highly variable and will be identified once firm locations of generation development are understood.

Figure 9: Potential asset upgrades to unlock new renewable generation

Table 1 sets out the various investments that may be required as highlighted in Figure 9. These potential projects would be funded in two ways – projects A to E would be commonly funded via a REZ, and projects F-I are interconnection projects, which would be funded via the standard regulatory investment process and recovered from customers via the Transmission Pricing Methodology.

Other network investments may be required depending on the location of new generation interest received during this consultation and the subsequent EOI phase. For example, new network build options could include a line to form a loop from Dargaville to Kaiwaka or Maungaturoto via Ruawai/Poutu.

There is also the potential to include storage technologies, such as a grid-scale battery, which could further change the network investments required.

Table 1: Potential network upgrades

	Potential project	Description
REZ funded projects		
A	Runback scheme on 110kV Kaikohe-Maungatapere circuit	Runback scheme to increase the loading limit with all circuits in service on Kaikohe to Maungatapere circuits.
B	Tactical Thermal Upgrade on 110kV Kaikohe-Maungatapere circuit	If feasible, increase line rating by increasing the operating temperature of Kaikohe to Maungatapere circuits.
C	Reconductor 110kV Kaikohe-Maungatapere circuit	IIf feasible, increase line rating by reconductoring Kaikohe Maungatapere circuits.
D	Complete second Kaitaia-Kaikohe 110kV circuit	Complete the ring along the east coast from Wiroa to Kaitaia. This increases the ability to transfer power from Kaitaia to Kaikohe, allowing for increased generation north of Kaitaia.
E	Upgrade Dargaville-Maungatapere circuit to 110kV	Increase the transfer capacity by upgrading the existing Dargaville-Maungatapere circuits to 110kV.
Interconnected investments		
F	Reconductor 110kV Henderson-Maungatapere circuits	If feasible, increase line rating by reconductoring Henderson-Maungatapere circuits.
G	Marsden ICT upgrade	Increase ICT capacity between 220kV and 110kV, upgrading the Marsden ICTs.
H	Marsden ICT upgrade, and split 110kV Henderson-Maungatapere circuits	Increase ICT capacity between 220kV and 110kV, split the 110kV network between Henderson and Maungatapere to remove the possibility of the 110kV circuits constraining the network.
I	220kV Bream Bay-Huapai upgrade	Duplex Bream Bay-Huapai circuit. Remove the branch limit on Huapai-Marsden. Remove the branch limit on Bream Bay-Marsden.

Note: These upgrades are focussed on unlocking thermal capacity, and do not cover voltage or stability issues which may need to be addressed in the development of a REZ.

2.4 Investment and consenting considerations

In Transpower's national consultation document *Renewable Energy Zones National Consultation 2022*, potential processes for both investment decisions and cost recovery are outlined. Section 4.0 overviews a potential process to determine network and generation investments that would make up a REZ .

Section 5.0 of the national consultation document then outlines how costs might be recovered for the network investment from REZ participants. Transpower, Northpower and Top Energy's intent is to define a funding model that ensures new generation connections or demand developers cover the cost of the network investments. This funding model would seek to ensure that the additional costs associated with a Northland pilot REZ do not fall on local consumers.

It is important to note that the upgrades to transmission connection or distribution assets would be recovered from generation developers as incremental costs (projects A-E). Upgrades to transmission interconnection assets would be recovered via charges according to the Transmission Pricing Methodology (projects F-I).

Another important consideration is that any generation development enabled by a REZ would need to follow resource consenting and land acquisition processes. This also applies to any upgrades of existing network assets. These processes are discussed in Section 5.3 of the national consultation document.

Questions

Q4.

Do you support enabling developments through upgrades to existing lines and substations as demand for connections to the networks emerge? If not, what alternatives would you propose?

Q5.

If new lines needed to be built to connect resources, where should they be constructed/not constructed?

Q6.

Are there alternative proposals that you think we should consider?

Q7.

Do you have development projects that a REZ might assist you to construct and connect?

3.0 Have your say

Transpower, Northpower and Top Energy are seeking feedback on the concept of developing a Northland pilot REZ. You are also invited to respond to Transpower's consultation document *Renewable Energy Zones National Consultation 2022*, which seeks feedback on the concept of REZs in the New Zealand context.

Your feedback will help guide Transpower, Northpower and Top Energy on the next steps and whether to proceed with an EOI from generation developers in Q3/4 of 2022 for a Northland pilot. This process will help to inform demand, possible size and location for a pilot REZ development in the Northland region.

This consultation is open until 5:00pm, Friday 8 April 2022.

Submissions can be emailed to rez@transpower.co.nz using the heading "Northland REZ consultation" or submitted via the online form at www.transpower.co.nz/REZ.

Submitters may comment on any relevant aspect of our topic. We have asked some specific questions and would welcome submissions on those questions, but all relevant comments are welcome.

Submissions are made jointly to Transpower, Top Energy, and Northpower and will be posted on Transpower's website. If any aspect of your submission is confidential, please advise us, together with the reasons why you consider it should be considered confidential, and we will not publish that part of the submission.

There are a number of parties with interests in the Renewable Energy Zone concept, including the New Zealand Infrastructure Commission, who have proposed the concept as part of their Infrastructure Strategy, the Ministry of Business, Innovation and Employment in their energy policy role, and electricity sector regulators, the Commerce Commission and Electricity Authority. We are likely to discuss elements of submissions with these parties except where a submitter has asked for confidentiality.

Appendix 1: Consultation questions

Your details

Full name

Who you are representing i.e. iwi, organisation (if applicable)

Email address or alternative contact details

What is your area of interest in relation to Renewable Energy Zones?

Are you a developer? ☐ Yes ☐ No

Would you invest in a Northland REZ if there was an opportunity to?

☐ Yes ☐ No

Have you applied previously to connect to a network in Northland?

☐ Yes ☐ No

Consultation questions

Potential benefits to Northland

1. Do you support the development of a REZ in Northland? Please provide your reasons as to why or why not.

2. What potential benefits of a REZ are important to you? Consider economic, social, cultural and environmental factors.

3. What potential costs of a REZ are important to you? Consider economic, social, cultural and environmental factors.

Potential generation and network infrastructure

4. Do you support enabling developments through upgrades to existing lines and substations as demand for connections to the networks emerge? If not, what alternatives would you propose?

5. If new lines needed to be built to connect resources, where should they be constructed/not constructed?

6. Are there alternative proposals that you think we should consider?

7. Do you have development projects that a REZ might assist you to construct and connect?

Any further comments

Would you like to receive occasional updates on the potential development of Renewable Energy Zones in New Zealand?

☐ Yes ☐ No

Appendix 2: Glossary

110kV/220kV: 110,000 Volts/220,000 Volts. The high voltage lines are designed to transmit electricity more efficiently over long distances, compared with the 230V seen in residential power.

2GW: A single Gigawatt is equivalent to 1,000,000kW. kW is the unit most household appliances are measured in. 2GW is enough to power almost half of all the electricity required in the North Island during peak demand.

Capacity Factor: A value to represent how frequently a generator generates close to maximum output, defined as the average generation output divided by the maximum power output.

Developers: In this document, developers are parties investing in the construction of renewable energy generation (wind/solar/geothermal) OR constructors of industrial loads that use large amounts of electricity

Distribution Network: Local networks that carry electricity from the transmission network to individual consumers.

Duplex/Duplexing: Upgrading powerlines by replacing single conductors with twin conductors of a similar size. This increases the capacity and allows more power to flow.

First Mover Disadvantage: The disadvantage of the first developer needing to pay for the entirety of the new electrical equipment required. For more information on this concept, refer to Section 2.4 of Transpower's *Renewable Energy Zones National Consultation 2022*.

Grid Backbone: The major lines that form part of the transmission network and connect major regions of load and generation.

ICT: Interconnecting transformer, transformers tying two transmission voltages such as 220kV and 110kV.

Interconnected electricity grid: A collection of electrical assets at a regional scale that are electrically tied together during normal operation.

Network Capacity: The maximum amount of electricity that can be safely carried by a network, or part of a network.

Nobelium: A type of conductor.

Peak Generation: The amount of electricity required at times of highest demand on the network, such as around dinner time when many people are using appliances at the same time.

Runback Scheme: A type of special protection scheme that automatically reduces power flow following an outage, which allows more power to flow with all circuits in service.

Simplex: Single line or conductor.

Tactical Thermal Upgrade: A type of upgrade to the transmission grid that allows more electricity to flow. This is achieved by tightening the powerlines between towers so they can operate at a higher temperature, and the resulting sag in the line stays above minimum ground clearance levels.

Transmission Network: The high voltage network carrying electricity from power stations to local areas.


TRANSPOWER


Northpower


TOP ENERGY
TePuna Hihiko