TRANSPOWER

Tararua Enabling Renewables: Major Capex Proposal Long List Consultation

Attachment 1: Need and Long List of Options

May 2026

Contents

1 Need for investment

1.1 The existing system

Transpower is investigating possible electricity infrastructure investments in transmission assets in Tararua and Wairarapa to boost transmission capacity in the region and unlock significant new renewable generation potential.

In this long list consultation, references to the Tararua and Wairarapa region and the relevant transmission lines mean the region contained within the highlighted area in Figure 1. The generator symbols on the map indicate connection points of both existing and planned power stations like new wind and solar farms.

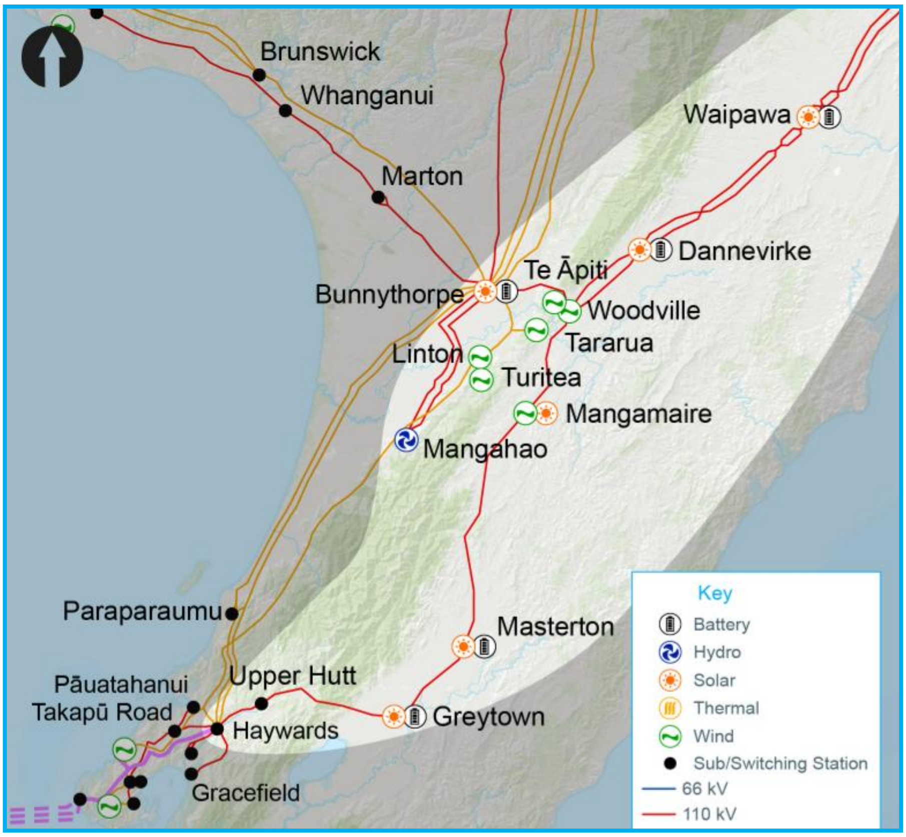

Figure 1: Geographic map of the Tararua and Wairarapa region

The area is home to a variety of loads including the city of Palmerston North and its environs (supplied from Bunnythorpe and Linton substations). Several generation sites, predominantly wind farms and a hydro power station, are also located in the area.[1]

The transmission system in the region comprises 220 kV and 110 kV transmission lines with interconnecting transformers at Bunnythorpe and Haywards. Power flows north or south are determined by generation, HVDC flow direction, and loads both within and outside the region.

1 Further detail on regional generation projects is provided in Table 1 of the Overview document.

The existing 220 kV circuits form part of the grid backbone. Most of the region's existing generation capacity is connected to the 220 kV circuits, and generation output significantly exceeds the local demand. The national grid enables surplus generation to be exported to other regions.

By contrast, the 110 kV transmission network in the eastern part of the region consists predominantly of low-capacity circuits. Under certain operating conditions, the network may become constrained, and operational measures are required to ensure the 110 kV circuits operate within their thermal capacity. Special protection schemes at Mangamaire and Woodville are also used to automatically reconfigure the grid or reduce generation to ensure the circuits operate within their thermal capacity. For more detailed information on the 110 kV transmission network, see Sections 1.2.1 to 1.2.4.

Why the Tararua and Wairarapa region?

We are focusing this Tararua Enabling Renewables investigation on the Tararua and Wairarapa region for several reasons, with one of the main factors being the availability of wind resources. These favourable conditions have also been mentioned in Transpower's NZGP1 scenarios update.[2]

- In terms of average wind capacity factor, the Tararua and Wairarapa region stands out with 47% compared to a maximum of 44% in other regions like Taranaki or Southland[3]
- New Zealand has currently 1.3 GW of operational wind farm capacity, with around 40% (0.5 GW) in the Tararua region (Tararua, Te Āpiti, Te Rere Hau and Turitea wind farms)
- The Tararua and Wairarapa region shows a wind generation potential of around 3 GW (existing + connection pipeline + additional potential)[4]
- This potential is substantially higher than in Waikato (1.5 GW), Taranaki (1 GW) and Otago-Southland (1 GW)[5]
- Additionally, there are close to 2 GW of solar farm (partly including battery storage) projects in the connection pipeline.[6]

This creates an opportunity for targeted transmission investment to unlock significant renewable generation capacity and provide greater certainty for future development, particularly where projects are consented but not yet committed.

While the Tararua Enabling Renewables project is focused on enabling the connection and dispatch of new renewable generation on the 110 kV network east of Bunnythorpe, upgrades to the existing 220 kV core grid circuits are not part of this initiative. Improvements to the existing 220 kV circuits north of Bunnythorpe will be addressed separately under the Net Zero Grid Pathways 1 – Central North Island project.[7] While upgrades to the existing 220 kV core grid are out of scope, new 220 kV connection and interconnection assets are included to test if they are a more efficient means of enabling large scale generation rather than (or in conjunction with) successive additional upgrades to the 110 kV network.

---

2 Transpower: Transpower NZGP1 Scenarios Update
3 Roaring40s Wind Power for MBIE, "Wind Generation Stack Update": Wind Generation Stack Update 2020
4 Beca and Concept Consulting, "2025 Generation Stack Report": 2025 Generation Stack Report
5 Beca and Concept Consulting, "2025 Generation Stack Report": 2025 Generation Stack Report
6 Transpower: What's the latest with grid connections?
7 Transpower: NZGP1 submission | Transpower

1.2 Overview of the need for investigation and investment

There is significant interest from generation developers in connecting new wind and solar farms and battery energy storage systems (BESS) to the 110 kV network between Waipawa, Woodville, and Greytown, but not all are committed yet. This creates a scenario where targeted transmission investment could unlock significant renewable generation opportunities. In addition, if all projects committed and in delivery were to generate concurrently, net power flow out of the region via the 110 kV network would exceed existing capability and are reliant on a regional special protection scheme (SPS) to manage overloads during contingencies.

Unlocking future renewable generation through coordinated regional development

By taking a broad regional view to possible network upgrades, this investigation considers how transmission capacity in the Tararua and Wairarapa region could be developed to accommodate potential new renewable generation and unlock valuable regional economic opportunities.

The investigation includes upgrades to the existing 110 kV network (including the Waipawa–Woodville–Haywards and Bunnythorpe–Woodville corridors) and considers whether adding 220 kV connection and interconnection assets, including a 220 kV coordinated regional upgrade, could more efficiently enable large-scale generation development and improve integration into the existing 220 kV core grid at Bunnythorpe.

We also consider that if Transpower leads in coordinating how multiple generation developments connect, it could reduce the amount of transmission infrastructure ultimately required and lower overall costs, compared with connections progressing in a piecemeal way.

Emerging constraints on the regional 110 kV network

This section provides a description of each of the constraints forecast to appear on the 110 kV transmission grid in the Tararua and Wairarapa region with additional generation connections. Further information and the wider context of development in the region can be found in Transpower's 2025 Transmission Planning Report.[8]

The potential transmission capacity constraints in the 110 kV network can be categorised into four key areas (highlighted in the single-line diagram below):

1. Bunnythorpe–Woodville circuits
2. Dannevirke–Woodville circuits
3. Masterton–Greytown–Upper Hutt circuits
4. Haywards–Upper Hutt circuits.

[8] Transpower: 2025 Transmission Planning Report, sections 11 (Central North Island) and 14 (Wellington)

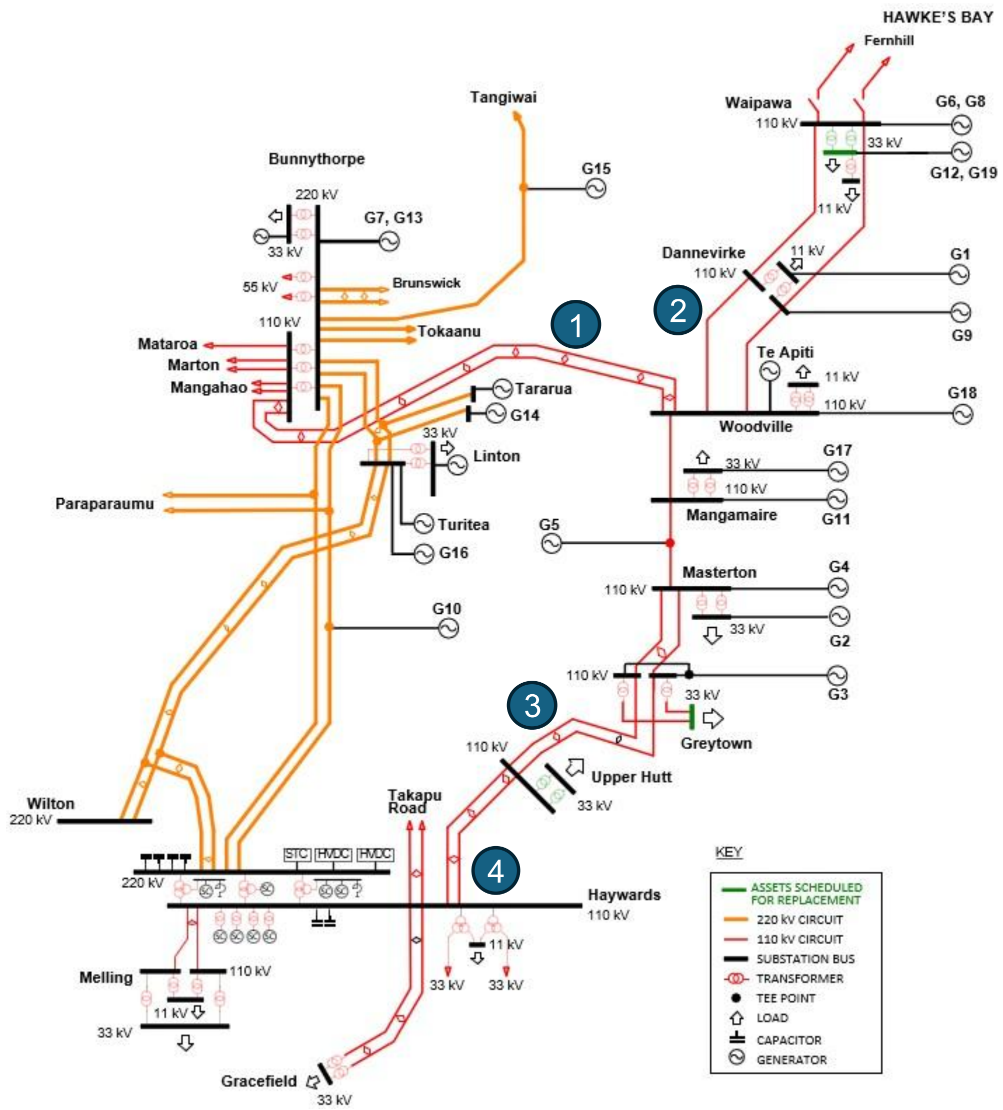

Figure 2: Single-line diagram of the regional transmission system

1.2.1 Bunnythorpe–Woodville 110 kV circuit overloading issues

There is significant scope for new solar and wind generation developments connecting to the 110 kV network. This will cause pre- and post-contingency overloading issues particularly on the Bunnythorpe–Woodville circuits. The generation injection could be constrained to approximately 100 MW over the Waipawa spur and Mangamaire.

The Bunnythorpe–Woodville circuits are rated at 57/70 MVA (summer/winter). The loading on these circuits depends on the HVDC transfer direction and magnitude, Te Āpiti wind farm generation and the loads in Wellington, Wairarapa, Dannevirke and Waipawa. The circuits may overload for an outage of:

- a Bunnythorpe–Woodville circuit, overloading the parallel circuit during high HVDC south flow and low Te Āpiti generation
- a 220 kV Bunnythorpe–Paraparaumu–Haywards, Bunnythorpe–Linton or Haywards–Wilton–Linton circuit during high HVDC south flow and low Te Āpiti generation

- a 220 kV bus at Bunnythorpe, Linton or Tararua Central overloading both Bunnythorpe–Woodville circuits during high HVDC south flow and low Te Āpiti generation
- both 110 kV circuits between Haywards and Greytown due to a 110 kV bus fault at Upper Hutt.

The circuits have a SPS to manage post-contingency overloads by reconfiguring the grid and reducing generation at the Te Āpiti wind farm. The scheme normally ensures the low rating of the Bunnythorpe–Woodville circuits are not the cause of pre-contingency generation constraints on Te Āpiti or HVDC transfer, although constraints are occasionally required.

It is possible to include limited additional generation in this scheme, at the expense of increased frequency, duration and magnitude of generation constraints. SPS can manage risk but does not remove the underlying need for enduring capacity.

Significant additional generation could be hosted by reconductoring the Bunnythorpe–Woodville circuits to increase their ratings. It would allow more generation to be connected at Woodville or along the Bunnythorpe–Woodville line.

1.2.2 Dannevirke–Woodville 110 kV circuit overloading issues

The Dannevirke–Woodville section of the Woodville–Dannevirke–Waipawa double-circuit line is rated at 50/62 MVA per circuit (summer/winter). As the 110 kV network is normally split at Waipawa, making it a spur connection from Woodville, the loading on this line section depends on the load at Dannevirke and Waipawa. During peak load periods, this section may overload for an outage of the parallel Woodville–Dannevirke–Waipawa circuit. While a special protection scheme could automatically and quickly reduce generation following a circuit outage, generation connected via the Waipawa spur would still be constrained to approximately 100 MW.

1.2.3 Masterton–Greytown–Upper Hutt 110 kV circuit overloading issues

Hosting an increasing amount of generation along the Masterton–Greytown–Upper Hutt corridor may overload the circuits. Given the current capacity and assuming a special protection scheme will manage generation following a circuit outage, generation injection could be constrained to approximately 200 MW between Mangamaire, Masterton and Greytown, not including contributions from Woodville. The double-circuit line between Masterton and Upper Hutt is strung with the same conductor, but has different ratings for each section:

- Upper Hutt–Greytown section is rated at 63/77 MVA (summer/winter)
- Greytown–Masterton section is rated at 88/98 MVA (summer/winter).

The capacity of the Upper Hutt–Greytown circuit is lower due to its lower thermal rating.

Significant additional generation could be hosted by reconductoring the Masterton–Greytown–Upper Hutt circuits to increase their ratings. Greytown generation runback is required to remove overloads for a parallel contingency.

1.2.4 Haywards–Upper Hutt 110 kV circuit overloading issues

Hosting generation along the Masterton–Greytown–Upper Hutt corridor may overload a Haywards–Upper Hutt circuit for an outage of the parallel circuit, for power flow into Haywards. However, the Greytown–Upper Hutt circuit section is of a lower capacity, and so would overload before the Haywards-Upper Hutt circuit. An upgrade of the Masterton–Greytown–Upper Hutt circuits is required for a Haywards-Upper Hutt circuit upgrade to be effective. Given the current capacity and assuming a special protection scheme will manage generation following a circuit outage, the generation injection could be constrained to approximately 200 MW between Mangamaire, Masterton and Greytown, not including contributions from Woodville. Noting that three solar farm projects with a total capacity of around 350 MW are already in delivery phase at Masterton and Greytown.

The Haywards–Upper Hutt circuit capacity is limited by a short section of cable at Haywards.

Q1. Do you agree with our assessment of the investment need?

Q2. Are there any other issues or considerations relating to the investment need that we should incorporate into the investigation?

2 Long list of options

A long list of options has been developed, setting out a wide range of possible ways to enable the connection and dispatch of new renewable generation in the Tararua and Wairarapa region, while addressing emerging constraints on the existing 110 kV transmission network.

The long list comprises individual investment components that could be combined in different ways to form development plans, depending on various generation scenarios.

We are committed to conducting a thorough evaluation of all possibilities, including relevant non-transmission alternatives.

In summary, the long list considers three broad categories:

- Non-transmission solutions (e.g. energy storage providers)
- Transmission options – upgrading and enhancing existing assets
- Transmission options – building new assets.

2.1 Long list of investment components

Table 1 contains a long list of investment components to address the need identified in section 1.2. To construct a solution which fully addresses the identified need, a development plan may need to be assembled using a combination of options from the long list table (i.e., using the long list of options as ’building blocks’).

Table 1: Long list of investment components[9]

Location	Type	Details
1. Non-transmission solutions (NTS)[10]		
Tararua and Wairarapa region	Demand-side NTS	Enter a grid-support contract with demand-side services to defer transmission investments
Tararua and Wairarapa region	Energy storage NTS	Enter a grid-support contract with energy storage providers to defer transmission investments
2. Transmission options: Upgrade existing assets		
Bunnythorpe–Woodville	Line upgrade	Reconductor 110 kV circuits[11] *Duration of works: 24-36 months*[12] *High-level cost estimate: $18-75 million*
Masterton–Greytown–Upper Hutt	Line upgrade	TTU[13] or reconductor 110 kV circuits *Duration of works: 24-36 months* *High-level cost estimate: $9-146 million*
Woodville–Mangamaire–Masterton	Line upgrade	TTU 110 kV circuits *Duration of works: 24-36 months* *High-level cost estimate: $21-87 million*[4]
Woodville–Dannevirke–Waipawa	Line upgrade	Reconductor 110 kV circuits *Duration of works: 24-36 months* *High-level cost estimate: $75-302 million*
Waipawa	Substation and protection upgrades	Reconfigure Waipawa substation to send power to Fernhill (Hawke's Bay) and associated Taupo-Hawke's Bay-Wairarapa regional protection upgrades *Duration of works: 24-48 months* *High-level cost estimate: $6-24 million*
Waipawa–Fernhill–Redclyffe	Line upgrade	Reconductor 110 kV circuits *Duration of works: 24-36 months* *High-level cost estimate: $64-257 million*
Haywards	Cable upgrade	Resolve Haywards-Upper Hutt incomer cable limit *Duration of works: 18-24 months* *High-level cost estimate: $8-15 million*
3. Transmission options: New transmission assets		
Bunnythorpe–Woodville	New line	Rebuild with new 110 kV duplex line *Duration of works: 60-72 months* *High-level cost estimate: $35-142 million*

9 The options are not currently proposed to be staged, but staging may be considered for future development and, if so, will be consulted on as part of the short list consultation.

10 We have not listed generation-side NTS as the transmission constraints are expected to be caused by excess generation and hence be resolved operationally by the market dispatch.

11 The BPE–WDV line is strung with copper conductor. Thermal uprating is not possible on copper.

12 Duration of works after planning investigation (i.e., design complete, property rights and consents secured).

13 Tactical thermal upgrade (TTU) to increase the transmission capacity of existing conductor. Reconductoring involves replacing the whole conductor of the relevant line section with a larger conductor, typically resulting in a higher increase of the transmission capacity than by TTU.

Location	Type	Details
Bunnythorpe–Woodville	New Cable	Rebuild with new 110 kV underground cable *Duration of works: 60-72 months* *High-level cost estimate: $94-379 million*
Masterton–Greytown–Upper Hutt	New line	Rebuild with new 110 kV duplex line *Duration of works: 60-72 months* *High-level cost estimate: $76-306 million*
Masterton–Greytown–Upper Hutt	New cable	Rebuild with new 110 kV underground cable *Duration of works: 60-72 months* *High-level cost estimate: $223-894 million*
Woodville–Dannevirke–Waipawa	New line	Rebuild with new 110 kV duplex line *Duration of works: 60-72 months* *High-level cost estimate: $105-422 million*
Woodville–Dannevirke–Waipawa	New cable	Rebuild with new 110 kV cable *Duration of works: 60-72 months* *High-level cost estimate: $311-1,244 million*
Mangahao to Tararua region	New line	Build a new 110 kV line connecting Mangahao with the Mangamaire-Masterton line *Duration of works: 60-72 months* *High-level cost estimate: $33-133 million*
Mangahao to Tararua region	New cable	Build a new 110 kV underground cable connecting Mangahao with the Mangamaire-Masterton line *Duration of works: 60-72 months* *High-level cost estimate: $79-317 million*
Bunnythorpe to Tararua region	New line and new GXP/GIP	Build a new 220 kV line from Bunnythorpe into the Tararua region and create a new GXP/GIP (possibly near Woodville) *Duration of works: 60-72 months* *High-level cost estimate: $80-341 million*
Bunnythorpe to Tararua region	New cable and new GXP/GIP	Build a new 220 kV underground cable from Bunnythorpe into the Tararua region and create a new GXP/GIP (possibly near Woodville) *Duration of works: 60-72 months* *High-level cost estimate: $195-782 million*
Bunnythorpe to Wairarapa region	New line and new GXP/GIP	Build a new 220 kV line from Bunnythorpe into the Wairarapa region and create a new GXP/GIP (possibly between Mangamaire and Masterton) *Duration of works: 60-72 months* *High-level cost estimate: $187-749 million*
Bunnythorpe to Wairarapa region	New cable and new GXP/GIP	Build a new 220 kV underground cable from Bunnythorpe into the Wairarapa region and create a new GXP/GIP (possibly between Mangamaire and Masterton) *Duration of works: 60-72 months* *High-level cost estimate: $453-1,814 million*
Tararua to Hawke’s Bay	New line	Build a new 220 kV line connecting the Tararua region with Hawkes’s Bay *Duration of works: 60-72 months* *High-level cost estimate: $292-1,168 million*

Location	Type	Details
Tararua to Hawke's Bay	New cable	Build a new 220 kV underground cable connecting the Tararua region with Hawkes's Bay *Duration of works: 60-72 months* *High-level cost estimate: $781-3,125 million*
Haywards to Whakatu via Masterton	New line	Build a new 220 kV line connecting Haywards (Wellington) with Whakatu (Hawke's Bay) via Masterton *Duration of works: 60-72 months* *High-level cost estimate: $548-2,193 million*
Haywards to Whakatu via Masterton	New cable	Build a new 220 kV cable connecting Haywards (Wellington) with Whakatu (Hawke's Bay) via Masterton *Duration of works: 60-72 months* *High-level cost estimate: $1,487-5,952 million*
Tararua and Wairarapa region	Voltage support	STATCOMs or shunt capacitors to resolve voltage stability issues *Duration of works: 36-48 months* *High-level cost estimate: $45-181 million*
Tararua and Wairarapa region	Protection upgrades	Protection upgrades to support the increase of inverter-based resources in the region *Duration of works: 24-48 months* *High-level cost estimate: $1-7 million*

We are not consulting on a preferred option at this stage. We are seeking input to refine the long list and to understand which components and locations are most relevant to load and generation developers.

Q3. Are there any other options we should add to our long list?

Q4. If new or upgraded shared transmission capacity were developed, which connection areas or locations would be most beneficial to you and why (e.g., proximity to your projects, lower curtailment risk, fewer consenting barriers)?

2.2 Evaluating our long list of options

We propose to evaluate our long list of options using a set of high-level screening criteria, as set out below. The screening criteria will be used to eliminate those options that are not appropriate for inclusion in the short-listed development plans to which we apply our options assessment, including the Investment Test.

We will consider the feedback we receive in this consultation both in terms of whether the criteria are appropriate, and in relation to developing and refining short list development plans.

Our short list options may be single options from the long list (such as a new line) or more often, combinations of options presented as a development plan. This allows options that only deliver short-term benefit to be compared with more extensive options that aim to meet the need over the longer term. We use the Investment Test as part of our assessment of the short-listed development plans based on costs and benefits. We will use this assessment to identify which development plans are expected to be economic, and to test what assumptions would need to hold for more ambitious development plans to be economic, and what they could unlock.

Broadly, we intend to use six criteria for screening:

- Fit for purpose
  - Extent to which the option provides usable capacity for multiple prospective connections
  - Reduces curtailment risk
  - Improves flexibility under different generation build pathways
  - Extent to which the option enables renewable generation
  - Extent to which the option can be staged to reduce investment risk.
- Technically feasible
  - Complexity of solution
  - Reliability, availability and maintainability of the solution
  - Future flexibility – fit with long-term strategy for the grid
  - Ideally the design can be staged or have flexibility to preserve options for future changes.
- Practical to implement
  - It must be possible to implement the solution within the proposed investment timeframe, which will be determined during the short list consultation
  - Implementation risks, including potential delays due to property and environmental issues.
- Good electricity industry practice
  - Ensure safety
  - Consistent with good international practice
  - Ensure safety and environmental protection
  - Accounts for relative size, duty, age and technological status
  - Technology risks.
- Provide system security (additional benefit resulting from an economic investment)
  - Improved system security
  - System operator benefits (controllability)
  - Dynamic benefits (modulation features and improved system stability).
- Indicative cost
  - Whether an option will clearly be more expensive than another option with similar or greater benefits
  - The design will meet current and forecast energy demand.

Other criteria depending upon feedback from consultation.

Q5. Are there any other criteria we should consider when evaluating our long list of options and reducing it to a short list?

Q6. Are there any constraints or limitations we might not be aware of regarding our options?

3 Regulatory process for investment approval

Should this investigation determine that the preferred option is to enhance the service provision of the existing grid, we expect that the cost will exceed $30 million, and we will submit an MCP to the Commerce Commission, to recover the costs of the project from transmission customers. In addition, we may consider alternative funding arrangements in addition to the MCP process.

The Transmission Pricing Methodology (TPM) sets out how the cost of the project (the covered cost) is recovered from those of our customers who are expected to benefit from the investment. The covered cost refers to the cost recovered through benefit-based charges for a benefit-based investment under the TPM. It includes capital components (return on and of investment) as well as an allocation of Transpower's operating costs, including overheads.

3.1 Investigation process

The process we are using for this investigation is consistent with the requirements of the Commission's Capital Expenditure Input Methodology (Capex IM). As this is an enabling renewables investment, we may also use non-standard assumptions and approaches where appropriate and may consider alternative funding arrangements.

The diagram in Figure 3 sets out the general process followed by this investigation. We are at the 'Option Identification' stage.

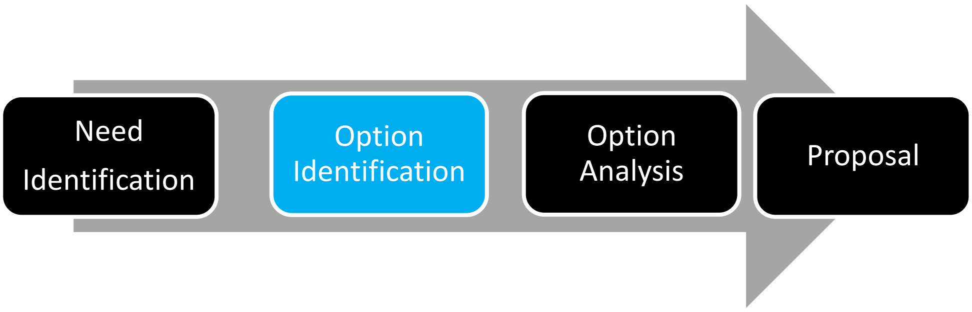

Figure 3: Options assessment approach

As well as targeted engagement with key stakeholders, we will undertake two consultations. The first is a long list consultation, which is the purpose of this document, and includes consultation on:

- Investment need (this Attachment, section 1)
- Long list of options to be considered (this Attachment, section 2)
- Demand and generation scenarios we will use in our assessment (Attachment 2)
- Some key assumptions we will use in our assessment (Attachment 3).

Our second consultation will be a short list consultation, outlining our refined short list of development plans, our options evaluation, application of the Investment Test, and other supplementary analysis, to identify which development plans are economic under what circumstances. This will test what input assumptions would need to hold for the development plans (including the more ambitious coordinated 220 kV regional approach) to be economic, and what renewable generation they could unlock if those conditions eventuate.

In addition to quantifiable benefits, our assessment will consider a range of unquantified benefits and other net economic benefits where they are material to the decision.

Sensitivity analysis will be undertaken to test the robustness of the analysis. The identified shortlisted development plans will form the basis of a short list consultation.

3.2 Relationship with the Transmission Pricing Methodology

The Electricity Authority's Transmission Pricing Methodology (TPM) has applied since 1 April 2023.[14] The TPM determines how Transpower's allowable revenue is recovered from its customers in each pricing year. To support the understanding of the TPM, we have released a TPM information sheet that explains the relationship between price-quality regulation and investment approval for transmission services, and price setting under the TPM.[15]

A key component of the TPM is the benefit-based charge (BBC), which recovers the costs of some historic interconnection investments, and all interconnection investments commissioned after 23 July 2019. BBCs recover the costs of these investments from those customers who are expected to benefit from the investment. For investments expected to have a capital cost greater than $30 million (high-value investments),[16] the modelled costs and benefits used to produce these allocations are aligned with electricity market benefits or cost elements under the Investment Test.

The Commerce Commission determines how much revenue Transpower, as the owner and operator of the National Grid, can recover from its customers according to its regulation of Transpower under Part 4 of the Commerce Act. The TPM determines how that amount of allowable revenue is recovered from (or allocated to) each of Transpower's customers in each pricing year.

Once Transpower's capital expenditure proposal has been approved by the Commerce Commission, whether as major capex or base capex, the covered cost[17] of the approved investment may be recovered under the TPM.

The TPM requires that allocations for high-value benefit-based investments (BBI) are based on customers' expected positive net private benefits. One or more of the solutions to meet the need of this project will be high value. Therefore, the assumptions and scenarios that we use in the application of the Investment Test are likely to be used to determine allocations for one or more components of this project under the new TPM, unless we consider these will result in allocations that are not broadly proportional to expected positive net private benefit. As such we propose that the assumptions in this investigation are consistent with the TPM Assumptions Book v3.0[18], unless otherwise noted.

---

14 Electricity Industry Participation Code, Part 12-Transport, Schedule 12.4: Part 12—Transport | Electricity Authority

15 TPM Information Sheet- Relationship between transmission investment and pricing

16 The TPM defines a high-value investment by reference to the base capex threshold in the Capex IM, which is currently $30 million.

17 The cost recovered through the BBCs for a BBI is referred to in the TPM as the BBI's covered cost. The covered cost of a BBI includes capital components (return on and of investment) and an allocation of Transpower's operating costs (including overheads).

18 Assumptions book | Transpower

In our operational review of the TPM[19] we identified the potential problem where in regions likely to see future generation, transmission upgrades are sometime needed ahead of new connections. This could be connection or interconnection investments (which might be the outcome of this MCP investigation). Under the current TPM, existing load customers mostly pay for these upgrades until the new generators connect, meaning the existing load customers fund benefits ultimately received by future generation customers (or, potentially, vice versa).[20] It has not yet been determined whether this issue will be addressed as part of the operational review or will be referred to the Authority for broader policy consideration.

19 TPM Operational Review | Transpower
20 Transpower: TPM Operational Review 2026 Workstream 1 (section 10.2)

TRANSPOWER

TRANSPOWER.CO.NZ