TRANSPOWER

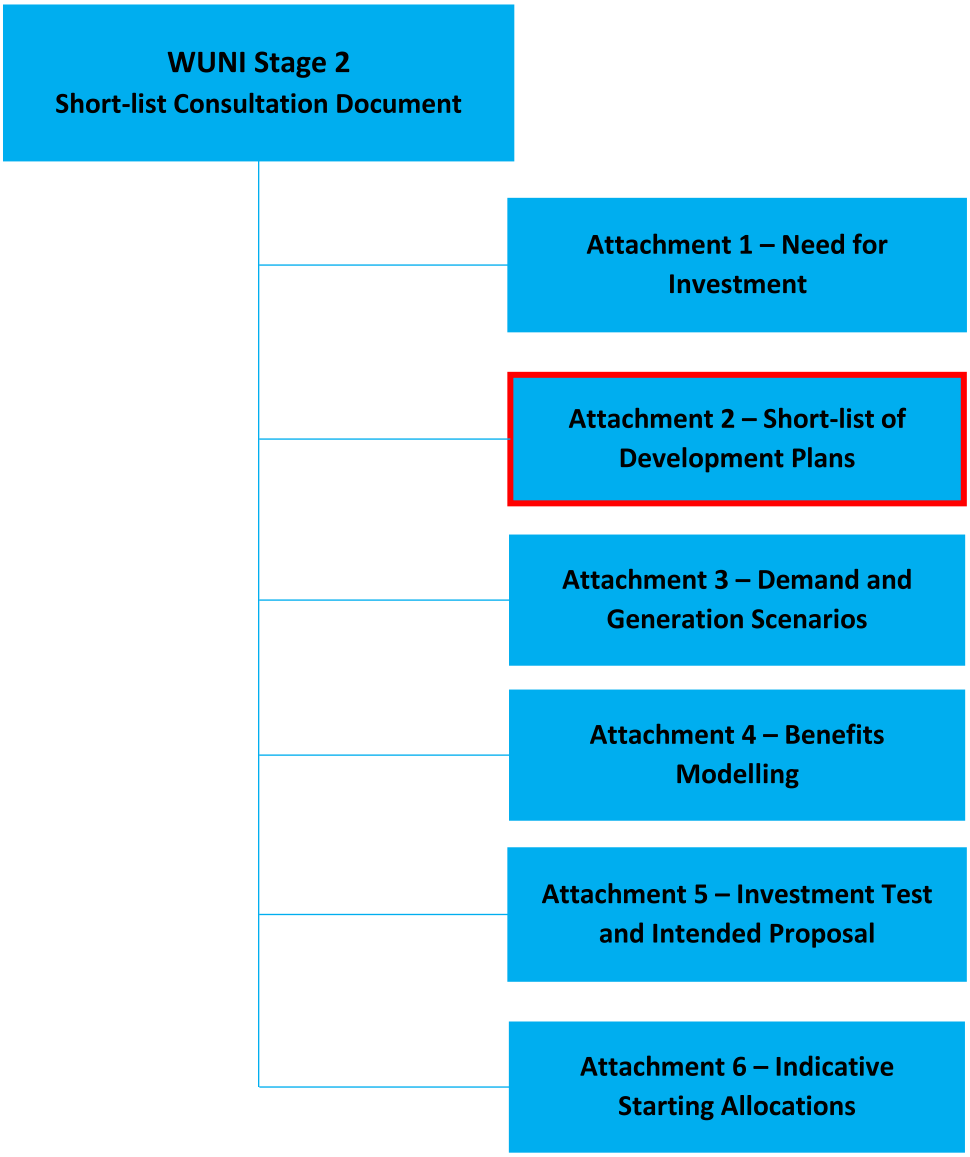
Waikato and Upper North Island Stage 2 (WUNI2): Major Capex Proposal Short-list Consultation

Attachment 2: Short-list of Development Plans

January 2026

Purpose

This Attachment is part of our Waikato and Upper North Island (**WUNI**) Stage 2 short-list consultation. The purpose of this Attachment is to outline our approach to developing options and detail how we derived our short-list of development plans.



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1 Options Assessment

1.1 Background

The WUNI programme is being implemented in stages to address the region's evolving need.

In 2016 we consulted on a long-list of components that could address anticipated grid issues in the WUNI region. We subsequently consulted on a short-list and in 2020 our preferred Stage 1 investments were approved. We are now considering Stage 2 of the WUNI programme.

1.2 Long-list of Investment Options

In 2016 we consulted on a long-list of components that could help play a potential role in addressing anticipated grid issues in the WUNI region.[1] These components served as building blocks for potential investment options; each development plan would comprise a specific set of these components, commissioned sequentially over the planning period, to address the investment need.

While there are many components that could contribute to the need for both thermal and voltage support, many were quite specific technologies. The long-list components were grouped into five broad categories:

1. Reactive power devices (e.g., capacitor banks, shunt capacitors, STATCOMs);
2. Transmission assets (e.g., series capacitors, constructing new transmission lines and upgrading existing lines, 400 kV conversion, grid reconfigurations);
3. Non-transmission solutions, such as battery storage, demand-side participation and special protection schemes;
4. System operation (dynamic analysis to determine dynamic voltage stability limits); and
5. Market generation.

Stakeholder submissions on our long-list consultation led to refinements before applying our short-listing criteria. A full summary of this process, including the criteria used, is available in the WUNI Stage 1 proposal document suite.[2]

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[1] Transpower, Waikato and Upper North Island Long-List Consultation, July 2016

[2] Our long-list to short-listing process is detailed in WUNI Stage 1 MCP Attachment C - Options and costing report, December 2019

1.3 Short-list of Investment Options and Stage 1 Preferred Option

Table 1 (next section) summarises the components short-listed in 2019 as potential solutions for the transmission challenges in the WUNI region. In Stage 1, the short-listed components were combined into various development plans representing potential investment options. When compiling those development plans, we added components to ensure the prudent peak demand forecast remained below the transmission limits. As components are commissioned, these limits increase, enabling the grid to accommodate growing demand and meet the N-1 reliability standard.

The preferred option for Stage 1, approved by the Commerce Commission in September 2020,[3] included two 150 Mvar STATCOMs at the Hamilton and Ōtāhuhu substations to enhance voltage stability. These works were successfully completed in 2023 and 2025.[4]

These investments were part of a broader development path, recognising the need for future investments to accommodate continued regional demand growth. Stage 1 funding also included preparatory work for the anticipated Stage 2 investments, ensuring we were prepared to address regional growth when conditions required it. Initial analysis identified series capacitors on the Brownhill–Whakamaru (BHL–WKM) circuits as the most likely Stage 2 investment but recognised that options would need to be reconsidered nearer to the need date.

For further details on WUNI Stage 1 please refer our WUNI1 Major Capex Proposal.[5]

2 Stage 2 Short-listed Components

Table 1 summarises the components short-listed in 2019 as potential solutions for the transmission challenges in the WUNI region.

As part of this Stage 2 investigation, we have reviewed these components and determined that they remain appropriate components from which to build Stage 2 development plans to meet our need.[6]

This review reconsidered the (long-listed) option of converting parts of the network to 400 kV, which was excluded from the Stage 1 short-list due to its significantly higher cost. Consistent with Stage 1, a 400 kV conversion has not been included in the Stage 2 short-list.

[3] Commerce Commission, Decision and reasons on Stage 1 of Transpower's WUNIVM staged major capex project, September 2020

[4] Waikato and Upper North Island (WUNI) Upgrades | Transpower

[5] Transpower, Waikato and Upper North Island Stage 1 Major Capex Proposal, December 2019

[6] As this is the second stage of a MCP (staged), there is no separate long-list consultation stage for this subsequent stage.

Table 1: Summary of short-listed components

Option	Components
Dynamic reactive devices	Dynamic reactive devices are power system components that can inject or absorb variable amounts of reactive power in a few milliseconds. Common examples are static synchronous compensators (**STATCOMs**), static var compensators (**SVCs**) and synchronous condensers. All are capable of fast dynamic response, with the performance varying by technology. Some types of renewable generating sources are also capable of providing dynamic reactive supply using power electronics, as are batteries. Dynamic reactive devices must be able to act rapidly following an event to inject or absorb reactive power to maintain voltage stability. *Duration of works: 36 months*
Shunt capacitors	Shunt capacitors help prevent a slow voltage collapse by supporting the voltage level. Post-fault, shunt capacitors can also be switched to assist with dynamic response and provide static support once the voltage has stabilised. *Duration of works: 24 months*
Series compensation	Series compensation reduces the impedance (electrical length) of a transmission line and could improve system stability in the WUNI region. We have considered series compensation on the 220 kV BHL–WKM overhead circuits. These are the high capacity 400 kV capable circuits built as part of the North Island Grid Upgrade Project. Since their design, Transpower's long-term plan has been to direct power off the highly loaded parallel 220 kV circuits onto these high-capacity circuits, firstly through series compensation and ultimately via a potential 400 kV upgrade. Series compensation on the BHL–WKM circuits would help to: • improve load distribution among the parallel lines in the WUNI region by diverting power flow from heavily loaded circuits to the BHL–WKM circuits, thus allowing higher power transfer • improve dynamic system response • raise the WUNI load limit • reduce transmission losses during high transfers as more power is transmitted through higher capacity circuits. Series compensation improves dynamic voltage stability and allows higher power transfer into the upper North Island without overloading the lower capacity parallel circuits. *Duration of works: 36 months*
Thermal transmission components	With further demand growth we are approaching the thermal transmission capacity limits for transfer into the region. This can be mitigated by increasing the grid capacity between Whakamaru and Auckland. There are many ways in which the grid could be developed to increase thermal transfer limits in the region. Such thermal options identified include a new cable between Brownhill and Ōtāhuhu (BHL–OTA), a tee connection of BHL–WKM 1 and 2 circuits into Ohinewai ('Ohinewai Tee'), and bussing OTA–WKM 1 and 2 circuits into

Option	Components
	Ohinewai and duplexing the southern section between Ohinewai and Whakamaru ('OHW Bussing'). *Duration of works 24-60 months*
Series reactors	By increasing the impedance in a circuit, series reactors limit the current flow through the line, preventing it from exceeding its thermal capacity and potentially damaging the conductor or other components. These can be a useful tool for balancing circuit loading where there are multiple parallel circuits, therefore maximising power transfer. *Duration of works: 36 months*
Non-transmission solutions (NTS)	To be considered closer to the need date. We are seeking a maximum recoverable costs allowance for potential future NTS, the quantum of which is based on the deferral value of the NTS. Any decision to proceed with an NTS will be subject to the investment satisfying a net benefit test at the time. This approach is consistent with that used for the recent Western Bay of Plenty and Upper South Island MCPs.

Q5. Do you agree with the components we have short-listed? Are there any additional considerations you believe should be included?

3 Approach to Creating Stage 2 Development Plans

Consistent with our approach at Stage 1, individual short-listed components at Stage 2 are not sufficient to provide a complete solution; therefore, multiple components must be combined to meet the investment need. These updated development plans use the latest demand and system information, with the investments aiming to address voltage stability and thermal capacity constraints through to 2055.

Table 2 summarises the short-listed Stage 2 development plans and their implementation timelines, with the first need date occurring in 2028 under the prudent demand forecast (Environmental scenario).

Table 2: Components in each short-list development plan (main differences between development plans highlighted in bold)

Option	2028-32/33 (Stage 2)	2033/34-39 (anticipated Stage 3)	2040+ (potential later stage)	High-level cost (2025 present value)
Option 1: Series Compensation and Ohinewai Tee	• ±150 Mvar STATCOM at HEN • **Series compensation on BHL-WKM circuits** • Shunt capacitors at various locations	• **Ohinewai tee connection to Brownhill–Whakamaru** • Shunt capacitors at various locations	• **±150 Mvar STATCOM** • Shunt capacitors at various locations • Series reactors on various circuits	~$420m
Option 2: Series Compensation and Brownhill–Ōtāhuhu Cable	• ±150 Mvar STATCOM at HEN • **Series compensation on BHL-WKM circuits** • **Brownhill 220 kV Bus** • **220 kV Brownhill-Ōtāhuhu cable** • Shunt capacitors at various locations	• Shunt capacitors at various locations	• Shunt capacitors at various locations • Series reactors on various circuits	~$590m
Option 3: Ōtāhuhu–Whakamaru Duplexing and STATCOMs	• ±150 Mvar STATCOM at HEN • **Connect OTA-WKM A&B at Ohinewai and duplex the OHW-WKM section** • Shunt capacitors at various locations	• **±150 Mvar STATCOM** • Shunt capacitors at various locations • Series reactors on OHW-OTA 3&4	• **±150 Mvar STATCOM** • Shunt capacitors at various locations	~$430m
Option 4: Series Compensation and Duplexing	• ±150 Mvar STATCOM at HEN • **Series compensation on BHL-WKM circuits** (*potential to defer to Stage 3*)[7] • **Connect OTA-WKM A&B at Ohinewai and duplex the OHW-WKM section** • Shunt capacitors at various locations	• Shunt capacitors at various locations	• Shunt capacitors at various locations	~$460m

- The capital investment in the Stage 2 transmission components could potentially be deferred by implementing an NTS.
- Common investments across all options are a 100 Mvar shunt capacitor at PAK in 2028 and a ±150 Mvar STATCOM at HEN in 2029.
- Substation acronyms: Henderson (HEN), Brownhill Road (BHL), Whakamaru (WKM), Ōtāhuhu (OTA), Ohinewai (OHW), Pakuranga (PAK).

[7] Depending on the final selection of the Option 4 variant (4a or 4b, see Section 4.4), the series compensation investment could potentially be deferred.

4 Stage 2 Investment Options

As outlined in section 3, we refined a short-list of development plans. The following sections provide a detailed overview of the short-listed options and their respective development paths over the analysis period.

The short-listed development plans are summarised below. Common to all short-listed development plans is the installation of a shunt capacitor at Pakuranga substation in 2028 and a STATCOM at Henderson substation in 2029.

- **Option 1 – Series Compensation and Ohinewai Tee:** An investment path integrating reactive power support (shunt capacitors and another STATCOM), series compensation on the Brownhill–Whakamaru circuits, and a new hard tee connection of the Brownhill–Whakamaru circuits at Ohinewai to enhance thermal transfer capacity. Series reactors are used to redirect power flow.
- **Option 2 – Series Compensation and Brownhill–Ōtāhuhu Cable:** A new 220 kV underground cable between Brownhill Road and Ōtāhuhu, combined with series compensation on the Brownhill–Whakamaru circuits to optimise power flow. Reactive power support is provided by shunt capacitors at various locations. At a later stage, series reactors are considered on the new cable and on other circuits.
- **Option 3 – Ōtāhuhu–Whakamaru Duplexing and STATCOMs:** This path upgrades the two lowest-capacity lines supplying the WUNI region, by duplexing the Ōtāhuhu–Whakamaru A and B lines south of Ohinewai and connecting to the Ohinewai switching station. This increases thermal capacity of the lines while voltage stability is increased with two additional STATCOMs and various shunt capacitors. Series reactors are used to redirect power flow.
- **Option 4 – Series Compensation and Duplexing:** An investment path integrating reactive power support (shunt capacitors), series compensation on the Brownhill–Whakamaru circuits, and upgrades of the two lowest-capacity lines supplying the WUNI region, by duplexing the Ōtāhuhu–Whakamaru A and B lines south of Ohinewai and connecting to the Ohinewai switching station. This optimises the power flow across the available circuits into the WUNI region and increases the transmission limit.[8]

Our short-listed development plans include a range of options that explore different investment paths to meet the investment need, using different approaches across the near and medium term. These options include optimising existing assets (such as duplexing the Ōtāhuhu–Whakamaru A and B lines south of Ohinewai), constructing new transmission assets and integrating static and dynamic voltage support technologies (such as STATCOMs and series compensation). Based on the shortlisting criteria presented in the WUNI Stage 1 proposal document suite, we believe that these options represent an appropriate balance of number and technology to address the identified

8 We have considered two variants of Option 4 to analyse the sequence and timing of the investments in series compensation and duplexing, see section 4.4.

investment need. Given the different components available, and the ways in which those components could be combined to meet the investment need, four options are appropriate.

All short-listed options could potentially be deferred using NTS, which could delay the capital investment in transmission components, and which will be investigated through an RFI/RFP process later. This NTS approach is in line with our recent proposals for the Western Bay of Plenty and Upper South Island MCPs.[9]

The following subsections provide a detailed breakdown of each short-listed option and its development path.

4.1 Option 1 – Series Compensation and Ohinewai Tee

Option 1 follows a staged investment approach, combining reactive power support, series compensation, and a new transmission connection to ensure the region can meet the N-1 reliability standard.

The initial investments focus on voltage stability, with shunt capacitors installed at key substations in the Auckland region to increase static limits. A STATCOM at Henderson (2029) further lifts these voltage stability limits.

In 2030, series compensation is introduced on the Brownhill–Whakamaru circuits to reduce their electrical impedance.[10] This has the effect of increasing the thermal capacity into Auckland and raising voltage stability limits. In 2033 a tee connection to the Brownhill–Whakamaru 220 kV lines is constructed at Ohinewai. This upgrade increases thermal transfer capacity into the upper North Island, supporting long-term load growth.

Additional STATCOM and shunt capacitor installations continue through the 2040s to increase system capacity as load increases. Series reactors are installed to re-balance power flows.

Table 3 outlines the commissioning timeline for the components of Option 1, and these are presented graphically in Figure 1.

Table 3: Option 1 – Series compensation and Ohinewai tee investment path

Year	MCP stage	Component	Description
2028	This stage	100 Mvar shunt capacitor at PAK	Shunt capacitors are required to raise the static limit.
2029	This stage	±150 Mvar STATCOM at HEN	To address voltage stability issues in the WUNI region, both under- and over-voltage. This technology is chosen particularly as it addresses the over-voltage need more effectively.

9 See the NTS attachments for the Western Bay of Plenty MCP and the Upper South Island MCP.

10 The risk of sub-synchronous resonance between the series capacitors and other components on the system, such as nearby generators, will be addressed in the detailed design of the series compensation.

Year	MCP stage	Component	Description
2030	This stage	Series compensation on BHL-WKM circuits (2x16.93 Ohm), site to be confirmed	Reduces the electrical distance between the central North Island generators and the upper North Island and improves system stability. Series capacitors improve dynamic voltage stability and allow higher power transfer without overloading the lower capacity parallel circuits.
2031	This stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor (Auckland region)[11]	Shunt capacitors are required to raise the static limit.
2032	This stage	100 Mvar shunt capacitor (Auckland region) 2x75 Mvar shunt capacitors at OHW[12]	Shunt capacitors are required to raise the static limit.
2033	Anticipated stage 3	Ohinewai tee connection to Brownhill–Whakamaru circuits	Constructing a double tee connection between Ohinewai and the Brownhill–Whakamaru 1 and 2 lines will increase thermal transfer limits into the WUNI region.
2034	Anticipated stage 3	2x100 Mvar shunt capacitors	Shunt capacitors are required to raise the static limit.
2035	Anticipated stage 3	2x100 Mvar shunt capacitors	Shunt capacitors are required to raise the static limit.
2038	Anticipated stage 3	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2044	Potential later stage	±150 Mvar STATCOM 100 Mvar shunt capacitor 2x7 Ohm series reactors on HTU-WKM 1&2 circuits	To address voltage stability issues in the WUNI region, both under- and over-voltage. Series reactors are used to limit the current flow on transmission lines to redirect power flow away from heavily loaded circuits.
2051	Potential later stage	100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2053	Potential later stage	2x75 Mvar shunt capacitors	Shunt capacitors are required to raise the static limit.

[11] The specific sites of the later investments have not been confirmed yet. However, the shunt capacitors will mainly be in the Auckland region, with a few in Waikato.

[12] The notation 2x… Mvar indicates that two shunt capacitor units are to be installed at one location.

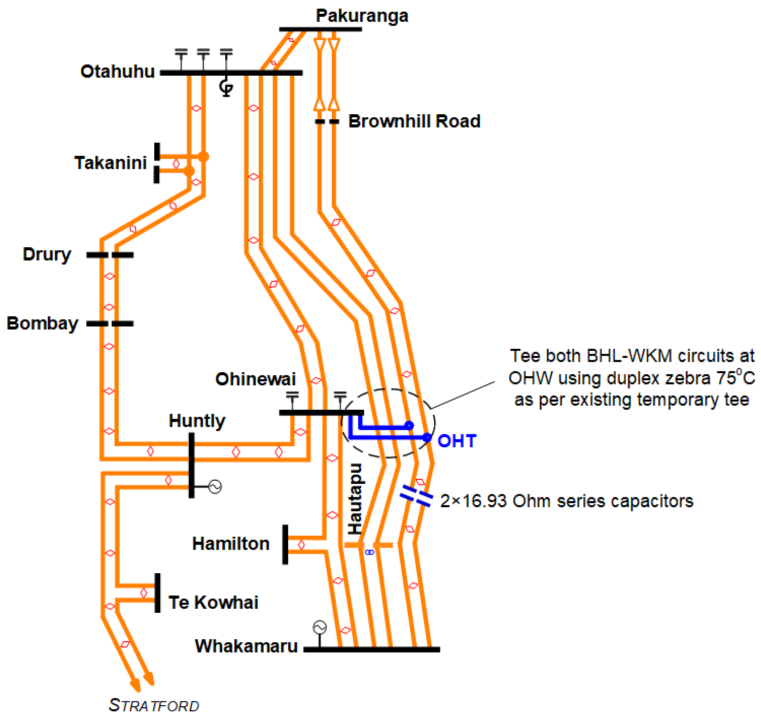

Figure 1: Single line diagram of Option 1

4.2 Option 2 – Series Compensation and Brownhill–Ōtāhuhu Cable

Option 2 involves upgrades to the transmission network by constructing a new 220 kV underground cable between Brownhill Road and Ōtāhuhu, along with series compensation on the Brownhill-Whakamaru circuits (2030). This investment, which also requires the establishment of a new 220 kV bus at Brownhill, increases the thermal transfer capacity into the upper North Island, enhances voltage stability and maximises the use of existing overhead transmission routes to meet the N-1 reliability standard.

The initial investments focus on voltage stability, with shunt capacitors installed at key substations in the Auckland region to increase static limits. A STATCOM at Henderson (2029) further lifts these voltage stability limits. Further shunt capacitor and series reactor installations in later years provide ongoing voltage support and re-balance power flows as demand continues to grow.

Table 4 outlines the components of Option 2 and their commissioning timeline, while Figure 2 visually represents this information.

Table 4: Option 2 – Series compensation and Brownhill–Ōtāhuhu cable investment path

Year	MCP stage	Component	Description
2028	This stage	100 Mvar shunt capacitor at PAK	Shunt capacitors are required to raise the static limit.
2029	This stage	±150 Mvar STATCOM at HEN	To address voltage stability issues in the WUNI region, both under- and over-voltage. This technology is chosen particularly as it addresses the over-voltage need more effectively.
2030	This stage	Series compensation on BHL-WKM circuits at Hangawera Road (2x26.15 Ohm) Brownhill 220 kV Bus 220 kV Brownhill-Ōtāhuhu cable	Reduces the electrical distance between the central North Island generators and the upper North Island and improves system stability. Series capacitors improve dynamic voltage stability and allow higher power transfer without overloading the lower capacity parallel circuits. Bussing at Brownhill and a new cable between Brownhill and Ōtāhuhu (BHL–OTA) will increase thermal transfer limits into the upper North Island.
2032	This stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor (Auckland region)	Shunt capacitors are required to raise the static limit.
2033	Anticipated Stage 3	100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2034	Anticipated Stage 3	2x75 Mvar shunt capacitors	Shunt capacitors are required to raise the static limit.
2035	Anticipated Stage 3	2x100 Mvar shunt capacitors	Shunt capacitors are required to raise the static limit.
2038	Anticipated Stage 3	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2045	Potential later stage	2x100 Mvar shunt capacitors	Shunt capacitors are required to raise the static limit.
2051	Potential later stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor 2x3 Ohm series reactors on HTU-WKM 1&2 circuits	Shunt capacitors are required to raise the static limit. Series reactors are used to limit the current flow on transmission lines to redirect power flow away from heavily loaded circuits.
2053	Potential later stage	2x100 Mvar shunt capacitors 3x3 Ohm series reactors on BHL cables	Shunt capacitors are required to raise the static limit. Series reactors are used to limit the current flow on transmission lines to redirect power flow away from heavily loaded circuits.

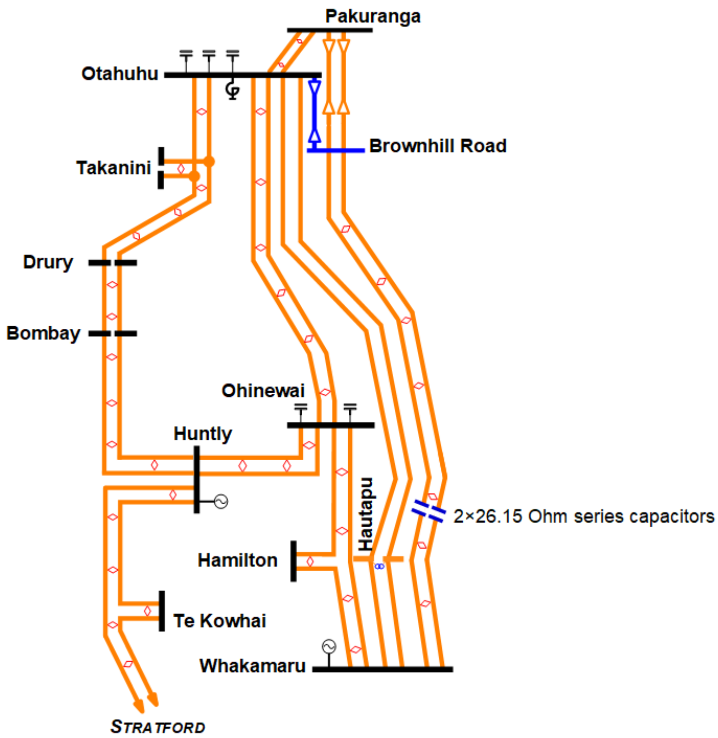

Figure 2: Single line diagram of Option 2

4.3 Option 3 – Ōtāhuhu–Whakamaru Duplexing and STATCOMs

Option 3 provides N-1 security by enhancing the capacity of a key transmission corridor. This approach involves connecting the Ōtāhuhu–Whakamaru A and B circuits at Ohinewai substation and duplexing the section between Whakamaru and Ohinewai substations (2030), doubling the capacity of these lines. This significantly improves power transfer capability into the upper North Island.

The initial investments focus on voltage stability, with shunt capacitors installed at key substations in the Auckland region to increase static limits. A STATCOM at Henderson (2029) further lifts these voltage stability limits. Further shunt capacitors will be installed later. In 2038, series reactors are installed on the Ohinewai–Ōtāhuhu circuits to re-balance power flows and prevent overloads. Additional STATCOMs will be required by 2034 and in the late 2040s.

Table 5 details the components of Option 3, including their commissioning timelines, while Figure 3 provides a graphical representation of this information.

Table 5: Option 3 – Ōtāhuhu–Whakamaru duplexing investment path

Year	MCP stage	Component	Description
2028	This stage	100 Mvar shunt capacitor at PAK	Shunt capacitors are required to raise the static limit.
2029	This stage	±150 Mvar STATCOM at HEN	To address voltage stability issues in the WUNI region, both under- and over-voltage. This technology is chosen particularly as it addresses the over-voltage need more effectively.
2030	This stage	Duplex OTA-WKM A&B circuits and connect at Ohinewai	Duplexing the Ōtāhuhu–Whakamaru A&B lines south of Ohinewai and connecting these lines to Ohinewai will increase the thermal capacity into the upper North Island.
2031	This stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor (Auckland region)	Shunt capacitors are required to raise the static limit.
2032	This stage	100 Mvar shunt capacitor (Auckland region) 2x75 Mvar shunt capacitors at OHW	Shunt capacitors are required to raise the static limit.
2033	Anticipated Stage 3	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2034	Anticipated Stage 3	±150 Mvar STATCOM (Auckland region)	To address voltage stability issues in the WUNI region, both under- and over-voltage.
2035	Anticipated Stage 3	2x100 Mvar shunt capacitors	Shunt capacitors are required to raise the static limit.
2038	Anticipated Stage 3	100 Mvar shunt capacitor 100 Mvar shunt capacitor 2x3 Ohm series reactors on OHW-OTA 3&4 circuits	Shunt capacitors are required to raise the static limit. Series reactors are used to limit the current flow on transmission lines to redirect power flow away from heavily loaded circuits.
2044	Potential later stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2049	Potential later stage	±150 Mvar STATCOM	To address voltage stability issues in the WUNI region, both under- and over-voltage.
2052	Potential later stage	100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2054	Potential later stage	100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.

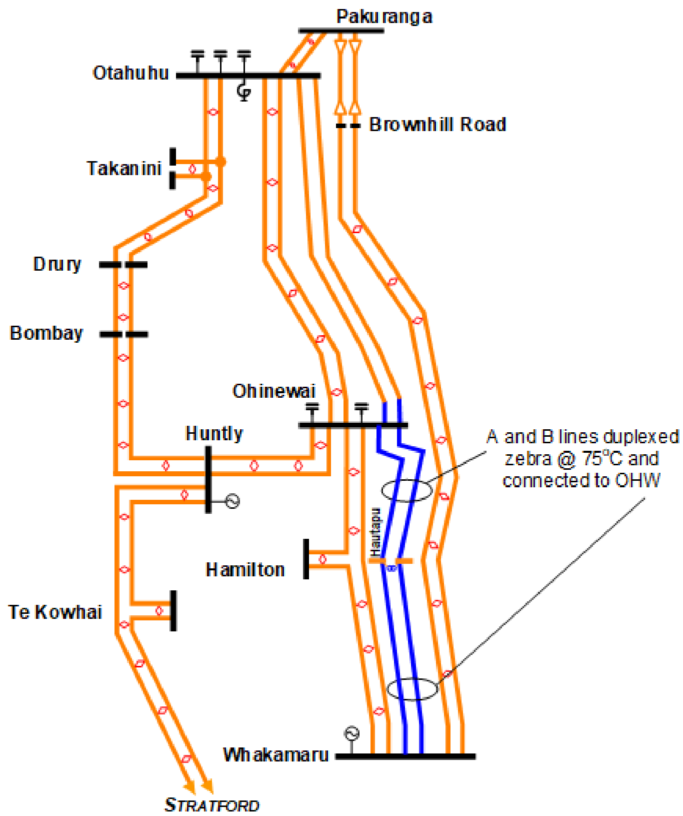

Figure 3: Single line diagram of Option 3

4.4 Option 4 – Series Compensation and Duplexing

Option 4 provides N-1 security by enhancing the capacity of a key transmission corridor. Series compensation is introduced on the Brownhill–Whakamaru circuits to reduce their electrical impedance. This has the effect of increasing the thermal capacity into Auckland and raising voltage stability limits. Together with connecting the Ōtāhuhu–Whakamaru A and B circuits at Ohinewai substation and duplexing the section between Whakamaru and Ohinewai substations, this significantly improves power transfer capability into the upper North Island.

We have considered two variants of Option 4: In Option 4a, series compensation is implemented first (in 2030), followed by duplexing in 2033. In Option 4b these timings are reversed, while all other components in the development plan remain unchanged. There are two key constraints with the Option 4 variants:[13]

- the duplexing must be completed by 2033, which is the condition-based replacement date of the existing simplex conductor, and
- duplexing by 2030 is very challenging for a section of over 100 km.

Option 4a (duplexing by 2033) provides more time for duplexing to be delivered because it builds series compensation in 2030. However, the duplexing cannot be deferred further even if the

[13] The duplexing constraints also apply to Option 3.

forecast load growth does not eventuate. This option commits us to the full cost of both the series compensation and duplexing by 2033.

Option 4b (duplexing by 2030) provides future optionality and possible staging, as the investment in series compensation can potentially be delayed if the forecast load growth does not eventuate. However, as mentioned above, there are risks with the deliverability of duplexing by 2030. This option therefore brings risk if, for example, high demand growth eventuates or if generation is on the lower side of our assumptions (particularly at Huntly). This is discussed further in Attachment 1.

The initial investments focus on voltage stability, with shunt capacitors installed at key substations in the Auckland region to increase static limits. A STATCOM at Henderson (2029) further lifts these voltage stability limits. Further shunt capacitors will be installed later.

Table 6 details the components of Option 4a, including their commissioning timelines, while Table 7 shows Option 4b. Figure 4 provides a graphical representation of Option 4 variants.

Table 6: Option 4a – Series compensation and duplexing investment path

Year	MCP stage	Component	Description
2028	This stage	100 Mvar shunt capacitor at PAK	Shunt capacitors are required to raise the static limit.
2029	This stage	± 150 Mvar STATCOM at HEN	To address voltage stability issues in the WUNI region, both under- and over-voltage. This technology is chosen particularly as it addresses the over-voltage need more effectively.
2030	This stage	Series compensation on BHL-WKM circuits at Hangawera Road (2x16.93 Ohm)	Reduces the electrical distance between the central North Island generators and the upper North Island and improves system stability. Series capacitors improve dynamic voltage stability and allow higher power transfer without overloading the lower capacity parallel circuits.
2031	This stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor (Auckland region)	Shunt capacitors are required to raise the static limit.
2032	This stage	100 Mvar shunt capacitor (Auckland region) 2x75 Mvar shunt capacitors at OHW	Shunt capacitors are required to raise the static limit.
2033	This stage	Duplex OTA-WKM A&B circuits and connect at Ohinewai	Duplexing the Ōtāhuhu–Whakamaru A&B lines south of Ohinewai and connecting these lines to Ohinewai will increase the thermal capacity into the upper North Island.
2035	Anticipated Stage 3	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2038	Anticipated Stage 3	2x100 Mvar shunt capacitors	Shunt capacitors are required to raise the static limit.
2047	Potential later stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.

Year	MCP stage	Component	Description
2052	Potential later stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.

Table 7: Option 4b – Duplexing and series compensation investment path

Year	MCP stage	Component	Description
2028	This stage	100 Mvar shunt capacitor at PAK	Shunt capacitors are required to raise the static limit.
2029	This stage	± 150 Mvar STATCOM at HEN	To address voltage stability issues in the WUNI region, both under- and over-voltage. This technology is chosen particularly as it addresses the over-voltage need more effectively.
2030	This stage	Duplex OTA-WKM A&B circuits and connect at Ohinewai	Duplexing the Ōtāhuhu–Whakamaru A&B lines south of Ohinewai and connecting these lines to Ohinewai will increase the thermal capacity into the upper North Island.
2031	This stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor (Auckland region)	Shunt capacitors are required to raise the static limit.
2032	This stage	100 Mvar shunt capacitor (Auckland region) 2x75 Mvar shunt capacitors at OHW	Shunt capacitors are required to raise the static limit.
2033	This stage	Series compensation on BHL-WKM circuits at Hangawera Road (2x16.93 Ohm)	Reduces the electrical distance between the central North Island generators and the upper North Island and improves system stability. Series capacitors improve dynamic voltage stability and allow higher power transfer without overloading the lower capacity parallel circuits.
2035	Anticipated Stage 3	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2038	Anticipated Stage 3	2x100 Mvar shunt capacitors	Shunt capacitors are required to raise the static limit.
2047	Potential later stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.
2052	Potential later stage	100 Mvar shunt capacitor 100 Mvar shunt capacitor	Shunt capacitors are required to raise the static limit.

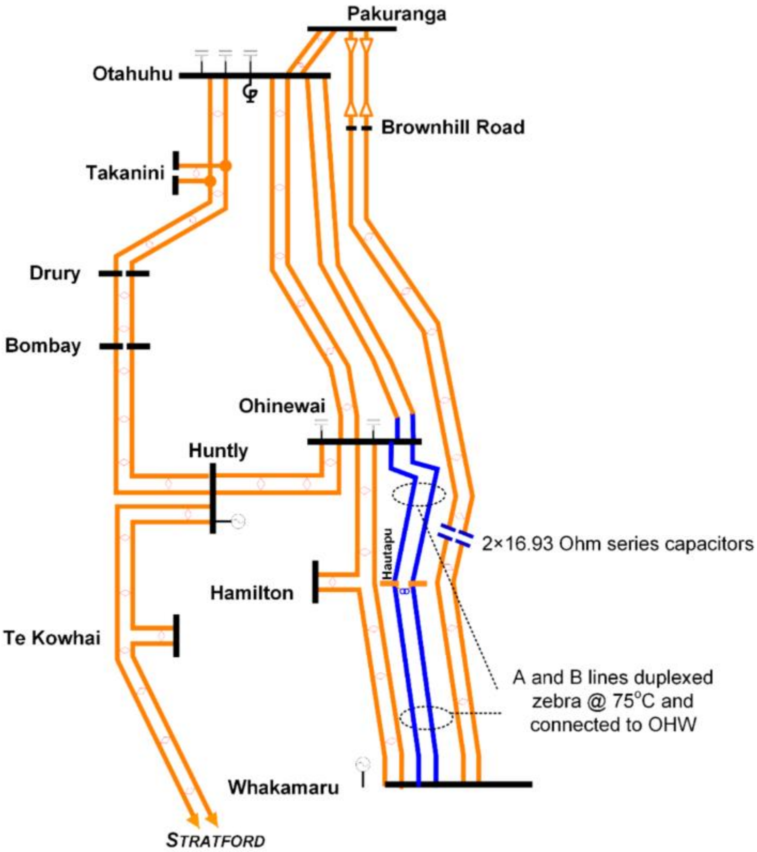

Figure 4: Single line diagram of Option 4 variants

4.5 Modelled Project

A related consideration is the modelled project involving the planned reconductoring works on the OTA–WKM A and B lines. These lines are approaching the need for condition-based reconductoring (i.e., replacing the conductors due to corrosion) soon. The next stage of this work is planned for 2028 and is subject of a separate investment proposal submitted to the Commission.[14]

Preliminary assessments indicate that the southern section of the OTA–WKM lines (between Ohinewai and Whakamaru) will require reconductoring during the 2030s. However, under our short-listed Options 3 and 4 this future work – and its associated costs – could be avoided, as these options include duplexing the lines to increase capacity ahead of the condition-based replacement need.

This future reconductoring work and its costs, or the potential avoidance of the work and the associated costs, has been included within the cost-benefit analysis for each option, see Attachment 5.

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14 Ōtāhuhu–Whakamaru A and B Lines Reconductoring Project

Q6. Do you agree with the development plans we have shortlisted?

Q7. Do you support the proposed NTS approach?

TRANSPOWER