TRANSPOWER

Keeping the energy flowing

Waikoukou
22 Boulcott Street
PO Box 1021
Wellington 6140
New Zealand
P 64 4 495 7000
F 64 4 495 6968
www.transpower.co.nz

25 May 2022

Andy Burgess
GM Infrastructure
Commerce Commission
Level 9, 44 The Terrace
Wellington 6011

By email Andy.Burgess@comcom.govt.nz

Copy to: regulation.branch@comcom.govt.nz; Matthew.Clark@comcom.govt.nz

Application to re-consider Transpower's RCP3 (Revenue Control Period 3) IPP (Individual Price Quality Path)

Dear Andy

This is our application to the Commerce Commission (the Commission) to re-consider the Transpower Individual Price-Quality Path Determination 2020 (the IPP) regarding additional Enhancement and Development (E&D) base capital expenditure (capex) funding requirements.

Under clause 3.7.4(1)(vi) of the Transpower IM (Input Methodologies), Transpower can apply to the Commission to re-consider its IPP when "two or more Enhancement and Development Projects have become reasonably likely to commence in the regulatory period". The criteria under this clause require that the projects were either unforeseen at the time of our submission of the Revenue Control Period 3 (RCP3) Proposal or they were foreseen but had a high degree of uncertainty.

Our RCP3 E&D base capex proposal and allowance

Our RCP3 E&D base capex application reflected a range of outcomes rather than a discrete forecast based on a set list of projects. The range we forecast was delineated by a low and high scenario:

- The low scenario ($59m 2017/18 constant $)[1] was based on projects that we assessed to be extremely or highly likely to occur in RCP3.
- The high scenario ($93m 2017/18 constant $) assumed a rapidly changing energy environment, focussing on carbon emission reduction targets driving electrification of industry and transport. The high scenario included all the low scenario projects,

[1] Constant $, excludes CPI and real price effects. These were added separately to our allowances.

plus system projects based on early-stage estimates and $10m for projects that were not identified but predicted based on historical spend and the forecast increase in demand.[2]

In our RCP3 Proposal, we proposed the Commission approve the mid-point expenditure level between these two scenarios ($76m 2017/18 constant $). The Commission approved an E&D base capex allowance based on our low scenario ($59m 2017/18 constant $) and created a specific reopener to deal with the uncertainty associated with E&D expenditure. The Commission stated:

> *"We also recognise that there is considerable uncertainty in this category of expenditure. Transpower's Transmission Planning Report (TPR) contains numerous E&D project possibilities to solve identified network capacity problems in a 10-year forward-looking horizon, with a small number of these projects actually being progressed to the detailed design stage.*
>
> *The decision to progress these potential projects will in many cases be outside of Transpower's control. They are usually externally driven by factors such as new generation, major new demand increases, or EDB decisions about their supply arrangements, for example.*
>
> *…*
>
> *Through the Transpower IM amendment determination we have addressed the inherent uncertainty of projects in the E&D base capex portfolio to allow additional funding during the RCP for those E&D projects:*
>
> *G161.1 that had not been approved at the time the IPP was reset; and*
>
> *G161.2 that were unforeseeable when the IPP was reset, or that were foreseeable but were unknown in their cost and/or timing."*[3]

Where we have spent (are spending) the existing allowance

Our E&D base capex allowance, less expenditure of $12.9m (2017/18 constant $) associated with the Bombay-Otahuhu Regional Major Capex Project (MCP), is $46.1m (2017/18 constant $).[4]

Excluding the projects proposed within this E&D reopener, we have 19 projects and investigations either started, or with an extremely high confidence that they will begin during RCP3. These projects and investigations have forecast capex of $45.2m (2017/18 constant $). This accounts for the majority (98%) of our E&D base capex allowance.

---

[2] Transpower, Transmission Planning Report, October 2018.]

[3] Commerce Commission, Transpower's individual price-quality path from 1 April 2020 – Decisions and reasons paper, August 2019, G155-G161.

[4] Following the approval of the BOB-OTA MCP, $12.9m (2017/18 constant $) will be removed from our base capex allowance. This will be dealt with separately to this E&D reopener application.

The projects range from small ($0.02m) to large ($9.1m). Most of these were included in the list of projects used to support our Low Scenario. As expected, some projects have not advanced while new projects have been identified.

We expect other (smaller) projects to arise that will need to start in RCP3. We will fund these projects from the remainder of the initial E&D base capex allowance.

Appendix A provides a list of the projects underway, or to start, under our current allowance.

Changes since our RCP3 Proposal

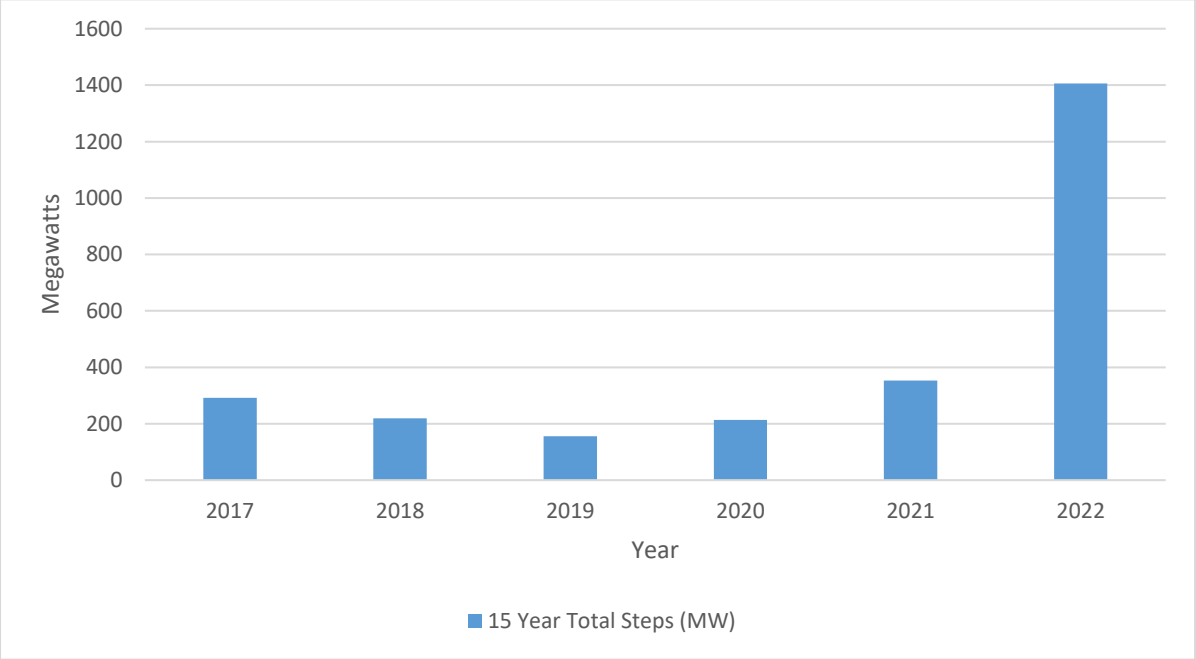
Since we submitted our RCP3 base capex application to the Commission in 2018, there have been changes in the external energy environment. Some of these were foreseen but had a high degree of uncertainty and some were unforeseen. These changes have increased Transpower's E&D base capex funding requirements beyond the Commission's conservative RCP3 E&D base capex allowance to a level close to our RCP3 high scenario.

We now expect our prudent and efficient expenditure on E&D base capex to be $83.9m (2017/18 $ constant). This is an increase of $38.9m (2017/18 constant $) over our RCP3 E&D allowance.

Change in long-term forecast step loads

As can be seen in Figure 1, we have had a significant uplift in customer forecast step loads arising from decarbonisation activities. This includes from initiatives supported by government grants such as the Government Investment in Decarbonising Industry (GIDI) fund, which was announced in November 2020 after our RCP3 proposal had been submitted. Several of our customers have committed to new grid exit points and other customers have signalled strong interest in new grid exit points.

Figure 1: Demand steps forecast (15 years) from load customers



There have also been changes in the way the grid is used; with some industrial consumers committing to retiring their operations. Industrial customers disconnecting from the grid can

trigger the need for new interconnection transformers when generation developed to serve the former industrial load remains in service.

Coupled with forecast load growth there is increasing enquiry about, and commitment to connecting new renewable generation. Addition of new renewable generation increases the likelihood of thermal generation retirement.

Combined, these factors drive the need for investment well above our forecast RCP3 application to enhance and develop the capability of the transmission grid.

Customers are required to fund the cost of their connection through new investment contracts. However, some customer investments can create the need for Transpower to invest in interconnection assets (E&D capex) to ensure we meet our reliability standards.

Change in step loads is driving short term investment needs

As well as the longer-term trend for more forecast step load changes, there are two projects identified to be completed before the end of RCP3 that directly result from step load changes. These are Redclyffe Interconnection (step load increase) and Kawerau Interconnection (step load decrease).[5]

Customer commitment to a new grid connection point in Canterbury will remove access to one operational measure to manage power quality in the upper South Island (Upper South Island High voltage management).

The volume of grid connected generation projects is increasing

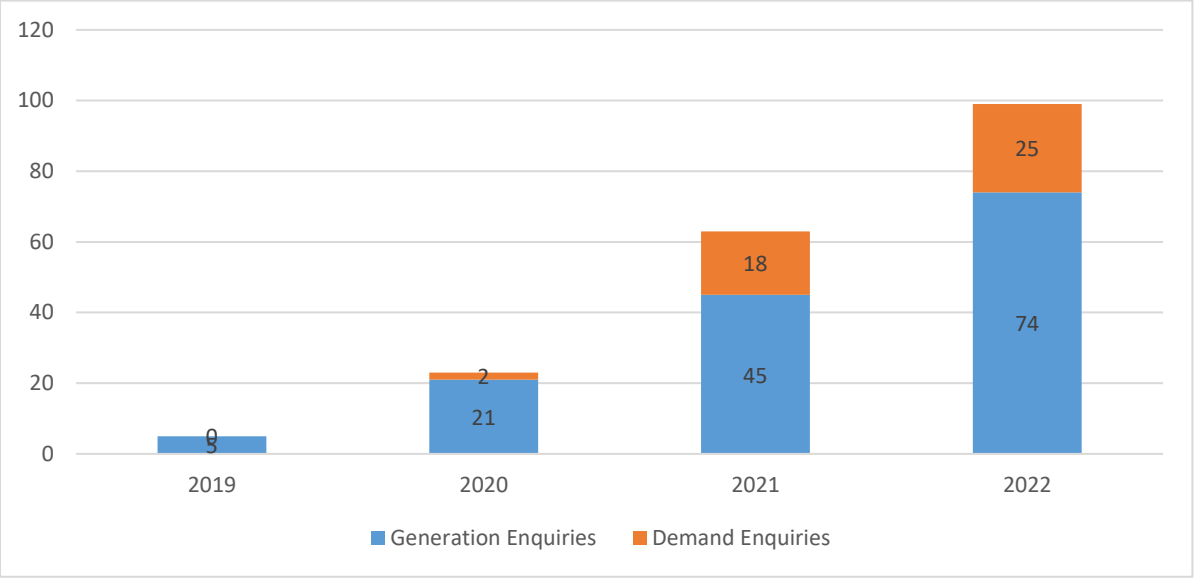
Commitment and connection of new generation is a driver for E&D investment to enable the economic dispatch of lower cost generation sources.

In Figure 2 we show the uplift in enquiries for new generation connections from five in 2019 to 74 in 2022. This uplift is a leading indicator of generation connection growth. We are also aware of significant increases in the number of embedded generators being connected or enquiring about connection.

We are working with customers to ensure they are well informed as to the capacity of the existing transmission network and what investment may be justified if their project is committed.

[5] Note, our plan is to cover the cost of the Redclyffe interconnection project (~$10m) under our initial RCP3 E&D allowance due to another project not progressing.

Figure 2: Connection enquiries



The following grid connected generation projects have been committed since we made our RCP3 application:

- Harapaki Wind Farm -176MW – Hawkes Bay – Committed February 2021
- Tauhara Geothermal – 152MW – Wairakei Area – Committed June 2020
- Turitea Wind Farm North – 119MW – Central North Island – Committed March 2019
- Turitea Wind Farm South – 103MW – Central North Island – Committed November 2019
- Waipipi Wind Farm – 133MW – Taranaki – Committed August 2019

The Harapaki and Tauhara generation projects increase power transfer through the area known as the Wairakei Ring. The investment in a series reactor to better use existing grid capacity through the Ring has been made to avoid constraints when the committed generation comes online. This allows for the economic dispatch of generation. This project was foreseen when we submitted our RCP3 base capex application (and hence included in the forecast range of E&D base capex). However, it was not included in the low scenario that the Commission provided for in its RCP3 decision.

Transpower IM requirements

The E&D reopener is covered under clause 3.7.4(1)(vi) of the Transpower IM. The Transpower IM requirements applicable for a Transpower IPP re-opener application for incremental E&D base capex funding require us to evidence:

- the types of E&D projects to be included in the application – capturing projects that were either foreseen or unforeseen at the time the IPP determination was set in 2019;
- that E&D projects included in the application are 'reasonably likely' to commence during RCP3 (including providing supporting analysis);
- the drivers for (or needs of) the E&D projects included in the application are one or more of those typically associated with E&D projects (including providing supporting analysis); and

- the timing of the application – being no later than 30 June 2022 (i.e. the end of the second disclosure year in RCP3).

Our compliance against the respective Transpower IM requirements is set out in Appendix B of this application. More project specific information is provided in Appendix C and our project plans are in Appendix D.

We ask the Commission to update Transpower's standard incentive rate base capex allowances to cover the efficient and prudent expenditure on these projects. In total **we are seeking a reopener for the remaining years of RCP3 totalling $41.1m (nominal)**. The changes required to Schedule C2 and Schedule C4 of the IPP for the remaining disclosure years in RCP3 are set out in Appendix E.

Please contact Joel Cook, Head of Regulation, (joel.cook@transpower.co.nz) if you wish to discuss this application or for any additional information you may require.

Yours sincerely,

Alison Andrew

Chief Executive

Appendix A Summary of RCP3 E&D projects covered by the existing base capex allowance

Project Class / Title	Description	Status
Complete		
RCP2 (Regulatory Control Period 2) Roll over	13 Projects rolled over from RCP2	Complete
Hangatiki Voltage Management	Capacitors at Hangatiki	Complete
Aviemore Benmore Special Protection Scheme	Special protection scheme to manage constraints	Complete
Underway		
Waitaki Protection	Interconnection protection changes to avoid load constraints	Underway
Southdown Exit	Site works to allow for sustainability of existing connections at site	Underway
Minor Projects	Minor protection changes to allow for constraint relief	Underway
Corridor Management Programme	Manage planning requirements under transmission lines	Underway
Redclyffe Special Protection Scheme	Enhancement to existing load shedding scheme	Underway
Islington Spare Transformer Connection	Allow for outages of interconnectors at Islington	Underway
Investigation		
Timaru Voltage Support	Manage voltage constraint at Timaru	Investigation
Brownhill cable designation	Retain designation for next Auckland cable	Investigation
Digital Substations	Investigate and enable the use of digital substation technology	Investigation
West Coast Reconfigurations	Allow for final exit of Westport and reconfiguration of network	Investigation
Bussing ARI-BOB at Hamilton	Busing of the Arapuni Bombay circuits into Hamilton	Investigation
Arapuni-Kinleith-Tarukenga transmission capacity	Increase capacity of the Arapuni-Kinleith-Tarukenga transmission circuits to allow for load growth	Investigation
HVDC (High Voltage Direct Current) Black Start	Allow for HVDC black start	Investigation

Project Class / Title	Description	Status
Hawkes Bay Interconnection	Allow for interconnection capacity into the Hawkes Bay	Investigation
Planned		
Studholme Restoration Time	Improve restoration time at Studholme post fault	Planned
Otahuhu-Penrose Capacity	Increase capacity between Otahuhu and Penrose	Planned

Appendix B Transpower E&D reopener IM compliance

In this appendix we demonstrate compliance against the Transpower IM requirements regarding additional Enhancement and Development base capex funding. This supports our application to the Commerce Commission to re-consider the Transpower Individual Price-Quality Determination 2020 requirements.

The below clauses are from the Transpower IM. Transpower's compliance against those clauses is demonstrated in the respective boxes.

3.7.4 When price-quality paths may be reconsidered

(1) Transpower's IPP may be reconsidered by the Commission if-

(vi) subject to subclauses (6) and (7), two or more Enhancement and Development Projects have become reasonably likely to commence in the regulatory period.

Five Enhancement and Development Projects have become reasonably likely to commence in RCP3.

(6) For the purposes of subclause (1)(a)(vi), Transpower may only apply once during a regulatory period for reconsideration of an IPP in respect of Enhancement and Development Projects, and that application must:

This is Transpower's first application of this kind during RCP3.

(a) be made to the Commission no later than the end of the second disclosure year commencing in that regulatory period; and

This application is made before the 30 June 2022.

(b) include:

(i) an explanation of why the Enhancement and Development Projects have become reasonably likely to commence in that regulatory period;

See Appendix B – Projects are either in delivery and will be commissioned during RCP3 or under investigation with the expectation of being commissioned in RCP3.

(ii) an explanation of the drivers of the E & D base capex project in accordance with either or both clauses 3.7.3B(2)(c) and 3.7.3B(3)(c); and

See Appendix B – 'Driver' and 'Needs' description per project.

(iii) supporting analysis for the explanations described in subclauses (6)(b)(i) and (ii),

See Appendix B (where relevant).

that is commensurate with the estimated capital expenditure and complexity of each Enhancement and Development Project that is the subject of the application.

The depth of project specific information provided in this application is consistent with the depth of information we included in our RCP3 base capex proposal for E&D base capex.

(7) For the purposes of subclause (1)(a)(vi), the total forecast value of the Enhancement and Development Projects must, in aggregate, amount to at least $20 million,

The total forecast value of the Enhancement and Development Projects included in this application is $41.1m (nominal).

where the two or more Enhancement and Development Projects may comprise either or both 'Unforeseeable Enhancement and Development Project' in accordance with clause 3.7.3B(2) or 'Foreseeable Enhancement and Development Project' in accordance with clause 3.7.3B(3).

Classification of Enhancement and Development Projects into unforeseeable and foreseeable projects is in Appendix B.

3.7.3B Enhancement and Development Projects

(1) 'Enhancement and Development Projects' means either an Unforeseeable Enhancement and Development Project as specified in subclause (2) or a Foreseeable Enhancement and Development Project as specified in subclause (3).

Classification of Enhancement and Development Projects into unforeseeable and foreseeable projects is in Appendix B.

(2) 'Unforeseeable Enhancement and Development Project' means an E & D base capex project where, in relation to a regulatory period:

(a) at the time the IPP determination was made for that regulatory period, an allowance for that E & D base capex project was not included in the base capex allowances for that regulatory period because:

(i) the E & D base capex project was not forecast to commence in that regulatory period; and

(ii) it was reasonably unforeseeable that the E & D base capex project was likely to commence during that regulatory period;

See Appendix B – 'Why this was not foreseen at RCP3 submission' description per project.

(b) Transpower can demonstrate that the E & D base capex project has become reasonably likely to commence in that regulatory period; and

See Appendix B – 'Status' description per project.

(c) drivers of the E & D base capex project include one or more of the following:

(i) a step change in demand that necessitates a capacity upgrade in the grid;

(ii) a generation commissioning or generation decommissioning;

(iii) meeting grid reliability standards or reliability service levels agreed between Transpower and its customer;

(iv) ensuring power quality complies with regulatory or legislative requirements;

(v) managing the power system dynamic voltage response to disturbances; or

(vi) any other development caused by a party outside the control of Transpower that requires a transmission network enhancement or transmission network development.

See Appendix B – 'Driver' and 'Needs' description per project.

Appendix C Project information

In this appendix, we summarise the five Enhancement and Development Projects included in this application, applying the definition for Enhancement and Development Projects as specified in the Transpower IM, clause 3.7.3B and providing the information as required under clause 3.7.4 of the Transpower IM.

The references provided in both tables ('2021 TPR Reference') is to the 2021 Transmission Planning Report. Capex amounts in this section are nominal.

Unforeseen E&D Project Details

Table 1: Unforeseen Enhancement and Development Projects

Project Description (Status)	Driver for issue	2021 TPR Reference	Capex Investigation Spend in RCP3 ($m)	Capex Build Spend in RCP3 ($m)
Upper South Island High voltage management, Islington Reactor **Delivery**	Grid Reliability Standards	6.6.2.2	0.12	8.3
Upper North Island Voltage Management, Pakuranga Reactors **Delivery**	Grid Reliability Standards	NA	0.1	15.2
Kawarau interconnecting capacity **Investigation**	Step change in demand (reduction)	10.4.2.1	0.2	10
OTA-WKM C Installation of Variable Lines Ratings **Investigation**	Grid Reliability Standards	NA	0.13	0.55
Total			**0.55**	**34.05**

Upper South Island High voltage management, Islington Reactor

Status: In Delivery

Driver: (iii) meeting grid reliability standards

Need: Security of Supply, Managing system dynamic response to disturbances.

Problem: During overnight low load periods it is increasingly difficult to manage high voltages in the Upper South Island. Reactive power injection has been continually increasing. The System Operator has had to take more operational actions in response to this increase.

The System Operator has historically manged voltages through the setting of dynamic reactive plant and operational measures such as removing transmission circuits from service. Operational measures are now commonplace most nights throughout the year.

Orion has committed to the connection of the Norwood 220kV Grid Exit point on the Livingston-Islington circuit. This GXP will remove the System Operator's ability to take this circuit out of service as an operating measure without effecting security of supply.

After considering the increasing voltage management requirements and the reduced operational measures available, the Grid Owner has concluded that a 220kV 80 MVAR shunt reactor should be installed at Islington during 2023. This solution is different to the indicative option in the 2021 Transmission Planning Report as that solution is insufficient for the long term needs of the network (see appendix D for details).

Why this was not foreseen at RCP3 submission: Customer commitment to a new GXP, which was not included in our range of plausible projects, has reduced our ability to manage power quality operationally and meet the Grid Reliability Standards.

Upper North Island Voltage Management, Pakuranga Reactors

Status: In Delivery

Driver: (iii) meeting grid reliability standards

Need: Security of Supply, Managing system dynamic response to disturbances

Problem: During low load periods it has become increasingly difficult to manage high voltages in the Upper North Island area. Reactive power injection has been continually increasing. The System Operator has had to take more operational actions in response to this increase.

One such operational action is to remove the Brownhill–Pakuranga cable sections from service to manage voltages and maintaining dynamic reactive power reserve. During these periods, these cables are not required to maintain security of supply and their removal avoids injecting significant reactive power into the grid. As a result, in recent years these cables have been switched in and out of service at an average rate of 180 times per year as an operational measure to manage high voltages.

We have recently experienced two significant cable joint failures on one Brownhill–Pakuranga cable which has resulted in a restriction on cable switching for operationally

managing voltages.[6] The System Operator's ability to manage voltages with cables remaining in service raise severe operation limitation and there is a need to invest in voltage management equipment (shunt reactors) to meet our obligations for voltage quality and meet security requirements.

Why this was not foreseen at RCP3 submission: Operational restrictions post failure of assets has reduced our ability to manage power quality and meet the Grid Reliability Standards.

Kawarau interconnecting capacity

Status: In Investigation

Driver: (i) a step change in demand that necessitates a capacity upgrade in the grid.

Need: Step change in demand (reduction), Security of supply and generation dispatch

Problem: A reduction in load in the Kawarau area from the closure of major industrial operations has resulted in net increase in generation export through the two 220/110 kV Kawarau interconnecting transformers. An existing Special Protection Scheme has been enabled to protect the smaller of the two interconnecting transformers (T13) from damage post a fault on the larger (T12). Planned generation developments in the area will mean this scheme is insufficient to protect the unit in the medium term. Replacing the existing transformer with a larger unit will allow for new generation connections in the area and retain security of supply for customers.

Why this was not foreseen at RCP3 submission: Customer load reduction step change.

Otahuhu–Whakamaru C Installation of Variable Line Ratings

Status: In Investigation

Driver: (iii) meeting grid reliability standards

Need: Deferral of investment

Problem: The capacity of the 220 kV Hamilton–Whakamaru 1 and Ohinewai–Whakamaru 1 circuits become the binding constraint supplying the Waikato and Upper North Island (WUNI) load during low generation in the WUNI region. To efficiently defer significant investment in the WUNI area, variable lines ratings need to be installed on the Otahuhu–Whakamaru C line. This will have the effect of raising the import limits of the WUNI region in a cost-efficient manner, and future significant projects can be deferred by one to two years.

Why this was not foreseen at RCP3 submission: Analysis of the WUNIVM (Waikato and Upper North Island Voltage Management) project post RCP3 submission found this solution to allow for deferral.

[6] We have notified the Commission of these outages.

Foreseen E&D Project details

Table 2: Foreseen Enhancement and Development Projects

Project Description	Driver for issue	2021 TPR Reference	Capex Investigation Spend in RCP3 ($m)	Capex Build Spend in RCP3 ($m)
Generation connection driven grid investments (Wairakei Reactor in **Delivery**)	Generation commissioning	6.3.2.2	0	6.5

Generation connection driven grid investments

Status: In Delivery

Driver: (ii) a generation commissioning or generation decommissioning.

Need: Efficient dispatch

Problem: The commitment to connect new generation at Harapaki and Tauhara will require constraints on power flow to avoid n-1 overloads on the Wairakei – Whakamaru A line. To avoid these constraints and allow for efficient generation dispatch, Transpower will install a series reactor on the Wairakei – Whakamaru A line at Atiamuri. This equipment will increase the transport capacity through the Wairakei ring by improving the power flow distribution between the low capacity Wairakei – Whakamaru A line and the high capacity Wairakei – Whakamaru C line. This has the effect of better utilising the high capacity Wairakei-Whakamaru-C line for existing and future generation in the area.

RCP3 submission status: Project was identified but not included in the Low Scenario.

Appendix D Project plans

Upper South Island High Voltage Management, Islington Reactor

Status: In Delivery

Foreseen at Time of Submission: No

Driver: (iii) meeting grid reliability standards

Need: Maintain System Security and Manage Voltage

Grid Need Date: 2023

Investigation Cost: $0.12M

Delivery Cost: $8.20M

Problem: During overnight low load periods it is increasingly difficult to manage high voltages in the Upper South Island. Reactive power injection has been continually increasing. The System Operator has had to take more operational actions in response to this increase.

The System Operator has historically manged voltages through the setting of dynamic reactive plant and operational measures such as removing transmission circuits from service. Operational measures are now commonplace most nights throughout the year.

Orion has committed to the connection of the Norwood 220kV Grid Exit point on the Livingston-Islington circuit. This GXP will remove the System Operator's ability to take this circuit out of service as an operating measure without effecting security of supply. This customer commitment to change in network configuration and the knock-on effect of reduced operational measures has resulted in the need for investment.

Driver: The reactive power injected into the transmission network has been increasing over the last 10 years and is expected to continue increasing. This is due to conversion of overhead lines to cables, building of new subdivisions with underground reticulation, irrigation load with fixed power factor compensation and a lack of increasing MW load within the distribution networks during the night.

The number of circuits that are required to be switched out to maintain dynamic reactive reserve has increased from none to three in the last ten years, even with the commissioning of a reactor at Kikiwa in 2019. There are now periods where the operator is running reactive plant at reactive margins to ensure voltages are managed in the steady state.

The commissioning of Norwood GXP will result in:

- Inability to maintaining acceptable voltages in the Canterbury region during periods of trough load if the ISL-LIV circuit is not available to be taken out of service, or
- Put Norwood on N security by switching out NOR-LIV and, at a later stage, parts of the USI (Upper South Island) on N security when we need to switch out a fourth circuit.

As this project is forecast to be commissioned in calendar year 2023 it is reasonably likely it will be completed during RCP3.

Options Considered:

The short list of options considered are given below

Option	Description	Explanation
1	Do nothing	This option manages the voltage issue by a combination of responses. It puts increasing load at risk at Norwood and the wider upper South Island as the reactive need becomes more severe. There is an increasing risk of system events. This option fails to meet the Grid Reliability Standards as core grid is forecast be on N security.
2	ISL reactor - 2023	80 Mvar reactor at the Islington substation.
3	ISL reactor - 2026	80 Mvar reactor at the Islington substation. Norwood is frequently exposed to the N security until 2026.
4	Reactor at Norwood GXP	Due to limitations of size and effectiveness the installation would not be an enduring solution requiring additional investment in the medium term.
5	Reactor elsewhere	Sites other than Islington are less effective at managing voltages.

Preferred Option:

Based on quantified and unquantified assessment **Option 2** was selected as the preferred option.

Costs considered

- Capital investment
- Risk cost of reduced security at Norwood
- Risk cost of reduced security for upper South Island
- Network losses

Why this was not foreseen at RCP3 submission: Customer commitment to a new GXP, which was not included in our range of plausible projects, has reduced our ability to manage power quality operationally and meet the Grid Reliability Standards in the medium term.

Upper North Island Voltage Management, Pakuranga Reactors

Status: In Delivery

Foreseen at Time of Submission: No

Driver: (iii) meeting grid reliability standards

Need: Maintain System Security and Manage Voltage

Grid Need Date: 2023

Investigation Cost: $0.1M

Delivery Cost: $15.5M

Problem: During light load periods, managing high voltage issues in the Waikato and Upper North Island areas has become increasingly difficult. We primarily manage the issue by switching the 400 kV-capable Pakuranga–Whakamaru circuits out of service when reactive power absorption is not available or is insufficient. In some instances, we have also switched Pakuranga–Penrose cable circuit and the Huntly–Stratford circuit out of service. Taking circuits out of service is an effective way to control voltages, but its application is limited, as we must also ensure security of supply to load in the area.

Over 2016-2020, each of the two Pakuranga–Whakamaru circuits have had 150-200 de-energise and re-liven operations per year. International research has identified that this frequent of switching of HV (High Voltage) cables is not common practice elsewhere.

Recent cable failures in the circuits being switched has resulted in operational restrictions on the switching of these cables.

Driver:

The driver for this investment is restriction to switching of the Brownhill-Pakuranga cables to manage voltage. During times of low load, the cables add significant capacitance to the network of in the vicinity of 150MVARs. As we are now limited in our ability to remove these from service compensation via other devices is required.

Options Considered:

The short list of options considered are given below

Option	Description	Explanation
1	Do nothing	With the operational restrictions in place voltage management is impractical. Doing nothing will not meet the security obligations of the GRS (Grid Reliability Standard)
2	Pakuranga Reactor – 2 x 100MVAR	Install two new reactors at Pakuranga.
3	Otahuhu Reactor 50MVAR Pakuranga Reactor 100MVAR	Utilise the spare NAaN (North Auckland and Northland) reactor at Otahuhu and replace spare. Install one new 100MVAR reactor at Pakuranga.
4	Bring forward WUNIVM STATCOM project	Bring forward the project of installing a +-150MVAR STATCOM at Otahuhu.

Preferred Option:

Based on quantified assessment of costs and unquantified assessment **Option 2** was selected as the preferred option.

Costs considered

- Capital investment

Why this was not foreseen at RCP3 submission: Operational restrictions post equipment failures were not foreseen.

Kawarau Interconnecting Capacity

Status: In Investigation

Foreseen at Time of Submission: No

Driver: (i) a step change in demand that necessitates a capacity upgrade in the grid.

Need: Step change in demand (reduction), Security of supply and generation dispatch

Grid Need Date: 2024

Investigation Cost: $0.2M

Delivery Cost: $10M

Problem: An industrial customer in the Kawerau area has ceased operations recently which has reduced load on the 110kV network. This has changed the generation load balance in the area resulting in stronger generation export.

Kawerau is a generation export region and is supplied through two 220/110 kV interconnecting transformers. KAW T12 is a 250 MVA transformer which can cater for existing levels of generation. KAW T13 is a smaller 80 MVA transformer, which cannot adequately support the generation in the area should an outage of T12 occur.

There is a Special Protection Scheme which manages loading on the smaller transformer if the larger unit trips by tripping off generation in the area.

Developments in the region mean that we plan to reconfigure the 110kV network in the area. Following this reconfiguration, all generation at Kawerau will be exported through the two interconnecting transformers. In this configuration the Special protection scheme will no longer be sufficient to unload the smaller transformer.

Without investment in security the grid will be reduced to the 110kV network in the area and generation export will be limited. We have several active enquires seeking to connect generation in the area.

Driver:

The driver for investment is to retain security and allow for generation export from the area.

Options Considered:

As this project is in its formal investigation phase, options assessment is yet to be completed. In planning studies have explored the following short list of options

Option	Description	Explanation
1	Do nothing	Reduce security to the area and constrain generation export.
2	Replace T13	Install a suitably sized transformer to replace 80MVA unit.
3	Continue to use Special Protection Scheme	This option will be insufficient to manage loading on the smaller transformer post grid reconfiguration.

Preferred Option:

As the investigation is on-going a preferred option has not been selected but the costs are modelled as the installation of a new interconnecting transformer to replace T13.

Why this was not foreseen at RCP3 submission: Customer load step change.

OTA-WKM C Installation of Variable Lines Ratings

Status: In Investigation

Foreseen at Time of Submission: No

Driver: (iii) meeting grid reliability standards

Need: Deferral of investment

Grid Need Date: 2023

Investigation Cost: $0.13M

Delivery Cost: $0.55M

Problem: The capacity of the 220 kV Hamilton–Whakamaru 1 and Ohinewai–Whakamaru 1 (OTA-WKM C line and HAM deviation) circuits imposes a transmission constraint on power flow between Whakamaru and Auckland. In the event of low generation and high load in the Waikato and Upper North Island regions, an outage of any of these circuits will cause the other to overload during winter period.

Driver:

As part of the Waikato and upper North Island voltage stability studies it was found that increasing the capacity of the circuits allows for deferral of major investment in the area by approximately one year. As the probable solution is relatively low cost it is a reasonable way of deferring future investment.

Options being considered:

As this project is in its formal investigation phase options assessment is yet to be completed. In planning studies have explored the following short list of options

Option	Description	Explanation
1	Do nothing (base case)	The 'do nothing' option will result in load in the regions being controlled within the capacity of the circuits pre-contingency.
2	Install Variable Line Ratings deviation	Having up to 12 ratings per day for each circuit. The circuits will have increased capacity thus increase import capability into the Waikato and Upper North Island regions.
3	Reconductoring	Replace the existing conductors with higher-rated conductors.

Preferred Option:

As the investigation is on-going a preferred option has not been selected but the costs are modelled as the installation of Variable Lines Ratings.

Why this was not foreseen at RCP3 submission: Accelerated regional demand growth

Generation Connection Driven Grid Investments (Wairakei Reactor)
Status: In Delivery

Foreseen at Time of Submission: Yes, but not funded

Driver: (ii) a generation commissioning or generation decommissioning.

Need: Efficient generation dispatch

Grid Need Date: 2023

Investigation Cost: $0

Delivery Cost: $6.5M

Problem:

The Wairakei Ring connects the generation rich regions of the central North Island with the high load centres of the Upper North Island, Waikato, and Bay of Plenty via two 220 kV transmission lines (a single and a double circuit line).

The capacity of the Wairakei–Ohakuri–Atiamuri–Whakamaru circuits on the single-circuit line may cause a transmission constraint during very high Wairakei Ring area generation. The recent reduction of industrial load in the Bay of Plenty Region (Norske Skogg at Kawerau) and the commitment to develop new generation at Tauhara (geothermal) and Harapaki (wind) in 2023 will increase the transmission constraint, both in terms of its magnitude and its frequency.

Driver:

Mitigating such constraints allows future committed generation to be dispatched. The investment is to install a series reactor on the lower-capacity Wairakei– Atiamuri–Ohakuri–Whakamaru single circuit line to balance flows on the higher capacity double circuit line in the Wairakei Ring.

Options Considered:

Short listed options considered as part of the investigation are described below.

Option	Description	Explanation
1	Do nothing	Committed generation will be constrained.
2	Install series reactor	Install a series reactor at Atamuri.
3	Reconductor or replace low-capacity line	Reconductor or replace Wairakei–Ohakuri–Atiamuri–Whakamaru line.

Costs considered

- Capital investment
- Inefficient generation dispatch

Unquantified

- Speed of execution

Preferred Option:

Based on quantified assessment **Option 2** was selected as the preferred option as it has the highest positive Net Benefit.

Appendix E Proposed replacement IPP Schedules C2 and C4

The proposed values as a result of this reopener application are in Column 5. Values in these tables are in nominal terms.

Schedule C2: Approved standard incentive rate base capex summary - commissioned basis (including capitalised operating leases)

all $m

Disclosure year ending	Value of standard incentive rate base capex allowance as determined 29 August 2019	Incremental approved standard incentive rate listed project base capex determined in 2020	Incremental approved standard incentive rate listed project base capex determined in 2021	Incremental approved standard incentive rate listed project base capex determined in 2022	Incremental approved standard incentive rate listed project base capex determined in 2023	Approved standard incentive rate base capex allowance for purposes of forecast MAR in the disclosure year
Column 1	Column 3	Column 3	Column 4	Column 5	Column 6	Column 7
30-Jun-21	206.7	0.0				**206.7**
30-Jun-22	266.8	0.0	0.0			**266.8**
30-Jun-23	303.3	0.0	0.0	7.0		**309.1**
30-Jun-24	274.8	0.0	0.0	14.7	0.0	**289.5**
30-Jun-25	347.2	0.0	0.0	19.4	0.0	**366.6**

Schedule C4: Approved standard incentive rate base capex summary - expenditure basis (excluding capitalised operating leases)

all $m

Disclosure year ending	Value of standard incentive rate base capex allowance as determined 29 August 2019	Incremental approved standard incentive rate listed project base capex determined in 2020	Incremental approved standard incentive rate listed project base capex determined in 2021	Incremental approved standard incentive rate listed project base capex determined in 2022	Incremental approved standard incentive rate listed project base capex determined in 2023	Approved standard incentive rate base capex allowance for purposes of forecast MAR in the disclosure year
Column 1	Column 3	Column 3	Column 4	Column 5	Column 6	Column 7
30-Jun-21	222.9	0.0				**222.9**
30-Jun-22	277.3	0.0	0.0			**277.3**
30-Jun-23	273.9	0.0	0.0	16.1		**288.8**
30-Jun-24	280.0	0.0	0.0	12.7	0.0	**292.7**
30-Jun-25	300.2	0.0	0.0	12.3	0.0	**312.5**