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Transpower's individual price-quality path for the regulatory control period from 1 April 2025

Final Decision Attachment B – Capital expenditure

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Contents

Chapter 1 Introduction

Purpose

1.1 The purpose of this Attachment is to set out our review of Transpower's proposal and our decision relating to base capex for Transpower's RCP4 individual price path (**IPP**) reset, and to explain our reasons for the final decision.

Background to our review

1.2 Setting an appropriate capital expenditure allowance for Transpower in RCP4 is a key focus area for us because the base capex allowance impacts the revenue Transpower can recover from its customers during RCP4 and beyond.

1.3 The base capex allowance is a fungible pool of expenditure for capex projects or programmes. Transpower has discretion on how the money is spent. The quantum of the base capex allowance is determined, taking into account Transpower's proposed base capex projects for RCP4.

Structure of this paper

1.4 Table 1.1 below provides an overview of what is covered by each of the chapters and attachments of this Topic Paper.

Table 1.1 Structure of this paper

Section	Title	Description
Chapter 1	Introduction	Sets out the purpose of this paper, what it covers, how it is structured, and the process we followed in reaching our decision.
Chapter 2	Our review framework	Describes the high-level framework and evaluation approach we have applied in reaching our decision.
Chapter 3	Our assessment of the RCP4 base capex proposal by asset category	Sets out a summary of the RCP4 base capex proposal, our assessment of the proposal, and our final decisions.
Chapter 4	Resilience	Sets out our consideration of Transpower's proposed resilience expenditure under base capex and uncertainty mechanism capex.
Chapter 5	Uncertainty mechanism expenditure	Sets out our consideration of Transpower's proposed uncertainty mechanism capex using Use-It-Or-Lose-It allowance.

Chapter 2 Our review framework

Purpose

2.1 In this chapter we discuss:

2.1.1 our review framework, and how capex is approved using the Capex IM approvals mechanisms;

2.1.2 how base capex proposals fit within the Capex IM framework; and

2.1.3 how we have used the Verifier's report to review Transpower's RCP4 proposal.

Base capex review and the Capex IM

2.2 In assessing a base capex proposal by Transpower, we are guided by whether a proposal is consistent with an expenditure outcome that represents the efficient costs of a prudent supplier.[1]

2.3 We consider this concept to be consistent with the purpose of Part 4, which is a required consideration under the capex evaluation criteria.[2]

2.4 In applying this concept, we consider that a 'prudent supplier' is a supplier whose planning and performance standards reflect Good Electricity Industry Practice (**GEIP**).

2.5 In evaluating the base capex expenditure proposal in Transpower's proposal, we must apply the evaluation criteria in the Capex IM, being:

2.5.1 the general evaluation criteria set out in clause 6.1.1(2) of the Capex IM (general capex evaluation criteria); and

2.5.2 the specific base capex evaluation criteria referred to in clause 6.1.1(3) of the Capex IM and specified in Schedule A of the Capex IM (base capex evaluation criteria).

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1 Commerce Commission "Transpower capex input methodology review – Decision and reasons" (29 March 2018), (**2018 Capex IM reasons paper**), para A15.

2 Capex IM, clause 6.1.1(2)(b) and Commerce Commission "Transpower's individual price-quality path for 2025-2030 – Our process, decision-making framework, and approach for setting expenditure allowances, quality standards and the price path" (9 October 2023) (**Process framework and approach paper**), chapter 3.

2.6 The general capex evaluation criteria are:

2.6.1 whether the proposal is consistent with the Transpower IM Determination and the Capex IM;

2.6.2 the extent to which the proposal promotes the purpose of Part 4 of the Act; and

2.6.3 whether the data, analysis, and assumptions underpinning the proposal are fit for the purpose of the Commission exercising its powers under Part 4 of the Act, which includes consideration of the accuracy and reliability of data, the reasonableness of assumptions, and other matters of judgement.

2.7 The base capex evaluation criteria are specified in Schedule A of the Capex IM. They include:

2.7.1 general factors we must have regard to when evaluating Transpower's proposal, such as reasonableness of key assumptions, overall deliverability of the proposed base capex during the regulatory period, and the extent to which grid output targets were met in the current and previous regulatory periods;

2.7.2 a non-exhaustive list of criteria we may use when evaluating each identified programme of work set out in the base capex proposal, such as reviewing Transpower's process used to determine each identified programme's reasonableness and cost effectiveness; and

2.7.3 a list of evaluation techniques we may employ, such as process benchmarking, and process or functional modelling.

2.8 The base capex evaluation criteria are not exhaustive, and the weighting of different criteria is at our discretion. Also, while Transpower is required to submit a base capex proposal, the final decision on Transpower's base capex allowance ultimately rests with us.

We used a Verifier to review Transpower's proposal

2.9 We have used a Verifier to assist us to better focus our review of Transpower's proposal on areas where forecast expenditures are less likely to meet the expenditure outcome.

2.10 The Verifier reviewed Transpower's RCP4 proposal to ensure prudency and efficiency in its investment expenditure, having regard to GEIP. In simple terms, prudency relates to confirming the expenditure is necessary to maintain safety, quality, reliability, and security of supply of regulated services. Efficiency relates to the provision of regulated services in the least cost manner, having regard to conditions in relevant markets for labour, capital, and materials inputs.[3]

2.11 We have used the verification report findings to:

2.11.1 help narrow our focus of the base capex proposal for investigation; and

2.11.2 make judgements about what areas of the RCP4 base capex forecast are consistent with an expenditure outcome, which represents the efficient costs of a prudent supplier of electricity transmission services.

2.12 The verification report also identified forecast expenditure categories in the proposal that the Verifier had not reviewed and verified.

2.13 For each asset class it reviewed, the Verifier tested Transpower's portfolio planning approach and asset management systems to test whether these were directed towards identifying, and developing, prudent and efficient solutions.

2.14 In our assessment of the proposal, we have been guided by our principle of proportionate scrutiny which we discussed in our Process, framework, and approach paper.[4] This ensures we focus our review on the more material issues in the proposal.

2.15 In its draft decision submission, Fonterra noted that the "use of the independent verifier provides some confidence in the requested capital expenditure."[5]

Our consultation process and how we considered submissions – capex

2.16 Following our review of the submissions to our Process, framework and approach paper, which informed our draft decision, we sought views of stakeholders and interested parties on our draft decision.[6]

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3 GHD Advisory and Castalia "Independent verification report – RCP4 base expenditure and service measures 2025-2030 proposal. Transpower New Zealand Limited" (12 September 2023) (**IV Report**) p i.

4 Commerce Commission, Process, framework and approach paper.

5 Fonterra, "Fonterra Submission on RCP4 draft decision papers" (26 June 2024) (**Fonterra submission on draft decision**)

6 Commerce Commission, "Transpower's individual price quality path draft decision papers (29 May 2024) (**Transpower RCP4 draft decision papers**)

Draft decision paper submissions and cross-submissions

2.17 We received a total of eight submissions and two cross-submissions of which five are relevant specifically to our capex draft decisions.

2.18 Most submission and cross-submission materials are related to five topics that are more general in nature, specifically, cost benchmarking, enhancement and development (**E&D**) reopeners and reopeners in general, demand forecasting, integrating transmission and distribution network planning, and alternatives to transmission.

2.19 We address the general submissions in the following section, and the specific submissions in the relevant expenditure section.

2.20 The submissions and cross-submissions related specifically to capex draft decisions include:

2.20.1 new conductor types (Rod Evans and Transpower);

2.20.2 E&D capex (Fonterra and Transpower);

2.20.3 Redclyffe substation rebuild as a Listed Project (Transpower);

2.20.4 other AC substation equipment (Transpower);

2.20.5 business support capex (Transpower);

2.20.6 resilience expenditure (Vector, MEUG and Transpower); and

2.20.7 Use-It-Or-Lose-It (**UIOLI**) funding mechanism (Fonterra and Vector).

General submission and cross-submission material

Cost benchmarking

2.21 MEUG's submission on our draft decision expressed support for the Verifier using cost benchmarking "to get an understanding of how Transpower's spending compares to comparable companies, particularly in Australia".[7]

2.22 Throughout the Verifier's report, the Verifier tested asset unit costs against Australian transmission asset owner costs to ascertain if Transpower's cost estimates were reasonable. This benchmarking in conjunction with Transpower's mature cost estimation processes has given us confidence that the proposal costs are efficient.

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[7] Major Electricity Users' Group, "MEUG Submission on RCP4 draft decision" (26 June 2024) (**MEUG submission on draft decision**), para 15.

E&D reopeners and reopeners in general

2.23 MEUG suggested in its submission that there appears to be "an over-reliance on mid-period E&D reopeners for several issues" and hoped that "processes can be streamlined to avoid administrative burden, while still providing scrutiny and transparency of Transpower's progress and planned works".[8]

2.24 Vector submitted that it was "concerned about the workability of relying solely on re-openers given the constraints on the Commission's resources".[9]

2.25 In its cross-submission, MEUG agreed with Vector's submission view stating that it recognises "re-openers can be an effective tool for dealing with this increased need for investment" but that "it is important that this process is robust and incorporates proper consumer engagement".[10]

2.26 Further, MEUG noted;

> "Multiple re-opener consultations could also place stress on consumer bodies, who have limited resources to engage fully [sic] through with submission process. Different approaches to consultation may be needed, to ensure interested and affected consumers can provide input into the Commission's process".[11]

2.27 We introduced the E&D mid-period reopener during the IPP reset process for RCP3 to address the uncertainty Transpower faces in predicting less certain E&D expenditure in a proposal well in advance of need.

2.28 Our view is that the Transpower E&D reopener process does not add significant administrative burden to either Transpower or us, considering the risk that it mitigates. Additionally, the E&D reopener is a single application reopener for Transpower during RCP4.

2.29 This allows us to mitigate the risk of consumers paying upfront for E&D that do not go ahead. The E&D reopener gives Transpower an opportunity to seek additional funding if projects become likely to proceed during RCP4 and Transpower can have two of more projects in the single-shot reopener application.

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8 Major Electricity Users' Group, MEUG submission on draft decision, para 15.

9 Vector Electricity, "Vector Electricity Submission on RCP4 draft decision" (26 June 2024) (**Vector submission on draft decision**), para 11.

10 Major Electricity Users' Group, "MEUG, Submission on RCP4 draft decision" (26 June 2024) (**MEUG Submission on RCP4 draft decision**) paras 6-7.

11 Major Electricity Users' Group, "MEUG Cross-submission on RCP4 draft decision" (15 July 2024) (**MEUG cross-submission on draft decision**), para 7.

2.30 We have already processed an E&D reopener application over RCP3 and consider the process to be efficient and robust. Transpower has previously expressed support for the process, which allows it to propose only the most certain and highly likely E&D projects in an RCP proposal.

2.31 Some submitters suggested that, given reopeners are available to Transpower, we should re-consider Transpower's Weighted Average Cost of Capital (**WACC**) percentile setting. A reconsideration of the WACC percentile is not a decision that can be made in this reset and was considered in the recent 2023 IM Review.

Demand forecasting and integrated planning

2.32 MEUG submitted that "there does not appear to be any cross checking of the assumptions made by Transpower and EDBs, to ensure that they present a consistent approach to demand forecasting and infrastructure planning".[12]

2.33 CAC submitted on the integration of transmission and distribution planning stating that it is good international practice to "ensure transmission planning is not undertaken in isolation from distribution planning and that both meet consumers' needs."[13]

2.34 Further, CAC recommended we consider whether Transpower is meeting good electricity industry practice in taking "an integrated planning approach to inform its expenditure forecasts."

2.35 In its cross-submission, Transpower provided additional information on the integrated approach to planning transmission and distribution, agreeing that it was considered "good practice integrated planning should also include taking account of generation".[14]

2.36 Transpower further explain its planning process stating that:[15]

> We engage with our connected (and prospective) customers to understand their perspectives and needs and take these into account when deriving expenditure forecasts for enhancement and development works. Our annual Transmission Planning Report details how we forecast demand and generation.

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[12] Major Electricity Users' Group, MEUG submission on draft decision, para 16.
[13] Consumer Advocacy Council, "Consumer Advocacy Council Submission on RCP4 draft decision" (26 June 2024) (**CAC's submission on draft decision**), paras 10-18.
[14] Transpower, Cross-submission on RCP4 draft decision, paras 6-8.
[15] Transpower, Cross-submission on RCP4 draft decision, para 7.

2.37 Transpower also summarised the general steps it takes when carrying out demand forecasting noting that it "considers how underlying, business-as-usual growth will evolve with input from distribution companies and major electricity users about their expectations".[16]

2.38 Transpower noted that the RCP4 proposal is "predominantly made up of expenditure to replace, refurbish, or maintain our existing assets" and that the "majority of expenditure driven by changing demand or generation requirements sit outside RCP4" and further that when it considers asset replacement or renewals it also considers "customers' views and the drivers for investment such as condition, electrification, and resilience to optimise".[17]

2.39 We agree that this proposal is focussed on the replacement and renewals of existing assets which is driven more by asset condition than customer demand. However, the E&D portfolio does contain demand driven projects, which is approximately 5% of the total capex in Transpower's proposal.

2.40 The Verifier carried out a review of Transpower's demand forecasting approach and concluded it was sound, although recommended Transpower consider reviewing how it accounted for EDB load step change timing.[18]

2.41 The Verifier noted that Transpower incorporates EDB demand forecasts as a key input into its bottom-up demand forecasting methodology and where necessary adjusts these to improve comparability with "regression models at the national, island and regional levels". Presumably this is to capture the effects of EDB demand diversity as it affects transmission network loading.[19]

2.42 Demand forecasting is a key variable when we review a Transpower demand driven major capex proposal (**MCP**). MCPs can be submitted at any time by Transpower and is a process that sits outside our consideration of an IPP proposal. When we review MCPs we test the assumptions Transpower has made, to ensure these are consistent with EDB forecasts.

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16 Transpower, Cross-submission on RCP4 draft decision, para 7.
17 Transpower, Cross-submission on RCP4 draft decision, para 8.
18 GHD Advisory and Castalia, IV Report, p 68-71 section 5.
19 GHD Advisory and Castalia, IV Report, p 68 section 5.1.

2.43 Additionally, when Transpower seeks to upgrade transmission at a regional level, it engages with the effected EDBs to refine demand forecasts to ensure any upgrades it proposes are appropriately timed. An example of this is the forthcoming Western Bay of Plenty (**WBOP**) MCP which Transpower is presently preparing. The local EDB affected is Powerco and its medium to long-term plans have been incorporated into Transpower's options, as these plans affect both transmission investment timing and the economics of the proposed solution.[20]

2.44 In this proposal there are a range of demand driven projects proposed in the E&D portfolio. Many of these upgrades are set out in Transpower's 2023 Transmission Planning Report (**TPR**), highlighting that in many cases the EDB demand and plans have been considered.[21]

2.45 For example, in the 2023 TPR, Transpower discusses its ongoing engagement with local EDBs Aurora and PowerNet to investigate solutions to address long-term capacity issues at the Cromwell and Frankton grid exit points (**GXP**). Both EDBs will be affected by the long-term transmission solution Transpower proposes.[22]

2.46 In some instances, EDB needs are considered when Transpower seeks to replace existing assets at GXP substations, such as transformers. In these situations, Transpower may investigate whether a like-for-like capacity is required or if an upgrade is more appropriate, which may include a request to do so by the EDB.

Alternatives to transmission

2.47 A number of submitters suggested that alternatives to transmission should be considered. Jeff Davies proposed that we should consider domestic solar panels to reduce the need for transmission.[23]

2.48 MEUG supported the "greater use of non-traditional solutions (**NTS**), across the transmission network, where it is cost-effective"[24], while Fonterra noted that "the ongoing support for and expansion of non-network solutions needs to be tracked and strengthened".[25]

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20 https://www.transpower.co.nz/projects/wbop.

21 Transpower, 2023 Transmission Planning Report available at https://www.transpower.co.nz/our-work/industry/transmission-planning.

22 Transpower, 2023 Transmission Planning Report, p 369 section 19.4.1.

23 Jeff Davies, "Jeff Davies Submission on RCP4 draft decisions" (26 June 2024), p 1.

24 MEUG, "MEUG submission on draft decision", para 16.

25 Fonterra, "Fonterra Submission on RCP4 draft decision papers" (26 June 2024) (**Fonterra submission on draft decision**) p 1.

2.49 CAC linked its views on integrated planning with technology developments that may avoid over-investment in infrastructure. CAC suggested that technology developments could provide lower cost options such as locally run microgrids (not tied to the national grid) that "offer the potential for a more efficient way of supplying power to some areas, particularly to geographically isolated communities". CAC's view is that these alternatives "could lessen the need for future transmission expenditure requested by Transpower".[26]

2.50 In its cross-submission Transpower agreed with MEUG that it needed to better understand how NTSs could be used by Transpower and EDBs.[27]

2.51 As noted earlier, this proposal is focussed on the replacement and renewal of existing transmission primary and secondary assets, largely driven by asset condition. While demand-side and generation alternatives to transmission exist, we are not aware of any developments with sufficient capacity to supplant the need for the existing transmission infrastructure at this point.

2.52 There is a capacity enhancement component of the proposal in the E&D portfolio. The projects in this portfolio are mostly (but not exclusively) to address demand increases affecting the transmission network. These projects are usually smaller tactical upgrades to increase transmission capacity. In these cases, transmission alternatives such as embedded generation or demand-side initiatives may defer the need for the upgrades.

2.53 Our approval process evaluates these projects and their forecast costs. Once we have established that these costs are prudent and efficient, we approve the total expenditure rather than individual expenditures that are project specific. Our approach incentivises Transpower to efficiently deliver projects over the RCP4 period including considering the use of non-transmission solutions where they are technically viable alternatives.

2.54 The E&D projects proposed by Transpower are all discussed in its 2023 Transmission Planning Report, which sets out transmission capacity issues, potential solutions, and identified need dates of upgrades.[28]

2.55 In many cases Transpower engages with local EDBs and seeks alternatives to transmission, which it is required to do as a consideration of its base capex proposals.

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[26] Consumer Advocacy Council, CAC submission on draft decision, para 15-16.
[27] Transpower, Cross-submission on RCP4 draft decision, para 15.
[28] Transpower, 2023 Transmission Planning Report available here https://www.transpower.co.nz/our-work/industry/transmission-planning.

2.56 As part of Transpower's proposal for a MCP for a grid enhancement and development project, Transpower is required to consider possible non-transmission solutions (**NTS**). As part of the requirement for NTS, Transpower must include reasonable information about the investment needs and consultation with interested persons.

2.57 In its cross-submission, Transpower noted that it had recently sought NTS as an alternative to a transmission upgrade in the Upper South Island and intended to seek NTS "in 2024 to support the grid in the upper North Island".[29] While we do not think it is necessary to introduce new Information Disclosure (**ID**) requirements at this time for this purpose, we will be focusing on the outcomes of Transpower's NTS procurement approach as we process a number of forthcoming MCPs.

2.58 Given advances in demand-side technologies, we will continue to review that Transpower is seeking and considering NTS options in its ongoing and future MCP processes to ensure that Transpower is identifying the most efficient solutions for the grid, in line with the investment test set out in Capex IM.[30]

2.59 Additionally, we will be focusing on whether Transpower is clearly setting out the NTS technical requirements, so that prospective providers are clear about the technical requirements and whether their solutions are likely to be appropriate.

Grid enhancement and development reopeners and capital contributions

2.60 In its draft decision submission, Fonterra suggested that "any new expansion of the transmission network to manage potential increased load demand should be covered by causer capital contributions and if necessary, use of a reopener".[31]

2.61 Transpower has extensive reopener opportunities available to it such as major capex proposal reopeners which can be applied for anytime, and the mid-period E&D reopener. Additionally, reopeners exist for Transpower when it seeks to invest in Anticipatory Connection Asset (**ACA**) capacity, which we discuss in-depth in our recent 2023 IM Review Transpower investment topic paper.[32]

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[29] Transpower, Cross-submission on RCP4 draft decision, paras 15-16.
[30] Commerce Commission, Transpower Capex IM Determination 2012.
[31] Fonterra, Fonterra Submission on RCP4 draft-decision, p 1.
[32] Commerce Commission, "Part 4 IM Review 2023 Final decision Transpower investment topic paper" (13 December 2023).

2.62 Regarding Fonterra's view on capital contributions. For connection assets Transpower engages with connecting parties and may enter into an agreement to build the connection asset which will be fully paid for by that connecting party. For upgrades that occur across the wider grid, capital contributions may be included but there is no formal capital contributions requirement in the IMs. Rather transmission costs, which includes costs for upgrades, are priced on a benefits-based allocation basis, in accordance with the Transmission Pricing Methodology (**TPM**), administered by the Electricity Authority (**EA**).[33]

[33] https://www.ea.govt.nz/projects/all/tpm/

Chapter 3 Our assessment of the RCP4 base capex proposal by asset category

Purpose

3.1 In this chapter we present our analysis of the RCP4 base capex proposal at an asset category level.

Background

3.2 Throughout this chapter we refer to Transpower's initial proposal. This is the expenditure that was reviewed by the Verifier prior to the RCP4 proposal being submitted to us by Transpower.

3.3 In some asset classes, Transpower has modified its proposal following Verifier conclusions, and as better information has become available. Where this is the case, we highlight those changes and discuss how we have considered these.

3.4 Any variation to the forecast estimates from those of Transpower's proposal of November 2023 is due to Transpower revising the expenditure model in response to our request for information (RFI). The forecast estimates in this attachment are the revised values.

3.5 We also make the distinction between asset category expenditure, and asset class expenditure, where appropriate. For example, substations capex is an asset category that contains expenditure related to replacement and renewals of a number of asset classes, like transformers and circuit breakers.

Transpower asset health and risk modelling

3.6 Since RCP3, Transpower has been developing asset health and risk models that fundamentally underpin the majority of the RCP4 proposal asset class capex forecasts.

3.7 During RCP3, we obtained an expert report on Transpower's progress in developing its asset health and risk models that concluded Transpower was maturing its modelling in most asset classes.[34]

3.8 In our review we relied on the expert opinion conclusions and the Verifier review of those conclusions. The Verifier also carried out its own review of Transpower's modelling processes as it tested the basis for each asset class forecast.

[34] GHD Advisory, "GHD Expert Opinion Progress Review - Report on Asset Health and Risk Modelling", (21 October 2022) contained in the IV Report.

3.9 We sampled asset health model information from Transpower to better understand the modelling process and to enable us to provide our own opinion. Information we sampled included:

3.9.1 how external and internal asset failure rate data has been used to tune the asset health models;

3.9.2 how the asset health models have been calibrated following post-asset replacement condition assessments; and

3.9.3 how asset data inputs track through to model outputs, illustrating how the asset health modelling framework feeds into expenditure forecasts.

3.10 As an example of how we reviewed Transpower's models, we tested the outdoor switchgear portfolio management plan (**PMP**) where Transpower describes the modelling approach and how it arrives at the asset probability of failure (**PoF**) curves that are used as inputs into expenditure forecasts.

3.11 We found that the asset class PMPs did not fully explain how the asset PoF curves were calibrated to reflect asset condition on replacement and failure rates.

3.12 Transpower provided more detail on its asset health modelling process, stating that:

3.12.1 Condition Based Risk Management (**CBRM**) asset health models are based on the international standard Distribution Network Operator (**DNO**) and the Common Network Asset Indices Methodology (**CNAIM**) used in the UK;

3.12.2 for asset classes with asset health models, PoF curves are developed to estimate asset degradation that assume an asset near its end-of-life is approximately 10 times more likely to fail than a new asset; and

3.12.3 the PoF curves are tuned to model predicted per annum failure rates based on DNO failure rate data and observed failure data.

3.13 Transpower has also started using backcasting analysis as another data input into the PoF curve calibration process, to help ensure that predicted and modelled asset health estimates are aligning.

3.14 In summary, after reviewing the asset health modelling process for outdoor circuit breakers, which is representative of Transpower's wider asset health modelling process, we are satisfied that it is consistent with GEIP and likely to result in robust expenditure forecasts.

3.15 Some asset health and risk models are more advanced than others, and the expert opinion identified where improvements could be made. Where model maturity could be improved, we note this in our asset class review.

Transpower base capex proposal for RCP4

3.16 Transpower is seeking approval for $2,167.4 million of base capex expenditure forecast.[35,36] This is a significant step change in capex (32%) when compared to what Transpower estimate it will spend by the end of RCP3 ($1,640.6 million), largely driven by asset age and condition issues, and asset input price increases.

AC substations

3.17 Transpower's AC substations asset category includes all the primary assets within the confines of the substation. The substations enable a safe operation of the grid through transforming transmission voltage, and provide points of connections to EDBs, generation, and major directly connected end users.

3.18 Transpower is seeking $509.1 million over RCP4 compared with the $384.2 million it estimates it will spend by the end of RCP3 (see Figure 3.1). This is a 32% increase in expenditure.

Figure 3.1 AC substations capex in RCP3/RCP4 ($ million constant 2022/2023)

[35] This $2,167.4 million amount does not include the enabling customer capacity mechanism capex ($100 million), resilience uncertainty mechanism expenditure ($123.8 million), listed project capex ($261.5 million), or capitalised leases expenditure ($58.7 million).

[36] In its original proposal Transpower's base capex was $2,197.2 million. After responding to our RFIs Transpower revised its base capex amount to $2,167.4 million.

3.19 The substations asset category consolidates expenditure in the following asset classes:

3.19.1 power transformers ($196.2 million);

3.19.2 indoor switchgear ($38.8 million);

3.19.3 outdoor switchgear ($102.6 million);

3.19.4 structures and buswork ($38.5 million);

3.19.5 power cables ($46.7 million);

3.19.6 other AC substation equipment ($48.0 million); and

3.19.7 outdoor-to-indoor 33kV switchgear conversions ($38.3 million).

3.20 In its initial proposal reviewed by the Verifier, Transpower proposed $441.5 million ($ constant 2021/2022) of substations capex, and the Verifier verified $416.1 million of that capex.

3.21 Following verification, Transpower made a number of changes to its proposal, due to a range of factors, and we discuss these changes in the relevant asset class analysis sections.

Power transformers

3.22 Transpower is proposing to spend $196.2 million over RCP4 in this asset class to replace or install 22 power transformers and 33 bushings.[37,38]

3.23 This proposed expenditure is an increase of 57% compared with Transpower's forecast of what it thinks it will spend by the end of RCP3.

3.24 Transpower describes the power transformer asset class as:[39]

> power transformers operating at system voltages of 11 kV and above, as well as supply and interconnector transformers in the main AC transmission network and the small auxiliary earthing and local service transformers.

3.25 Transpower is continuing with power transformer life extension works and intends to progress its replacement programme through to RCP4, RCP5 and RCP6.

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[37] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 98 section 8.2.1.

[38] Transpower confirmed the number of transformers to replace or install as 22 in its summary of proposal changes.

[39] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 96 section 9.3.1.

3.26 The expected life of power transformers can range from 40 to 70 years. A large portion of Transpower's power transformer fleet is less than 40 years old, and there are still some transformers that have been in service for over 60 years.[40]

3.27 To establish the number of replacement power transformers required in RCP4, Transpower states: [41]

> To establish the replacements, we assess the risk that each unit presents at present and into the future and compare this risk with the different investment options and the residual risk after each investment option on a net present value (NPV) basis to find the lowest whole of life cost solution for each asset.
>
> As a result of targeting component replacement in RCP2 and 3 to enable life extension, planned expenditure on power transformers has increased for RCP4 (relative to RCP3). Our investment focus remains on mid-life extension activities, such as replacing bushings, complete corrosion repaints, protection and instrumentation upgrades and maintenance activities which result in delaying full replacements. From RCP4, there will be an increase in the number of full power transformers that need replacing as a result.

Verifier review – power transformers[42]

3.28 The Verifier reviewed $154.1 million ($ constant 2021/2022) of proposed power transformer expenditure and agreed that $144.1 million ($ constant 2021/2022) of that capex was verified.

3.29 The Verifier's top-down review concluded that Transpower's asset management strategy documents and processes give confidence that expenditure was prudent and efficient having regard to GEIP, and consistent with the Capex IM evaluation criteria. Transpower has mature asset health models and monetised asset risk understanding for this asset class.

3.30 The Verifier concluded that the cost estimate processes that Transpower has followed are reasonable. Cost estimates are based on building block models and compared reasonably with "independently sourced costing information".

3.31 The Verifier rejected $10.0 million ($ constant 2021/2022), relating to investment in two transformers it considered not justified.

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[40] GHD Advisory and Castalia, IV Report, p 112 section 9.3.1.3.
[41] Transpower RCP4 Portfolio management plan – power transformers (October 2023), p 6.
[42] GHD Advisory and Castalia, IV Report, p 109-117 section 9.3.1.

3.32 For the expenditure that it rejected, the Verifier noted that Transpower had not followed its asset management system and investment decision making process to justify the investment. The Verifier stated that two power transformer investments had been justified on a self-insurance or contingency basis, rather than as direct replacements for any specific transformers, with Transpower claiming it had:[43]

> historically experienced 2 power transformer failures in 5-year period in average and hence is proposing to provision coverage for such eventuality during RCP4.

3.33 The Verifier concluded that it was not convinced about Transpower's justification for the two contingency transformers, and that this proposed expenditure was not consistent with the Capex IM evaluation criteria.

Our review - power transformers

3.34 Transpower's asset health and risk modelling processes for this asset class are at a high maturity level for asset health, and a moderate level for risk. This gives confidence that the forecast replacement and renewals volumes are reasonable.

3.35 The Verifier tested Transpower cost estimates and building blocks models and benchmarked these against external counterparts. We agree with the Verifier's conclusion regarding investment cost efficiency.

3.36 In its proposal Transpower removed the spare transformers the Verifier rejected and changed transformer investment priority based on updated condition data and connected party decisions. The proposed power transformer capex has increased to $196.2 million.

3.37 We reviewed Transpower's revised need case, particularly the need to accelerate replacements based on an update of its asset condition assessment. Transpower provided additional information stating that:[44]

> In our submission to the Verifier we had 19 power transformer replacements. We have removed the two proposed spare transformers based on feedback from the Verifier resulting in 17 transformers. We accelerated two transformers from RCP4 to RCP3 (as outlined above - WAI T1 & T2), we deferred two transformers from RCP3 to RCP4 (as outlined above – BRK T1 & TMI T1) and accelerated five transformers from RCP5 to RCP4 (as outlined above - Hangatiki (HTI) T1 & T2, Halfway Bush (HWB) T5 and Twizel (TWZ) T18 and T19). This results in a total of 22 power transformer replacements in RCP4.

[43] GHD Advisory and Castalia, IV Report, p 115 section 9.3.1.5.
[44] Transpower response to RFI013 – Replacement of transformer quantities, 16 February 2024.

3.38 On the issue of why transformer modelling has been amended since verification to support acceleration of the proposed transformer investments, Transpower state that:[45]

> The modelling we undertake in support of replacement and refurbishment decisions for power transformers has not changed since our submission to the Verifier however inputs to the modelling have been updated based on new field and customer data/information. The updated asset health scores are reviewed alongside other drivers for replacement timing such as customer engagement, and alignment of Transpower work with customer developments to optimise the replacement costs and resource needs. This has led to the five units outlined being accelerated into RCP4.

3.39 While we understand that judgements must be made regarding replacements and that asset condition assessments do not necessarily identify when an asset is going to fail, priorities may change based on condition assessment updates from the field and be driven by connected party decision making.

3.40 In summary, we conclude that Transpower has adequately explained the difference between what was verified and what was proposed in this asset class.

3.41 We received no submissions on our power transformers draft decision.

Our decision – power transformers

3.42 The Verifier concluded that $144.1 million ($ constant 2021/2022) of power transformer expenditure was verified.

3.43 We have accepted Transpower's explanation for the change in transformer investment priority, based on updated asset condition data and connected party decisions. Based on the Verifier's report and our review of the proposal changes, we consider the proposed power transformer expenditure is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.44 Our decision is to approve $196.2 million over RCP4 in the power transformers asset class.

[45] Transpower response to RFI013 – Replacement of transformer quantities, 16 February 2024.

Indoor Switchgear

3.45 Transpower is proposing to spend $38.8 million over RCP4 on the indoor switchgear asset class for investments in circuit breakers, instrument transformers, and busbars that provide switching and control functions for the grid. The proposed expenditure is a decrease of 27% when compared with Transpower's forecast of what it thinks it will spend by the end of RCP3.[46]

3.46 Transpower states the majority of the proposed expenditure is to continue to manage operational defects at existing installations, and to replace approximately four switchboards.[47]

Verifier review of indoor switchgear [48]

3.47 The Verifier reviewed $46.7 million ($ constant 2021/2022) of proposed indoor switchgear expenditure and agreed that this was verified.

3.48 The Verifier top-down tested Transpower's portfolio planning approach and observed the alignment between Transpower asset management documentation and its asset class strategy and portfolio management plan.

3.49 The Verifier's bottom-up review noted asset health modelling could improve but that risk was well understood. Investment need is primarily based on risk, obsolescence issues or safety concerns.

3.50 The Verifier noted the cost estimate processes that Transpower has followed are reasonable. Cost estimates are based on building block models that compare reasonably with Australian counterparts.

3.51 The Verifier concluded that the proposed indoor switchgear asset expenditure of $46.7 million ($ constant 2021/2022) was prudent and efficient having regard to GEIP and was consistent with the evaluation criteria in the Capex IM.[49]

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[46] Transpower's RCP4 Regulatory Template (RT01) – This spreadsheet provides the forecast capex and opex expenditure.

[47] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 99 section 8.2.1 table 16.

[48] GHD Advisory and Castalia, IV Report, p 117-123 section 9.3.2.

[49] Note that the expenditure the Verifier reviewed contained expenditure for resilience, which has since been re-categorised by Transpower into the RCP4 proposal resilience expenditure portfolio.

Our review – indoor switchgear

3.52 Transpower's asset health and risk modelling processes have been reviewed and while some improvements could be made to improve asset health modelling, Transpower's understanding of asset and network risk for this asset class is considered reasonable. We agree with the Verifier that Transpower has reasonably demonstrated the investment need.

3.53 The Verifier tested Transpower cost estimates and building blocks models and benchmarked these against external counterparts. We agree with the Verifier's conclusion regarding investment cost efficiency.

3.54 Transpower proposed a lower expenditure amount than what was verified. We observed two material changes, namely:

3.54.1 the proposed expenditure does not include the resilience expenditure which it has recategorised in its resilience expenditure portfolio in the proposal; and

3.54.2 Transpower has reduced its proposed indoor switchboard replacement volumes.

3.55 In its proposal, Transpower did not discuss the reduction in proposed indoor switchboard replacement volumes since verification, apart from noting that the resilience component of what was verified is now part of its RCP4 proposal resilience programme. We sought an explanation for this and Transpower stated:[50]

> The decrease in RCP4 indoor switchgear proposed expenditure is largely due to the acceleration, into RCP3, of the Kaiapoi (KAI) switchboard project due to the poor health of these assets. The building block unit costs for indoor switchgear have also reduced which makes up the remainder of the proposed expenditure decrease.

3.56 In our view, Transpower has reasonably explained the difference between the verified expenditure and what it has proposed.

3.57 We received no submissions on our indoor switchgear draft decision.

Our decision – indoor switchgear

3.58 We consider the indoor switchgear programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.59 Our decision is to approve $38.8 million over RCP4 in the indoor switchgear asset class for investments in circuit breakers, instrument transformers, and busbars.

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[50] Transpower response to RFI015 – Capital expenditure projects and programmes, 2 February 2024.

Outdoor switchgear

3.60 Transpower is proposing to spend $102.6 million over RCP4 in the outdoor switchgear asset class is comprising of investments in:[51]

3.60.1 outdoor circuit breakers ($42.0 million);

3.60.2 outdoor instrument transformers ($34.3 million); and

3.60.3 outdoor disconnectors and earth switches ($26.3 million).

3.61 The proposed expenditure is an increase of 190%, compared with Transpower's forecast of the $35.3 million it predicts it will spend by the end of RCP3. Transpower states that the expenditure increase is due to asset health issues following life extension benefits realised in RCP2 and RCP3.

Verifier review – outdoor switchgear[52]

3.62 The Verifier reviewed and verified $106.5 million ($ constant 2021/2022) of outdoor switchgear expenditure. The Verifier noted the increase in forecast expenditure when compared to RCP3, is due to an increase in the asset quantities rather than unit costs.

3.63 The Verifier top-down tested Transpower's portfolio planning approach for the three asset types in this portfolio, concluding that the asset management approach was prudent, and that each asset class has different investment drivers, namely:

3.63.1 outdoor switchgear expenditure driven by the SF_6 Management Strategy and replacing breaker with leakage issues;

3.63.2 instrument transformer expenditure need is being driven by corrosion issues; and

3.63.3 outdoor disconnector and earth switch expenditure driven by ongoing maintenance and an asset type issue.

3.64 The Verifier tested replacement rates against the asset health model outputs and was satisfied these were robust and resulted in prudent forecasts.

3.65 Building block unit rates were comparable with Australian NEM median unit cost information for similarly described asset types in the most recent Australian Energy Regulator's replacement expenditure models (repex model), and the RCP3 submission.

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[51] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 100-101 section 8.2.1.

[52] GHD Advisory and Castalia, IV Report, p 130-136 section 9.3.4.

3.66 Following its review, the Verifier concluded that the proposed outdoor switchgear expenditure was prudent and efficient, having regard to GEIP, and was consistent with the evaluation criteria in the Capex IM.

Our review – outdoor switchgear

3.67 In our review of this asset portfolio, we were particularly interested in how Transpower had reached the conclusion that it needed a 190% uplift in expenditure when compared to what it is likely to spend over RCP3. We focussed on this asset portfolio when we tested Transpower's asset health and risk modelling processes because of the significance of the expenditure uplift.

3.68 We sought additional information from Transpower about how:

3.68.1 external and internal asset failure rate data had been used to tune the asset health models;

3.68.2 the asset health models have been verified by backcasting analysis following post-asset replacement condition assessments;

3.68.3 asset data inputs track through to model outputs, illustrating how the asset health modelling framework feeds into expenditure forecasts; and

3.68.4 safety risk costs for some key asset classes have been quantified and monetised.

3.69 Transpower provided additional information explaining that:[53]

3.69.1 Condition Based Risk Management (**CBRM**) asset health models are based on the international standard Distribution Network Operator (**DNO**) and the Common Network Asset Indices Methodology (**CNAIM**) used in the UK;

3.69.2 for each asset class modelled, a PoF curve is developed to model asset degradation that shows an asset failing at its end-of-life, as being approximately 10 times more likely than a new asset; and

3.69.3 the PoF curves are tuned to model predicted failure rates in a year, based on the DNO failure rates and observed failure data.

3.70 Transpower has started using backcasting analysis as another data input into the PoF curve calibration process, to help ensure that predicted and modelled asset health estimates are aligning.

[53] Transpower, RFI011 "Asset health modelling and modelling process", 19 February 2024.

3.71 After reviewing the asset health modelling process for outdoor circuit breakers, we are satisfied that it is consistent with GEIP, and likely to result in robust expenditure forecasts.

3.72 Improved asset health and risk modelling does indicate if there is an incipient asset risk in a fleet. This largely explains the significant step change in expenditure required in the outdoor switchgear fleet.

3.73 While some of the outdoor switchgear expenditure uplift relates to asset unit rates increasing, most of it relates to replacement volumes. This indicates that replacement volumes are likely to have been too low in previous regulatory periods, as they appear not to have been reflective of asset health.

3.74 We investigated Transpower's policy related to SF_6 circuit breaker replacement. In 2021 Transpower released its SF_6 Management Strategy to manage SF_6 leaks and undertake maintenance activities, with a goal to reduce SF_6 emissions and meet net zero emissions by 2050.[54,55]

3.75 Transpower notes in its outdoor circuit breaker PMP, it is "trying to avoid installing SF_6 circuit breakers where possible, as SF_6 circuit breakers inherently have natural leakage rates".[56] While alternative solutions are not yet available for 110kV and 220kV circuit breakers, there are non-SF_6 alternatives for 66kV and below. Some RCP4 expenditure uplift relates to SF_6 replacements, and will increase over future periods as alternatives become available for 110kV and above.

3.76 In terms of cost efficiency, we considered the Verifier review, noting Transpower RCP4 proposal cost consistency with external peers and RCP3 costs. Our view is that Transpower has demonstrated efficient costs in this asset portfolio.

3.77 We received no submissions on our outdoor switchgear draft decision.

Our decision – outdoor switchgear

3.78 Following our review, we consider the outdoor switchgear programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.79 Our decision is to approve $102.6 million over RCP4 in the outdoor switchgear asset class, comprising investments in outdoor circuit breakers, outdoor instrument transformers, and outdoor disconnectors and earth switches.

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[54] Transpower RCP4 proposal Portfolio Management Plan (PMP005) – Outdoor circuit breakers, Oct 2023.

[55] SF_6 (or sulphur hexafluoride) is an insulant gas used in the electrical industry, particularly in circuit breakers. It is widely known as a greenhouse gas which is "23,500 times more effective at trapping infrared radiation than CO_2", meaning 1kg of SF_6 has the same effect as 23,500kg of CO_2 https://www.nationalgrid.com/stories/energy-explained/what-is-sf6-sulphur-hexafluoride-explained.

[56] GHD Advisory and Castalia, IV Report, p 121 section 9.3.3.4.

Structures and buswork

3.80 Transpower is proposing to spend $38.5 million over RCP4 in the structures and buswork asset class, comprising investments in:[57]

3.80.1 outdoor switchyard structures, including support structures for various switchgear;

3.80.2 outdoor buswork, including conductors and insulators;

3.80.3 outdoor substation tie lines including conductors, insulators and associated fittings; and

3.80.4 substation earthwires, and associated hardware and attachments.

3.81 The proposed expenditure is an increase of 305% when compared with Transpower's forecast of what it predicts it will spend by the end of RCP3. Transpower states that the expenditure increase is due to the impact of corrosion and natural degradation of the aged assets.[58]

Verifier review – structures and buswork[59]

3.82 The Verifier reviewed and verified $32.6 million ($ constant 2021/2022) of structures and buswork expenditure.

3.83 The Verifier noted that the increase in forecast expenditure when compared to RCP3, is due to an increase in the asset quantities rather than unit costs, with the bulk of the expenditure relating to lattice gantry painting, refurbishment of busbar supports, and insulators and hardware replacement.

3.84 Transpower has used site-based asset condition assessments to inform its investment decisions, which is a reasonable approach and provides a more focussed and site relevant intervention estimate than asset health modelling alone. The Verifier concluded that approach was reasonable and prudent.

3.85 The Verifier reviewed the asset building block unit rates used in the Transpower RCP3 submission (in $ constant 2017/2018) and RCP4 submission (in $ constant 2021/2022), and noted that "the increase in the building block unit rates between the RCP3 and RCP4 is generally very modest when CPI is factored in".[60]

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[57] Transpower NZ Limited - Asset Management Plan 2023, November 2023, p 83.
[58] Transpower's Substation portfolio overview document.
[59] GHD Advisory and Castalia, IV Report, p 123-130 section 9.3.3.
[60] GHD Advisory and Castalia, IV Report, p 135 section 9.3.4.5.

3.86 Following its review, the Verifier concluded that the proposed structures and buswork expenditure of $32.6 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and was consistent with the evaluation criteria in the Capex IM.[61]

Our review – structures and buswork

3.87 Transpower's asset health modelling is not at a high maturity level for this asset class and relies on site inspections to provide site specific intervention estimates. We agree with the Verifier that this is a reasonable approach to identify investment need in this asset class.

3.88 The Verifier tested Transpower's cost estimates and processes, and we agree with the Verifier's conclusion regarding investment cost efficiency.

3.89 Transpower is seeking a slightly higher forecast expenditure than the Verifier reviewed and verified but did not explain why. We sought further explanation for this increase and Transpower responded that:[62]

> The increase was primarily driven by increases in building block unit costs associated with concrete post repairs. Some of these increases have been offset by a reduction in building block unit costs for other work types and some work being moved out of RCP4, however the overall affect is an increase in cost from that reviewed by the Verifier

3.90 Our view is that Transpower has reasonably explained the difference between the verified expenditure, and what it has proposed.

3.91 We received no submissions on our structures and buswork draft decision.

Our decision – structures and buswork

3.92 We consider the structures and buswork programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.93 Our decision is to approve $38.5 million over RCP4 in the structures and buswork programme for investment in outdoor switchyard structures, outdoor buswork, including conductors and insulators, outdoor substation tie lines, including conductors, insulators and associated fittings, and substation earthwires and associated hardware and attachments.

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[61] Note that the expenditure the Verifier reviewed contained expenditure for resilience, which has since been re-categorised by Transpower into the RCP4 proposal resilience expenditure portfolio.

[62] Transpower response to RFI015 – Capital expenditure projects and programmes, 2 February 2024.

33kV outdoor switchyards to indoor (ODID) switchgear conversion[63]

3.94 Transpower is proposing to spend $38.3 million over RCP4 in converting 33kV outdoor switchyards to indoor switchgear at six substation sites.

3.95 The proposed expenditure is a decrease of 47% compared to the $71.6 million Transpower forecasts it will spend by the end RCP3.[64] Transpower states the expenditure reduction is because it is only converting six sites over RCP4 compared to the 10 sites it will complete by the end of RCP3.

3.96 Transpower describes the ODID conversion programmes as:[65]

> In 2008, we commenced a nationwide programme for the conversion of most of our outdoor 33 kV switchyards to indoor switchgear, to mitigate safety hazards, improve reliability, and achieve least lifecycle cost associated with outdoor 33 kV switchyards. This is known as our ODID programme.

3.97 Transpower has indicated that the ODID programme is well advanced, and that it plans to fully complete it over RCP5.[66]

Verifier review - ODID switchyard conversions

3.98 The Verifier reviewed and verified $30.2 million ($ constant 2021/2022) of ODID conversion expenditure.

3.99 The Verifier noted Transpower's investment programme has been guided by its compliance obligation to meet the health and safety jurisdictional regulation, which requires it to "eliminate health and safety risk" or to minimise that risk to a reasonably practicable level. Since these assets were designed and installed over 40 years ago, there is a significant gap between those designs and current design standards, especially safety requirements.

3.100 To test investment efficiency, the Verifier noted cost per site conversion appears greater than RCP3 site costs, but that this was due to site specific design costs. Each site will be a bespoke design solution, which means costs cannot be reasonably benchmarked. The Verifier concluded that Transpower's historical record of delivering ODID conversions was well-managed and prudent.

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63 GHD Advisory and Castalia, IV Report, section 9.3.5, p 136-141.

64 Transpower's RCP4 Regulatory Template (RT01), Expenditure forecast, November 2023, spreadsheet - Base capital expenditure RPE.

65 Transpower NZ Limited – Asset Management Plan 2023, (November 2023), p 90.

66 Transpower NZ Limited – Asset Management Plan 2023, (November 2023), p 90.

3.101 Following its review, the Verifier concluded that the proposed ODID switchyard conversion expenditure of $30.2 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and was consistent with the evaluation criteria in the Capex IM.

Our review – ODID switchyard conversions

3.102 Transpower is seeking to convert six ODID switchyards at a proposed expenditure of $38.3 million compared with the $30.2 million ($ constant 2021/2022) that was verified.

3.103 We sought further explanation from Transpower about the change in costs, compared to what was verified. Transpower's stated that unit costs had increased, particularly switchroom asset costs. We have accepted Transpower's explanation for cost increasing since verification as unit prices in building block models are constantly being updated with revised supplier cost estimates.

3.104 We understand that this is an industry-wide cost pressure issue.

3.105 We received no submissions on our ODID switchgear conversion draft decision.

Our decision – ODID switchyard conversions

3.106 We agree the ODID switchyard conversion programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria, and our decision is to approve $38.3 million for the ODID switchyard conversion programme.

Power cables

3.107 Transpower is proposing to spend $46.7 million over RCP4 in the power cables asset portfolio, which is a decrease of 12% when compared to the $52.8 million it predicts it will spend by the end of RCP3. [67]

3.108 As well as power cable replacement and refurbishment activities, Transpower forecasts it will replace 18 cable joints and 48 cable terminations.[68] Over RCP3 it intends to complete 42 cable joint, and 48 cable termination replacements.[69]

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[67] Transpower's RCP4 Regulatory Template (RT01) – This spreadsheet provides the forecast capex and opex expenditure.

[68] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 101 section 8.2.1.

[69] Transpower NZ Limited – Asset Management Plan 2023, (November 2023), p 74.

3.109 Transpower describes the power cables asset portfolio as:[70]

> Our HV power cables have operating voltages from 66 kV to 220 kV. Since 2010, we have installed 116.5 km of HV cables both buried underground and in tunnels. MV cables are generally used in short lengths (< 500 metres), inside substations, mainly to connect power transformers and indoor switchgear. MV cables have operating voltages between 11 kV and 33 kV.
>
> LV cables that operate at voltages lower than 11 kV are not included in this asset class.

3.110 In its 2023 Asset Management Plan (**AMP**), Transpower states that cable replacement decisions are made based on risk. The primary driver for investment is asset health and risk, with the risk assessment taking into consideration cable performance, and overseas power cables failure data.

3.111 Transpower has had one HV termination failure and two HV joint failures since 2018. Following this, Transpower is communicating with international experts to understand the cause of such cable joint failures.[71]

Verifier review - power cables[72]

3.112 The Verifier reviewed and verified $25.1 million ($ constant 2021/2022) of power cables capex.

3.113 The Verifier identified that the need for investment is predominantly based on risk using Transpower's asset health and criticality modelling to prioritise replacement and refurbishment works. While the average asset age is low, replacements are mainly driven by older oil filled technologies. The Verifier concluded that the need identification process was reasonable and demonstrated a risk-based approach.

3.114 Replacement costs were consistent with RCP3 costs and compared reasonably with similar cost estimate information sourced from Australian DNSPs and TNSPs.

3.115 Transpower identified the quality of workmanship in installing cable joints and terminations to be a crucial determination of interventions and investment need timing. The Verifier noted most of the proposed power cable expenditure in the first year of RCP4 is for repairing the Brownhill-Pakuranga (**BHL-PAK**) circuit and replacing cable joints after the cable failures in 2020 and 2021.

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70 Transpower NZ Limited – Asset Management Plan 2023, (November 2023), p 75.
71 Transpower NZ Limited, Asset Management Plan 2023 (November 2023), p 75.
72 GHD Advisory and Castalia, IV Report, p 141-146, section 9.3.6.

3.116 However, the Verifier noted some limitations in asset health model for this portfolio, namely the absence of models for cable joints, terminations, and oil-filled cables. Given this absence, the Verifier reviewed Transpower's asset failure rate curves, and concluded these were consistent with recent observed asset performance.

3.117 Following its review, the Verifier concluded the proposed power cables expenditure of $25.1 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

Our review – power cables

3.118 Transpower is seeking a higher forecast expenditure than was verified. We sought information about the reason for the change. Transpower responded that the increase was due to:[73]

3.118.1 an expected increase in costs of $18.7 million associated with the BHL-PAK cable repair work, which started in RCP3, and will continue into RCP4; and

3.118.2 the inclusion of 110kV oil filled cable terminations and joint replacements, instead of the original plan to repair these.

3.119 We sought further information from Transpower about why costs associated with the BHL-PAK cable repair work were not covered by manufacturer warranty.

3.120 Transpower informed us that since the cables were covered under the warranty period, it had approached the supplier to cover the repair costs. Transpower also engaged cable experts to determine the root cause of the cable joint failures, and to ascertain if cable operation, eg, switching the cables in and out of service to manage Auckland regional voltages, contributed to the failures.

3.121 In response to our RFIs, Transpower provided additional information and explanations for:

3.121.1 the increase in proposed expenditure; and

3.121.2 the need for urgent replacement of cable joints on the BHL-PAK cables to minimise Auckland regional supply security risk.

3.122 We consider the reasons presented by Transpower are reasonable explanations for the proposed expenditure increases. The BHL-PAK cables are a key component of Auckland regional supply security and need to be repaired to maintain reliability.

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[73] Transpower response to RFI015 – Capital expenditure projects and programmes (2 February 2024).

3.123 We received no submissions on our power cables draft decision.

Our decision – power cables

3.124 We agree with the Verifier that the power cables expenditure it reviewed and verified, is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.125 Our view is that Transpower has sufficiently justified why it has proposed a higher level of expenditure since verification. Our decision is to approve $46.7 million for power cables.

Other AC substation equipment

3.126 Transpower is proposing to spend $48.0 million over RCP4 in 'other AC substation equipment'. This is an increase of 30% compared to RCP3, where Transpower is projecting to spend $37.0 million.

3.127 Transpower describe this portfolio as assets that are essential to support the operation of primary assets at substation sites and covers the following two asset classes:

3.127.1 'low voltage AC (**LVAC**) distribution systems' consisting of LV switchboards, LV distribution boards, main/submains/LV distribution cabling, and AC junction boxes; and

3.127.2 'other substation equipment' consisting of oil containment and interception systems, cable trenches, air compressor systems, cranes and lift gear, earth grid, neutral earthing resistors, outdoor lighting, outdoor fire hydrant, roof and wall bushings, surge arrestors, and washing systems. HVDC substation sites are excluded from this asset portfolio.

3.128 Transpower states the key drivers for the proposed investments include:[74]

3.128.1 replacement of LVAC local switchboards based on condition;

3.128.2 replacement of LVAC switchboards and/or cabling where maintenance is uneconomical or safety risk high; and

3.128.3 asset condition considerations.

[74] Transpower NZ Limited, Asset Management Plan 2023, p 80.

Verifier review - other AC substation equipment[75]

3.129 The Verifier reviewed $46.2 million ($ constant 2021/2022) for 'other AC substations equipment' expenditure and agreed that $30.8 million ($ constant 2021/2022) of that capex was verified.

3.130 The Verifier noted that, due to the diverse nature of assets and smaller expenditure items, much of the expenditure forecast is based primarily on observed asset condition assessments, rather than asset health modelling.

3.131 The Verifier concluded Transpower's process and modelling to identify investment need in this LVAC distribution systems asset class was reasonable, and consistent with GEIP.

3.132 The Verifier also reviewed additional information provided by Transpower which attempted to substantiate funding in the 'other substation equipment' asset class. It concluded there was insufficient evidence to explain the steep increase in funding requested. The information was unclear regarding investment need and the basis for cost estimates.

3.133 The Verifier could not corroborate the stated drivers of some capex, such as discrepancy of the existing transformer bunds with Transpower's standards TP.DS.20.03, the performance criteria applied to oil containment systems, and the allocation of placeholder projects.

3.134 The Verifier concluded that it could not trace 'other substation equipment' building block rates through to the budget breakdown detail provided in the additional information Transpower provided.

3.135 The Verifier concluded that $30.8 million ($ constant 2021/2022) of the proposed $46.2 million ($ constant 2021/2022), for 'other AC substation equipment', was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

Our review – other AC substation equipment

3.136 We have reviewed the proposal and Verifier's report and agree that Transpower's asset health and risk modelling processes are at a reasonable level of maturity for LVAC distribution systems.

3.137 We accept that, for other expenditure items in this portfolio, using observed asset condition assessments is a reasonable approach given the diverse nature of the assets covered. Developing asset health modelling is not always practical.

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[75] GHD Advisory and Castalia, IV Report, p 147-152, section 9.3.7.2.

3.138 While the Verifier only verified $30.8 million ($ constant 2021/2022) of the proposed of $46.2 million ($ constant 2021/2022) for 'other AC substation equipment', Transpower is seeking $48.0 million in its proposal.

3.139 In its main proposal documentation, in response to the Verifier rejecting $15.4 million ($ constant 2021/2022) of 'other substation equipment' expenditure, Transpower stated it had 'increased the information around the AC substation equipment'[76].

3.140 We investigated Transpower's statement that it had addressed the Verifiers specific concerns regarding the rejection of $15.4 million ($ constant 2021/2022) of 'other substation equipment' expenditure but could find no evidence of this following our review of the Transpower proposal material.

3.141 While Transpower's AMP documentation appears to be reasonably well-developed, the Verifier's concerns centred around justification of the large step change in expenditure, compared with RCP3, and that it could not adequately trace how Transpower had arrived at its cost estimates. We found no evidence of Transpower addressing these two key points raised by the Verifier.

3.142 In our draft decision we approved $32.9 million of the proposed $46.2 million ($ constant 2021/2022) for 'other AC substation equipment' capex after agreeing with the Verifier's assessment.

3.143 In its draft decision submission, Transpower agreed the proposal information that supported its reasons for the expenditure was not provided to us, and that it accepted our draft decision.[77]

3.144 Since Transpower accepted our draft decision in its submission, our final decision is the same as our draft decision for other AC substation equipment.

Our decision – other AC substation equipment

3.145 We agree with the Verifier that $30.8 million ($ constant 2021/2022) of the $46.2 million ($ constant 2021/2022) it reviewed for 'other AC substation equipment' is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.146 We have inflated this verified amount to 2022/2023 constant prices using Transpower's expenditure forecast model inflators. Our decision is to approve $32.9 million of 'other AC substation equipment' capex.

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[76] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 102 section 8.2.1.1.

[77] Transpower, "Transpower Submission on draft decision", p 5 para 24-25, Appendix B.

Buildings and grounds

3.147 Transpower is proposing to spend $89.3 million in the buildings and grounds asset class, which includes expenditure in buildings, site infrastructure, building services, and access ways to Transpower's substation sites. Transpower states its buildings and grounds asset class comprises approximately 670 buildings across 200 sites.[78]

3.148 The proposed expenditure is consistent with the $90.6 million Transpower predicts it will spend by the end of RCP3 in this asset class.[79]

3.149 Transpower states the key drivers for the proposed expenditure are:

3.149.1 maintaining building warrant of fitness compliance, in accordance with the requirements of the territorial authority;

3.149.2 increasing warehouse expenditure to support the growing work programme;

3.149.3 fencing, accessway resurfacing, prevention of building water ingress, air conditioning; and

3.149.4 upgrading sites where infrastructure related to potable, sewage, and wastewater needs to be upgraded.

3.150 Transpower notes its buildings and grounds assets are in good condition overall, with condition assessed over a rolling three-year inspection period. Based on the condition assessment, 3% of the assets are in poor condition, reflecting severe deterioration but no performance loss, and 1% in very poor condition, reflecting deterioration to a point of performance loss.[80]

Verifier review – Buildings and grounds[81]

3.151 The Verifier reviewed $121.0 million ($ constant 2021/2022) of buildings and grounds expenditure, verified $108.0 million ($ constant 2021/2022) and suggested $13.0 million ($ constant 2021/2022), for drinking water supply sanitation compliance, be re-categorised.[82]

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78 Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 103 section 8.2.2.

79 Transpower's RCP4 Regulatory Template (RT01) - This spreadsheet provides the forecast capex and opex expenditure.

80 Transpower NZ Limited, Asset Management Plan 2023, p 95.

81 GHD Advisory and Castalia, IV Report, p 152-160, section 9.3.8.3.

82 Note that the expenditure the Verifier reviewed contained expenditure for resilience, which has since been re-categorised by Transpower into the RCP4 proposal resilience expenditure portfolio.

3.152 The Verifier noted that, while the forecast expenditure in RCP4 was consistent with the expenditure Transpower considers it will spend by the end of RCP3, there are two proposed work programmes that differ, specifically:

3.152.1 the addition of resilience expenditure for seismic strengthening of buildings, fire stopping, and detection upgrades to comply with building standards; and

3.152.2 the addition of expenditure for new drinking water requirements to comply with new Taumata Arowai drinking water requirements.

3.153 The Verifier noted that Transpower's planning approach identifies activities to manage and mitigate the risks in the fleet, using the International Infrastructure Management Manual (**IIMM**) and a site criticality ranking to determine investment priority.

3.154 Unlike network assets, Transpower does not take a routine asset management approach for this asset category, and instead relies on its facility management service providers who use industry software to forecast work programme for the next 15 years.

3.155 The Verifier concluded Transpower's asset management approach is directed towards identifying and developing prudent and efficient solutions.

3.156 In its review the Verifier suggested due to uncertainty about water regulation obligations the $13.0 million ($ constant 2021/2022) Transpower was proposing to upgrade site water supplies should be re-categorised as either uncertainty mechanism capex, or capex considered under a similar mechanism.

3.157 The Verifier noted that, while Transpower was likely to need to meet new requirements for drinking water, there was still uncertainty around the full implication of the proposed Water Service Act 2021 (**WSA**).[83]

3.158 The Verifier noted up to 100 sites may not meet the "the proposed drinking water quality compliance standard", and that at the time the proposal was being reviewed "the actual work needed, the options considered, cost involved etc. presently has high degree of uncertainty", with costs based on desktop studies only[84].

3.159 Following its review, the Verifier concluded proposed buildings and grounds expenditure of $108.0 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

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[83] https://www.legislation.govt.nz/act/public/2021/0036/latest/LMS374564.html

[84] GHD Advisory and Castalia, IV Report, p 159 section 9.3.8.4.

Our review – Buildings and grounds

3.160 Transpower is proposing $89.3 million for buildings and grounds expenditure, which is substantially less than what was verified. The main difference is that buildings and grounds resilience capex has been proposed in a separate category of expenditure.

3.161 We agree with the Verifier that Transpower's asset management process and procedures are reasonable and will result in prudent forecasts. The Verifier tested the cost efficiency of sample projects, and considered these were costed reasonably, and we agree with that assessment.

3.162 We reviewed Transpower's proposed expenditure to meet drinking water supply compliance. When the Verifier reviewed Transpower's initial proposal, Transpower had set aside $13.0 million ($ constant 2021/2022) to upgrade site water supplies. In its proposal, Transpower's proposed expenditure for the buildings and grounds PMP has risen to $21.3 million.

3.163 In its buildings and grounds PMP, Transpower provided additional information that indicates it is an unregistered supplier with unregistered supplies under the new definition of supply under WSA, s 9 and is required to meet all the legislation requirements under the WSA.[85]

3.164 Transpower notes that, where there is a supply at one of its sites, it needs to exercise due diligence around the nature of the supply and the risks and hazards to the safe supply of water (s 29 WSA), as well as meeting other requirements.

3.165 We consider that Transpower has adequately addressed the Verifier's concerns around the prudency of its proposal to meet the requirements of s 29 of the WSA.

3.166 However, our view is that Transpower has not addressed the Verifier's cost estimation concerns, where it noted the proposed expenditure had a high degree of uncertainty, as it was based solely on a desktop study.

3.167 Transpower states in its buildings and grounds PMP that its cost "estimates are for a first order approximation of the problem, not detailed plan for its solution" and it has yet to fully quantify the extent of its needs, stating that its site estimates were "not an exact figure, and the actual numbers will change, based on individual on-site assessment".

[85] Transpower NZ Limited, Portfolio Management Plan, Buildings and Grounds (October 2023), Appendix B.

3.168 Our view is that, while Transpower has not fully demonstrated the water supply upgrade component of its proposed buildings and grounds expenditure is prudent and efficient, we should approve some of this expenditure. Transpower has demonstrated the compliance need for some investment to upgrade its site water supplies but has not yet quantified the scope of the water supply upgrade projects or the costs.

3.169 We have decided to approve some, but not all, of the expenditure associated with site water supply upgrades as an approval envelope. Over RCP4, Transpower will then be able to develop its projects and invest in those that proceed to business case implementation.

3.170 We consider approving 50% of this expenditure is reasonable, given the information Transpower has provided the Verifier, and to us, in its proposal.

3.171 We received no submissions on our buildings and grounds draft decision.

Our decision

3.172 We consider the majority of the buildings and grounds programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.173 Our decision is to approve $78.8 million over RCP4 in the buildings and grounds asset class for investment in buildings, site infrastructure, building services, and access ways to Transpower's substation sites.

HVDC and reactive assets

3.174 Transpower is proposing to spend $161.4 million in High Voltage Direct Current (**HVDC**) and reactive assets compared with the $109.4 million it predicts it will spend by the end of RCP3.

3.175 Figure 3.2 shows the annual actual, estimated and proposed expenditure over RCP3 and RCP4 for HVDC and reactive asset portfolio.

Figure 3.2 HVDC and reactive assets capex RCP3/RCP4 ($ million constant 2022/2023)

HVDC assets

3.176 Transpower is proposing to spend $80.5 million on HVDC capex over RCP4. The proposed activities include:[86]

3.176.1 begin HVDC submarine cables replacement, and complete pole 2 midlife refurbishment;

3.176.2 HVDC investigation projects, refurbishment of tap changers and reactors;

3.176.3 tactical HVDC upgrades, such as net zero grid programme stage 1, and STATCOM enhancement with battery storage; and

3.176.4 putting in place sufficient plans, skilled personnel, and emergency equipment to enable rapid restoration of HVDC transmission service following failure.

3.177 The proposed expenditure is an increase of 16% when compared with Transpower's forecast of the $69.5 million it predicts it will spend by the end RCP3.[87]

3.178 Transpower states the proposed increase in the refurbishment and replacement work programme over RCP4 is due to asset condition issues, while the focus over RCP3 was due to HVDC Pole 2 midlife life-extension.

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[86] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 133 section 8.2.4.1.

[87] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 113 section 8.2.4.1.

Verifier review – HVDC assets [88]

3.179 The Verifier reviewed and verified $78.1 million ($ constant 2021/2022) of HVDC expenditure.

3.180 The Verifier noted that a major driver of investment is component obsolescence and that HVDC systems are complex and bespoke. Where feasible asset health and risk models were mature.

3.181 HVDC assets are difficult to price competitively due to the lack of manufacturers. Where possible, the Verifier noted Transpower had used pricing based on similar historical projects.

3.182 The Verifier noted that, while the Pole 2 life-extension works were planned to be completed by the end of RCP3, "approximately 50% of the work and expenditure on Pole 2 will now be carried out in RCP4".[89]

3.183 During the Verifier's review, Transpower disclosed that it was deferring $16.4 million ($ constant 2021/2022) of HVDC work from RCP3. Over $15 million ($ constant 2021/2022) of this is due to assets being in a better condition than expected.

3.184 The Verifier noted that some variation is understandable due to new information being available compared to five years ago and that HVDC systems are complex.

3.185 Following its review, the Verifier concluded that the proposed HVDC expenditure of $78.1 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

Our review – HVDC assets

3.186 We have considered the Verifier report and reviewed Transpower's proposal for the HVDC asset class.

3.187 Transpower's asset health and risk modelling has been reviewed by the expert opinion and is at a good level of maturity for key assets in this asset class. The HVDC portfolio contains a wide range of asset types, and it is not always clear that asset health and risk modelling is appropriate for all of these.

3.188 We agree with the Verifier's conclusion that Transpower's asset management strategy gives confidence that holistically, the expenditure forecast is consistent with GEIP.

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[88] GHD Advisory and Castalia, IV Report, p 196-201 section 9.3.14.
[89] GHD Advisory and Castalia, IV Report, p 197 section 9.3.14.2.

3.189 In terms of cost efficiency, the Verifier noted that, in the absence of manufacturer information on asset costs, it had based some of its forecasts on historical actual costs. We consider that this is a reasonable approach in the circumstances.

3.190 We understand the lack of HVDC asset manufacturers makes it difficult for Transpower to obtain a wide range of competitive costs for assets. There are also delivery lead time issues that Transpower must manage, an issue exacerbated by global supply chain issues. We consider this more fully when we discuss deliverability as a whole in the Decision Attachment D: Deliverability paper.

3.191 In general, we considered that Transpower had demonstrated the proposed expenditure for HVDC is prudent and efficient.

3.192 However, during our review, we identified two issues that required clarification from Transpower, specifically:

3.192.1 the expenditure related to HVDC cable surveillance, operational support, investigation projects, condition assessments, refurbishment of tap changers and reactors is noted in the 2023 AMP as opex but in the proposal Transpower is seeking this funding as capex; and

3.192.2 why Transpower was seeking funding for tactical HVDC upgrades and maintenance related to the net zero grid programme stage 1 and STATCOM enhancement with battery storage, when this investment is subject to a recently approved major capex proposal.

3.193 Transpower responded that:[90]

3.193.1 HVDC cable surveillance, operational support, investigation projects, condition assessment, refurbishment of tap changers and reactors, and defect management are opex activities and were incorrectly listed as capex in Table 22 of Transpower's RCP4 proposal.

3.193.2 the HVDC PMP sets out the wider activities associated with the HVDC programme and costs related to Net Zero Grid Pathways 1 stage one MCP are not included in the RCP4 base capex proposal.

3.194 We are satisfied with Transpower's response. The incorrect listing of HVDC opex activities has not been reflected in Transpower's expenditure modelling, and Transpower has confirmed that MCP costs are not included in the base capex proposal.

[90] Transpower response to RFI019 – HVDC (19 February 2024).

3.195 We received no submissions on our HVDC assets draft decision.

Our decision – HVDC assets

3.196 Following our review of the Verifier report and Transpower's proposal, we consider that the proposed HVDC expenditure is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.197 Our decision is to approve $80.5 million over RCP4 in the HVDC asset class for investment in the HVDC submarine cables replacement project, completion of pole 2 life extension works, and other tactical HVDC investments.

Reactive Assets

3.198 Transpower is forecasting to spend $80.9 million over RCP4 in the reactive assets class comprising investments to:[91]

3.198.1 replace Islington SVC 9's control and auxiliary systems, upgrade all STATCOMs from Windows XP, and an SVC refurbishment. The forecast spend for this work is $28.1 million;

3.198.2 replace a number of capacitor banks with forecast expenditure of $8.9 million; and

3.198.3 carry out major refurbishment of synchronous condensers over RCP4 to extend the asset lives to 2042, with a forecast spend of $43.9 million.

3.199 The proposed expenditure is an increase of 103% when compared with Transpower's forecast of what it predicts it will spend by the end of RCP3.

3.200 Transpower states that the expenditure increase is mainly due to synchronous condenser refurbishment costs and a delivery reforecast of two projects that are already in progress in RCP3, resulting in a portion of the expenditure being deferred to RCP4.

3.201 Transpower states that due to a limited number of suppliers of reactive equipment, it is seeing price increases above inflation, due in part to global demand in reactive support assets driven by renewable energy developments.[92]

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[91] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023) , section 8.2.4.2, table 22: HVDC and reactive assets overview, p 114.

[92] Transpower NZ Limited, Asset Management Plan 2023, p 136.

Verifier review – Reactive assets[93]

3.202 The Verifier noted that while there are a relatively small number of assets within this asset portfolio the defect/failure history, quantity, manufacturer, and ages of the assets are well recorded, better and granular asset information needs to be gathered on capacitors to improve modelling of asset health.

3.203 Transpower has asset performance targets and measures in place for capacitor banks, SVC's, STATCOMS and synchronous condensers and these targets and measures, help monitor and assess how effectively Transpower manages the assets. Transpower life cycle analysis reflects typical industry life cycles expected for the asset types in this portfolio.

3.204 The Verifier noted that age profiles of synchronous condensers and dynamic reactive power, and that remediations are considered comparable with industry practices. The Verifier considered that Transpower's proposed work plan to be prudent for its dynamic reactive assets.

3.205 The asset health model for capacitors, with its limitations, indicate this asset class is in relatively good health. Since $0.3 million was spent in the first two years of RCP3, this indicates a low rate of failed or problematic assets. The last two years of RCP3 forecasts an expenditure of $5.5 million. The RCP4 spend is similar to that forecast for RCP3.

3.206 The Verifier concluded that, in general, the risk-based investment drivers used to define investment need, are reasonable and prudent.

3.207 The Verifier did not comment or review the cost competitiveness of individual quotations but concluded that Transpower's tender and negotiation process appeared to be designed to achieve cost efficient procurement outcomes.

3.208 Following its review, the Verifier concluded that the proposed reactive asset expenditure of $72.5 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

Our review – Reactive assets

3.209 We have considered the Verifier report, and reviewed Transpower's proposal for reactive assets. Transpower's health and risk models for this asset portfolio are at a reasonable level of most of the assets in this portfolio.

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[93] GHD Advisory and Castalia, IV Report, p 202-208, section 9.3.15.

3.210 We observe that where Transpower asset health modelling has limitations, Transpower forecast expenditure is consistent with historical failure rates, asset age profiles, with inputs into forecasts driven by expert opinion.

3.211 We agree with the Verifier that Transpower has reasonably demonstrated that the proposed investment in reactive assets is prudent and consistent with GEIP. The key driver of the expenditure uplift when compared to RCP4 is due to the synchronous condenser refurbishment.

3.212 We understand that like the HVDC asset class, there are a limited number of manufacturers that can provide these assets, and obtaining competitive and timely quotes is challenging. We agree with the Verifier's conclusions that Transpower has reasonable processes in place to obtain cost information, and that these processes are designed to achieve cost efficient procurement outcomes.

3.213 We received no submissions on our reactive assets' draft decision.

Our decision – Reactive assets

3.214 Following our review of the Verifier report and Transpower's proposal, we consider that the reactive assets programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.215 Our decision is to approve $80.9 million over RCP4 in the reactive asset portfolio for investment in synchronous condensers, SVCs, STATCOMs, capacitors, reactors, control and protection systems, and reactive power controllers.

Business support

3.216 Transpower is proposing to spend $34.7 million on business support capex assets not included in other asset classes.[94] Transpower states these assets are required for a successful operation of Transpower's business as a whole and include office buildings, office equipment and information technology assets.

3.217 The forecast expenditure is an increase of 45% when compared with Transpower's forecast of what it predicts it will spend by the end of RCP3 in this expenditure category.

3.218 Transpower states that the majority increase in business support capex is driven by the need to increase its training capacity to support Transpower's service providers in training additional new grid workers.[95]

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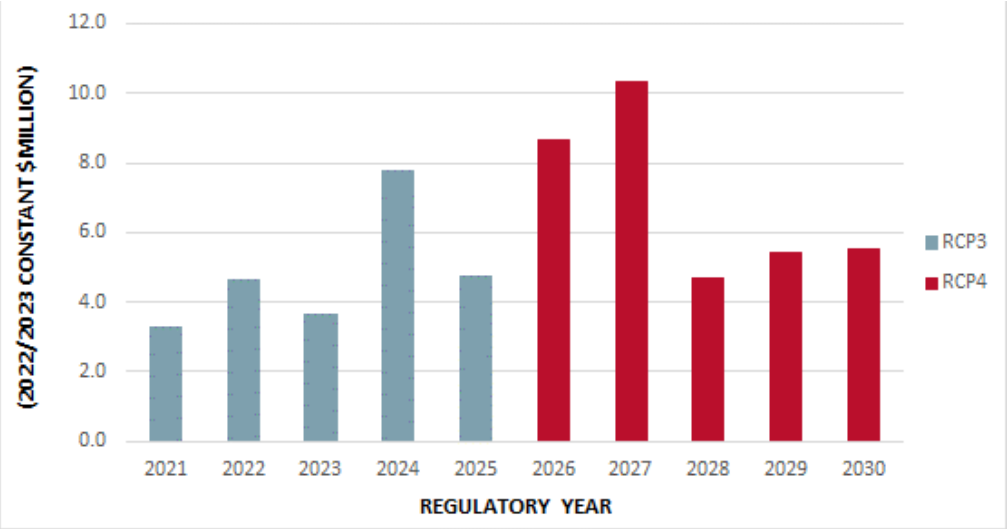
[94] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 158 section 8.6.2.

[95] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 158 section 8.6.2.

3.219 Figure 3.3 shows the annual actual, estimated and proposed expenditure for RCP3 and RCP4 for business support capex.

Figure 3.3 Business support capex in RCP3/RCP4 ($ million constant 2022/2023)



Verifier review – Business support[96]

3.220 The Verifier reviewed $43.1 million ($ constant 2021/2022) of business support expenditure, of which, the Verifier rejected $16.0 million ($ constant 2021/2022) for the Wellington office building upgrade since this proposed expenditure was not supported by a business case.

3.221 The Verifier's evaluation focussed on three categories of business support capex, namely:

3.221.1 vehicles – proposed expenditure of $3.8 million ($ constant 2021/2022) meets GEIP and the Capex IM evaluation criteria. The vehicle replacement is not only age-based but also condition-based. The reviewed vehicles expenditure was deemed prudent and efficient;

3.221.2 a further $0.4 million ($ constant 2012/2022) of forklifts which is reallocated from office equipment to vehicles;

[96] GHD Advisory and Castalia, IV Report, p 289-301 section 12.2.

3.221.3 office equipment – proposed expenditure of $30.1 million ($ constant 2021/2022) is not fully accepted. $14.1 million (including $0.4 million of forklifts) is accepted and meets GEIP and Capex IM evaluation criteria. The $16.0 million expenditure associated with the Wellington Office was rejected as it did not have a supporting business case, but $14.1 million for office equipment was deemed prudent and efficient; and

3.221.4 office buildings and facilities – proposed expenditure of $9.2 million ($ constant 2021/2022) meets GEIP and Capex IM evaluation criteria. This expenditure is largely associated with the development of Bunnythorpe grid skills training facilities. This training facility is the only provider of qualifications required for transmission work for line mechanics and power technicians. The proposed expenditure is deemed prudent and efficient. It meets GEIP and is consistent with the Capex IM evaluation criteria.

3.222 The Verifier verified $27.1 million ($ constant 2021/2022) of the $43.1 million ($ constant 2021/2022) it reviewed.

Our review – Business support

3.223 We considered the Verifier report and reviewed Transpower's proposal for the business support asset portfolio.

3.224 In its proposal Transpower sought $34.7 million for business support capex which excluded the expenditure associated with its Wellington office while it considers developing its business case.

3.225 We consider that the Verifier's report provided a robust analysis of the expenditure that it reviewed, and we agree with the review approach and findings. Expenditure in this asset class is largely driven by age and condition for assets such as vehicles and office equipment, and a clear need to upgrade capability related to the proposed new training facility.

3.226 We consider that Transpower has made the case for the Bunnythorpe training facility as it seeks to train the staff it needs to deliver the RCP4 work programme and beyond.

3.227 We could find no explanation for why the proposed amount of $34.7 million exceeded the $27.1 million ($ constant 2021/2022) the Verifier accepted as verified, when the verified amount is inflated to $ constant 2022/2023.

3.228 As such we are not satisfied that the increase Transpower proposed above the inflated verified amount is prudent and efficient.

3.229 In our draft decision, we approved $27.1 million ($ constant 2021/2022) of the proposed $34.7 million business support capex because we could find no explanation for the increase above the verified amount.

3.230 In its draft decision submission, Transpower noted that it "did not provide the underlying calculations for the revised forecast as business support capex was not an 'identified programme'", accepted our draft decision, and that in future proposals it will "provide the Commission with evidence of all increases from the forecasts the Independent Verifier reviews."[97]

3.231 Taking into consideration Transpower's submission above and their commitment to provide more detail on their proposed expenditures in the future, our final decision below is the same as our draft decision on business support.

Our decision – Business support

3.232 We agree with the Verifier that business support capex expenditure of $27.1 million ($ constant 2021/2022), that it reviewed and verified, is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.233 Our decision is to approve the verified amount for business support capex. We have inflated this verified amount to 2022/2023 constant prices using Transpower's expenditure forecast model inflators, for an approval amount of $28.9 million for business support capex.

Secondary assets

3.234 Transpower proposed a total of $281.8 million expenditure for secondary assets. The secondary asset portfolio is for expenditure related to protection systems, batteries and DC systems, revenue metering, and substation management systems.[98]

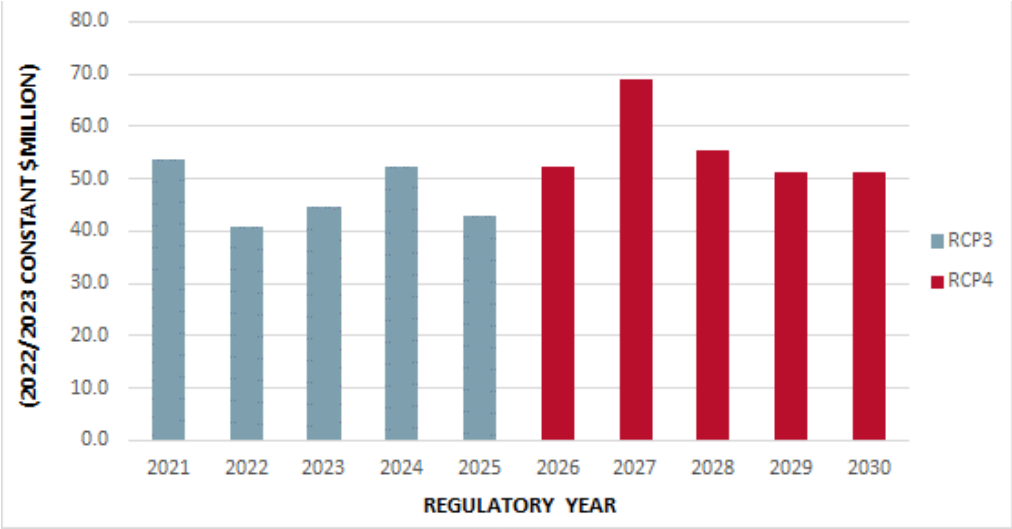
3.235 The proposed expenditure is 21% higher than the predicted RCP3 spend of $233.8 million.

3.236 Figure 3.4 shows the annual actual, estimated and proposed secondary assets expenditure for RCP3 and RCP4.

[97] Transpower, "Transpower Submission on draft decision", p 8 para 43, Appendix B.

[98] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 116 section 8.2.5, Table 24.

Figure 3.4 Secondary assets capex in RCP3/RCP4 ($ million constant 2022/2023)



3.237 Transpower stated that the primary driver of the protection, battery systems and metering renewal forecast was asset health. The wide range of expected asset lives in this portfolio means that required work volumes fluctuate over time.

3.238 We evaluated the secondary asset portfolio using two categories: (1) a combination of protection systems, revenue meters, batteries and DC systems, and (2) substation management systems (**SMS**). We focussed our review on protection systems given the materiality of the proposed expenditure.

Secondary assets - Protection systems, revenue metering, batteries and DC systems

3.239 Transpower proposed to spend $256.3 million over RCP4 on protection schemes, revenue meters, batteries and DC systems.[99] Transpower's forecast expenditure for RCP4 for these asset classes is an increase of 51% when compared to the $169.8 million Transpower predicts it will spend over RCP3.

3.240 Transpower describes protection metering and DC systems as:[100]

> **protection schemes**: used throughout the grid to detect and initiate isolation of electrical faults, protect primary equipment, and ensure people's safety; includes protection for bus zones feeders, lines, transformers, and reactive assets, along with special protection schemes.
>
> **revenue meters:** supply electricity volume information and are used for wholesale market reconciliation and billing.

[99] In its original proposal submission Transpower proposed $282.3 million for secondary assets capex. Transpower has decreased this by $0.5 million for the Redcliffe 220kV substation rebuild project, in response to RFI026.

[100] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 116 section 8.2.5, Table 24.

station DC systems: provide power (even when the local AC service supply has failed) to protection schemes, circuit breaker trip and close coils, control and metering.

3.241 Transpower proposed to spend $242.9 million in the protection systems asset class to replace approximately:

3.241.1 650 protection schemes at the end of their useful lives, or aligned with replacement of primary assets; and

3.241.2 350 outdoor junction boxes.[101]

3.242 Transpower states that most protection and metering assets are in good condition. Due to the importance of these assets, they are regularly monitored, tested and replaced as required. The asset condition assessment is a binary pass/fail test with failure resulting in a replacement decision.

3.243 Transpower proposes to install 65 bus and line protection schemes to comply with the fault clearance times as agreed under the Electricity Industry Participation Code (EIPC) 2010 (**the Code**). [102]

3.244 For revenue metering, Transpower is proposing to spend $0.8 million on power system modelling tools, standalone phasor measurement units and power quality meters. Most revenue meters are expected to be replaced by the end of RCP3, leading to a significant reduction in forecast expenditure for RCP4.

3.245 For substation DC systems, Transpower proposed to spend $13.0 million to replace approximately 150 battery banks.

3.246 Transpower explains the increase in proposed expenditure when compared to RCP3 is due to an increase in the volume unit replacements in the protection and DC system asset classes.

Verifier review – Protection systems, revenue meters, batteries, and DC systems[103]

3.247 The Verifier reviewed and verified $227.6 million ($ constant 2021/2022) of protection, revenue metering, batteries, and DC systems expenditure.

3.248 In its top-down review, the Verifier noted that Transpower's primary strategy is to replace assets based on age, increased probability of failure, unacceptable operation risks, or asset obsolescence.

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[101] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 116 section 8.2.5, Table 24.

[102] Transpower New Zealand Limited, "Portfolio Management Plan, Protection and Revenue metering Assets", (October 2023), 10.0 Appendix A: Benchmark Agreement Fault Clearance Times.

[103] GHD Advisory and Castalia, IV Report, p 208-215 section 9.3.16.

3.249 Investment need is driven by risk and maintaining service performance, which is informed by asset health scores which consider asset condition and consequences of asset failure.

3.250 The Verifier stated that protection relay assets cannot generally be maintained like other assets or inspected for wear. Replacement interventions typically occur when the asset or protection scheme has reached end-of-life, with an assumed relay life expectancy of 20-25 years.

3.251 The Verifier noted that "An issue generally internationally with a replacement of age strategy is that failure rate data on ageing protection relays is limited and this makes determining an asset health model difficult".[104]

3.252 In its review the Verifier noted that Transpower had carried out a building block cost review in 2022 and that actual project cost data was used to calibrate the cost modelling. This review resulted in building block cost estimates increasing mainly due to higher labour and materials costs, and a new standard design strategy. The Verifier concluded that cost estimates in this asset class were reasonable.

3.253 Following its review, the Verifier concluded that the proposed protection systems, revenue meters, batteries, and DC systems expenditure of $227.6 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

Our review – Protection systems, revenue meters, batteries, and DC systems

3.254 We have considered the Verifier report, and reviewed Transpower's proposal for protection systems, revenue meters, batteries, and DC systems.

3.255 We agree with the Verifier that Transpower has reasonably demonstrated that the proposed investment is prudent and consistent with GEIP, and that Transpower has reasonably estimated costs.

3.256 In our review we focused on understanding what was driving the expenditure increase since verification, and Transpower's proposed new protection design standard.

3.257 In its review the Verifier commented that protection systems cost increases were being driven by a new protection systems standard design strategy that provides "the benefit of consistency and redundancy across these asset types, rather than the previous bespoke designs with the associated risks".[105]

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[104] GHD Advisory and Castalia, IV Report, p 212 section 9.3.16.4.

[105] Transpower RCP4 proposal Portfolio Management Plan (PMP014) – Protection and Revenue Metering Assets (October 2023), p 36, section 7.5.

3.258 We sought additional information from Transpower about its new protection systems standard design strategy asking Transpower:

3.258.1 to provide us with more information about the drivers of the new protection systems standard design strategy;

3.258.2 whether the new protection design strategy is to implement redundant protection systems and if so, provide business cases to show how this has been demonstrated as economic; and

3.258.3 the approximate cost impact of the new protection design strategy when compared with the previous standard protection system designs.

3.259 Transpower responded that:[106]

> the main drivers to update the Transformer Protection standard design in 2017 was to take account of modern standards (to reflect the modern relays that were available), that would improve longer-term efficiency, and which could be consistently used across a range of transformer types i.e. supply banks, interconnectors, transformer feeders, transformers with a breaker and half primary configuration, dual incomers. This also allowed the number of main relays to be streamlined from 3 or 4 down to 2 main relays, allowing for longer term procurement savings.

3.260 Transpower confirmed that the main drivers of the protection design change did not include a need to implement new redundant/duplicated protection schemes.

3.261 Transpower noted that its upgraded design standards, while more costly in the near term, should lead to "efficiencies in average costs of implementing a standard transformer or capacitor protection scheme"[107] over the longer term because standard schemes will be easier to design and implement. Transpower did not provide a formal economic analysis of the benefits of design standardisation.

3.262 We have accepted Transpower's explanation for its change in design strategy that seeks to streamline protection designs across the fleet, and that this should provide efficiencies over the longer term. Transpower has indicated that the change in design strategy is being driven by modern protection design standards and that new protection relay systems are standardising, which is largely out of Transpower's control.

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[106] Transpower, Secondary systems - protection RFI021.
[107] Transpower response to RFI021 – Secondary systems - protection, 29 February 2024.

3.263 Since verification, Transpower states that it refined its proposed expenditure due to minor timing, scope and volume changes.[108]

3.264 After converting the verified amount to $ constant 2022/2023, this equates to $243.1 million. In its proposal, Transpower forecasted it needs $256.7 million in RCP4 for protection systems, revenue meters, batteries, and DC systems. This is an increase of $13.6 million.

3.265 In its Protection and Revenue Metering Assets PMP Transpower notes that:[109]

> there are "increased costs especially in the bus zone replacement work due to the replacement of bus zone schemes on big sites like the 220kV Otahuhu bus zone protection schemes (which are duplicated and have 6 bus sections) and at least 3 other sites with 4 bus sections (Roxburgh 220kV, Manapouri 220kV and Tiwai 220kV)";

3.265.1 building block cost estimates continue to be updated as actual cost data is received;[110] and

3.265.2 asset data quality is being constantly improved for protection and metering portfolios. Several workstreams to fill in gaps in data are ongoing: [111, 112]

> further work is required to "develop asset health, probability of failure and criticality frameworks for Outdoor Junction Boxes (**ODJBs**). This will allow for a more accurate model that could estimate intervention points for ODJBs, which would help in determining the appropriate level of investment versus risk trade-off".

3.266 We accept that Transpower is still refining its asset data and modelling for this portfolio which results in changes in replacement volumes. The expert opinion and the Verifier accepted Transpower's modelling process as being mature. We accept that more up to date asset condition data will calibrate asset health models and modify forecasts.

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[108] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 118 section 8.2.5.

[109] Transpower RCP4 proposal Portfolio Management Plan (PMP014) – Protection and Revenue Metering Assets, (October 2023), p 44 section 8.0.

[110] Transpower RCP4 proposal Portfolio Management Plan (PMP014) – Protection and Revenue Metering Assets, (October 2023), p 36 section 7.5.

[111] Transpower RCP4 proposal Portfolio Management Plan (PMP014) – Protection and Revenue Metering Assets, (October 2023), p 30 section 6.8.

[112] Transpower RCP4 proposal Portfolio Management Plan (PMP014) – Protection and Revenue Metering Assets, (October 2023), p 11 section 5.3.

3.267 Transpower's use of historical project cost data to estimate project costs is reasonable with unit rates in the building block models being updated as projects are commissioned.

3.268 We received no submissions on our draft decision for protection systems, revenue meters, batteries, and DC systems.

Our decision – Protection systems, revenue meters, batteries, and DC systems

3.269 Following our review of the Verifier report and Transpower's proposal, we consider that proposed expenditure for protection systems, revenue meters, batteries and DC systems programmes is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.270 Our decision is to approve $256.3 million over RCP4 on protection schemes, revenue meters, batteries, and DC systems.

Substation management systems

3.271 Transpower proposed to spend $25.6 million in this asset class which includes lifecycle replacements and telemetry data standard improvements.

3.272 The proposed expenditure is a reduction of 60% when compared with Transpower's forecast of what it predicts it will spend over RCP3 ($64.0 million).

3.273 Transpower describes substation management systems as:[113]

> A telemetry system based on computers and local area networks that have been designed to operate in electricity utility environment; these systems are maintained within the ICT portfolio, enabling the remote control and real-time monitoring of our substations and are essential to ensuring visibility and control of the transmission network.

Verifier review – Substation management systems[114]

3.274 The Verifier noted that "condition assessment of this asset portfolio poses challenge" and that "measuring, observing and recording the condition of the equipment (and its sub-components) within this asset portfolio can be economically prohibitive as such activities will require a substantial amount of effort for the value". [115]

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[113] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 115 section 8.2.5.
[114] GHD Advisory and Castalia, IV Report, p 215-221 section 9.3.17.
[115] GHD Advisory and Castalia, IV Report, p 218 section 9.3.17.3.

3.275 Technology obsolescence, manufacturer recommendations, and market support are more influential drivers for intervention decisions, with asset health estimates based on asset age to derive probability of failure. Despite this the Verifier noted that this strategy to identify investment need was consistent with GEIP.

3.276 Following its review, the Verifier concluded that the proposed substations management systems expenditure of $23.5 million ($ constant 2021/2022) was prudent and efficient, has regard to GEIP, and is consistent with the evaluation criteria in the Capex IM.

Our review – Substation management systems

3.277 We considered the Verifier's report and reviewed Transpower's proposal for substation management systems as part of the secondary assets portfolio.

3.278 We agree with the Verifier that carrying out comprehensive asset health modelling for this asset class may not be feasible and that technical obsolescence and manufacturer recommendations are practical investment drivers. We also agree with Transpower's approach to SMS asset risk by linking this to the substation site risk criticality. Failure of the substation site SMS renders the site largely inoperable.

3.279 The cost estimation process appears reasonable. Given each site will have different requirements, bespoke component solutions for each site will be required and driven by manufacturer quotes at the time upgrades are deemed necessary.

3.280 In conclusion we consider Transpower has demonstrated a reasonable approach to identifying prudent and efficient need for investment.

3.281 We received no submissions on our substation management systems draft decision.

Our decision – Substation management systems

3.282 Following our review of the Verifier report and Transpower's proposal, we consider that the substation management system programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.283 Our decision is to approve $25.6 million over RCP4 in the substations management system asset class.

Transmission line structures

3.284 Transpower proposed to spend $485.9 million over RCP4 in the transmission line structures and insulators asset category comprising investments in transmission towers ($50.0 million), poles ($62.7 million), tower painting ($324.2 million), and insulators ($49.0 million).[116]

3.285 The proposed expenditure is 49% more than Transpower's forecast of what it predicts it will spend by the end of RCP3.

3.286 Figure 3.5 shows the annual actual, estimated and proposed transmission line structures for RCP3 and RCP4.

Figure 3.5 Transmission lines capex in RCP3/RCP4 ($ million constant 2022/2023)

3.287 Transpower states that the increase in transmission line expenditure over the next 15 years is due to the increase in the number of assets reaching end-of-life, with the primary driver of investment being asset health.

3.288 Transpower state that:[117]

3.288.1 assets are planned for replacement based on their asset health score; bundling of related activities together occurs where this is economic; and

3.288.2 asset risk and criticality are considered when prioritising work.

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[116] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030" (21 November 2023), p 108 section 8.2.3.

[117] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 107 section 8.2.3.

3.289 Over RCP3 Transpower has been carrying out some tower to pole conversions as an alternative to tower painting. Transpower notes this conversion is now the preferred option on many small and lightly loaded towers. Tower painting is the preferred option for larger towers and is considered cheaper than tower replacement.

Transmission line structures: towers and poles

3.290 This asset portfolio includes "transmission line towers and poles operating at 11kV up to 220kV. The tower and pole asset portfolio includes approximately 13,000 poles and 26,000 towers".[118]

Verifier review - Transmission line structures: towers and poles[119]

3.291 The Verifier identified the need for the investment was "based on risk and lifecycle cost management i.e. asset health scores, criticality modelling and lifecycle cost models to prioritise R&R work".[120] Life extension strategies are applied to most transmission line towers through tower painting to manage corrosion.

3.292 The Verifier reviewed the asset health and network risk modelling tools that have been used to identify and prioritise proposed expenditure and consider them to be reasonable. The Verifier considered that the strategy to decide on life extension, partial replacement or complete replacement was reasonable and appropriate.

3.293 The Verifier observed that the average replacement/retirement age for transmission structures – towers and poles was generally higher than those of comparable Australian DNSPs and TNSPs, but that is largely due to Transpower's life extension strategy using corrosion zone modelling and tower painting.

3.294 Intervention and replacement volumes were tested using the asset health models with and without interventions, confirming that forecasts were reasonable.

3.295 Following its review, the Verifier concluded that the proposed transmission line structures – towers and poles expenditure of $78.7 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

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[118] GHD Advisory and Castalia, IV Report, p 161 section 9.3.9.1.
[119] GHD Advisory and Castalia, IV Report, p 160-167 section 9.3.9.
[120] GHD Advisory and Castalia, IV Report, p 163 section 9.3.9.3.

Our review - Transmission line structures: towers and poles

3.296 We have considered the Verifier report, and reviewed Transpower's proposal for transmission line structures: towers and poles. Transpower's asset health and risk modelling processes have also been reviewed by the expert opinion and are at a high level of maturity in this asset class.

3.297 Transpower is seeking $112.7 million in its proposal while the Verifier reviewed and verified $78.7 million ($ constant 2021/2022) This verified amount inflates to $84.1 million in $ constant 2022/2023, an increase of 34%.

3.298 In its proposal Transpower explain that the increase in proposal expenditure for this asset category is due to unit cost increases, rather than volume increases. It notes that $27.9 million attachment point expenditure has been recategorized from maintenance opex to capex following auditor review.[121]

3.299 We received no submissions on our transmission line structures: towers and poles draft decision.

Our decision - Transmission line structures: towers and poles

3.300 Following our review of the Verifier report and Transpower's proposal, we consider that the transmission line structures – poles and towers programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.301 Our decision is to approve $112.7 million over RCP4 in transmission line poles, towers, and attachment points.

Transmission line structures: tower painting

Verifier review – Transmission line structures: tower painting[122]

3.302 The Verifier noted that this "asset portfolio consists of the protective coating of transmission line steel structures where environmental conditions are forecast to reduce the mechanical capacity of the structure".[123]

3.303 At the time of its review, the Verifier noted that Transpower proposed to significantly increase tower painting capex from $215.5 million ($ constant 2021/2022) in RCP3 to $293.9 million ($ constant 2021/2022) in RCP4. This reflects the higher quantities of towers that Transpower considers require repaint.

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[121] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 108 section 8.2.3.1.
[122] GHD Advisory and Castalia, IV Report, pp 167-174 section 9.3.10.
[123] GHD Advisory and Castalia, IV Report, p 167 section 9.3.10.1

3.304 Tower painting expenditure and quantities will grow until 2028. Expenditure should then stabilise near the end of RCP4 because, at that stage, a greater proportion of painting is for recoating which is less costly.

3.305 The investment need for tower painting relies heavily on corrosion zone analysis and tower failure risk with forecast expenditure volumes based on asset health estimates.

3.306 The Verifier observed that the average replacement/retirement age for transmission structures was generally higher than those of comparable Australian DNSPs and TNSPs, but that is largely due to Transpower's life extension strategy using corrosion zone modelling and tower painting. The Verifier concluded that Transpower's tower painting approach was a prudent life-extension technique.

3.307 There are no annualised risk considerations for tower painting, rather intervention decision making is based on the optimal economic intervention point when compared with asset replacement.

3.308 While the Verifier could not compare with equivalent Australian TNSP and DNSP tower painting costs, as there were no equivalent building blocks, it noted that the RCP4 building block costs compared favourably to Transpower's RCP3 rates.

3.309 Following its review, the Verifier concluded that the proposed transmission line structures – tower painting expenditure of $293.9 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

Our review – Transmission line structures: tower painting

3.310 We have considered the Verifier report, and reviewed Transpower's proposal for transmission line structures: tower painting.

3.311 We investigated Transpower's view that tower painting has a lower lifecycle cost than replacement and reviewed its tower painting portfolio management plan.[124] We also tested Transpower's decision making framework regarding investment need and the use of corrosion zones.

3.312 Transpower provided us with additional information about tower repainting intervention rates. These range from 10 years for extreme corrosion zones, 15 years for severe corrosion zones, and up to 25 years for benign corrosion zones.[125]

[124] Transpower RCP4 proposal Portfolio Management Plan (PMP010) – TL Paint (October 2023).
[125] Transpower RCP4 proposal Portfolio Management Plan (PMP010) – TL Paint (October 2023), p 13 table 5.

3.313 We tested the economics for the most extreme corrosion zone with the highest repaint rate, against the cost of tower replacement. The repaint life extension strategy is more economic for both single circuit and double circuit tower replacements. If tower replacements are deferred for more than 5 years after the identified repaint intervention date, replacement becomes more economic.

3.314 The repaint rate is determined by Transpower's corrosion zone analysis that is set out in its portfolio management plan TL Paint PMP. Estimated tower degradation is based on "observed condition codes, whereas painted structures use time-based forecast per corrosion zone from last paint date.[126]" While condition-based assessments do not drive the forecast repaint volumes, they do "identify any substantive failures informing planning and delivery teams where proactive interventions are required ahead of the typical recoat intervention timing".

3.315 Transpower has identified repaint rates based on its corrosion zone analysis and experience with the performance of paint coatings. The asset health (**AH**) models are calibrated based on these inputs. Transpower notes that (with reference to Figure 7 of its TL Paint PMP):[127]

> The strategy identifies towers are to be first painted before they reach CA 30 (in the case of those located in benign to moderate corrosion zones), CA 40 (severe and very severe corrosion zones) or CA 50 (extreme corrosion zones); these equate to an AH8.
>
> Latest forecast quantities from the AH model reflects this strategy. The asset health data shows some 9% of structure at or greater than AH8, with a further 28% between AH6 and AH8. Figure 7 shows that without intervention the quantity of structures at or greater than AH8 will increase to approximately 31%, with a further 20% of structures between AH6 and AH8 by 2030.

3.316 We consider that Transpower has demonstrated it has sound strategies in place and a robust modelling process, informed by onsite condition data to calibrate modelling, to identify the investment need. We have tested the cost of the repaint strategy against the replacement strategy, and found that for the assumptions made, it appears to be economic.

3.317 We received no submissions on our draft decision for transmission line structures: tower painting.

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[126] GHD Advisory and Castalia, IV Report, p 171 section 9.3.10.4.
[127] Transpower New Zealand Limited – TL Paint, Portfolio Management Plan, p 14.

Our decision - Transmission line structures: tower painting

3.318 Following our review of the Verifier report and Transpower's proposal, we consider that the transmission line structures – tower painting programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.319 Our decision is to approve $324.2 million over RCP4 in the transmission line structures – tower painting asset class.

Transmissions line structures: insulators

Verifier review - Transmission line structures: insulators[128]

3.320 This asset portfolio includes transmission line insulators and fittings, and earthwire hardware. There are approximately 53,000 glass, porcelain or composite insulators installed in the transmission network.

3.321 The Verifier noted that Transpower is proposing to significantly increase insulator capex from $22.1 million ($ constant 2021/2022) in RCP3 to $49.0 million ($ constant 2021/2022) in RCP4. This reflects the higher cost of insulator replacement between RCP3 and RCP4 where the average cost per insulator has increased from $6.5k to $8.3k.

3.322 The Verifier noted that this is a volumetric programme, and that investment need is driven by asset health model outputs to forecast future insulator replacement volumes and expenditure.

3.323 The Verifier observed that the average replacement/retirement age for transmission structures – insulators, was generally higher than those of comparable Australian DNSPs and TNSPs based on regulatory reporting.

3.324 Intervention and replacement volumes were tested using the asset health models with and without interventions, confirming that forecasts were prudent.

3.325 The Verifier noted that the increase in building block unit costs between RCP3 submission and RCP4 submission was due to unit rate increases from material costs and concluded Transpower's cost estimates were reasonable.

3.326 The Verifier concluded that the proposed transmission line structures – insulators expenditure of $49.0 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.[129]

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[128] GHD Advisory and Castalia, IV Report, p 174-180 section 9.3.11.

[129] Note that the expenditure the Verifier reviewed contained $1.6 million ($ constant 2021/2022) expenditure for resilience, which has since been re-categorised by Transpower into the RCP4 proposal resilience expenditure portfolio.

Our review - Transmission line structures: insulators

3.327 We considered the Verifier report, and reviewed Transpower's proposal for transmission line structures – insulators. Transpower's asset health and risk modelling processes have also been reviewed by the expert opinion and are at a mature level of maturity in this asset class.

3.328 We agree with the Verifier that Transpower has reasonably demonstrated that the proposed investment in transmission line structures – insulators is prudent and consistent with GEIP, and that Transpower has reasonably estimated costs.

3.329 While the proposed RCP4 forecast expenditure is a significant increase when compared to RCP3, the Verifier notes this can be explained by insulator cost increases. Additionally, Transpower has been maturing its asset health and risk modelling processes which gives us greater confidence it is reasonably forecasting investment volume need.

3.330 We received no submissions on our transmission line structures: insulators draft decision.

Our decision - Transmission line structures: insulators

3.331 Following our review of the Verifier report and Transpower's proposal, we consider that the transmission line structures – insulators programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.332 Our decision is to approve $49.0 million over RCP4 in the transmission line structures – insulators asset class.

Transmission line structures: foundations and accessways

Verifier review – Transmission line structures: foundations and accessways [130]

3.333 This asset portfolio includes transmission line foundations works (grillage and non-grillage) and accessways expenditure. The Verifier noted that there are "approximately 23,700 transmission line foundations of which over half (13,600) are grillage or concrete over grillage with a further 9,400 are mass concrete foundations".[131]

[130] GHD Advisory and Castalia, IV Report, pp 188-195 section 9.3.13.
[131] GHD Advisory and Castalia, IV Report, p 188 section 9.3.13.1.

3.334 At the time of its review, the Verifier noted that Transpower proposed to:

3.334.1 decrease foundations capex from $68.7 million ($ constant 2021/2022) by the end of RCP3 to $59.6 million ($ constant 2021/2022) over RCP4; and

3.334.2 increase accessways capex from $8.9 million ($ constant 2021/2022) by the end of RCP3 to $10.3 million ($ constant 2021/2022) over RCP4.

3.335 The Verifier reviewed the investment need, key drivers, and effectiveness of the asset health and inspection program to assess condition as a driver for forecasting foundations expenditure. The Verifier concluded that the method and information was appropriate.

3.336 The Verifier reviewed the foundations asset health and network risk modelling tools that have been used to identify and prioritise proposed expenditure and considered them to be reasonable. The Verifier considered that the strategy to decide on life extension, partial replacement or complete replacement was reasonable and appropriate.

3.337 The foundations investment need is based on asset health, with grillage refurbishment required to avoid these "deteriorating to a point where higher cost tower propping and major steel replacement is required". Other key drivers include "replacing poor condition foundations, undertaking waterway protection work on foundations in or adjacent to riverbeds, and remediating slope stability issues".[132]

3.338 The asset health profile of "non-grillage concrete foundations is overall very good given the age profile and the normal expected life for most foundation types is 120 years".[133]

3.339 For accessways Transpower's strategy is to manage existing accessways "at least lifecycle cost and develop better knowledge of these assets to enable cost-effective management".[134]

3.340 The Verifier concluded that Transpower's forecast volumes were considered reasonable.

3.341 Following its review, the Verifier concluded that the proposed expenditure of $59.5 million ($ constant 2021/2022) for transmission line grillage and foundations and $10.3 million ($ constant 2021/2022) for transmission line accessways was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

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[132] GHD Advisory and Castalia, IV Report, p 193 section 9.3.13.4.
[133] GHD Advisory and Castalia, IV Report, p 193 section 9.3.13.4.
[134] GHD Advisory and Castalia, IV Report, p 194 section 9.3.13.4.

Our review – Transmission line structures: foundations and accessways

3.342 Transpower proposed $70.3 million foundations and accessways expenditure comprising $43.6 million for grillage foundation works and $26.7 million for other foundations and accessways.

3.343 We considered the Verifier report, and reviewed Transpower's proposal for transmission line structures: foundations and accessways. Transpower's foundations asset health and risk modelling processes have also been reviewed by the expert opinion and are at a good level of maturity for this asset class.

3.344 We agree with the Verifier that Transpower has reasonably demonstrated the proposed investment in transmission line structures – foundations and accessways, is prudent and consistent with GEIP, and Transpower has reasonably estimated costs.

3.345 We received no submissions on our transmission line structures: foundations and accessways draft decision.

Our decision – Transmission line structures: foundations and accessways

3.346 We consider the transmission line structures – foundations and accessways programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.347 Our decision is to approve $70.3 million over RCP4 in the transmission line structures – foundations and accessways asset class.

Conductors and hardware

3.348 Transpower proposed to spend $139.0 million over RCP4 in the transmission line conductors and hardware asset category, comprising investments to replace approximately 265 circuit kilometres of conductor and associated hardware.[135]

3.349 The proposed expenditure is 50% higher than predicted expenditure for RCP3 of $93.0 million.

[135] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 110 section 8.2.3. Transpower has decreased its proposed expenditure by $29.0 million in response to RFI025, where it re-categorised the OTA-WKM A&B reconductoring as a future listed project.

3.350 In its Transmission line conductor PMP, Transpower states its proposed RCP4 expenditure, while an increase compared to RCP3 expenditure, is significantly less than what it predicted it needed over RCP4 at the RCP3 proposal stage. It states that this is due to:[136]

> significant investment and focus to improve our condition assessment and innovative forecasting techniques. This is primarily based on high quality imagery from close aerial surveys (CAS) using drones and extensive laboratory testing. However, most of our network was built between the 1950s and the 1980s and therefore our revised models still show an increasing volume of reconductoring work over the next 15-20 years.

Verifier review – Conductors and hardware[137]

3.351 The Verifier reviewed and verified $155.8 million ($ constant 2021/2022) of conductors and hardware expenditure.

3.352 The Verifier concluded that Transpower's asset management system is directed towards identifying and developing prudent and efficient solutions.

3.353 The investment need is based on conductor condition, the risk of conductor and associated asset failure, and regulatory compliance to address conductor under-clearance. Transpower currently has condition assessment data for approximately 65% of its transmission lines, and visual of the tower condition assessments for 100% of the network.

3.354 The Verifier confirmed replacement forecast volumes have reduced from those anticipated in the RCP3 submission, due to investment in improved condition assessments from "high-quality imagery from close aerial surveys using drones and extensive laboratory testing.[138] Following a review of Transpower's process, the Verifier considered it was reasonable and appropriate.

3.355 The Verifier observed that, while the average replacement/retirement age for transmission line conductors and hardware assets was generally longer than those of comparable Australian DNSPs and TNSPs, replacement volumes were prudent and linked to risk estimates.

3.356 The Verifier noted the increase in building block unit costs between RCP3 submission and RCP4 submission was modest after considering the effect of CPI on costs over the period.

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[136] Transpower RCP4 proposal Portfolio Management Plan (PMP006) – TL conductors (October 2023).
[137] GHD Advisory and Castalia, IV Report, p 181-187, section 9.3.12.
[138] GHD Advisory and Castalia, IV Report, p 185 section 9.3.12.4

3.357 The Verifier concluded the proposed conductors and hardware expenditure of $155.8 million ($ constant 2021/2022) was prudent and efficient, having regard to GEIP, and is consistent with the evaluation criteria in the Capex IM.

Our review – Conductors and hardware

3.358 We considered the Verifier report, and reviewed Transpower's proposal for conductors and hardware.

3.359 We consider Transpower has a robust planning process and strategy to identify the replacement volumes, and where those replacements are likely to be needed, largely driven by modelling, and confirmed by improved aerial survey inspection processes. Costs appear reasonable and compare with those estimates from the RCP3 submission, factoring in CPI.

3.360 We agree with the Verifier that Transpower has reasonably demonstrated the proposed investment in conductors and hardware is prudent and consistent with GEIP, and that Transpower has reasonably estimated costs.

3.361 In its original proposal Transpower proposed $168.1 million for AC transmission lines conductors and hardware. Transpower decreased this by $29.0 million in response to a request for information, in which it re-categorised the Otahuhu-Whakamaru A&B line reconductoring as a future listed project.

Draft decision submissions

3.362 In our draft decision we approved $139.0 million in the AC transmission lines – conductors and hardware asset class.[139]

3.363 The majority of the proposed expenditure over RCP4 (approximately 80% of total expenditure) in this asset class is to replace existing overhead transmission conductors in localised sections where Transpower's condition assessments have ascertained that section has reached end-of-life.

3.364 In his submission following Draft decision, Rod Evans states; "work is being done in the U.S. around replacing power lines with composite carbon fibre and aluminium, negating the requirement to replace pylons" and that it would be "prudent to examine this option."[140]

[139] Commerce Commission, "Draft Decision Attachment B Capex for Transpower's IPP commencing 1 April 2025" (29-May-2024) (**Draft Decision Capex**), pp 56-57 para 3.328 to 3.343.

[140] Rod Davies, "Rod Evans Submission on RCP4 draft decision" (26 June 2024).

3.365 Most legacy transmission line conductor types are Aluminium Conductor Steel Reinforced (**ACSR**) and since 2010, All Aluminium Alloy Conductor (**AAAC**) is the preferred conductor type. Transpower note in its Transmission Line conductor Portfolio Management Plan (**PMP**) that while it prefers AAAC conductor "its use on existing lines can be limited by corridor width (it tends to blow out more than ACSR), ground clearance (it sags more than ACSR), and areas with significant snow and ice loading due to lower mechanical strength."[141]

3.366 Transpower cross-submitted that it has "a keen interest in new and developing conductor technologies for both underground to overhead applications, including High Temperature Low Sag (**HTLS**) and superconducting types."[142]

3.367 Transpower states that in previous transmission upgrade projects it had considered alternative high-capacity conductor types, specifically for "the 400kV cable line from Whakamaru to Pakuranga via Brownhill (**BHL-WKM_A**) in 2012 and the 220kV underground cable from Albany to Penrose (**ALB-PEN_A**) in 2014."[143]

3.368 Further, in both projects "the cost of the conductor and its increased reactive power consumption…required additional equipment to compensate." In Transpower's analysis, this resulted in the HTLS conductor option being uneconomic when compared to traditional conductor types.

3.369 Transpower also highlighted some transmission line design considerations when considering new non-traditional conductor types. It noted that a key challenge it faces with its transmission line assets is wind induced conductor vibration, damage, and possible early failure. The newer conductor types are usually lighter than traditional ACSR conductors and are more susceptible to movement in the wind.

3.370 Notwithstanding the economic and wind vibration issues, Transpower notes that it has an active research, testing and trial programme, so that it can have confidence in the selection and application of HTLS conductors in the NZ environment. This involves a pilot installation that includes:[144]

3.370.1 test spans for three new HTLS conductor types over a strain section (approximately 3km) by reconductoring traditional conductors in that area;

3.370.2 installation of environmental test samples; and

3.370.3 design and development of accelerated corrosion test cells with new conductor samples.

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[141] Transpower NZ Limited – Portfolio Management Plan (PMP006) - TL Conductors (October 2023).
[142] Transpower, Cross-submission on RCP4 draft decision, p 3 para 9-13.
[143] Transpower, Cross-submission on RCP4 draft decision, p 3 para 10.
[144] Transpower, Cross-submission on RCP4 draft decision, p 3 para 12.

3.371 We are satisfied that Transpower is prudently utilising alternative conductor types where it judges that these are appropriate (such as AAAC) and is actively investigating alternatives (such as HTLS) for future use. While carbon fibre conductor technology may become available in the future it is not a technology Transpower has yet investigated for use.

3.372 After taking into consideration both Rod Evans's and Transpower's submission, we have decided to make no change to our draft decision for conductors and hardware asset class.

Our decision – Conductors and hardware

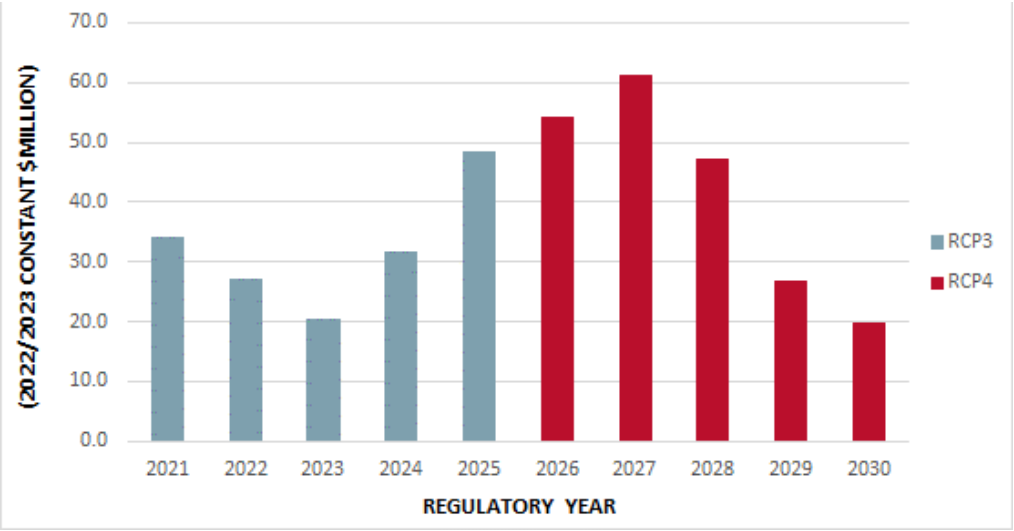
3.373 We consider the conductors and hardware programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.374 Our decision is to approve $139.0 million over RCP4 in the conductors and hardware asset class.

ICT expenditure

3.375 Transpower proposed expenditure of $209.4 million for ICT capex (excluding SaaS opex) over RCP4, is a 30% higher than the predicted expenditure for RCP3 of $160.9 million.

Figure 3.6 ICT capex in RCP3/RCP4 ($ million constant 2022/2023)



3.376 The key driver of the step change is the TransGO Refresh project cost that started in RCP3, with the bulk of costs incurring in RCP4. Transpower notes in its proposal that the TransGO Refresh programme is the largest expenditure item within the ICT portfolio in RCP4, and that cost uncertainty is significant. To mitigate the cost uncertainty, Transpower proposed to apply the low incentive rate for base capex apply to this expenditure to better balance the risk of under/overspend.[145]

3.377 Since submitting its proposal in November 2023, Transpower has since requested a proposal for its TransGO Refresh project, which lead to the price firming and an increase of $0.3 million capex.[146]To improve its ICT investment justification process following the issues identified during our assessment of the RCP3 proposal, Transpower engaged external expertise, noting:[147]

> Following our RCP3 submission, we undertook a project to improve our ICT investment process. We engaged Australia Energy Market Consulting Associate (EMCa) to advise us. This framework builds on EMCa's recommendation and incorporates the improvements that we have implemented since their engagement.

3.378 To support the TransGO Refresh project expenditure proposal, Transpower engaged Deloitte New Zealand to perform an independent review of the costing approach and key assumptions. Deloitte made ten observations that Transpower actioned and incorporated into its proposal.

3.379 The ICT capex proposal has been categorised across five ICT asset portfolios: asset management systems, corporate systems, ICT shared services, IT telecoms, network and security services, and transmission systems. Each expenditure category is supported by 12 investment business cases.

3.380 The proposed ICT capex totals $209.4 million ($ constant 2022/2023). The draft proposal reviewed by the Verifier totalled $212 million after being inflated to $ constant 2022/2023.[148]

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[145] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 127 section 8.3.3.

[146] Transpower's response to RFI025 -TransGO further information (27 February 2024).

[147] Transpower NZ limited, 'ICT Investment Framework' (24 February 2023).

[148] All values mentioned in the eight investment business cases below, are in constant 2021/2022 dollars.

Verifier review – ICT expenditure

3.381 In its review, the Verifier noted the ICT investment business cases:[149]

> set out the proposed solutions to meet ICT strategic objectives, evaluate costs and benefits and subsequently set out the investment decision made and a resulting forecast of expenditures. Each investment case contains projections of capex, step up opex, investigation expenditure (invex) and software as a service (SaaS) expenditure for the investment options considered and the investment decision taken forward.

3.382 The Verifier review focussed on the content of the ICT investment business cases. Since these did not link to the ICT expenditure schedules Transpower provided a reconciliation analysis that provided "line of sight between the costs included in the investment cases, and the costs set out in the RT01 expenditure schedule". Transpower also provided explanations and reasons for any notable differences.[150]

3.383 At the time of its review, the Verifier noted that Transpower was in the process of refining its cloud migration strategy that include what 'infrastructure as a service' can be cost effectively migrated to cloud-based architecture when compared to capital expenditure of maintaining in-house server.[151]

3.384 Cost effectiveness is not the only consideration in this strategy, as Transpower must judge which servers are necessary for critical systems operation and control, and which servers are less strategic.

3.385 Consequently, the Verifier carried out a combined ICT capex and opex (**totex**) review of the ICT capex investment business cases.

3.386 Of the 12 ICT investment business cases that support Transpower's proposal, eight have a capex component. The Verifier reviewed five of these investment business cases, and we reviewed the remaining three.

3.387 At the time of verification, Transpower ICT forecast capex totalled $198.5 million ($ constant 2021/2022). The TransGO Refresh capex project is the main contributor to the step change in ICT capex, when compared to RCP3.[152]

3.388 The Verifier reviewed and accepted $180.3 million ($ constant 2021/2022) of ICT capex, and did not review $18.2 million ($ constant 2021/2022) related to the following three ICT investment business cases:[153]

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[149] GHD Advisory and Castalia, IV Report, p 232 section 11.2.
[150] GHD Advisory and Castalia, IV Report, p 232 section 11.2.
[151] GHD Advisory and Castalia, IV Report, p 252 section 11.5.3.
[152] GHD Advisory and Castalia, IV Report, p 240.
[153] GHD Advisory and Castalia, IV Report, p 231, c 11.

3.388.1 ICT Corporate forecast expenditure of $2.1 million ($ constant 2021/2022);

3.388.2 ICT Asset management forecast expenditure of $8.1 million ($ constant 2021/2022); and

3.388.3 ICT Digital switch management forecast expenditure of $8.0 million ($ constant 2021/2022).

3.389 We have reviewed these remaining three investment business cases for prudency and efficiency, having regard to GEIP, and whether the expenditure was consistent with the Capex IM evaluation criteria.

3.390 The Verifier investigated the system operation service provider agreement (**SOSPA**) costs in two ICT investment business cases to confirm these costs had been separated out of Transpower's ICT base capex proposal. SOSPA costs are funded through another funding mechanism and should not be recovered as base capex.

3.391 The Verifier confirmed that SOSPA costs are not included in the RCP4 proposal.

3.392 The Verifier noted Transpower is aware of ICT project under-delivery in the first three years of RCP3. Transpower commented that this is caused by global challenges in acquiring expertise and supply chain problems. If these issues related to a single project, then the impact may not be significant, but the Verifier noted these issues impact most ICT projects, meaning ICT project deliverability is a concern.

3.393 The Verifier noted Transpower has addressed under-deliverability by deferring or cancelling specific projects, that has led to $10.6 million ($ constant 2021/2022) of expenditure being deferred into RCP4, and $3.3 million ($ constant 2021/2022) of expenditure being cancelled.[154]

3.394 RCP4 average annual forecast ICT capex would be $21.0 million without the TransGO Refresh project. It is$39.7 million per year with the TransGO Refresh project included.

3.395 The Verifier comments its evaluation process involved reviewing the original tranche of documents relating to ICT capex, interviewing Transpower management team, and subject matter experts.

3.396 The Verifier also requested and reviewed additional information to test, corroborate, and challenge the assumptions and supporting evidence that informed Transpower's proposed RCP4 ICT capex.

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[154] GHD Advisory and Castalia, IV Report, section 11.4.1, p 236.

3.397 The Verifier stated its evaluation of investment prudency and efficiency focussed on the content of the investment business cases, the process Transpower followed, and investment business case alignment to the defined ICT strategy and framework.

3.398 The Verifier carried out a detailed bottom-up review of the following six ICT investment business cases that, at the time of verification, constituted 91% of the ICT capex programme by expenditure:

3.398.1 ICT Maintain services;

3.398.2 ICT TransGO Refresh;

3.398.3 ICT Transmission systems;

3.398.4 ICT Data Centre Services Modernisation (**DCSM**);

3.398.5 ICT Digital workplace; and

3.398.6 ICT Cybersecurity.

3.399 Below we summarise the Verifier findings for the ICT investment business cases it reviewed, and our consideration of the three it did not review.

ICT Maintain services

3.400 Transpower's ICT Maintain services business case details an expenditure plan to spend capex of $67.6 million ($ constant 2021/2022), and a totex of $72.0 million ($ constant 2021/2022), that includes investigations expenditure (**invex**). This compares to the $76.8 million ($ constant 2021/2022) of capex, and $81.9 million ($ constant 2021/2022) of totex Transpower predicts it will spend by the end of RCP3.[155]

3.401 The proposed expenditure relates to:[156]

3.401.1 telecommunications – provides connectivity to substations, offices and data centres, and provides Transpower with 24/7 infrastructure support;

3.401.2 infrastructure - supports connectivity, the operational environment workplace productivity services, and equipment for the business activities; and

3.401.3 applications – supports activities across Transpower such as planning, commissioning, maintenance on a 24/7 basis.

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[155] Transpower NZ Limited, 'IC01 Maintain Services, ICT Investment Case', p 13.
[156] Transpower NZ Limited, 'IC01 Maintain Services, ICT Investment Case'.

Verifier review – ICT Maintain services[157]

3.402 The Verifier noted that, while processes were complex, Transpower had policies in place that were clearly applied to identify investment need. A three-step approach is used:

3.402.1 identify the asset/application that needs replacing;

3.402.2 review if the asset/application crosses over into another investment case; and

3.402.3 confirm the solution is appropriate.

3.403 The Verifier noted;[158]

> Transpower undertakes a review of each asset when it reaches its end-of-life to assess whether a replacement is needed, consider whether the investment need is addressed by works proceeding under another investment case, and assess whether any additional services provided by the modern equivalent asset can be leveraged.

3.404 The Verifier concluded Transpower had prudently identified the investment need.

3.405 Transpower, as part of its investment decision making, considered alternative investment options together with the interaction with opex costs and other programmes.

3.406 Several cost estimation processes are used depending on the investment type. For recurrent expenditure items, Transpower compares forecast costs with historical costs to test forecast reasonableness. For non-recurring expenditure items, Transpower uses expert judgement from subject matter experts with experience and understanding of project requirements to develop forecast costs.

3.407 The Verifier noted for this category of ICT capex that "there is a continual replacement of assets, and the costs should be well understood, even when it comes to modern equivalents" with some cost reallocation "from capex to opex to deliver a prudent and efficient solution".

3.408 The Verifier noted the expenditure it reviewed, was based on modelled forecast expenditure of $72.0 million ($ constant 2021/2022), which was $0.7 million ($ constant 2021/2022) lower than the totex in the ICT Maintain services investment business case.

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[157] GHD Advisory and Castalia, IV Report, p 241-251 section 11.5.2.
[158] GHD Advisory and Castalia, IV Report, p 249 section 11.5.2.

3.409 The difference relates to $0.1 million ($ constant 2021/2022) of capex, and $0.6 million ($ constant 2021/2022) of invex. The Verifier noted this difference did not change the integrity and conclusions of its findings.

3.410 Following its review, the Verifier concluded that $67.6 million ($ constant 2021/2022) of capex, and $72.0 million ($ constant 2021/2022) of totex for ICT Maintain services was prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

Our review – ICT Maintain services

3.411 We consider the Verifier comprehensively reviewed this sub-category of expenditure. The link to opex and other ICT programmes was tested and confirmed as reasonable, and cost estimation processes were reviewed.

3.412 The Verifier also noted which expenditure items were shifted from capex to opex as Transpower utilises more cost-effective cloud-based solutions.

3.413 We reviewed the IC01 investment business case and consider it explains Transpower investment policy and processes, explains how investment need is identified, and how alternatives are considered. Cost estimation processes for recurring and non-recurring expenditures are reasonable.

3.414 We received no submissions on our ICT maintain services draft decision.

Our decision – ICT Maintain services

3.415 Our decision is to approve $67.6 million ($ constant 2021/2022) for ICT Maintain services capex and a totex of $72.0 ($ constant 2021/2022), that includes investigations expenditure.

ICT TransGO Refresh

3.416 Transpower's ICT TransGO Refresh project business case details an expenditure plan to spend capex of $93.7 million ($ constant 2021/2022) on investment business case, and a totex of $96.9 million ($ constant 2021/2022), including step opex and invex.[159]

3.417 Transpower's TransGO Refresh programme started during RCP3, and it predicts it will spend $19.0 million ($ constant 2021/2022) on the project by the end of RCP3.

[159] When we sought additional information from Transpower about the most recent TransGO Refresh project costs, it notified us that the capital cost estimates had firmed and increased by $0.3 million.

3.418 TransGO is a private telecommunications network, owned and operated by Transpower which it uses for substation protection, substation supervisory control and data acquisition (**SCADA**), HVDC protection, voice communications, and other corporate applications. The expected useful life of TransGO assets is between 10 and 15 years.

3.419 Without this network, Transpower comments that it would not be able to protect, monitor or control its primary grid assets, run the wholesale electricity market, meet regulatory obligation, or function as a corporate entity.[160]

3.420 Currently the assets embedded in the network are expected to reach end of life, and technical support from manufacturers is expected to be withdrawn during RCP4.

Verifier review – ICT TransGO Refresh

3.421 The Verifier reviewed the TransGO Refresh strategy and sub-strategies, and how these were linked and aligned. The Verifier concluded the expenditure drivers have been correctly identified, and the internal review processes and authorisations provided confidence that a robust and economic solution would be delivered.[161]

3.422 The Verifier considered the ICT TransGO Refresh capex of $93.7 million ($ constant 2021/2022), is prudent and efficient, consistent with GEIP, and satisfies the Capex IM evaluation criteria.

3.423 To verify that the costing approach was producing reasonable results, the Verifier noted that Transpower engaged Deloitte New Zealand to carry out an independent review of the costing approach and assumptions. Deloitte made ten observations that Transpower actioned and incorporated into its cost estimation approach.

3.424 The Verifier noted that, along with the expert review and Transpower benchmarking costs internally, the benchmark total costs for the project are between $125 million ($ constant 2021/2022), and $132 million ($ constant 2021/2022), indicating costs may have been understated in the draft proposal it reviewed.[162]

3.425 Despite this reservation, the Verifier concluded the cost evaluation and methodology were reasonable, and cost estimates reasonably accurate.

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[160] Transpower NZ Limited, 'TransGO Refresh, ICT Investment Case'.
[161] GHD Advisory and Castalia, IV Report, p 255 section 11.5.3.
[162] GHD Advisory and Castalia, IV Report, p 256 section 11.5.3.

3.426 The Verifier reviewed the extra staff requirement for the TransGO Refresh project and concluded that the additional staff for the period of the project was reasonable.

3.427 The Verifier noted Transpower is proposing the TransGO Refresh programme be subject to the base capex low incentive rate due to cost uncertainty.

3.428 At the time of its review, the TransGO Refresh project was estimated to cost $116.1 million ($ constant 2021/2022) across RCP3 and RCP4. Based on the expected range of expenditure proposed by Transpower, the cost uncertainty is in the order of 17% of the P50 forecast cost.

3.429 The Verifier believed the level of cost uncertainty was not excessive, and that the TransGO Refresh did not meet the requirements to be considered a low incentive rate base capex project.

3.430 The Verifier concluded Transpower investment business case sets out the necessary plan for the expenditure and presents a prudent and efficient solution to address investment need.[163]

Our review – ICT TransGO Refresh

3.431 Transpower initially sought $99.4 million capex over RCP4 for the TransGO Refresh project. This is similar to the $93.7 million ($ constant 2021/2022) expenditure that was reviewed by the Verifier once it is inflated to $ constant 2022/2023.

3.432 Transpower, despite the Verifier conclusion, maintains the view that the TransGO Refresh project be "designated as a low incentive rate project for RCP4" and "an incentive rate of 15 per cent would apply rather than a standard rate of 34 per cent".[164]

[163] GHD Advisory and Castalia, IV Report, p 260 section 11.5.3.

[164] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 128 section 8.3.3.

3.433 We sought additional information from Transpower about the most up-to-date TransGO Refresh project costs to inform whether the low incentive rate was still appropriate. Transpower responded:[165]

3.433.1 the TransGO Refresh Programme has progressed to the Request for Proposal (**RFP**) procurement stage; and

3.433.2 the current RFP based cost estimate of $99.7 million for capex, and $8.7 million for capitalised leases is higher than what was submitted in the RCP4 proposal, of $99.4 million for capex and $6.4 million for capitalised leases.

3.434 We have accepted Transpower's assurance that it is more certain of costs and consider the standard base capex incentive rate should apply to the TransGO Refresh project. Cost gathered during an RFP process are close to procurement decisions, therefore cost estimate uncertainty is significantly reduced.

3.435 While the capex cost increase of $0.3 million is marginal, we tested the reasoning behind capitalised lease costs increasing. Transpower state this increase is due to 24-month temporary fibre leases and other associated service leases during the project. We consider this is a reasonable project cost.

3.436 We agree with the Verifier that Transpower has reasonably made the investment need case, and reasonably estimated costs. The RFI information has largely confirmed the proposal costs and, in our view, significantly reduced the uncertainty around which incentive rate should apply.

3.437 While external service providers may also provide this fibre service, the risk of contracting out such critical and strategic services to third parties, where Transpower does not have full control over asset availability and maintenance, is driving Transpower's policy of owning and operating fibre assets. We agree that this is a reasonable strategic decision.

3.438 We also agree with Transpower's updated costing information that TransGO capex be increased to $99.7 million following the RFP process, and that related capitalised lease expenditure be increased from $2.3 million to $8.7 million.

3.439 We received no submissions on our ICT TransGo Refresh draft decision.

Our decision – ICT TransGO Refresh

3.440 Our decision is to approve $99.7 million for ICT TransGO Refresh capex, and to increase related capitalised lease expenditure from $2.3 million to $8.7 million.

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[165] Transpower, TransGO cost update RFI025.

ICT Transmission systems

3.441 Transpower's ICT Transmission systems business case details an expenditure plan to spend capex of $9.9 million ($ constant 2021/2022) and totex of $12.3 million ($ constant 2021/2022), that includes step opex, and invex.[166, 167]

3.442 The ICT Transmission systems investment case is not a single activity or service for delivery, rather it is a collection of seven individual initiatives that intend to modernise functions used in the management of the transmission systems.[168]

Verifier review – ICT Transmission systems

3.443 The Verifier noted the key expenditure drivers for the ICT Transmission systems capex are risk reduction, increasing efficiencies, and reducing health and safety, and reputational risk.

3.444 Transpower has chosen the proactive investment approach because it "enhances resiliency and enables proactive response to change and complexity (including ability to adapt)".[169]

3.445 The Verifier concluded Transpower had justified its proactive investment strategy because "Transpower has identified that the proactive option is preferred as it will enable the full realisation of VoLL, opex efficiency and capex reduction benefits gained from better tools, data and improved speed to competency for new personnel".[170]

3.446 The Verifier accepted $9.9 million ($ constant 2021/2022) capex, and a totex of $12.3 million ($ constant 2021/2022), that includes step opex, and invex, in the IC04 investment case was verified as being prudent and efficient and consistent with GEIP.

Our review – ICT Transmission systems

3.447 We reviewed the Verifier report which carried out a reasonable top-down assessment. We consider Transpower has sound policies and procedures in place to identify investment need, and cost-effective solutions.

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[166] Transpower also want to spend $1.5 million of related opex and $0.9 million of related invex.
[167] Transpower NZ Limited, 'Transmission Systems, Transmission Systems IC04 – ICT Investment Case'.
[168] GHD Advisory and Castalia, IV Report, p 262 section 11.5.4.
[169] Transpower NZ Limited, 'Transmission Systems, Transmission Systems IC04 – ICT Investment Case' (March 2023), p 5.
[170] GHD Advisory and Castalia, IV Report, p 264 Table 11-23.

3.448 We reviewed the ICT Transmission systems investment business case. Transpower states the pro-active strategy will provide upwards of $6.4 million of realisable net benefits when compared to the base case and double the benefit of the reactive strategy at a third of the cost.

3.449 Transpower's view is that the proactive strategy builds resiliency and "It enables us to avoid utility supply outages or, when high impact events occur, to maintain or quickly restore service delivery".

3.450 Appendix 2 of the ICT Transmission systems business case sets out the various quantified benefits of the proactive strategy. Some key benefits include:[171]

3.450.1 the expectation that the proposed investments will be able to avoid incidents when load was lost and restored within under 20 mins;

3.450.2 project efficiency improvements by automating manual tasks at substations to increase productivity/utilisation, and improve quality;

3.450.3 reduce the diagnostic period required for incidents when load was lost and restored over 20 mins – restoration time assumed to improve by 5% following the ICT investments; and

3.450.4 FTE productivity and efficiency with better tools - 5% efficiency gain assumed from using machine learning to identify trends to drive improved decisions, and digitising data collection of data (currently input manually).

3.451 We consider that Transpower has made the case for proactive investment and has attempted to quantify the benefits that may accrue from it.

3.452 In conclusion, we agree with the Verifier and consider the ICT Transmission systems expenditure programme is likely to be prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.453 We received no submissions on our ICT Transmission systems draft decision.

Our decision – ICT Transmission systems

3.454 Our decision is to approve $9.9 million ($ constant 2021/2022) capex and totex of $12.3 million ($ constant 2021/2022), that includes opex, and invex, in the ICT Transmission systems portfolio.

[171] Transpower NZ Limited, 'Transmission Systems, Transmission Systems IC04 – ICT Investment Case' (March 2023), p 17-18.

ICT Data centre service modernisation

3.455 Transpower's ICT Data centre service modernisation (**DCSM**) business case details an expenditure plan for $7.8 million ($ constant 2021/2022) of capex and $31.7 million ($ constant 2021/2022) of opex which includes SaaS opex after the IFRS accounting change. This compares to the $16.4 million ($ constant 2021/2022) of capex and $17.6 million ($ constant 2021/2022) of opex Transpower forecasts it will spend by the end of RCP3.

3.456 The ICT DCSM business case sets out Transpower's plan to mitigate ICT asset lifecycle risk and optimise its infrastructure by adopting 'as a service' technologies to lower longer term costs.[172]

3.457 Transpower considered two options. The first option is to remain with existing data centres, and continue to invest in Transpower infrastructure, and the second option, is to transition to service/platform as a service solution.

3.458 Transpower's preferred option is to utilise 'as a service' technologies where these are cost-effective. In its proposal business case, it notes this option has a lower totex cost, and a lower NPV cost over a 10-year period than the existing strategy.

3.459 While migrating to a cloud-based solution increases opex, this is offset by the longer-term capex that will no longer be required. Transpower currently has two data centres that house ICT assets such as servers, routers, and other associated hardware. The DCSM strategy sets out a future where the requirement to have physical data centres will be reduced.

Verifier review – ICT DCSM[173]

3.460 Transpower has updated its proposed expenditure forecast since developing the ICT DCSM business case. At the time of verification, the Verifier identified that the costs set out in this business case did not align with the costs set out in Transpower's expenditure forecast schedules.

3.461 The ICT DCSM business case forecast a totex of $39.5 million ($ constant 2021/2022). The RCP4 expenditure forecast schedule, forecast totex of $25.4 million ($ constant 2021/2022).[174] This compares with the $34.0 million ($ constant 2021/2022) totex that Transpower estimates it will spend by the end of RCP3.

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[172] Transpower NZ Limited, 'Data Centre Service Modernisation, IC05 – ICT Investment Case'.
[173] GHD Advisory and Castalia, IV Report, p 270-276 section 11.5.5.
[174] GHD Advisory and Castalia, IV Report, p 275 section 11.5.5.

3.462 The Verifier noted the expenditure drivers are:[175]

3.462.1 capitalised leases that refer to expenditure associated with the lease of current data centre hardware;

3.462.2 recurrent maintenance that relates to maintaining the core systems in operation, and mitigating risk related to non-support in the future; and

3.462.3 opex that is the ongoing expenses to operate the data centre facilities.

3.463 The Verifier investigated the two strategic investment options, and noted that regardless of the option, Transpower needed to invest.

3.464 To establish costs, Transpower carried out a bottom-up assessment of current services, and decided it was cost-effective for certain services to be transferred to infrastructure as a service (**IaaS**) or platform as a service (**PaaS**).

3.465 The bottom-up costing can be traced to the source which is based on market pricing. The Verifier considered this was a reasonable approach for the investment case.

3.466 After reviewing the information provided by Transpower the Verifier concluded:[176]

3.466.1 Transpower has adequately supported the proposed investment to shift away from traditionally Transpower owned data centres, to a third-party service provider; and

3.466.2 there is a clear expectation that Transpower will not transfer certain services linked to transmission system control and will maintain these servers for strategic reasons.

3.467 Following its evaluation, the Verifier accepted $1.8 million ($ constant 2021/2022) of capex and a totex of $25.4 million ($ constant 2021/2022), that includes SaaS opex was prudent and efficient, consistent with GEIP, and met the Capex IM evaluation criteria.

Our review of ICT DCSM

3.468 We have reviewed the Verifier's report and Transpower's proposal business case for the ICT DCSM programme. We consider that Transpower has considered its options reasonably, and that the transition to cloud-based as-a-service solutions is a good strategy if it is cost-effective. Transpower's supporting analysis suggests this is the case, and this was confirmed by the Verifier review.

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[175] GHD Advisory and Castalia, IV Report, p 272 section 11.5.5.
[176] GHD Advisory and Castalia, IV Report, p 270-275 section 11.5.5.

3.469 Transpower has also considered its strategic infrastructure exposure risk and made the decision that ICT infrastructure concerned with transmission network control and operations remains in New Zealand. We consider this is a prudent strategy for critical assets.

3.470 We consider Transpower has reasonably made the case for the proposed expenditure. We agree with the Verifier and consider the ICT DCSM expenditure programme is likely to be prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.471 We received no submissions on our ICT DCSM draft decision.

Our decision – ICT DCSM

3.472 Our decision is to approve $1.8 million capex ($ constant 2021/2022) and totex of $25.4 million ($ constant 2021/2022), that includes step opex, and invex, in the ICT DCSM portfolio.

ICT Cybersecurity

3.473 Transpower's ICT Cybersecurity business case details its plan to spend capex of $7.3 million ($ constant 2021/2022), and totex of $16.4 million ($ constant 2021/2022), that includes step opex, SaaS opex, and invex.

3.474 This is a totex increase of 44% compared to the $11.4 million ($ constant 2021/2022) Transpower predicts it will spend by the end of RCP3, with capex spend not increasing.

3.475 Investment business case, ICT Cybersecurity, seeks to continue investing into maintaining and modernising Transpower's existing cybersecurity assets and capabilities, sustain security control effectiveness, and enable new capabilities to evolving threats, business, and technology change.[177]

Verifier review – ICT Cybersecurity [178]

3.476 In its review the Verifier notes:

> Cybersecurity is constantly evolving, as the threats of cyber-attacks on the business evolve, the business needs to respond. Transpower needs to manage the risk exposure to cyber-attacks as the worst-case impact of a successful attack could lead to the loss of ability to operate the electricity system.

[177] Transpower, 'Cybersecurity, IC09 – ICT Investment Case'.
[178] GHD Advisory and Castalia, IV Report, p 281-288 section 11.5.7.

3.477 Transpower manages its cybersecurity risk and strategy with reference to two international standards:

3.477.1 ISO2700:2002-Information security management; and

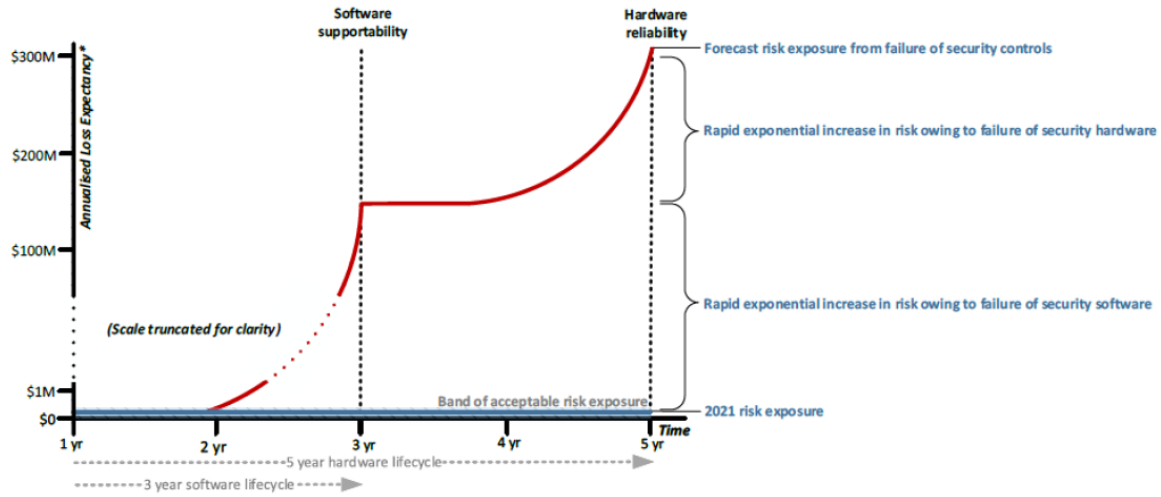
3.477.2 VCSS-CSO-Voluntary security standards for control system operators.

3.478 The Verifier noted Transpower's cybersecurity sub strategy sets out the latest business and technology cybersecurity trends impacting Transpower. These have the potential to increase the vulnerability of Transpower's business if it does not continue to invest to counter threats and technology changes.

3.479 The Verifier also noted that should security be breached through a high-impact cybersecurity event, the estimated cost-of-consequence could be in the region of $320 million to Transpower and consumers.[179]

3.480 Figure 3.7 shows Transpower's view of estimated loss expectancy if a 'do nothing' scenario is followed, and no continuing cybersecurity investment is made.

Figure 3.7 Transpower's cybersecurity risk profile for 'do nothing' investment scenario[180]



3.481 The Verifier noted the cybersecurity strategy involves five key activities:

3.481.1 maintain and modernise existing capabilities;

3.481.2 sustain security control effectiveness;

3.481.3 new capabilities in response to threats;

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[179] GHD Advisory and Castalia, IV Report, p 284 section 11.5.7.
[180] GHD Advisory and Castalia, IV Report, figure 5.1.

3.481.4 new capabilities in response to business change; and

3.481.5 new capabilities in response to technology change.

3.482 The Verifier noted that the proposed expenditure increase was not new expenditure. It is "a continuous expenditure to maintain the current level of security and enable new capabilities in response to evolving threats as the technology evolves".[181] This largely explains the increase in proposed RCP4 expenditure when compared to RCP3.

3.483 To establish the RCP4 cost of cybersecurity, the Verifier noted Transpower takes a comparative approach where replacement cost is based on historical costs, and the most recent cost is extrapolated forward to develop the recurrent capex forecast.

3.484 The Verifier commented that Transpower has established an adequate level of risk based on the nature of the business and system accessibility. The Verifier does not see any reason for Transpower to increase or lower the level of risk and is of the opinion it is appropriate for Transpower to maintain the level of risk.[182]

3.485 The Verifier reviewed the cost forecast and observed the costs are based on bottom-up cost estimates, a comparative assessment, and expert judgement where there are no reasonable benchmarks.

3.486 The Verifier noted at a minimum, Transpower is proposing to maintain its present level of cybersecurity risk, consistent with the requirements set out in the two international standards, namely ISO27001 and New Zealand VCSS-CSO, but risk exposures have increased.

3.487 The Verifier concluded $7.3 million ($ constant 2021/2022) of capex, and a totex of $16.4 million ($ constant 2021/2022) was prudent and efficient, consistent with GEIP, and met the Capex IM evaluation criteria.

[181] GHD Advisory and Castalia, IV Report, p 281 section 11.5.7.
[182] GHD Advisory and Castalia, IV Report, p 286 section 11.5.7.

Our review – ICT Cybersecurity

3.488 We have considered the Verifier's report, and reviewed Transpower's proposal for ICT Cybersecurity investment both as totex, and the capex portion of the totex.

3.489 We agree Transpower needs to invest in cybersecurity to maintain its present level of security, and to protect its systems from any security breach in the future. The Verifier noted that Transpower has reduced its capex and incurred more SaaS opex in this portfolio, but that external risks have increased. This has resulted in increased expenditure to maintain existing levels of risk as external risk exposures increase.

3.490 The Verifier has evaluated Transpower's bottom-up approach to its expenditure forecast, and accepts the costing methodology, and its forecast expenditure is likely to be efficient.

3.491 We agree with the Verifier's finding that Transpower's forecast expenditure for cybersecurity is prudent and efficient, is consistent with GEIP, and meets Capex IM requirements.

3.492 We received no submissions on our ICT Cybersecurity draft decision.

Our decision – ICT Cybersecurity

3.493 Our decision is to approve $7.3 million ($ constant 2021/2022) capex, and $16.4 million ($ constant 2021/2022) totex, that includes step opex, and invex, in the ICT Cybersecurity portfolio.

ICT investment cases not reviewed by the Verifier

3.494 We carried out a limited review of the three ICT investment business cases that were not reviewed by the Verifier.

ICT Corporate systems

3.495 Transpower propose to spend $2.1 million ($ constant 2021/2022) capex for ICT Corporate systems, and $.36.9 million ($ constant 2021/2022) totex, including SaaS opex, step opex, and invex.[183]

3.496 Transpower states this investment is required to replace Transpower's end-of-life corporate systems and improve corporate capability of its internal and external facing processes.

[183] Transpower Corporate Systems, IC06 – ICT Investment Case.

3.497 Transpower comments this investment case sets out the most efficient and prudent investment to modernise the corporate business capability, since the existing systems have reached end-of-life.

3.498 We reviewed the ICT Corporate systems business case. We note that Transpower has carried out a substantial analysis to justify its proposed investment, including consideration of different investment options, a cost-benefit analysis to select its preferred investment path, and a supporting risk analysis.

3.499 Project costs have been estimated based on historical costs, experience from similar projects, and supported cost estimates.

3.500 We consider this proposed expenditure is well supported, and the strategy is mature. We are reasonably satisfied the proposed corporate systems expenditure is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.501 We received no submissions on our ICT Corporate systems draft decision.

3.502 Following our high-level review of this business case our decision is to approve $2.1 million ($ constant 2021/2022) capex and $36.9 million ($ constant 2021/2022) totex for ICT Corporate Systems.

ICT Asset management systems

3.503 Transpower proposed $8.2 million ($ constant 2021/2022) capex for ICT Asset management systems, and $17.7 million ($ constant 2021/2022) totex, including SaaS opex, step opex, and invex.[184]

3.504 In its ICT Asset management systems business case Transpower notes, with reference to its **AHNR** roadmap, the first stage execution has been a success, and the related expert opinion was favourable regarding implementation.

3.505 This investment will further improve quality, reduce the level of manual inspection and analysis, as well as assist both quality and efficiency in a period of increased electrification.[185]

3.506 Transpower considered four possible options and chose the option that has the best scope and strategic fit to the AHNR roadmap. The proposed solution has higher benefit realisation potential, and the lowest implementation risk when compared to the do-nothing option.[186]

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[184] Transpower Asset Management Programme, IC07 – Investment Case.
[185] Transpower Digital Switch Management, IC11 – Investment Case.
[186] Transpower Digital Switch Management, IC11 – Investment Case. p 13.

3.507 Project costs have been estimated based on experience from similar projects.

3.508 We consider this proposed expenditure is well supported, and the strategy is mature. We are reasonably satisfied that the proposed asset management systems expenditure is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.509 We received no submissions on our ICT Asset management systems draft decision.

3.510 Following our high-level review of this business case our decision is to approve $8.2 million ($ constant 2021/2022) capex and $17.7 million ($ constant 2021/22) totex for ICT Asset management systems.

ICT Digital switch management

3.511 Transpower proposes to spend $6.5 million ($ constant 2021/2022) capex for ICT Digital switch management.[187]

3.512 The digital switch management programme is designed to reduce dependence on manual paper-based processes. Since Transpower carries out approximately 160 grid outages per week, reducing a manual paper-centric process will assist in reducing error rate, expand control room capacity, and reduce the potential for errors which has safety implications.

3.513 Transpower considered two investment options, namely:

3.513.1 Option 1 – to fully digitise all planning and control room execution functions for digital switch management; and

3.513.2 Option 2 – to fully digitise all field execution functions for digital switch management.

3.514 Transpower's preference is Option 2 because it mitigates safety risk more fully and ensures switching event errors will be reduced.

3.515 We reviewed the investment case associated with this proposed expenditure. Transpower has considered a range of investment options, identified the risks and benefits of each, and carried out cost-benefit analysis to support its preferred solution.

3.516 Project costs have been estimated based on historical costs for the ongoing project over RCP3, and experience from similar projects.

[187] Transpower Digital Switch Management Programme, IC11 – Investment Case.

3.517 We consider this proposed expenditure is well supported, and the strategy is mature. We are reasonably satisfied the proposed digital switch management expenditure is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

3.518 We received no submissions on our ICT Digital switch management draft decision.

3.519 Following our high-level review of this business case our decision is to approve $6.5 million ($ constant 2021/2022) capex for ICT Digital switch management.

Capitalised leases

3.520 Since 2019/2020 operating leases have been capitalised by Transpower to align with GAAP, and the change in accounting treatment under NZ IFRS 16.

3.521 The Verifier did not review Transpower's proposed capitalised lease expenditure, and the proposal did not discuss what the expenditure was related to. We sought additional information from Transpower about each lease category, the expenditure in each category, start dates and end dates of leases, and the annual quantum of lease related expenditure.

3.522 Transpower provided a summary of the $58.7 million lease payments by category, and this set out in Table 3.1.[188]

Table 3.1: Summary of proposed RCP4 capitalised leases

Number	Description	Amount ($ million)
1	Existing leases - data centres, fibre, and property	39.7
2	Extension leases – fibre, office buildings, and property	10.6
3	Transmission line lease	1.1
4	TransGo amendments[189]	7.3
	Total capex	**58.7**

[188] Transpower's reply to RFI09 and RFI25.

[189] When we sought additional information from Transpower about the most recent TransGO Refresh project costs, it notified us that the capitalised lease costs had increased by $2.3 million. Transpower stated that this increase is due to 24-month temporary fibre leases and other associated services leases during the project.

3.523 Of the 99 capitalised leases that are current, 14 of these will end during RCP4. The proposed RCP4 capitalised lease costs are largely for a continuation of existing leases in RCP3, which Transpower has confirmed as $56.3 million by the end of RCP3.

3.524 Transpower noted in its RFI response it has assumed the extension of existing lease costs in RCP4 have been calculated using net present value (NPV) analysis, using a 4.5% discount rate, resulting in an RCP4 forecast estimate that is virtually the same as the RCP3 capitalised lease amount.

3.525 Given that most proposed capitalised lease costs are a continuation of existing leases, and these align with RCP3 lease costs, we accept the proposed $58.7 million for capitalised leases is prudent and efficient, and consistent with the Capex IM evaluation criteria.

3.526 We received no submissions on our capitalised leases draft decision.

3.527 Based on our review our decision is to approve $58.7 million for capitalised leases.

Enhancement and Development (E&D) expenditure

3.528 E&D expenditure is concerned with investment in the network which leads to an enhancement in grid capability, but where a project in the portfolio is estimated to cost less than the base capex threshold.[190]

3.529 Transpower is proposing E&D expenditure of $111.7 million, and describes its E&D portfolio as investments that:[191]

3.529.1 provide more capacity to generators or connected loads;

3.529.2 match reliability or security of supply to the required standard or agreed service level;

3.529.3 maintain or improve power quality measures; and

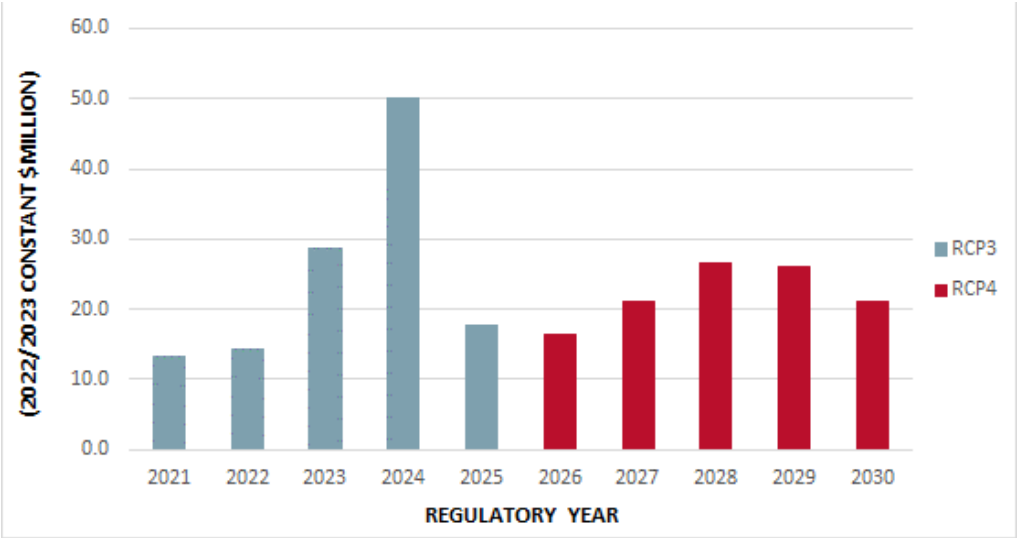
3.529.4 manage the dynamic response of the power system to disturbances.

3.530 Figure 3.8 shows the annual actual, estimate and proposed expenditure for RCP3 and RCP4 for E&D capex.

[190] Prior to RCP4 proposal submission in November 2023, the Capex IM base capex threshold was $20 million. In our recent 2023 IM Review decision we amended the base capex threshold to $30 million.

[191] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 191 section 10.3.

Figure 3.8 Enhancement and development capex in RCP3/RCP4 ($million constant 2022/2023)



3.531 In our RCP3 decision we approved the 'extremely likely' and 'highly likely' E&D projects but did not approve the E&D projects that were less certain.[192]

3.532 As part of our RCP3 decision we made an IM change and introduced the mid-period E&D reopener. The reopener mitigated the risk that, at the time a base capex proposal is made, the E&D allowance we set was too low, and to consumers it was too high. The reopener gives Transpower the opportunity to seek additional funding for E&D projects that become more certain, following an RCP proposal submission to us, and in the first two years of a regulatory control period.

3.533 We approved an E&D reopener application from during RCP3, and Transpower expressed support for the E&D reopener approach in the recent IM Review process, but proposed we extend the E&D drivers to include resilience expenditure.[193]

3.534 Transpower has based its RCP4 E&D expenditure proposal on an "aggregated portfolio of 'extremely likely' and 'highly likely' projects" (see Table 3.2) that have been "identified through our enhancement and development investment planning approach".[194] This planning approach links to Transpower's 2023 Transmission Planning Report.[195]

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[192] Commerce Commission Transpower IPP RCP3 Decisions and reasons paper (29 August 2019) (**RCP3 Decisions paper**) Attachment G.10, p 267-273.

[193] Transpower "Submission on IM Review 2023 draft decisions" (19 July 2023), para 106.

[194] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 192 section 10.3.

[195] Tables 4-1 and 4-2 of the 2023 Transmission Planning Report (TPR) sets out the projects Transpower has defined as 'extremely likely' and 'highly likely' investment expenditure. The 2023 TPR is available here

3.535 This approach taken by Transpower is consistent with the approval decision we made for E&D expenditure in our RCP3 decision.

Table 3.2 Extremely and highly likely E&D portfolio investments in RCP4[196]

Extremely likely expenditure	Highly likely expenditure
Investments we expect to progress through our options assessment and to meet approval stage gates This includes projects that are already well into the design process, where we have confidence in projected generation or load changes, and/or that have other drivers (such as asset condition) we consider certain	Investments we expect to progress through the options assessment and to meet approval stage gates, but that have a less certain identified solution and associated cost This also includes projects with less certain drivers, or those that would occur later in the period when we have more certainty around the costs of the project

Verifier review of E&D expenditure [197]

3.536 The Verifier reviewed $98.5 million ($ constant 2021/2022) of E&D capex and verified $93.5 million ($ constant 2021/2022) of proposed capex. The Verifier suggested $5.0 million ($ constant 2021/2022) for corridor management programme costs should be re-categorised as opex.

3.537 In its review the Verifier tested the drivers for the proposed E&D projects with reference to Transpower's 2022 Transmission Planning Report. The Verifier stated:[198]

> For RCP4 Transpower has consider the drivers of the system need, the stages of decision framework completed to date, credible options and cost to resolve the issue, along with whether the investment will meet the requirements of the option assessment approach for approach to inform its view of the certainty of the base E&D capex.

3.538 To test the prudency of the proposed investments, the Verifier scrutinised a sample of E&D projects "to corroborate the network planning approach undertaken, the details of system need, and proposed solution, scope and costs of those projects".[199] The Verifier concluded the proposed investment solutions were prudent and reasonable, and consistent with the Grid Reliability Standards, and the Grid Planning Technical Guideline.

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196 Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 192 section 10.3, table 54.
197 GHD Advisory and Castalia, IV Report, p 222-230 section 10.
198 GHD Advisory and Castalia, IV Report, p 226 section 10.4.
199 GHD Advisory and Castalia, IV Report, p 228 section 10.5.1.

3.539 The planning approach taken suggested a "consistent application of Transpower's frameworks and processes, thereby indicating a well-established planning and base E&D capex development function".[200]

3.540 The Verifier suggested the $5.0 million ($ constant 2021/2022) proposed for corridor management be re-categorised as opex, because this expenditure "does not renew or extend the life of Transpower assets beyond its average life", and "capitalising such activity would lead to creation of assets which will need to be depreciated over the estimated life".[201]

3.541 The corridor management expenditure is proposed as a "programme of activities to seek and advocate for provisions in statutory planning documents of respective territorial authorities/owners, under the Resource Management Act 1991".[202]

3.542 To test project cost efficiency, the Verifier reviewed the E&D cost estimation processes and concluded these were "based on using similar scoped building blocks from TEES and/or engineering judgement from previous experience". The Verifier concluded "a reasonable approach in developing capital cost estimate of projects",[203] and this was consistent with its observations regarding Transpower's cost estimation framework.

3.543 The Verifier concluded "the proposed base E&D capex totalling $93.5 million ($ constant 2021/2022) satisfied the evaluation criteria" in the Verifier terms of reference and is "prudent and efficient having regard to GEIP".

Our review of E&D expenditure

3.544 We tested the Verifier review of Transpower's proposed E&D expenditure and the Transpower's approach to identify E&D projects sourced from its Transmission Planning Report process. The TPR documents are produced annually by Transpower and are a 10-year forecast of potential network issues and likely solutions.

3.545 We agree with Transpower's proposed approach to identify E&D expenditure it needs at this reset using the 'extremely likely' and 'highly likely' test, then to seek additional funding later in the RCP4 period using the mid-period E&D reopener. This is the approach we decided was prudent in our RCP3 decision which has proven useful to Transpower. This approach mitigates the risk that we set allowances that are too high or are too low at the IPP decision stage.

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[200] GHD Advisory and Castalia, IV Report, p 228 section 10.5.1.
[201] GHD Advisory and Castalia, IV Report, p 229 section 10.5.1.
[202] GHD Advisory and Castalia, IV Report, p 229 section 10.5.1.
[203] GHD Advisory and Castalia, IV Report, p 229 section 10.5.2.

3.546 Transpower amended the E&D funding quantum it is seeking approval for since verification.[204] This followed stakeholder consultation over 2023, that took account of feedback about projects driven by step-change demand or generation. The proposal's 'extremely likely' and 'very likely' E&D projects and programmes are summarised in the 2023 Transmission Planning Report.[205]

3.547 We carried out our own sample bottom-up review of E&D project investment need, any alternatives considered, and proposed solutions, namely:

3.547.1 Otahuhu–Penrose transmission capacity ($15.5 million) – demand driven need based on outage of a 220kV between Otahuhu, Southdown and Henderson, which overloads the 220 kV Hobson Street–Wairau Road circuit from 2025 at peak. Solution is to a install reactor at Penrose which will also resolve Hobson Street–Wairau Road capacity issue around 2035. A 220kV N-1 capacity issue resolved by a reactor is a very cost-effective solution when compared to installing new capacity (extremely likely);

3.547.2 Aviemore-Benmore circuit overload protection scheme upgrade ($0.4 million) – generation dispatch driven based on the impact of low generation dispatch in the South Island eg, low lake levels and likely HVDC south flow. A range of scenarios tested identified that upgrading the present Aviemore–Benmore circuit overload protection scheme to also operate for south flow conditions has both market and operational value (extremely likely); and

3.547.3 Fernhill–Redclyffe–A and B line reconductoring ($16.5 million) – demand driven based on an outage of one Fernhill–Redclyffe circuit overloading the other. Ability to constrain on generation to manage overload is not possible post-2028. Special protection scheme is an interim solution but it is complex and results in N-1 issues elsewhere. Long-term solution is to reconductor circuits with a higher rated conductor. Resolves many operational issues in the region (highly likely).

3.548 For the projects that we sampled Transpower has clearly identified the investment need and likely timing, as well as discussing alternatives when they are viable and cost-effective. We have relied on the Verifier conclusions that Transpower has robust cost estimation systems in place based on building block models and regularly updated unit rates, to judge that the proposed investments are likely to be efficient.

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[204] The verified amount of $93.5 ($ constant 2021/2022) inflates to $99.9 million in $ constant 2022/2023 using the Transpower expenditure model inflator.

[205] Tables 4-1 and 4-2 of the 2023 Transmission Planning Report sets out the projects included as extremely likely and highly likely investment expenditure.

3.549 We also completed a top-down review of the 2023 TPR which Transpower used as its analysis basis to support the E&D portfolio. We consider this is a comprehensive and mature foundation for identifying likely E&D expenditure projects, and that for the projects we reviewed, the TPR supports the proposed investments.

3.550 The Verifier reviewed Transpower's demand forecasting used in the TPR to identify E&D projects and likely project timing. The Verifier concluded that while some improvements could be made, it was a sound basis for identifying demand driven grid enhancement need.

3.551 Following our review of the Verifier findings and Transpower's proposal we consider that the E&D proposal is largely prudent and efficient. The exception is the $5.0 million expenditure for corridor management which the Verifier concluded should be re-categorised as opex.[206]

3.552 Transpower included this corridor management expenditure in its E&D proposal and considered that these costs should be capitalised after obtaining external advice that this treatment is consistent with GAAP.[207]

3.553 The corridor management expenditure was proposed by Transpower as a "programme of activities to seek and advocate for provisions in statutory planning documents of respective territorial authorities/owners under the Resource Management Act 1991".[208]

Our draft decision

3.554 In our draft decision we concluded the E&D proposal was mostly prudent and efficient. The exception was the $5.0 million expenditure for corridor management which the Verifier concluded should be re-categorised as opex. In our draft decision we approved $106.7 million of the proposed $111.7 million E&D expenditure.

3.555 We reviewed the proposed corridor management expenditure and tested whether this met the definition of 'electricity transmission services'. We concluded that unless the corridor management expenditure was related to costs for a specific E&D project, it could not be included as E&D expenditure. Transpower had not demonstrated that this was the case.

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[206] Note that Transpower amended its proposal amount following stakeholder consultation over 2023 which has resulted in a slightly higher forecast E&D expenditure than the Verifier reviewed.

[207] GAAP means 'generally accepted accounting practice' and is a business accounting standard that sets out financial reporting principles.

[208] GHD Advisory and Castalia, IV Report, p 226, table 10-3.

3.556 We were also unclear as to why Transpower was seeking additional funding for the purpose of meeting its current corridor management regulatory compliance. The Verifier report noted that this funding was for an ongoing programme where costs were being incurred over RCP3.[209] As such these ongoing costs will already be accounted for in the proposal base opex.

3.557 We concluded that the proposed corridor management opex of $5 million did not meet the definition of 'electricity transmission services' and couldn't be included as E&D capex. Additionally, our view was that these opex costs were already being incurred as base opex.

Draft decision submissions

3.558 In its draft decision submission, Transpower provided additional information on the proposed corridor management expenditure. Transpower disagreed with our view that the expenditure does not relate to 'transmission line services' expenditure because it relates to protecting existing transmission corridor rights under the Resource Management Act (**RMA**).[210] Protecting existing rights ensures that existing transmission capacity is maintained. Additionally, the expenditure is used to ensure that ongoing access rights are maintained.

3.559 Transpower also submitted that the programme of corridor management works was ongoing expenditure, and not included in its base year opex because its accounting advice was that the expenditure should be capitalised. Transpower confirmed that it had historically treated corridor management expenditure this way over RCP3.

3.560 We revisited our analysis about whether this expenditure relates to 'transmission line services'. Based on the additional clarifying information we agree that expenditure that ensures that existing transmission assets are adequately maintained to their existing capacity can be considered 'transmission line services'.

3.561 We tested whether the expenditure should be capitalised and sought confirmation of Transpower's advice on this. Transpower responded to our request for information stating that while it could not locate its original 2014 advice, it had been capitalising corridor management opex since RCP2 since "it was related to fixed life intangible assets" and that the Commission had been accepting that practice.[211] We accept that corridor management expenditure should be capitalised based on Transpower's information and our previous treatment of this expenditure.

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[209] GHD Advisory and Castalia, IV Report, p 229 section 10.5.1.
[210] Transpower, "Transpower Submission on draft decision", para 26-38.
[211] RFI034 Enhancement and Development – Corridor management being capex.

3.562 Finally, Transpower note that in its draft decision submission that it had "included this expenditure in E&D capex, as it does not fall neatly into any of the other existing categories defined in the Input Methodologies."

Our final decision

3.563 Having considered Transpower's submission on this point, we consider this expenditure falls within the definitions of both base capex and E&D base capex. Therefore, we have reconsidered our draft decision in relation to this expenditure on this basis.

Our decision – E&D expenditure

3.564 Following our review and consideration of submissions our decision is to approve $106.7 million in the E&D expenditure portfolio and $5.0 million corridor management expenditure as base capex. We conclude that these expenditures are prudent and efficient, consistent with GEIP, and meet the Capex IM evaluation criteria.

Redclyffe substation rebuild project as a Listed Project

3.565 During our review of the proposal Transpower notified us that it wanted to amend its proposed Listed Projects. Transpower informed us in an RFI response that the Redclyffe substation rebuild project was a Listed Project.

3.566 In our draft decision we did not agree that the Redclyffe substation rebuild project was a Listed Project because we were not convinced that it met the Listed Project criteria. In particular, we did not consider that the project could be fully defined as an asset replacement or asset refurbishment (consistent with cl. 2.2.2(8) of the Capex IM) as it includes a reliability improvement component following the resilience mitigation works.

> The Redclyffe substation rebuild project is a resilience capex project and depending on the cost of the works, is either E&D capex or an MCP. In its draft decision submission Transpower agreed with our decision and will "undertake the Redclyffe 220kV substation rebuild as an E&D project. If the project is below $30 million, we will fund it out of base capex, if the project is over $30 million, we will treat it as a major capex project (MCP)."[212]

3.567 Further, Transpower stated that its substation resilience workstream does not include funding for Redclyffe, and that if it did fund the Redclyffe rebuild under base capex (if the project cost was estimated to be less than the base capex threshold of $30 million), it would leave other E&D projects unfunded. In this case Transpower will use the E&D reopener provision to seek additional funding for the unfunded projects.

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[212] Transpower, RCP4 draft decision submission, para 14.

3.568 Following our review of submissions and given Transpower agrees with our assessment and intends to fund this project via an appropriate mechanism (E&D or MCP), we have decided to confirm our draft decision that the Redclyffe 220kV Switchyard rebuild project is not included as a Listed Project.

Chapter 4 Resilience

Purpose

4.1 This chapter sets out our assessment of Transpower's proposed resilience expenditure as base capex, and resilience expenditure. Transpower has proposed using a Use-It-Or Lose-It (**UIOLI**) uncertainty mechanism (**UM**).

Background and summary

4.2 Transpower has split its proposed resilience expenditure into two tranches; proposed resilience expenditure and proposed resilience UM expenditure.

4.3 In the resilience expenditure tranche in the Transpower proposal, Transpower is seeking approval for $87.2 million of expenditure to address major event issues it considers are sufficiently well understood and with developed solutions. [213]

4.4 In the resilience UM expenditure tranche in the Transpower proposal, Transpower is seeking approval for $126.7 million of totex in a pre-approved expenditure cap in a UIOLI funding arrangement.

4.5 Transpower considers that for the resilience UM projects and programmes, where there are significant timing and cost uncertainties, a UIOLI approach is favoured.[214]

4.6 Following our review of the resilience UM project and programme business cases we concluded that the proposed resilience UM opex total was $3.8 million rather than the $2.9 million set out in the main proposal document (a proposed resilience UM totex of $127.6 million). We reviewed the revised totex of $127.6 million as the correct resilience UM expenditure being proposed by Transpower.

4.7 Transpower has proposed both capex and opex solutions in its wider resilience programme, and we have considered these together in our analysis rather than separate considerations within the capex and opex workstreams.

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[213] Transpower New Zealand Limited "Regulatory control period 4 proposal April 2025 – March 2030" (21 November 2023), p 177 section 9.3, table 50.

[214] Transpower New Zealand Limited "Regulatory control period 4 proposal April 2025 – March 2030" (21 November 2023), p 177 section 9.3, table 50.

4.8 Following our review our decision is to approve:

4.8.1 $67.2 million of the proposed $75.0 million resilience capex and $3.8 million of the proposed $12.2 million resilience opex; and

4.8.2 $64.4 million of the proposed $123.8 million resilience UM capex and $3.8 million of the proposed $3.8 million resilience UM opex.

4.9 We discuss these two packages of work separately in our analysis below.

Verifier view of Transpower's resilience programme

4.10 In its draft proposal, that was consulted on and reviewed by the Verifier, Transpower forecast it needed $78.0 million ($ constant 2021/2022) of resilience expenditure.[215]

4.11 At the draft proposal stage Transpower also forecast it needed $53.2 million ($ constant 2021/2022) of resilience UM expenditure as a UIOLI fund for resilience projects and programmes that it was less certain of.

4.12 The Verifier concluded that $60.8 million ($ constant 2021/2022) of Transpower's proposed resilience expenditure and $53.2 million of the resilience UM expenditure met the requirements of the Capex IM, and was verified.

4.13 The Verifier in its report noted that:[216]

> As part of its grid resilience strategy Transpower is proposing a programme of resilience workstreams. Most of these resilience workstreams are embedded in the above itemised base expenditures (grid maintenance, ICT opex, base R&R capex and ICT capex). The remainder of the resilience workstreams are capex programme and are being proposed using the UIOLI uncertainty mechanism.

4.14 The resilience expenditure reviewed by the Verifier was embedded within the wider capex programmes. The Verifier analysis did not focus on specific business case justifications instead concluding that, on balance, it appeared reasonable in meeting the Capex IM.

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[215] https://static.transpower.co.nz/public/2023-11/RCP4%20Main%20Proposal%202023.pdf?VersionId=TRqSogShhDfomL4gVwFzlzzzGSfRjz30 , p 179 table 51.

[216] GHD Advisory and Castalia, IV Report, p 12 section 2.4.2.

4.15 The Verifier also reviewed the proposed resilience UM expenditure and concluded that: [217]

4.15.1 it agreed that the five potential projects (or capex workstreams) would indeed provide important benefits to consumers and noted was consistent with feedback from customers and consumers;

4.15.2 while the exact scope and cost of these projects is uncertain when Transpower submits its proposal, it would be prudent to allow a reasonable UIOLI expenditure allowance to address the identified issues; and

4.15.3 the proposed risk allocation between Transpower and customers is considered appropriate because the proposed resilience UM capex is a relatively small expenditure amount, underspend is not charged to customers, and Transpower would be penalised for any overspend.

Transpower's resilience planning approach

4.16 Transpower has matured and developed its resilience planning in recent years as a response to recent major events and following customer feedback.[218] Transpower considers that, relative to its international peers, a large proportion of its infrastructure is exposed to natural hazards and climate change effects.

4.17 In its proposal, Transpower set out the planning approach it has taken to support its proposed investment plan over RCP4 and beyond. This includes identifying and prioritising the investment need for vulnerable and critical assets, testing options to mitigate identified risks, developing a prudent and efficient funding envelope, and high-level cost-benefit analysis to ascertain whether the proposed resilience expenditure is cost-effective.

4.18 We consider Transpower has taken a prudent planning approach to identifying resilience risks and planning how to mitigate for these risks. The policy framework appears to be systematic and enduring, and should help ensure the transmission network is more resilient to major event risk in the long-term.

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[217] GHD Advisory and Castalia, IV Report, p 421 section 19.1.3.

[218] Transpower New Zealand Limited "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 165 section 9.1.

Our analysis approach

4.19 In our review, we have taken a bottom-up approach to reviewing the proposed resilience expenditure projects and programmes that Transpower had developed since verification, testing:

4.19.1 proposed investment need and the assumptions that underpin that need;

4.19.2 the options that have been considered;

4.19.3 whether prioritisation has been carried out;

4.19.4 whether project and programme capital costs can be relied upon; and

4.19.5 whether the economic case for investment is reasonable for the assumptions made.

4.20 We also reviewed the resilience UM expenditure proposed by Transpower as a pre-approved fund that it can access on a Use-It-Or-Lose-It (**UIOLI**) basis, where the funds would not be part of base capex or opex we approve, or the revenue we set. Transpower states that its revenue requirements would only increase if it spent the money up to the pre-approved funding cap.

4.21 In its draft decision submission MEUG welcomed "the greater analysis and focus on resilience expenditure, and discussion of the specific projects in greater depth".[219]

4.22 During our 2023 IM Review process Transpower proposed that we include UIOLI funding IMs in either the Capex IM or Transpower IM. Transpower proposed that these UIOLI mechanisms be included for resilience and connection asset capacity issues related to customer electrification.

4.23 In our 2023 IM Review final decision, we decided that a UIOLI IM change for resilience expenditure was not favoured. We considered that the Capex IM did not need to change to explicitly address resilience.

4.24 We concluded that the existing regulatory framework did not prevent resilience expenditure being proposed by Transpower as it could follow the economic approach it had taken in the past for resilience expenditure as base capex or major capex.[220]

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[219] Major Electricity Users' Group, "MEUG Submission on draft decision.

[220] Upper South Island Grid upgrade Stage 1 (June 2012) (**USI Grid upgrade**) and Transpower Expenditure proposal for Regulatory Control Period 2 (December 2013) (**RCP2**) p 68.

4.25 In our 2023 IM Review final decision we expanded the list of E&D drivers to include resilience. This gives Transpower the opportunity to recover appropriate resilience expenditure using the mid-period E&D base capex reopener as projects and programmes become more certain.

4.26 There are three resilience UM expenditure investment programmes in particular that we focussed our review on, namely:

4.26.1 HVDC tower strengthening due to wind exposure ($14.1 million of capex);

4.26.2 HVAC and HVDC tower strengthening due to flood exposure ($27.3 million of capex and $2.9 million of opex); and

4.26.3 flood resilience at substation sites ($45.9 million of capex).

4.27 Two of these proposed UIOLI mechanism expenditures are related to recent events, namely:

4.27.1 the Rangitata River flood event in December 2019, which damaged nine towers on the Islington-Livingstone HVAC transmission line resulting in a 220kV circuit outage; and

4.27.2 the substation flood event following Cyclone Gabrielle in 2023, in which the Redclyffe substation site was flooded and damaged leading to an extended outage event in the Hawke's Bay region.

4.28 During our review of Transpower's resilience proposal we found that Transpower appeared to have advanced the analysis of some resilience UM expenditure projects and programmes since verification.

4.29 In many cases, the programmes have advanced to the point where need has been clearly identified, alternative options have been considered, and a top-down economic analysis has been carried out, to demonstrate that the wider programme will be economic. However, specific mitigation designs and costings are yet to be fully developed.

4.30 We considered the resilience UM expenditure project and programme uncertainties in our analysis. One option we considered was to decline to approve any of this expenditure and direct Transpower to use the E&D mid-period reopener.

4.31 However, some of this expenditure is directed towards mitigating high-priority exposures that Transpower needs to progress now, particularly those related to flood event mitigations. We carried out our analysis with this in mind and considered how 'likely' it is that some of the expenditure will be required even if detailed mitigation costs are not yet defined for specific locations.

4.32 With this in mind, we applied the E&D expenditure likelihood analysis framework for some, or all, of the resilience UM expenditure that is 'extremely likely' or 'very likely' to be required.

4.33 For the resilience UM expenditure which we have not approved at this time, we consider further Transpower investigations are needed to define investment need and develop economic justifications. In these cases, Transpower can utilise the E&D capex mid-period reopener when Transpower is more certain of investment need, solution, economic viability, and/or cost.

Resilience expenditure assessment

Seismic strengthening of buildings

4.34 Transpower has identified it needs $29.5 million to complete seismic strengthening on 34 buildings.[221]

4.35 Transpower stated:[222]

> This workstream is an ongoing policy-based initiative aligned to the Civil Defence Emergency Management Act 2002. Our seismic policy requires that any buildings classified as IL4 under the Building Code,[223] together with any permanently occupied buildings classified as IL2, that are found to have an ultimate structural capacity of less than 75 per cent of the New Building Standard (NBS)[224] must be strengthened to not less than 75 per cent NBS.
>
> Our buildings that are classified as IL4 are those containing essential equipment and facilities, mainly control buildings and other adjacent buildings that could potentially impact the control buildings if damaged.
>
> If a control building is significantly damaged in an earthquake, a lengthy service disruption would be expected for a substation. There is also a life safety risk relating to permanently occupied buildings.

4.36 Transpower carried out a seismic needs assessment of its buildings following reviews in 2008 and 2015. The latest review identified 47 buildings (classified as IL2 or IL4) that were assessed at less than 75 per cent of National Building Standards (**NBS**). The assessment found 22 IL4 buildings were rated at less than 34 per cent of NBS, with six occupied buildings below 75 per cent of NBS.[225]

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[221] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 47 Appendix 1 – Workstream Details.

[222] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 47 Appendix 1 – Workstream Details.

[223] Building Code (Schedule 1 to the Building Regulations 1992).

[224] NBS is the earthquake rating of a building when built to meet the Building Code.

[225] Transpower note that a rating of less than 34 per cent NBS means the building is considered 'earthquake prone'. The Building Act sets out the requirements in relation to this type of building.

4.37 Transpower considered several investment strategies, including whether the buildings were required long-term, or could be dismantled. Mitigation costs per site will vary depending on the complexity of the site.

4.38 Following its review, Transpower refined its preferred solution to "address 34 buildings (all IL4 buildings < 34% NBS, all IL2 buildings accommodating personnel or with a high impact if they were to fail, plus 6 more IL4 buildings between 34%-40% NBS)".[226]

4.39 A cost-benefit analysis was applied that factored loss of supply costs following an event, and safety risk that considered the cost of a multiple fatality event where appropriate. Most sites in the proposal were found to provide benefit cost ratio (**BCRs**) of greater than 1.0 with most BCRs in the 5.0 to 15.0 range.

4.40 The Verifier reviewed Transpower's building seismic strengthening programme and concluded:[227]

4.40.1 Transpower's seismic strengthening plan is to ensure any buildings classified as IL4, together with any high occupancy buildings classified as IL2, must be strengthened to not less than 75% NBS, and is consistent with the Building Regulations 1992;

4.40.2 the prioritisation of the proposed seismic strengthening work is based on risk, and aligned with the Transpower asset investment and decision framework; and

4.40.3 Transpower's insurance premium is not impacted by this proposed capex, rather the insurance provider expects to see assets adhering to the Building Regulations 1992.

4.41 The Verifier concluded that the seismic building strengthening capex it had reviewed was prudent, however, did not provide an opinion on the cost efficiency of proposed seismic expenditure specifically.

4.42 Our view given Transpower has been carrying out building seismic strengthening work since RCP1,[228] is that Transpower has a good understanding of mitigation costs and the complexities involved. We consider Transpower will have a mature degree of certainty about efficient costs for this programme in RCP4.

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[226] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 48.

[227] GHD Advisory and Castalia, IV Report, p 158 section 9.3.8.5.

[228] Transpower Expenditure proposal for Regulatory Control Period 2 (December 2013) (**RCP2**), p 23.

4.43 In our draft decision we concluded that the resilience expenditure for seismic strengthening of buildings met the requirements of the Capex IM evaluation criteria and should be approved.

4.44 We received no submissions on our draft decision.

4.45 Our decision is to approve $29.5 million of resilience capex for seismic strengthening of buildings.

Land stability works for towers and poles

4.46 Transpower has identified it needs $7.9 million of capex and $3.0 million of opex to carry out land stability works for transmission towers and poles.[229]

4.47 Transpower noted it has been consolidating known land instability issues into a register and this has "highlighted the significant scale of this major hazard across our fleet of transmission line structures".[230]

4.48 The investment need is described as:[231]

> These assets can be affected by a range of issues, e.g. a landslide from above covering or displacing a route, a drop-out from below destroying the access track or bridge abutment, and river flooding resulting in scour, wash-out of an access track or, in the extreme, complete displacement of a bridge.
>
> A total of 40 issues relating to access tracks and/or bridges are currently recorded in the register. Regional SMEs workshops have assessed risk levels and identified mitigation options and cost estimates to build a picture of the present and future need.

4.49 Land stability issues can lead to transmission line and pole structure failure, and potential service outages. Transpower notes over the last five to ten years it has spent approximately $1 million per year on 'reactive' land stability mitigations.

4.50 Transpower has prioritised its work programme based on its resilience risk decision making framework in Section 6.2 of its Resilience Portfolio Management Plan. The RCP4 plan is to mitigate six risks - a mixture of bridge replacements and access track rebuilds.

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[229] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 62.

[230] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 33.

[231] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), Appendix 1 – Workstream Details, p 33.

4.51 Several mitigation investment options were considered, with justification of the proposed investment based on 'cost of asset failure' estimates and asset criticality. Transpower concluded the BCR of the proposed investments significantly exceed 1.0 for the 53 structures it proposes to mitigate.

4.52 The Verifier reviewed $5.1 million ($ constant 2021/2022) capex, and $2.5 million of opex ($ constant 2021/2022) in Transpower's land stability works programme when it reviewed the initial proposal.[232]

4.53 However, while the Verifier indicated that it reviewed this expenditure, it did so within the wider context of Transpower's overall transmission line grillage, foundation and accessways capex, and preventive maintenance programmes, and did not specifically comment on the resilience aspect of these.

4.54 In terms of cost efficiency, the Verifier noted cost estimates in the transmission line grillage, foundation and accessways capex programme are based on building block unit rate estimates in Transpower's cost estimation processes.

4.55 These cost estimation processes are reviewed in Chapter 4 of the Verifier report, where it concluded:[233]

> the cost estimation framework, its supporting tools and inputs adopted by Transpower and its practice to budget the expenditures proposed in RCP4 meets all the evaluation criteria having regard to GEIP.

4.56 The Verifier noted it had also verified the proposed $2.5 million of opex within the wider preventive maintenance opex programme, however, this expenditure item was not discussed specifically in its report.[234]

4.57 While the Verifier report did not carry out a detailed review of Transpower's proposed capex and opex to mitigate land instability risk, we have relied on our own review of Transpower's proposal material.

4.58 We consider Transpower has demonstrated the investment need, considered a range of investment options, and the work appears to be demonstrably prudent when compared with the cost impact of potential events.

4.59 Transpower carried out cost-benefit analysis to confirm that the investments are economically justified, and based on the Verifier review of Transpower's cost estimation processes, ensures cost estimates are efficient.

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[232] GHD Advisory and Castalia, IV Report, p 189-195 section 9.3.13.2 for the capex review, and p 432 section 19.3.2 for the opex review.
[233] GHD Advisory and Castalia, IV Report, p 49 section 4.2.3.
[234] GHD Advisory and Castalia, IV Report, p 432 section 19.3.2.

4.60 In our draft decision we concluded that the resilience expenditure for land stability works for towers and poles met the requirements of the Capex IM evaluation criteria and should be approved.

4.61 We received no submissions on our draft decision.

4.62 Our decision is to approve $7.9 million of resilience capex to mitigate land instability risk for 17 structures, and $3.0 million of resilience opex to mitigate land instability risk for 36 structures.

Fire stopping, detection, and suppressive upgrades to substation buildings

4.63 Transpower has identified it needs $7.1 million of resilience capex to carry out fire mitigation works to improve resilience at 82 substation buildings across 49 substations.[235]

4.64 Needs analysis performed by Transpower concluded its substation building fire risk management is below standard, leaving many substation buildings vulnerable to this hazard.

4.65 Transpower has prioritised its work programme based on its resilience risk decision making framework in Section 6.2 of its Resilience Portfolio Management Plan. The RCP4 plan is to mitigate the fire risk at 49 substation sites.

4.66 Prioritisation considers a range of factors, including probability of a substation fire (that results in lost load), set at a 1-in-2500-year return period, and site criticality ($/hr based on lost load estimates). Criticality analysis has been used to calculate risk costs, with a fire in one building assumed to interrupt load/transmission from the entire substation site.

4.67 The Verifier noted:[236]

> We reviewed the building fire detection and fire stopping upgrade programme as part of the resilience driven base R&R programme. It is based on a recent survey that has identified a number of sites that presently does not meet its standard. Transpower has identified around 15 vulnerable buildings with varying level of criticality based on its functions and occupancy and has prioritised strengthening work on 8 of them in RCP4 under the resilience programme. This prioritisation is based on risk and aligned with the Transpower asset investment and decision framework.

[235] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 56.

[236] GHD Advisory and Castalia, IV Report, p 158 section 4.2.3.

4.68 While the Verifier did not specifically conclude the substation building fire mitigation expenditure was prudent or efficient, it did find it was verified and met the requirements of the Capex IM within its review of the wider buildings and grounds capex programme.

4.69 We carried out our review of this resilience capex programme. Transpower states the identified sites are not meeting its fire prevention standard, this standard appears to be demonstrably economic. Cost-benefit analysis shows 41 of the 49 sites have BCRs or greater than 1.0 on the analysis assumptions, with the remaining eight sites having BCRs close to 1.0.

4.70 Given this resilience analysis is based on return periods and loss of supply costs that are estimates, we are willing to accept Transpower has demonstrated a reasonably prudent mitigation strategy overall.

4.71 In terms of cost efficiency, Transpower note in its proposal it "undertook a substantial rework" of the mitigation options it had considered over 2023, and this "showed a much lower cost per site utilising DSPA as a key fire mitigation system".[237]

4.72 We consider Transpower has demonstrated the investment need, and the work is prudent and efficient when compared with the cost impact of potential events, and alternative investment options.

4.73 In our draft decision we concluded that the resilience expenditure for substation building fire mitigation works met the requirements of the Capex IM evaluation criteria and should be approved.

4.74 We received no submissions on our draft decision.

4.75 Our decision is to approve $7.1 million of resilience capex to carry out fire mitigation works to improve resilience at 82 substation buildings across 49 substations.

Portable substation assets

4.76 Transpower has identified it needs $15.1 million to acquire a portable switchroom (PSX), two portable protection assets, a portable control room, and $800,000 of opex to undertake emergency exercises of the new portable/mobile solutions.[238]

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[237] DSPA is a Dry Sprinkler Powder Aerosol system. Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 56.

[238] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 56.

4.77 Transpower states the need for these mobile and portable substation solutions is:[239]

> Following a catastrophic resilience event, such as major flooding or fire, restoration will be reliant on either portable/mobile solutions, or on utilising available infrastructure at the affected site and the availability of spares to replace the damaged equipment. Depending on the nature of the event, there may be a stand-down period before the site is deemed safe for personnel to operate within.

4.78 Transpower argues these portable and mobile solutions are distinct from its asset spares strategy because, following an event, spares may not be usable if the site is not able to be fully accessible to carry out asset replacements (such as the flood event at the Redclyffe substation site). In addition, relocating spares requires significant coordination and could delay a return to service, particularly for transformers.

4.79 Transpower considered several emergency response scenarios and options to reduce loss of service. The proposal includes portable protection, control room and switchroom to reduce "recovery time and consequently shortening the duration of a service interruption. These solutions can be used at many substations, for many different types of resilience threat".[240]

4.80 Transpower describes the portable solutions as:

4.80.1 **portable protection** – a set of substation protection units that can be relocated by air or road within 3 days following an event;

4.80.2 **portable control room** – transportable control room that can provide the functionality of a standard substation control room; and

4.80.3 **portable switchroom** – similar to the existing portable switchroom (located at Bunnythorpe in the North Island), to be located in the South Island.

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[239] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 82.

[240] Transpower "RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0" (October 2023), Appendix 1 – Workstream Details, p 83.

4.81 Transpower notes:[241]

> Recent failures of circuit breaker poles relating to an aging switchboard have highlighted the potential need to deploy the portable switchroom at short notice for an extended period of up to three years, which is highly dependent on procurement lead-times for a replacement switchboard. Developing a second portable switchroom would mitigate our exposure to a "no cover" scenario if a second major failure was to happen in the interim, as well as broadening our specialist capability.

4.82 Transpower considers its cost estimates for the portable substation equipment are dependable, based on previous projects and refined building block unit rates.

4.83 In our initial review of this proposed expenditure, we could find no supporting cost-benefit analysis to substantiate the investment or supporting information for the emergency exercises operating expenditure.

4.84 We sought additional information from Transpower about this proposed expenditure using an RFI, to ascertain if Transpower had advanced the economic justification for it. We also wanted to understand how the existing mobile substation was utilised, and how the proposed portable/mobile substation could be used to assist with maintenance outages.[242]

4.85 Transpower provided us with its Portable/Mobile substation Resilience Workstream Report to support the proposed expenditure that was finalised following the submission of the RCP4 proposal, which sets out:[243]

4.85.1 emergency event scenarios and responses based on historical events, and identification of portable solutions that might reduce loss of supply in an emergency;

4.85.2 how a deployment exercise could be developed and undertaken to test emergency event preparedness;

4.85.3 the capital cost and deployment exercise cost estimation; and

4.85.4 a cost-benefit analysis.

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[241] Transpower "RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0", (October 2023), p 36 section 7 – Resilience Workstreams.

[242] Transpower, Resilience programme - portable/mobile substation programme, RFI026.

[243] Transpower, *Resilience Programme Workstream Report - Substation Portable Emergency Assets and Deployment Exercise for Response and Restoration*, December 2023.

4.86 Transpower carried out investigations that considered substation site loss of supply, for a range of events including earthquake, flood, and fire. Event consequences have been estimated and previous events considered to ascertain how return to service improvements could be made. Portable solutions were tested with a view to reducing outage durations, and cost estimates made for different solutions. Finally, a cost-benefit analysis was carried out, and determined that, overall, the programme provided a positive net market benefit.

4.87 Transpower identified a range of features and potential benefits of the investments in this resilience package, including:

4.87.1 a portable protection solution to restore substation protection within three days of an event, and save three days of site outage duration until portable control room can be set up;

4.87.2 a portable control room to reduce substation site wide outage duration by at least five days;

4.87.3 a portable switchroom to connect substation 33/22/11 kV supply transformer/s and local EDB feeders using cables. There have been 10 failures in the last 25 years. Two portable switchrooms are proposed as a single failure would require a portable unit to be in service for between one to three years until replacement switchgear arrives; and

4.87.4 the existing mobile substation presently used at N-security sites during maintenance. A larger mobile substation with capability for 220/110/33 kV and higher capacity, would enable wide substation coverage, with restoration time estimates reduced by up to 14 days for significant outages.

4.88 Cost-benefit analysis was carried out for all four investment packages in the programme based on the following assumptions:

4.88.1 for every third flood, either protection in a box, portable control room or a portable switchboard will be required;

4.88.2 for every fifth flood the mobile substation will be required; and

4.88.3 for fire and seismic events, a portable solution would be required for every event.

4.89 In all cases, Transpower has calculated benefit cost ratios (**BCR**) of greater than 1, with the minimum BCR of 5 for the portable switchroom.

4.90 While capital costs are not at a design level of accuracy, we consider Transpower has demonstrated that the proposed capex solutions in this programme are prudent and efficient.

4.91 Transpower has also set out the costs and plan for emergency deployment exercises noting:

4.91.1 there will be a deployment exercise involving each portable solution every five years;

4.91.2 a key success factor supporting effectiveness of portable solutions is to ensure resources are familiar with each asset, and capable of delivering under emergency situations;

4.91.3 known challenges to deployment are site-specific logistics, including location and placement constraints, feeder cable connections and customer expectations; and

4.91.4 contracted service providers currently have no opportunity to familiarise themselves with or test readiness for events. Specialist craning and heavy transport arrangements would be needed to be established to facilitate uplift, transfer, and placement.

4.92 Transpower has not formally quantified the benefits of the proposed deployment expenditure, and we note the difficulty in doing so. However, Transpower does set out several unquantified issues that would likely impact on event recovery times, and lost load costs following events:[244]

> Known challenges to deployment are site-specific logistics including location and placement constraints, feeder cable connections and customer expectations. Other untested aspects are transportation capability, adaptability of protection settings, connection protocols, etc. Our contracted service providers currently have no opportunity to familiarise themselves with it nor to test their readiness for an event.

4.93 We note that developing plans, and understanding deployment issues will have benefit, and that the level of benefit is likely to be difficult to quantify. We are willing to accept this expenditure is prudent on the basis that good planning and faster response requires good processes and procedures, and these need to be developed.

4.94 Finally, Transpower noted it had not considered using this proposed investment package to manage maintenance outages as most 220kV sites (where it may be deployed) have N-1 supply security.

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[244] Transpower, Resilience programme - portable/mobile substation programme, RFI026.

4.95 In our draft decision we concluded that this proposed resilience expenditure met the requirements of the Capex IM evaluation criteria and should be approved.

4.96 We received no submissions on our draft decision.

4.97 Our decision is to approve $15.1 million to acquire a second portable switchroom (PSX), two portable protection assets, a portable control room, and approve $800,000 of opex to undertake emergency exercises of the new portable/mobile solutions.

Improve information to enable decision making

4.98 In its Main Proposal Transpower states it is seeking $9.2 million of expenditure ($4.2 million of capex and $5.0 million of opex) to "improve information to enable decision making and improve visibility and awareness of high-impact events that can affect the grid in order to react and restore faster and avoid utility supply outages", and that the funding will be for "tools to support operations".[245]

4.99 Following our review of the Verifier report we noted several information systems resilience expenditures such as:

4.99.1 the $2.2 million S.04.4.3 Grid Operator Role Flexibility and Work Distribution (Resilience) initiative which is Transmission Systems capex to "reduce risk and improve operator efficiency by improved logging, and to provide workload management to safely and efficiently prioritise and allocate work in line with skills of available resources";[246]

4.99.2 $1.1 million for a step change in predictive maintenance opex for a range of HVDC and resilience opex increases;[247]

4.99.3 $7.0 million for capex investigations for major capital project, base capex, resilience & sustainability;[248] and

4.99.4 $1.4 million for the Transmission Systems Grid Operator Role Flexibility and Work Distribution (Resilience) initiative.[249]

[245] Transpower New Zealand Limited "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 176 section 9.3.
[246] Transpower RCP4 proposal Transmission Systems IC04 – ICT Investment Case, January 2023, p 25.
[247] GHD Advisory and Castalia, IV Report, p 328 section 14.9.3.
[248] GHD Advisory and Castalia, IV Report, p 353 section 15.4.2.
[249] Transpower RCP4 proposal Transmission Systems IC04 – ICT Investment Case, January 2023, p 27.

4.100 While we noted there are several minor resilience expenditures embedded with the ICT capex and opex programme forecasts, we could find no explanation for these expenditures or how they related to the $9.2 million package of resilience works set out in the proposal.

4.101 Our draft decision was to reject this expenditure because there was no explanation of why the investment was needed, no demonstration that it was prudent and efficient, and no explanation of how it was consistent with the Capex IM.

4.102 In its draft decision submission, Transpower noted that "the links between the investment cases and the resilience workstreams were not as clear as they could have been as our decision to reallocate these amounts to resilience was made after the investment cases were completed."[250]

4.103 We re-evaluated the ICT business case information and concluded that our initial assessment was valid. Our view is that there is not sufficient supporting information to justify the proposed resilience investments.

4.104 Following our review after consideration of submissions, our decision is to reject the $9.2 million resilience expenditure for 'Improve information to enable decision making' as this expenditure has not been sufficiently supported.

Resilience expenditure assessment of minor projects and programmes

4.105 We have summarised our review of the minor resilience expenditure projects and programmes (those estimated to cost less than $5 million over RCP4), and that summary is set out in Table 4.1.

4.106 We received no submissions on our draft decisions.

[250] Transpower, "Transpower Submission on Draft decision, p 7-8 para 39-42, Appendix B.

Table 4.1: Summary of our review of minor resilience projects and programmes

Resilience project or programme	Our analysis
$1.2 million capex Hardening bridges and access tracks against land instability and flooding.[251]	• 40 access tracks and bridges are currently recorded in the slope stability register with varying levels of risk. • Proposed expenditure focusses on bridges and access tracks that are exposed to flood and land stability issues. • Flood risk analysis for towers and poles resilience programme is mature – we have accepted the approach, and consider the expenditure meets the Capex IM. • Economic solution based on probabilistic analysis linked to flood risk analysis for towers and poles. • Capital cost estimates are generally well understood. • Our decision is to approve this expenditure as justification appears consistent with the Capex IM.
$1.1 million capex Hardening transmission lines for a volcanic ash event.[252]	• Transmission line service interruptions have occurred in the past due to eruptions. • Volcanic ash on insulators can cause flashovers and outages. • Detailed insulator ash modelling confirms need and return period analysis confirms potential issues on Central North Island (CNI) circuits (60 towers in particular). • Economic solution is based on probabilistic analysis. • Costs are well understood as this is an ongoing work programme with some work being carried out over RCP3. • Our decision is to approve this expenditure as justification appears consistent with the Capex IM.
$3.4 million capex Remove overhead earth wires (OHEW) at substations – common mode failure risk mitigation.[253]	• OHEWs were historically installed above substations as lightning protection. • Failure of OHEW above substation can result in significant service loss. Since OHEW failure at OTA substation in 2006, a number have been replaced. • Site analysis and risk assessment completed in 2011, and further desktop studies completed to determine current risk, identified 26 sites with 16 posing material risk. • A range of mitigation options were considered with capital cost estimates well understood due to previous work. Some uncertainty about refined costs at each site, and estimates based on average costs. • Economic solution based on probabilistic analysis linked to failure risk which has not specified failure probability, and likely linked to known failure rates. • Our decision is to approve this expenditure as justification appears consistent with the Capex IM.
$1.9 million capex Pre-enabling works for faster connection of a spare transformer with	• A small number of sites (9) have transformers with non-air bushings. • Major failure of non-air bushings is problematic. Spares are not carried for this type of transformer and post-event mitigation is complex. • Need predicated on double contingent event: $2.4 million NPV benefit vs cost of mitigation at $1.9 million for Wilton.

[251] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 59.
[252] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 59.
[253] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 73.

air bushings to the Wilton substation.[254]	• Based on analysis assumptions made, the proposed investment appears economic. • Cost estimate considered relatively certain, although Transpower states these are 'high-level' as they are not common investments. • No explanation in proposal why spares are not carried. • Transpower provided additional information suggesting spares are not economically feasible at Wilton but "pre-enabling work to use the existing strategic spare is cost-effective as it will significantly reduce duration of any loss of supply in a double contingency event". • Worst case scenario is a GIS failure event, leading to a 2–3-month outage of site GIS, leading to an extended outage event for Wellington supply out of Wilton. • Based on analysis assumptions made, the proposed investment appears economic. Cost estimate considered relatively certain, although Transpower states these are 'high-level' as they are not common investments. • Our decision is to approve this expenditure as justification appears to be prudent and efficient, consistent with GEIP, and meets Capex IM evaluation criteria.
$3.4 million capex Equipment spares for the new seismic hazard model risk (sites exceeding IEEE693 'high').[255]	• Proposal is to invest in additional spares for circuit breakers, current transformers, and voltage transformers. • Transpower notes further analysis is required to optimise investment plan to match equipment types and warehousing locations. • While the need has been identified, further analysis is required to identify the exact voltage level / make model / location of these assets. Options assessments have yet to be carried out and business cases are yet to be completed. • Our decision is to reject this expenditure at this time, due to uncertainties of cost and scope, and supporting business cases have yet to be completed.
$1.2 million opex Emergency exercises for tower restoration.	• Proposal is to invest $1.2 million opex over RCP4 on 10 emergency exercises for emergency structures, one per annum over RCP4 for each specialist service provider. • Transpower stated experience has shown there is value in practising erection and dismantling process for emergency structures on a regular basis, even in non-emergency situations. • Transpower stated this is a continuation of existing work in RCP3 noting that 'we currently run practice exercises for emergency tower restoration each year (funded by OPEX maintenance budgets) and recommend this continues as a minimum". • No information provided about how this was cost estimated although presumably based on existing programme.
	• There is no business case demonstrating why additional expenditure, above what is already being incurred in the maintenance opex budget, is justified and meets the Capex IM. • A review of Transpower's RCP4 opex modelling indicates no step change in opex for this proposed expenditure has been modelled, suggesting that it has been included in base year opex in the base step and trend modelling. • Our decision is to reject this expenditure - there is no supporting information to justify the increase above existing expenditure. Following our decision $0.24 million per annum will be removed from Transpower's proposed RCP4 opex.

[254] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 71.

[255] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 81.

$2.2 million opex Development of new cybersecurity capability[256]	• Following our decision $0.44 million per annum will be removed from Transpower's proposed RCP4 opex.

Resilience expenditure decision

4.107 We reviewed all proposed resilience expenditure projects and programmes. We consider that most of the proposed expenditure is justified and meets the Capex IM evaluation criteria.

4.108 For the expenditure that we consider cannot be approved at this stage we encourage Transpower to continue to develop its business cases, and to then utilise the E&D mid-period reopener if the unapproved projects and programmes become more certain in terms of risk, need, solution, and/or cost.

4.109 Our decision is to approve $67.2 million of the $74.8 million resilience capex and $3.8 million of the proposed $12.2 million resilience opex.

Resilience uncertainty mechanism expenditure assessment

Our analysis approach to resilience UM expenditure

4.110 We reviewed the resilience UM expenditure, taking a similar approach to Transpower in judging the likelihood of projects in its proposed E&D capex programme.[257]

4.111 We consider that the following resilience UM capex project and programme expenditures are sufficiently certain and well developed for likely expenditure to be approved as E&D base capex rather than under a UIOLI funding approach. We discuss the proposed UIOLI funds in Chapter 5.

4.112 For resilience UM expenditure we have not approved at this time Transpower has the opportunity to utilise the E&D capex mid-period reopener as these projects and programmes become more certain in need, solution, timing, and cost.

[256] Transpower New Zealand Limited "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 176 section 5.3.6.

[257] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, (October 2023), pp 42-45 section 8.3, and Appendix 1 – Workstream Details, pp 47-86.

HVDC tower strengthening due to wind exposure

4.113 Transpower has identified that it needs $14.1 million for "hardening HVDC towers against wind damage" following a re-assessment of tower loading to identify overloaded structures.

4.114 Transpower note that over nearly 60 years there have been seven major HVDC tower asset failures due to wind gust issues where wind speeds have reportedly exceeded 200 km/h, which is about seven times the failure rate than that experienced in the wider network.[258]

4.115 In its investment needs analysis, Transpower carried out detailed tower strength modelling for different wind speed return periods and tested the results against the HVDC tower design wind speed withstand capability. Transpower note that some tower modelling is yet to be completed as detailed tower models are not yet available to it (about 25% of HVDC tower structures).

4.116 The tower modelling analysis suggested that at a 50-year return period wind speed withstand capability, 375 HVDC towers required mitigation, with 14 requiring major works or replacement.

4.117 Transpower note that tower mitigation costs vary between $23,000 to over $500,000 per tower with three investment scenarios considered in conjunction with the HVDC tower strengthening programme to mitigate against flood exposure. Transpower conclude that it may need to mitigate 122 HVDC towers for wind speed exposures.[259]

4.118 Transpower concede that the wind loading analysis approach it has taken is likely to be conservative, and that many HVDC towers may be more resilient than the preliminary analysis suggests.

4.119 We reviewed Transpower's cost-benefit analysis, and it suggests that avoided risk cost for the higher priority HVDC tower failure events cumulatively could be upwards of $300 million, with positive BCRs for the investment strategies investigated.

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[258] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, (October 2023), p 42-45 section 8.3 and Appendix 1 – Workstream Details, p 76.

[259] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, (October 2023), Appendix 1 – Workstream Details, p 76.

4.120 While we consider the analysis approach Transpower has taken is a sound basis for this resilience programme, Transpower has assumed that all locations are equally affected by the extreme wind gusts it has modelled, which we consider may not be entirely accurate. This is a minor point as climate change effects appear to be changing risk exposures due to higher wind speeds, and increased flood frequency and impact.

4.121 We applied the E&D investment approval criteria to the proposed expenditure and consider that Transpower has adequately demonstrated that it is at least very likely to be needed over RCP4. On this basis we consider that the expenditure meets the requirements of the Capex IM evaluation criteria and should be approved as E&D base capex.

4.122 In our draft decision we approved $14.1 million of capex as E&D expenditure to strengthen HVDC towers due to wind exposure risk.

4.123 In its draft decision submission Vector noted the investigations due to the recent "pylon collapse, which caused a major power outage in Northland". Vector suggested that if we needed to “consider additional resilience expenditure” following these investigations we should re-consult.[260]

4.124 At the time of this decision, the investigation into the recent Northland outage is yet to be completed and Transpower has publicly stated that the outage was due to a maintenance process error.

4.125 In its draft decision submission, Transpower did not suggest it needed additional resilience expenditure funding to mitigate for outages due to maintenance issues. Rather, improved maintenance processes and ensuring these are followed are likely to be a better and more cost-effective mitigation strategy.

4.126 Following our review and after consideration of draft decision submissions, our decision is to approve $14.1 million of capex as E&D expenditure to strengthen HVDC towers due to wind exposure risk.

HVAC and HVDC tower strengthening due to flood exposure

4.127 Transpower has identified that it may need $27.3 million of capex and $2.9 million of opex to “harden 61 (50 capex, 11 opex) critical and vulnerable HVAC and HVDC towers in braided rivers through strengthening or protection”. [261]

[260] Vector, ”Vector Electricity Submission on Draft decision”, p 1 para 3.

[261] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 50-52.

4.128 Transpower has identified river flooding as a major hazard where transmission towers cross rivers, where there are "significant river widths, high flood flows and velocities, and the river course frequently changes".[262]

4.129 Transpower referred to the Rangitata River flood event in December 2019, where nine towers were damaged on the Islington-Livingstone transmission line resulting in a 220kV circuit outage.

4.130 While the Rangitata River flood event did not result in loss of supply Transpower has identified other river flooding exposures which may affect transmission towers, where extended loss of load outage events may occur, an exposure likely to be exacerbated by climate change effects.

4.131 Transpower's needs assessment:

4.131.1 identified towers near braided rivers vulnerable to flood damage;

4.131.2 assessed and rated the risk levels for those towers;

4.131.3 estimated the return period of a significant event for the highest-risk locations; and

4.131.4 identified the locations of relatively high probability.

4.132 Additionally, the needs analysis also factored in flood assessment reports, previous flood event investigations and data held from site visits to identify towers with specific vulnerability. The analysis was enhanced by "flood modelling at three river crossings to validate return period estimates".[263]

4.133 The needs assessment identified a shortlist of 61 towers that required some form of flood mitigation based on a comprehensive risk analysis.

4.134 For each exposure Transpower considered a range of solutions to mitigate flood risk, including "river management, gabion baskets, rip rap, foundation strengthening, line reconfigurations (installing single circuit towers/monopoles, strain towers, increasing span length), monitoring, etc.".[264]

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[262] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 50 Appendix 1 – Workstream Details.

[263] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), p 50 Appendix 1 – Workstream Details.

[264] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), p 47 Appendix 1 – Workstream Details.

4.135 Cost estimates vary depending on the solution and a range of investment scenarios has been considered in the supporting analysis. Transpower's preferred option was to mitigate flood risk for 51 HVAC towers and 10 high-risk HVDC towers in the work programme.

4.136 An investment prioritisation framework has been applied that considers the probability of tower failure and loss of load or market impact for each HVAC and HVDC tower exposure.

4.137 Other key assumptions include that the restoration time for towers following an event is generic given a river tower foundation will take longer to restore due to the environment, and that flood event return periods for high-risk towers, range between 10 and 100 years (and are commonly 20 years).

4.138 Finally, based on these inputs, Transpower carried out cost-benefit analyses to test the economic reasonableness of this investment programme. While 46 towers had benefit-cost ratios (BCRs) ranging from 2,742 to 1.1, 15 tower locations had a CBR below 1.0 but greater than 0.4.

4.139 We applied the E&D expenditure approval criteria in our consideration of the proposed expenditure, and we consider that Transpower has adequately demonstrated that it is at least very likely to be needed over RCP4. On this basis we consider that the expenditure meets the requirements of the Capex IM evaluation criteria and should be approved as E&D expenditure.

4.140 While 15 tower locations have a strict cost-benefit analysis outcome of less than 1.0, given the nature of resilience risk analysis eg, that return periods and loss of supply durations and costs are estimates, we are willing to accept that Transpower has demonstrated a reasonably prudent mitigation strategy overall.

4.141 We received no submissions on our draft decision.

4.142 Our decision is to approve $27.3 million of capex and $2.9 million of opex as E&D expenditure to strengthen or protect HVAC and HVDC towers due to flood exposure.

Space weather mitigations for transformers

4.143 Transpower has identified that it may need $18.1 million to "further investigate and then mitigate the impacts of geomagnetically induced currents (**GIC**)". GICs can result following solar flares and may impact transformers through half-cycle saturation, voltage harmonics, and overheating.[265]

[265] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 68.

4.144 To mitigate the effect of GIC on the transmission network Transpower is proposing the following expenditure as UM capex:

4.144.1 $0.9 million to carry out further investigations following on from RCP3 investigations to understand "protection stability, reactive power swings, thermal capability of transformers, HVAC circuit breaker ability to interrupt GICs"[266]; and

4.144.2 $18.1 million to invest in ten neutral blocking devices to protect the highest priority seven transformers.

4.145 Transpower note that the proposed investment package is likely to be refined following further investigation, but that it expects the investment quantum to be similar to what has been proposed.

4.146 Transpower state that GIC events may lead to shortened transformer lives and, in an extreme event, transformer burn-out. GICs are low frequency, typically below 1Hz and flow through transformer neutral earth connections.

4.147 As examples of how GIC events can affect power system equipment and security of supply, Transpower reference the Quebec black out in 1989, where a GIC event caused a wide-area power outage, where it was several days before power was fully restored, and the 2001 GIC event where a transformer at Halfway Bush was damaged. More recently, in May 2024, Transpower removed some transmission circuits from service as a precaution due to a major geomagnetic storm event.[267]

4.148 Transpower's needs analysis is based on studies carried out by Otago University and MBIE and "provided insights into predicted impacts, relativity of risk and potential mitigations". Transpower state that:[268]

> Subsequent analysis identified 42 transformers (with a total of 45 neutrals) as being our most vulnerable, based on recorded history of high grid currents from HVDC operations, large supply banks and interconnectors, and separately researched correlations found between harmonic distortion, recorded currents and known GIC events.

4.149 Three investment scenarios were considered with mitigation options in each focussed on reducing the likelihood of transformer damage, loss of supply or potential grid instability.

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[266] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 68 Appendix 1 – Workstream Details.

[267] https://www.transpower.co.nz/news/transpower-restores-electricity-transmission-circuits-after-solar-storm-subsides

[268] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 69 Appendix 1 – Workstream Details.

4.150 Following Verifier feedback, Transpower refined its investment scenarios concluding that "the prudent option is to undertake additional detailed and wide-ranging studies into the potential effects of GIC on our network and assets before committing to installation of neutral blocking devices".[269]

4.151 We applied the E&D expenditure approval criteria in our consideration of space weather mitigation resilience capex programme. Our view is that Transpower has not fully demonstrated that all of the proposed expenditure is at least very likely to be needed over RCP4.

4.152 We agree that the $0.9 million funding package for further investigation work is extremely likely to be needed and should be approved now as E&D expenditure.

4.153 Following the result of its investigations Transpower can utilise the E&D mid-period reopener when it has further developed its plans for this programme of work.

4.154 We received no submissions on our draft decision.

4.155 Our decision is to approve $0.9 million to carry out further investigations to understand "protection stability, reactive power swings, thermal capability of transformers, HVAC circuit breaker ability to interrupt GICs".

Flood resilience at substation sites

4.156 Transpower has identified it may need $45.9 million to undertake site-wide mitigations to improve flooding resilience for 11 substation sites.

4.157 Transpower has identified that a number of "substations are vulnerable to inundation when flooding occurs. Flooding can occur from storm water, local drainage and proximity to coastal areas, rivers, lakes, and hydro dams".[270]

4.158 Of note is the recent substation flood event that occurred following the Cyclone Gabrielle event in 2023. This cyclone resulted in the Redclyffe substation site being flooded and damaged leading to an extended outage event in the Hawke's Bay region. [271]

4.159 As a consequence of this Transpower has accelerated its resilience plan for substation site flood exposures.

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[269] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 69.

[270] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 53.

[271] https://www.transpower.co.nz/news/transpower-expects-complete-bypass-flooded-substation-today

4.160 A desktop study identified 34 substations that are susceptible to flooding with the potential for service loss risk. Transpower has prioritised the 12 highest priority substations sites based on a risk-consequence analysis.

4.161 While it has identified the highest risk sites, Transpower has yet to fully carry out site specific surveys to determine the extent of flood height risk and likely damage estimates.

4.162 Transpower notes that each site is different and unique solutions will be required at each. Estimated costs will vary and will be dependent on whether site relocation is deemed necessary in extreme circumstances.

4.163 In concluding that 12 sites require mitigation, Transpower applied a prioritisation framework based on probability of site flood exposure and site criticality, to calculate a loss of load estimate. Transpower states that:[272]

> 12 substations have been shortlisted based on those most vulnerable to flooding with 150- year or less return periods, the potential for lost load, and substations with the highest service performance criticality.

4.164 Transpower anticipates that it will address the highest priority substation sites over RCP4, and that the work will continue into RCP5 and RCP6.

4.165 A preliminary cost-benefit analysis was carried out for the 12 high priority sites indicating that seven sites have BCRs ranging from 1.39 to 42.3, and four sites where the BCR ranged from 0.73 to 0.97. Given the uncertainties surrounding the risk quantification, and that solution costs are uncertain, these initial BCRs demonstrates that the mitigations are very likely to be cost-effective.

4.166 While Transpower has yet to carry out site specific surveys to determine the extent of flood height risk and likely damage estimates, we consider that it has made the case that expenditure is extremely likely to be required to mitigate flood exposure at high-risk sites.

4.167 Transpower is currently uncertain of the amount of expenditure required, but has clearly demonstrated the prudency of the investment need. Recent events have highlighted that flood risk is a key exposure, particular as the climate changes and event return periods reduce.

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[272] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 54.

4.168 We consider that it would be unreasonable to deny Transpower funding for this programme of work now but note that the proposed amount is based on a preliminary funding estimate.

4.169 Our view is that it would be prudent to approve some of the proposed $45.9 million now to progress site-wide mitigation work, particularly at the highest risk sites. As Transpower matures its plans it can access the E&D mid-period reopener for additional funding it may need over the remainder of RCP4.

4.170 In our draft decision we approved $23 million of the proposed $45.9 million for this programme of works. We received no submissions on this draft decision.

4.171 Our decision is to:

4.171.1 agree that 50% of Transpower's proposed funding estimate is extremely likely to be required over RCP4 and is consistent with the Capex IM evaluation criteria; and

4.171.2 approve $23.0 million for Transpower to carry out mitigation works for flood resilience at substation sites over RCP4.

Mobile substations

4.172 Transpower has identified that it may need to "invest $13.5 million to acquire a new 220kV capable fully mobile substation" although the need, solution, and cost is uncertain, including technical feasibility.[273] This investment would contain the transformer, switchgear, protection, and control equipment in a single mobile unit.

4.173 Our decision is to reject this proposed expenditure as E&D expenditure, due to the uncertainties listed in the paragraph above. We encourage Transpower to utilise the E&D mid-period reopener if it sufficiently matures its economic justification for this project.

Loss of time synchronisation

4.174 Transpower has identified that it may need to "invest $4.9 million to add eight high precision terrestrial clocks, and associated assets, to distribute a time signal at the required precision".[274]

[273] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 83-84.

[274] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p. 9.

4.175 Transpower's needs analysis suggests that the network is "vulnerable to the loss of GPS time services due to our reliance on the current single time source" and that "there is a need to mitigate the loss of time synchronisation".[275]

4.176 As an example, Transpower discussed potential outages on the ISL-CUL-WPR-KIK 2 & 3 circuits that may lead to the loss of time synchronisation issue. A number of options have been considered, and the preferred solution has been incorporated into the TransGo project procurement process.

4.177 Transpower conclude by stating that the need may be addressed another way but do not specify what that may be. Additionally, "integration requirements with substations are not yet known" and "solution and cost currently uncertain".[276]

4.178 Our decision is to reject this proposed expenditure as E&D expenditure due to these uncertainties mentioned in the paragraph above. We encourage Transpower to utilise the E&D mid-period reopener if it sufficiently matures its economic justification for this project.

Resilience UM expenditure decision

4.179 We have reviewed all resilience UM expenditure projects and programmes. We consider that a number of these projects and programmes are sufficiently well-developed to the point that some, or all, of the expenditure meets the Capex IM evaluation criteria and can be approved now.

4.180 For the expenditure that we consider cannot be approved at this stage, we encourage Transpower to continue to develop its business cases, and to then utilise the E&D mid-period reopener, if the unapproved projects and programmes become more certain in terms of risk, need, solution and/or cost.

4.181 Our decision is to approve $64.4 million of resilience UM capex and $3.8 million of resilience UM opex.

[275] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 79.

[276] Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 80

Chapter 5 Uncertainty mechanism expenditure

Purpose

5.1 This chapter discusses Transpower's proposed UM capex and how we have considered this capex.

5.2 We have considered Transpower's proposed resilience UM expenditure in the resilience chapter and our focus in this chapter is on Transpower's proposed UIOLI funding for what it terms enabling customer capacity.

Background

5.3 In this chapter we discuss:

5.3.1 Transpower's proposal and reasoning for including UM capex;

5.3.2 the Verifier review of Transpower's proposed UM capex;

5.3.3 the changes we have made in the 2023 IM Review that affect our consideration of UM capex; and

5.3.4 our analysis of Transpower's proposed UM capex and our decision.

5.4 Following our review of Transpower's proposed UIOLI funds for resilience ($126.7 million) and customer electrification ($100 million), we have decided to not approve the UIOLI funding mechanism.

5.5 We consider there are other avenues available to Transpower that already exist in the Capex IM and Transpower IM to address the issues Transpower has raised that UIOLI funds seek to address.

Transpower's proposed Use-It-Or-Lose-It funds

5.6 Transpower's proposed UM expenditure is for a pre-approved fund that it can access on a UIOLI basis, where the funds would not be part of base capex or opex we approve or the revenue we set. Transpower states that its revenue requirements would only increase if it spent the money up to a pre-approved funding cap for each UM.

5.7 Transpower states that if the UM funds are not spent then "funds are not recovered from consumers, and we would not receive an incentive payment for underspending".[277]

[277] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 176 section 9.3.

5.8 Transpower is proposing three UIOLI uncertainty mechanisms to:[278]

5.8.1 undertake specific resilience workstreams ($126.7 million);

5.8.2 enable customer capacity by adding anticipatory capacity at connection points ($25 million); and

5.8.3 enable customer capacity by bringing forward customer asset replacements ($75 million).

5.9 We describe the proposed UM expenditure funds below, the Verifier conclusions for each, and our analysis and decision. Firstly, though we describe our recent 2023 IM Review decision regarding Transpower's proposed UIOLI funding mechanisms and how we addressed these in that decision.

Our 2023 IM review decisions regarding Use-It-Or-Lose-It funds

5.10 During our 2023 IM review process Transpower proposed that we include UIOLI funding mechanisms in either the Capex IM or the Transpower IM. Transpower proposed that these UIOLI mechanisms be included for resilience, and connection asset capacity issues related to customer electrification.

5.11 We decided against making IM changes to allow UIOLI funding but instead introduced two IM changes to:

5.11.1 include a resilience driver to the mid-period E&D capex reopener to address uncertain resilience capex needs that may not be fully quantified at the time an IPP proposal is made;[279] and

5.11.2 provide a new anticipatory connection asset capacity project funding mechanism, for any ACA capacity investment with project costs that are estimated to be less than the base capex threshold of $30 million and exceed $10 million. We decided that this ACA capacity funding mechanism can be applied for at any time over a regulatory period as the timing of these projects is outside of Transpower's control.[280]

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[278] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 59 section 5.3.6.

[279] Commerce Commission, "Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision" (13 December 2023), pp 150-152.

[280] Commerce Commission "Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision" (13 December 2023), pp 87-91.

5.12 We also noted in our 2023 IM Review final decision that Transpower may include smaller prospective ACA capacity investments, that are estimated to cost less than $10 million, in the E&D portfolio of base capex proposals or use the mid-period E&D reopener. We consider ACA capacity investments are E&D capex until the ACA capacity is taken up by subsequent connection parties (or party).

5.13 We concluded that the existing regulatory framework did not prevent resilience expenditure being proposed by Transpower, as Transpower could follow the economic approach it had taken in the past in proposing resilience expenditure as base capex or major capex.[281]

5.14 We further explained that:[282]

> Resilience investments are to mitigate for multiple asset outages following high impact low probability events that affect the ability to meet demand or allow generation access to the electricity market. They are investments that need to provide a positive net market benefit because they are investments that are not necessary to meet the deterministic limb of the grid reliability standards.

Transpower's proposed enabling customer capacity UIOLI fund

Transpower's proposal

5.15 Transpower is proposing a $100 million UIOLI fund to enable customer capacity increases due to electrification. This includes:

5.15.1 a pre-approved $25 million UIOLI fund for "adding anticipatory connection assets (**ACA**) capacity with a new or augmented connection (where it is prudent and efficient to do so)"[283]; and

5.15.2 a pre-approved $75 million UIOLI fund for "bringing forward connection asset replacements (eg, replacing a transformer earlier than planned in order to replace it with a larger-capacity transformer)".[284]

5.16 Transpower states that the ACA capacity UIOLI fund is to address the first mover disadvantage (**FMD**) issue – type 2 following recent changes to the transmission pricing methodology that took effect on 1 April 2023.[285]

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[281] Upper South Island Grid Upgrade Stage 1 Aug 2012 and Transpower "Regulatory Control Period Expenditure Proposal" (2 December 2023) p 68.

[282] Commerce Commission "Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision" (13 December 2023), para 11.47.

[283] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), section 10.4, p 195.

[284] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), section 10.4, p 195.

[285] Electricity Authority "Electricity Industry Participation Code Amendment (Transmission Pricing Methodology) 2022, Amendment 2022" (21 November 2022), schedule 12.4.

5.17 It is proposing the $75 million UIOLI fund to bring forward connection asset replacement to:[286]

> help our customers deal with the step changes in demand, we are proposing a new funding mechanism for RCP4. This would provide us with access to funding for bringing forward asset replacements, where they are nearing end of life. For example, this would fund the replacement of a transformer near the end of its useful life with a transformer with a higher capacity. The customer would pay the incremental costs of the transformer and the costs associated with bringing forward the replacement (e.g. paying for the remaining net book value of the asset).

5.18 In its proposal, Transpower states that because it has been unable to recover ACA capacity costs prior to the TPM changes in 2023 and does not have any historical data to estimate what level of funding it might need for ACA capacity over RCP4, a UIOLI funding approach is appropriate.[287]

5.19 Additionally, there are no details about likely early connection asset replacement projects presented in the Transpower proposal, apart from the Gore transformer upgrade which was taking place when the RCP4 proposal was submitted to us.[288]

Enabling customer capacity – Verifier assessment

5.20 The Verifier reviewed the proposed $100 million UIOLI fund for enabling customer capacity and agreed that it was both prudent and efficient. It came to this conclusion by testing Transpower's electrification scenarios which are used as inputs into the Whakamana i Te Mauri Hiko report, last published in March 2020.[289]

5.21 The Verifier tested "the inputs and assumptions supporting the base case 'accelerated electrification' scenario in Whakamana i Te Mauri Hiko, especially pertaining to electrification of transport and heat processing industries".[290]

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[286] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 195 section 10.4.1.

[287] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 196 section 10.4.2.

[288] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 196 section 10.4.2.

[289] Transpower's Whakamana i Te Mauri Hiko reports are intended to show how decarbonisation and electrification of fossil fuel-based load affects electricity energy needs. The most recent report was published in March 2020, with regular monitoring published as updates. The Whakamana i Te Mauri Hiko reporting is available here.

[290] GHD Advisory and Castalia, IV Report, p 444 section 19.3.3.

5.22 The Verifier challenged Transpower's adopted base case scenario in Whakamana i Te Mauri Hiko with an alternate scenario, to model the impact of a different level of customer connection requests. It concluded that the proposed capex of $100 million was unaffected by its sensitivity analysis, and that this demonstrated customer connection requests in RCP4 would be "at similar level under a less aggressive electrification scenario".[291]

5.23 The Verifier also reviewed three of Transpower's six monthly monitoring reports for Whakamana i Te Mauri Hiko (March 2022, September 2022 and March 2023) to test the currency of Transpower's assumptions. The Verifier concluded that the "three most recent monitoring reports consistently confirmed that the chosen base case 'accelerated electrification' scenario is aligned with the observed industry indicators".

5.24 In reaching a conclusion that the $100 million enabling customer capacity fund will be efficient, the Verifier noted that, given these investments are initiated by customers, customer scrutiny during negotiation of the Transpower Works Agreement (**TWA**) should ensure investment prudency.[292]

The 2023 IM Review changes we made to address ACA capacity

5.25 In our 2023 IM Review we made some key decisions to address the ACA capacity issue following the TPM changes.

5.26 When a party wants to connect to the grid (**first mover**) and requires a new connection asset, Transpower and the connecting party enter into a New Investment Contract (**NIC**). An NIC is a bilateral contract between Transpower and the connecting party for the provision of new electricity transmission services, with costs recovered by Transpower from the connecting party.

5.27 The new Transmission Pricing Methodology (**TPM**) recognises that connection asset capacity provided by Transpower, that is additional to that required by the first mover (called anticipatory connection asset capacity), should be cost allocated and priced in addition to the initial connection asset capacity initiated by the first mover under an NIC.

[291] GHD Advisory and Castalia, IV Report, pp 444-445 section 19.3.3.
[292] GHD Advisory and Castalia, IV Report, p 444 section 19.3.3.

5.28 Prior to the TPM change, the Electricity Authority (**the Authority**) described the Type 2 FMD issue as:[293]

> The Type 2 FMD occurs when a connection asset is built with more capacity than the first mover requires (i.e., anticipatory capacity for anticipated future connections) and the first mover bears the cost of the anticipatory capacity until the second and subsequent movers connect, as well as the risk that no future customers connect. This may deter the first mover from connecting in the first place or deter the building of the anticipatory capacity even if that were efficient.

5.29 Under the new TPM, Transpower can cost allocate ACA capacity costs to transmission customers, as follows:

5.29.1 50% of the capital cost of the ACA capacity to identified regional beneficiaries under a benefit-based approach (using the simple method regional allocation tables); and

5.29.2 the remaining 50% of the capital cost of the ACA capacity to all transmission customers under a "pool-and-share" approach, through an addition to the asset of the connection charge.[294]

5.30 If a second mover takes up the ACA capacity, that second mover is then subject to the transmission pricing methodology for the ACA capacity it has taken up as a connecting party, with the ACA capacity treated in Transpower's regulated asset base as a 'nil value' asset.

5.31 To ensure that we are able to review and approve ACA capacity investments, and to enable Transpower to invest and account for these in its RAB (consistent with our IM), we made some key changes to the Capex IM.[295] We considered that ACA capacity investments were enhancements to the grid and could be either major capex proposals or E&D capex in a base capex proposal.

5.32 We introduced three new ACA capacity funding mechanisms in the Capex IM based on the estimated capital cost of the ACA capacity investment. Transpower would be required to seek approval for ACA capacity:[296]

5.32.1 using the MCP approvals process for ACA capacity investments where the estimated cost is greater than the base capex threshold of $30 million;

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[293] Electricity Authority "Transmission Pricing Methodology 2022 Decision Paper" (12 April 2022), para 4.22.
[294] Electricity Authority "Transmission Pricing Methodology 2022 Decision Paper" (12 April 2022), para 4.22.
[295] Commerce Commission "Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision" (13 December 2023), p 9 para X19.
[296] Commerce Commission "Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision" (13 December 2023),chapter 6, p 79-98.

5.32.2 using an 'anytime' E&D reopener process for ACA capacity investments that are estimated to cost less than the base capex threshold of $30 million but greater than $10 million; and

5.32.3 using the E&D capex portfolio in a base capex proposal for all other ACA capacity investments that are estimated to cost less than $10 million, including the ability to seek additional ACA capacity funding using the mid-period E&D reopener.

5.33 During the 2023 IM Review process Transpower also raised the issue of how to fund bringing forward asset replacements under NICs with higher capacity assets. However, we had insufficient information about how a regulated funding arrangement would interact with the existing NIC mechanism and made no decision on this until we were able to investigate Transpower's plans in its RCP4 proposal.

Enabling customer capacity – our review

5.34 In our review of the $100 million UIOLI enabling customer capacity proposal we have assessed the ACA capacity investment component and bringing forward connection asset replacements component separately.

5.35 While these two enabling customer capacity workstreams are intended to address connection asset capacity need, different IM considerations apply to each.

Enabling customer capacity – ACA capacity investment

5.36 In its proposal Transpower is not seeking funding for ACA capacity investments using the E&D capex portfolio, instead it is seeking a pre-approved UIOLI fund that would sit outside our review process.

5.37 Transpower noted that it could not "produce a prudent and efficient forecast for anticipatory connection assets for RCP4" because its customers would face "both volume risk and unit cost risk if we included any expenditure for such assets in our base capex".[297]

5.38 Transpower's view is that because there is no historical record of ACA capacity investments or supporting analysis of potential opportunities a UIOLI approach is more appropriate.

[297] Transpower New Zealand Limited, "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 194 section 10.4.2.

5.39 However, Transpower holds the most up to date information about enquiries for connection to the grid and publicly discloses these on its Connection Enquiries Dashboard website.[298]

5.40 Transpower also holds information about the likelihood of connecting parties entering into new investment contracts. Any potential ACA capacity investment can only occur once a party enters into an NIC, as there has to be a first mover before an ACA capacity investment can be made.

5.41 Our view is that Transpower should coordinate the likelihood of NICs and the connection enquiry information it holds, into an estimate of potential ACA capacity that is likely to be economic to invest in.

5.42 Over time we anticipate that Transpower will be able to incorporate potential ACA capacity opportunities into its annual planning process as first mover connections and ACA capacity opportunities become more certain. These opportunities can then form a component of E&D base capex with funding options available in a base capex proposal or using the 'anytime' and mid-period E&D reopeners.

5.43 Our draft decision was to not approve the $25 million UIOLI fund for enabling customer capacity related to ACA capacity but encourage Transpower to utilise the E&D capex 'anytime' and mid-period reopeners once potential ACA capacity investment opportunities become more certain.

Enabling customer capacity – bringing forward connection asset replacements

5.44 In our 2023 IM Review decision, we did not make any IM changes related to Transpower seeking a pass-through cost mechanism related to bringing forward connection asset replacements. We had insufficient information to make an IM change and were unclear how this mechanism would be consistent with the existing NIC arrangements.

5.45 We were unclear about whether Transpower should have access to a pre-approved UIOLI fund, or base capex, to invest in and cost recover connection asset investments which are usually fully funded by customers under new investment contracts.

[298] https://www.transpower.co.nz/connect-grid/connection-enquiry-information

5.46 We sought additional information from Transpower, using RFI, on cost allocation of replacement connection assets that are upgrade earlier than expected.[299] We sought to understand:

5.46.1 how Transpower was treating upgraded early replacement connection assets in its RAB and what aspect of the early replacement cost was subject to an NIC;

5.46.2 if there is an early replacement of the connection asset does the connecting party pay for the asset write down costs of the existing connection asset;

5.46.3 when there is an asset write-down component following connection asset replacement, confirmation that asset write-down costs are not included in the revenue wash-up in the EV account; and

5.46.4 whether connection charges under the TPM are allocated to parties that share upgraded early replacement connection asset capacity.

5.47 We also asked Transpower to provide us with examples where it had replaced connection assets over RCP3, with and without an upgrade component, to demonstrate how asset write down and upgrade costs were treated in its regulatory accounts.

5.48 Transpower explained that when it replaces a connection asset with a modern equivalent asset (ie, there is no electrification upgrade capacity), it does so under base capex and not under a new NIC. If there is a capacity enhancement requested, then the customer will "directly fund incremental and any write-off costs of assets with a RAB value via an NIC".[300]

5.49 While the former connection asset enters the regulated asset base as base capex the cost of the replacement asset is recovered from the customer via the connection charge component of the TPM.

5.50 Transpower further explain that, if the connection asset is not close to the end of its useful life (ie, within approximately 10 years for long life assets) then it would require the customer to fund the entire investment and the write-off costs through a new NIC.

[299] RFI002 - Replacement of NIC connection assets (14 December 2023).
[300] RFI002 - Replacement of NIC connection assets – 14 December 2023.

5.51 Transpower also made the following points in its RFI response:

5.51.1 if a replaced connection asset still has a useful life, it will enter its asset base as a spare;

5.51.2 if a replaced connection asset cannot be repurposed as a spare, then it will be written off and the remaining asset value will enter the EV account and be recovered via the residual charge component of the TPM;

5.51.3 if a shared connection point has an asset replaced under base capex, then the connected customers will be charged via the TPM connection charge; and

5.51.4 if there is a new connecting party at a connection point that drives a capacity upgrade of the existing connection asset, then they will sign a NIC to cover the cost of the upgrade.

5.52 Our view is that Transpower's treatment of connection assets being replaced with modern equivalents, and the replacement connection asset entering the RAB as base capex, is consistent with the Transpower IM.

5.53 Transpower has acknowledged that when it brings forward replacement of a connection asset with additional capacity that it enters into a new NIC to cover the incremental capacity, and a new NIC for the entire connection asset capacity if the asset has more than 10 years of asset life remaining.

5.54 Our view is that this 10-year 'remaining asset life' threshold is arbitrary and demonstrates that a UIOLI fund to cover connection assets that will be upgraded with less than 10 years of remaining asset life, could equally be covered by the existing NIC process.

5.55 Following our review our draft decision was to reject the proposed $75 million electrification UIOLI fund driven by bringing forward connection asset replacements because it was not supported.

5.56 For all connection asset replacements that involve additional incremental capacity, and where these assets are replaced before they have reached the end of their useful lives, Transpower should apply its existing NIC process. This will ensure that the customer is fully engaged in decision making about the replacement connection asset capacity it will pay for.

Draft decision submissions

5.57 We received a number of draft decision submissions regarding UIOLI funding. Vector was “concerned about the workability of relying solely on re-openers given the constraints on the Commission’s resources" for the E&D and ACA capacity reopeners.[301]

5.58 Further, Vector recommend we “give further consideration to utilising UIOLI mechanisms for both EDBs and Transpower in their fourth regulatory period” suggesting this better promoted the Part 4 purpose by “providing greater certainty for EDBs and Transpower that they will be able to fund investments once the need for them becomes clear."[302]

5.59 Fonterra submitted that a UIOLI mechanism would be “a good way to drive the correct actions and manage deliverability risk."[303]

5.60 In our recently completed 2023 IM Review we addressed the use of UIOLI mechanisms in general and decided against implementing these. We were not convinced that their introduction better met the Part 4 purpose.

5.61 While UIOLI mechanisms are an option to manage deliverability risk, their implementation would sit outside our incentive’s regime. This was an option we considered when we investigated mechanisms to address RCP4 programme delivery risk.

Enabling customer capacity – final decisions

5.62 Following draft decision submissions and our review, we have decided not to change our draft decisions for enabling customer capacity UIOLI mechanisms. Our decision is to:

5.62.1 reject the $25 million UIOLI fund for enabling customer capacity related to ACA capacity, but encourage Transpower to utilise the E&D capex ‘anytime’ and mid-period reopeners once potential ACA capacity investment opportunities become more certain; and

5.62.2 not approve the $75 million UIOLI fund for enabling customer capacity related to bringing forward connection asset replacements.

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[301] Vector, Vector submission on draft decision”, para 11.
[302] Vector, Vector submission on draft decision, para 13.
[303] Fonterra, Fonterra submission on draft decision, p 1.