

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

Draft Decision Attachment B - Capex

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Chapter 1 Introduction

Purpose

- 1.1 The purpose of this Attachment is to set out our review of Transpower's proposal and our draft decision relating to base capex for Transpower's RCP4 individual price path (IPP) reset, and to explain our reasons for the draft decision.
- 1.2 We also use this paper to seek submissions on our draft decision, which will inform our final decision for the IPP reset.

Background to our review

- 1.3 Setting appropriate capital expenditure allowances for Transpower in RCP4 is a key focus area for the Commission because base capex allowances impact the revenue Transpower can recover from its customers during RCP4 and beyond.
- 1.4 The base capex allowance is a fungible pool of expenditure for capex projects or programmes. Transpower has discretion on how the money is spent. We will be setting the quantum of the base capex allowance, taking into account Transpower's proposed base capex projects for RCP4.

Structure of this paper

- 1.5 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 draft decision.
Chapter 3	An overview of the RCP4 base capex proposal	Sets out a summary of the RCP4 base capex proposal.
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 allowances.

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 which 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).

¹ Commerce Commission “*Transpower capex input methodology review – Decision and reasons*” (29 March 2018), **(2018 Capex IM reasons paper)** at [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 allowances ultimately rest with the Commission.

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 prudence and efficiency in its investment expenditure, having regard to GEIP. In simple terms, prudence 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 had not been 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.

Our consultation process and how we considered submissions - capex

- 2.15 We sought views of stakeholders and interested parties using our Process, framework, and approach paper, and our Issues Paper.^{5, 6}
- 2.16 We also reviewed submissions made in response to Transpower's draft proposal consultation, which provided valuable insight into stakeholder views on Use-It-Or-Lose-It (**UIOLI**) funding for customer electrification, and resilience expenditure.⁷

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 "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" \(9 October 2023\) \(Process framework and approach paper\).](#)

⁵ [Commerce Commission "Transpower's individual price-quality path for the next regulatory control period – Issues paper \(25 January 2024\) \(Issues paper\).](#)

⁶ [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" \(9 October 2023\) \(Process framework and approach paper\).](#)

⁷ <https://www.transpower.co.nz/our-work/industry/regulation/rcp4/consultation-our-draft-rcp4-proposal>

- 2.17 In our Issues paper we identified likely focus areas for our capital expenditure review. The focus areas included:
- 2.17.1 how asset health and risk models are used to inform expenditure forecasts;
 - 2.17.2 proposed ICT capex not reviewed by the Verifier, and the TransGO Refresh project incentive rate;
 - 2.17.3 proposed capitalised leases not reviewed by the Verifier;
 - 2.17.4 tower painting and structure interventions;
 - 2.17.5 Transpower's proposed UIOLI fund of \$100 million for customer electrification; and
 - 2.17.6 increases in proposed expenditure since verification.
- 2.18 Submitters provided feedback on a number of the issues we identified, and these are summarised in Attachment A.

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 response for information (RFIs). 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.⁸
- 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.

⁸ GHD Advisory, "GHD Expert Opinion Progress Review - Report on Asset Health and Risk Modelling", (21 October 2022).

- 3.9 As we progressed our review of the proposal, 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.

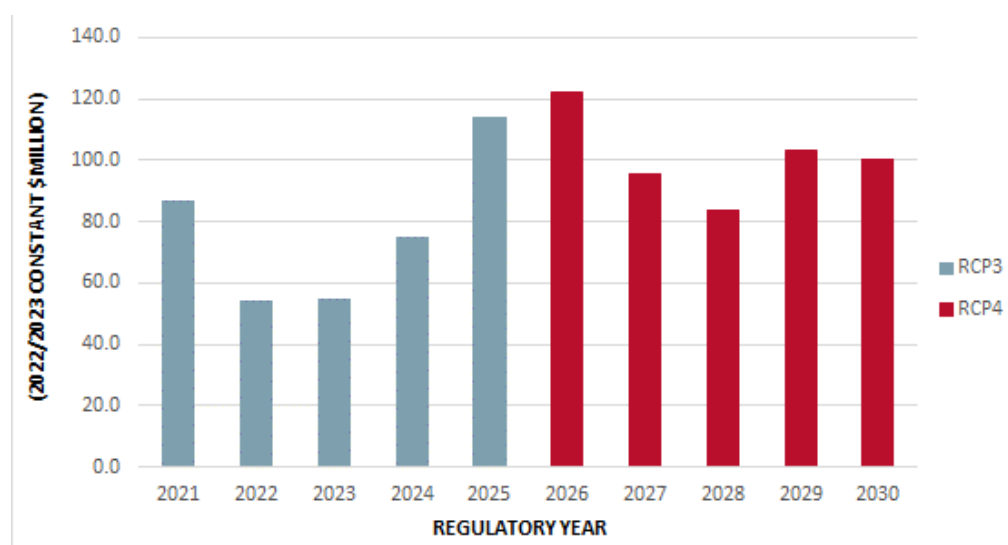
Transpower base capex proposal for RCP4

- 3.16 Transpower is seeking approval for \$2,167.4 million of base capex expenditure forecast.^{9, 10} 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)



⁹ 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).

¹⁰ In its original proposal Transpower's base capex was \$2,197.2 million. After responding to our RFIs Transpower revised their 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^{11,12}
- 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 power transformer asset class as:¹³
- 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.

¹¹ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 98 section 8.2.1.

¹² Transpower confirmed the number of transformers to replace or install as 22 in its summary of proposal changes.

¹³ 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.¹⁴
- 3.27 To establish the number of replacement power transformers required in RCP4, Transpower states:¹⁵

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 transformers¹⁶

- 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 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 have 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.

¹⁴ GHD Advisory and Castalia, [IV Report](#), p 112 section 9.3.1.3.

¹⁵ Transpower RCP4 Portfolio management plan – power transformers (October 2023), p 6.

¹⁶ 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:¹⁷

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:¹⁸

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.

¹⁷ GHD Advisory and Castalia, [IV Report](#), p 115 section 9.3.1.5.

¹⁸ 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:¹⁹

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.

Our draft decision – power transformers

- 3.41 The Verifier concluded that \$144.1 million (\$ constant 2021/2022) of power transformer expenditure was verified.
- 3.42 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.
- 3.43 Our draft decision is to approve \$196.2 million over RCP4 in the power transformers asset class.

Indoor Switchgear

- 3.44 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 RCP3.²⁰

¹⁹ Transpower response to RFI013 – Replacement of transformer quantities, 16 February 2024.

²⁰ Transpower's RCP4 Regulatory Template (RT01) – This spreadsheet provides the forecast capex and opex expenditure.

- 3.45 Transpower states the majority of the proposed expenditure is to continue to manage operational defects at existing installations, and to replace approximately four switchboards.²¹

*Verifier review of indoor switchgear*²²

- 3.46 The Verifier reviewed \$46.7 million (\$ constant 2021/2022) of proposed indoor switchgear expenditure and agreed that this was verified.
- 3.47 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.
- 3.48 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.
- 3.49 The Verifier noted cost estimate processes that Transpower have followed are reasonable. Cost estimates are based on building block models that compare reasonably with Australian counterparts.
- 3.50 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.²³

Our review – indoor switchgear

- 3.51 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.
- 3.52 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.

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

²² GHD Advisory and Castalia, [IV Report](#), p 117-123 section 9.3.2.

²³ 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.

3.53 Transpower has proposed a lower expenditure amount than what was verified. We observed two material changes, namely;

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

3.53.2 Transpower has reduced its proposed indoor switchboard replacement volumes.

3.54 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:²⁴

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.

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

Our draft decision – indoor switchgear

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

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

Outdoor switchgear

3.58 Transpower is proposing to spend \$102.6 million over RCP4 in the outdoor switchgear asset class is comprising of investments in:²⁵

3.58.1 outdoor circuit breakers (\$42.0 million);

3.58.2 outdoor instrument transformers (\$34.3 million); and

3.58.3 outdoor disconnectors and earth switches (\$26.3 million).

²⁴ Transpower response to RFI015 – Capital expenditure projects and programmes, 2 February 2024.

²⁵ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 100-101 section 8.2.1.

- 3.59 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 switchgear²⁶

- 3.60 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.
- 3.61 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:
- 3.61.1 outdoor switchgear expenditure driven by the SF₆ Management Strategy and replacing breaker with leakage issues;
 - 3.61.2 instrument transformer expenditure need is being driven by corrosion issues; and
 - 3.61.3 outdoor disconnector and earth switch expenditure driven by ongoing maintenance and an asset type issue.
- 3.62 The Verifier tested replacement rates against the asset health model outputs and was satisfied these were robust and resulted in prudent forecasts.
- 3.63 Building block unit rates were comparable 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.
- 3.64 Following its review, the Verifier concluded that the proposed outdoor switchgear expenditure was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

Our review – outdoor switchgear

- 3.65 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.

²⁶ GHD Advisory and Castalia, [IV Report](#), p 130-136 section 9.3.4.

- 3.66 We sought additional information from Transpower about how:
- 3.66.1 external and internal asset failure rate data had been used to tune the asset health models;
 - 3.66.2 the asset health models have been verified by backcasting analysis following post-asset replacement condition assessments;
 - 3.66.3 asset data inputs track through to model outputs, illustrating how the asset health modelling framework feeds into expenditure forecasts; and
 - 3.66.4 safety risk costs for some key asset classes have been quantified and monetised.
- 3.67 Transpower provided additional information explaining that:²⁷
- 3.67.1 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;
 - 3.67.2 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;
 - 3.67.3 the PoF curves are tuned to model predicted failure rates in a year, based on the DNO failure rates and observed failure data;
- 3.68 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.
- 3.69 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.
- 3.70 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.
- 3.71 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.

²⁷ Transpower, RFI011 “Asset health modelling and modelling process”, 19 February 2024.

- 3.72 We investigated Transpower's policy related to SF₆ circuit breaker replacement. In 2021 Transpower released its SF₆ Management Strategy to manage SF₆ leaks and undertake maintenance activities, with a goal to reduce SF₆ emissions and meet net zero emissions by 2050.^{28,29}
- 3.73 Transpower notes in its outdoor circuit breaker PMP, it is "trying to avoid installing SF₆ circuit breakers where possible, as SF₆ circuit breakers inherently have natural leakage rates".³⁰ While alternative solutions are not yet available for 110kV and 220kV circuit breakers, there are non-SF₆ alternatives for 66kV and below. Some RCP4 expenditure uplift relates to SF₆ replacements, and will increase over future periods as alternatives become available for 110kV and above.
- 3.74 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.

Our draft decision – outdoor switchgear

- 3.75 Following our review, we consider the outdoor switchgear programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.
- 3.76 Our draft 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.

Structures and Buswork

- 3.77 Transpower is proposing to spend \$38.5 million over RCP4 in the structures and buswork asset class, comprising investments in:³¹
- 3.77.1 outdoor switchyard structures, including support structures for various switchgear;
 - 3.77.2 outdoor buswork, including conductors and insulators;
 - 3.77.3 outdoor substation tie lines including conductors, insulators and associated fittings; and
 - 3.77.4 substation earthwires, and associated hardware and attachments.

²⁸ Transpower RCP4 proposal Portfolio Management Plan (PMP005) – Outdoor circuit breakers, Oct 2023.

²⁹ SF₆ (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 CO₂", meaning 1kg of SF₆ has the same effect as 23,500kg of CO₂
<https://www.nationalgrid.com/stories/energy-explained/what-is-sf6-sulphur-hexafluoride-explained>

³⁰ GHD Advisory and Castalia, *IV Report*, p 121 section 9.3.3.4.

³¹ Transpower NZ Limited - Asset Management Plan 2023, November 2023, p 83.

- 3.78 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.³²

Verifier review – structures and buswork³³

- 3.79 The Verifier reviewed and verified \$32.6 million (\$ constant 2021/2022) of structures and buswork expenditure.
- 3.80 The Verifier noted that the increase in forecast expenditure when compared to RCP3, is due to 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.
- 3.81 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 estimates than asset health modelling alone. The Verifier concluded that approach was reasonable and prudent.
- 3.82 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".³⁴
- 3.83 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 consistent with the evaluation criteria in the Capex IM.³⁵

Our review – structures and buswork

- 3.84 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.
- 3.85 The Verifier tested Transpower cost estimates and processes, and we agree with the Verifier's conclusion regarding investment cost efficiency.

³² Transpower's Substation portfolio overview document.

³³ GHD Advisory and Castalia, [IV Report](#), p 123-130 section 9.3.3.

³⁴ GHD Advisory and Castalia, [IV Report](#), p 135 section 9.3.4.5.

³⁵ 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.

- 3.86 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:³⁶

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

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

Our draft decision – structures and buswork

- 3.88 We consider the structures and buswork programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.
- 3.89 Our draft 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.

33kV outdoor switchyards to indoor (ODID) switchgear conversion³⁷

- 3.90 Transpower is proposing to spend \$38.3 million over RCP4 in converting 33kV outdoor switchyards to indoor switchgear at 6 substation sites.
- 3.91 The proposed expenditure is a decrease of 47% compared to the \$71.6 million Transpower forecasts it will spend by the end RCP3.³⁸ 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.
- 3.92 Transpower describes the ODID conversion programmes as:³⁹

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.

³⁶ Transpower response to RFI015 – Capital expenditure projects and programmes, 2 February 2024.

³⁷ GHD Advisory and Castalia, [IV Report](#), section 9.3.5, p 136-141.

³⁸ Transpower's RCP4 Regulatory Template (RT01), Expenditure forecast, November 2023, spreadsheet - Base capital expenditure RPE.

³⁹ Transpower NZ Limited – Asset management plan 2023, (November 2023), p 90.

- 3.93 Transpower has indicated that the ODID programme is well advanced, and that it plans to fully complete it over RCP5.⁴⁰

Verifier review - ODID switchyard conversions

- 3.94 The Verifier reviewed and verified \$30.2 million (\$ constant 2021/2022) of ODID conversion expenditure.
- 3.95 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.
- 3.96 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 so costs cannot reasonably be benchmarked. The Verifier concluded that Transpower's historical record of delivering ODID conversions was well-managed and prudent.
- 3.97 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 consistent with the evaluation criteria in the Capex IM.

Our review – ODID switchyard conversions

- 3.98 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.
- 3.99 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.
- 3.100 We understand that this is an industry-wide cost pressure issue.

⁴⁰ Transpower NZ Limited – Asset Management Plan 2023, (November 2023), p 90.

Our draft decision – ODID switchyard conversions

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

Power cables

- 3.102 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 RCP3.⁴¹

- 3.103 As well as power cable replacement and refurbishment activities, Transpower forecasts it will replace 18 cable joints and 48 cable terminations.⁴² Over RCP3 it intends to complete 42 cable joint, and 48 cable termination replacements.⁴³

- 3.104 Transpower describes the power cables asset portfolio as:⁴⁴

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.

- 3.105 In its 2023 Asset Management Plan, 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.
- 3.106 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.⁴⁵

Verifier review - power cables⁴⁶

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

⁴¹ Transpower's RCP4 Regulatory Template (RT01) – This spreadsheet provides the forecast capex and opex expenditure.

⁴² Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 101 section 8.2.1.

⁴³ Transpower NZ Limited – Asset Management Plan 2023, (November 2023), p 74.

⁴⁴ Transpower NZ Limited – Asset Management Plan 2023, (November 2023), p 75.

⁴⁵ Transpower NZ Limited – Asset Management Plan 2023, (November 2023), p 75.

⁴⁶ GHD Advisory and Castalia, [IV Report](#), p 141-146, section 9.3.6.

- 3.108 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.
- 3.109 Replacement costs were consistent with RCP3 costs and compared reasonably with similar cost estimate information sourced from Australian DNSPs and TNSPs.
- 3.110 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 circuit and replacing cable joints after the cable failures in 2020 and 2021.
- 3.111 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.
- 3.112 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

- 3.113 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:⁴⁷
- 3.113.1 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
- 3.113.2 the inclusion of 110kV oil filled cable terminations and joint replacements, instead of the original plan to repair these.
- 3.114 We sought further information from Transpower about why costs associated with the Brownhill-Pakuranga (**BHL-PAK**) cable repair work were not covered by manufacturer warranty.

⁴⁷ Transpower response to RFI015 – Capital expenditure projects and programmes, 2 February 2024.

- 3.115 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.

Our draft decision – power cables

- 3.122 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.
- 3.123 Our view is that Transpower has sufficiently justified why it has proposed a higher level of expenditure since verification. Our draft decision is to approve \$46.7 million for power cables.

Other AC substation equipment

- 3.124 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.
- 3.125 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:
- 3.125.1 'low voltage AC (**LVAC**) distribution systems' consisting of LV switchboards, LV distribution boards, main/submains/LV distribution cabling, and AC junction boxes; and
 - 3.125.2 '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.
- 3.126 Transpower states the key drivers for the proposed investments include:⁴⁸
- 3.126.1 replacement of LVAC local switchboards based on condition;
 - 3.126.2 replacement of LVAC switchboards and/or cabling where maintenance is uneconomical or safety risk high; and
 - 3.126.3 asset condition considerations.

*Verifier review - other AC substation equipment*⁴⁹

- 3.127 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.
- 3.128 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.
- 3.129 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.

⁴⁸ Transpower NZ Limited – Asset Management Plan 2023, p 80.

⁴⁹ GHD Advisory and Castalia, [IV Report](#), p 147-152, section 9.3.7.2.

- 3.130 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.
- 3.131 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.
- 3.132 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.
- 3.133 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

- 3.134 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.
- 3.135 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.
- 3.136 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.
- 3.137 In its main proposal documentation, in response 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'⁵⁰.
- 3.138 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.

⁵⁰ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 102 section 8.2.1.1.

- 3.139 While Transpower's asset management plan 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.

Our draft decision – other AC substation equipment

- 3.140 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.
- 3.141 We have inflated this verified amount to 2022/2023 constant prices using Transpower's expenditure forecast model inflators. Our draft decision is to approve \$32.9 million of 'other AC substation equipment' capex.

Buildings and grounds

- 3.142 Transpower is proposing to spend \$89.3 million in the buildings and grounds asset class, that 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.⁵¹
- 3.143 The proposed expenditure is consistent with the \$90.6 million Transpower predicts it will spend by the end of RCP3 in this asset class.⁵²
- 3.144 Transpower states the key drivers for the proposed expenditure are:
- 3.144.1 maintaining building warrant of fitness compliance, in accordance with the requirements of the territorial authority;
 - 3.144.2 increasing warehouse expenditure to support the growing work programme;
 - 3.144.3 fencing, accessway resurfacing, prevention of building water ingress, air conditioning; and
 - 3.144.4 upgrading sites where infrastructure related to potable, sewage, and wastewater need to be upgraded.

⁵¹ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 103 section 8.2.2.

⁵² Transpower's RCP4 Regulatory Template (RT01) - This spreadsheet provides the forecast capex and opex expenditure.

- 3.145 Transpower note 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.⁵³

*Verifier review – Buildings and grounds*⁵⁴

- 3.146 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.⁵⁵
- 3.147 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:
- 3.147.1 the addition of resilience expenditure for seismic strengthening of buildings, fire stopping, and detection upgrades to comply with building standards; and
 - 3.147.2 the addition of expenditure for new drinking water requirements to comply with new Taumata Arowai drinking water requirements.
- 3.148 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.
- 3.149 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.
- 3.150 The Verifier concluded Transpower's asset management approach is directed towards identifying and developing prudent and efficient solutions.

⁵³ Transpower NZ Limited – Asset Management Plan 2023 p 95.

⁵⁴ GHD Advisory and Castalia, [IV Report](#), section 9.3.8.3, p 152-160.

⁵⁵ 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.

- 3.151 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
- 3.152 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 2021.⁵⁶
- 3.153 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 only⁵⁷.
- 3.154 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

Our review – Buildings and grounds

- 3.155 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.
- 3.156 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.
- 3.157 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, the buildings and grounds PMP estimate has risen to \$21.3 million.
- 3.158 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 Water Services Act (**WSA**), s 9 and is required to meet all the legislation requirements under the WSA.⁵⁸

⁵⁶ <https://www.legislation.govt.nz/act/public/2021/0036/latest/LMS374564.html>

⁵⁷ GHD Advisory and Castalia, *IV Report*, section 9.3.8.4, p 159.

⁵⁸ Transpower NZ Limited – Portfolio Management Plan, Buildings and Grounds (October 2023), Appendix B.

- 3.159 Transpower note 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.
- 3.160 We consider that Transpower has adequately addressed the Verifier's concerns around the prudence of its proposal to meet the requirements of s 29 of the WSA.
- 3.161 However, our view is that Transpower has not addressed the Verifier cost estimation concerns, where it noted the proposed expenditure had a high degree of uncertainty, as it was based solely on a desktop study.
- 3.162 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".
- 3.163 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.
- 3.164 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.
- 3.165 We consider approving 50% of this expenditure is reasonable, given the information Transpower has provided the Verifier, and to us, in its proposal.

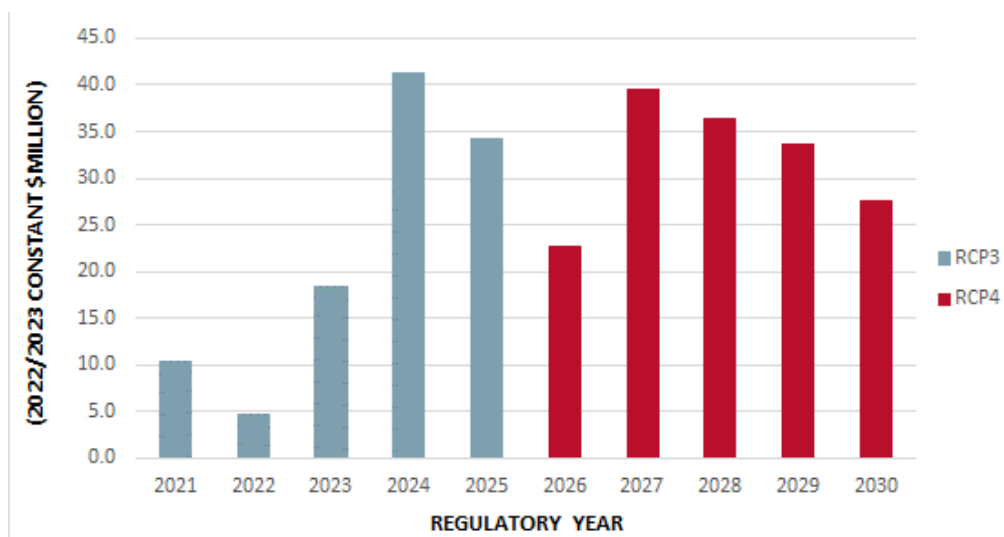
Our draft decision

- 3.166 We consider the majority of the buildings and grounds programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.
- 3.167 Our draft 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

3.168 Transpower is proposing to spend \$161.4 million in HVDC and reactive assets compared with the \$109.4 million it predicts it will spend by the end of RCP3.

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



HVDC

3.169 Transpower is proposing to spend \$80.5 million on HVDC capex over RCP4. The proposed activities include:⁵⁹

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

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

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

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

3.170 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 RCP3.⁶⁰

⁵⁹ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 133 section 8.2.4.1.

⁶⁰ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 113 section 8.2.4.1.

- 3.171 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.

Verifier review – HVDC ⁶¹

- 3.172 The Verifier reviewed and verified \$78.1 million (\$ constant 2021/2022) of HVDC expenditure.
- 3.173 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.
- 3.174 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.
- 3.175 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”.⁶²
- 3.176 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.
- 3.177 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.
- 3.178 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

- 3.179 We have considered the Verifier report and reviewed Transpower’s proposal for the HVDC asset class.
- 3.180 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.

⁶¹ GHD Advisory and Castalia, [IV Report](#), p 196-201 section 9.3.14.

⁶² GHD Advisory and Castalia, [IV Report](#), p 197 section 9.3.14.2.

- 3.181 We agree with the Verifier’s conclusion that Transpower’s asset management strategy gives confidence that holistically, the expenditure forecast is consistent with GEIP.
- 3.182 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.
- 3.183 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 much manage, an issue exacerbated by global supply chain issues. We consider this more fully when we discuss deliverability as whole in the Draft Decision Attachment D: Deliverability paper.
- 3.184 In general, we considered that Transpower had demonstrated the proposed expenditure for HVDC was prudent and efficient.
- 3.185 However, during our review, we identified two issues that required clarification from Transpower, specifically:
- 3.185.1 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
 - 3.185.2 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.
- 3.186 Transpower responded that:⁶³
- 3.186.1 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.
 - 3.186.2 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.

⁶³ Transpower response to RFI019 – HVDC, 19 February 2024.

- 3.187 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.

Our draft decision – HVDC

- 3.188 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.
- 3.189 Our draft 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

- 3.190 Transpower is forecasting to spend \$80.8 million over RCP4 in the reactive assets class comprising investments to:⁶⁴
- 3.190.1 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;
 - 3.190.2 replace a number of capacitor banks with forecast expenditure of \$8.9 million; and
 - 3.190.3 carry out major refurbishment of synchronous condensers over RCP4 to extend the asset lives to 2042, with a forecast spend of \$43.9 million.
- 3.191 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.
- 3.192 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.
- 3.193 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.⁶⁵

⁶⁴ 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.

⁶⁵ Transpower NZ Limited – Asset Management Plan 2023, p 136.

Verifier review – Reactive assets⁶⁶

- 3.194 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.
- 3.195 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.
- 3.196 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.
- 3.197 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.
- 3.198 The Verifier concluded that, in general, the risk-based investment drivers used to define investment need, are reasonable and prudent.
- 3.199 The Verifier did not comment or review the cost competitiveness of individual quotations but concluded that Transpower's tendering and negotiation process appeared to be designed to achieve cost efficient procurement outcomes.
- 3.200 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

- 3.201 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.

⁶⁶ GHD Advisory and Castalia, [IV Report](#), p 202-208, section 9.3.15.

- 3.202 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.
- 3.203 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.
- 3.204 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.

Our draft decision – Reactive assets

- 3.205 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.
- 3.206 Our draft decision is to approve \$80.8 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

- 3.207 Transpower is proposing to spend \$34.7 million on business support capex assets not included in other asset classes.⁶⁷ 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.
- 3.208 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.
- 3.209 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.⁶⁸

⁶⁷ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023) , section 8.6.2, p 158.

⁶⁸ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023) , section 8.6.2, p 158.

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

*Verifier review – Business support*⁶⁹

- 3.210 The Verifier reviewed \$43.1 million (\$ constant 2021/2022) of business support expenditure but rejected \$16.0 million (\$ constant 2021/2022) for the Wellington office building upgrade as it was not supported by a business case.
- 3.211 The Verifier’s evaluation focussed on three categories of business support capex, namely:
- 3.211.1 vehicles – proposed expenditure of \$3.8 million (\$ constant 2021/2022) which includes \$0.4 million of forklifts from office equipment to vehicles, 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 prudent and efficient;
 - 3.211.2 office equipment – proposed expenditure of \$30.1 million (\$ constant 2021/2022) is not fully accepted. \$14.1 million is accepted and meets GEIP and Capex IM evaluation criteria. The \$16.0 million expenditure associated with 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

⁶⁹ GHD Advisory and Castalia, [IV Report](#), p 289-301 section 12.2.

3.211.3 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 prudent and efficient, meets GEIP and is consistent with the Capex IM evaluation criteria.

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

Our review – Business support

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

3.214 In its proposal Transpower is seeking \$34.7 million for business support capex. Since verification it removed the \$16 million for the Wellington office while it considers developing its business case.

3.215 We consider that the Verifier's report provided a robust analysis of the expenditure that it reviewed, and we agree with its 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.

3.216 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.

3.217 However, in our review of the proposal we could find no explanation for why the Transpower 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.

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

Our draft decision – Business support

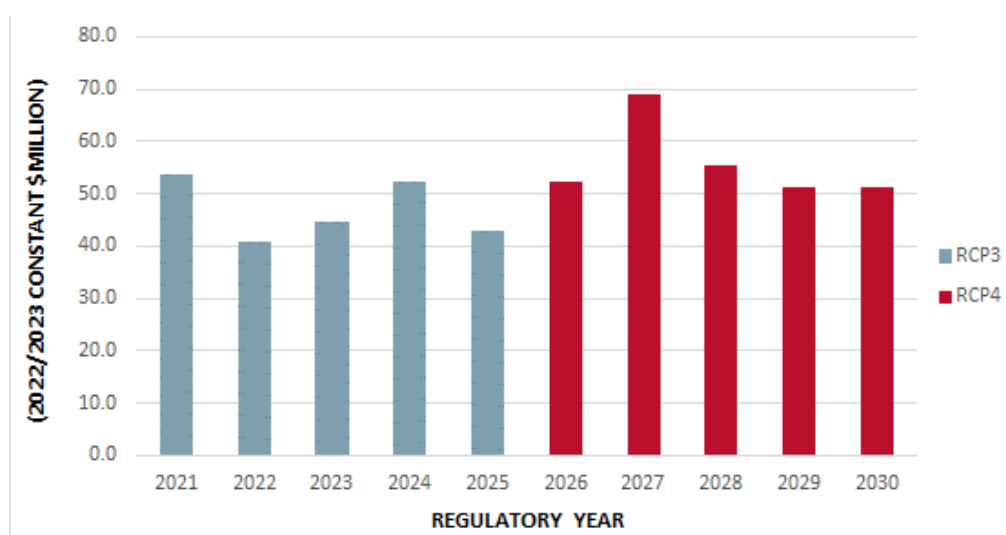
3.219 Following our review, we agree with the Verifier that business support capex expenditure of \$27.1 million (\$ constant 2021/2022), that it reviewed and verified, is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

- 3.220 Our draft 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 a draft decision approval amount of \$28.9 million for business support capex.

Secondary assets

- 3.221 Transpower is proposing 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.⁷⁰
- 3.222 The proposed expenditure is an increase of 21% when compared to the \$233.8 million Transpower predicts that will spend by the end of RCP3.

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



- 3.223 Transpower states that the primary driver of the protection, battery systems and metering renewal forecast is asset health. The wide range of expected asset lives in this portfolio means that required work volumes fluctuate over time.
- 3.224 We have considered and evaluated the secondary asset portfolio under two separate categories; a combination of protection systems, revenue meters, batteries and DC systems, and substation management systems (**SMS**). We have focussed our review on protection systems given the materiality of the expenditure being proposed.

⁷⁰ Transpower New Zealand Limited, “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 116 section 8.2.5, Table 24.

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

3.225 Transpower proposes to spend \$256.3 million over RCP4 on protection schemes, revenue meters, batteries and DC systems.⁷¹ 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.

3.226 Transpower describes protection metering and DC systems as:⁷²

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.

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.

3.227 Transpower is proposing to spend \$242.9 million in the protection systems asset class to replace approximately 650 protection schemes at the end of their useful lives, or aligned with replacement of primary assets, and to approximately 350 outdoor junction boxes.⁷³

3.228 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.

3.229 In addition, 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**).⁷⁴

3.230 For revenue metering, Transpower is proposing to spend \$0.8 million to cover the costs of 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 in RCP4.

⁷¹ 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.

⁷² Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 116 section 8.2.5, Table 24.

⁷³ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 116 section 8.2.5, Table 24.

⁷⁴ Transpower New Zealand Limited, "Portfolio Management Plan, Protection and Revenue metering Assets", (October 2023), 10.0 Appendix A: Benchmark Agreement Fault Clearance Times.

- 3.231 For substation DC systems, Transpower is proposing to spend \$13.0 million to replace approximately 150 battery banks.
- 3.232 Transpower explain 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*⁷⁵

- 3.233 The Verifier reviewed and verified \$227.6 million (\$ constant 2021/2022) of protection, revenue metering, batteries, and DC systems expenditure.
- 3.234 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.
- 3.235 Investment need is driven by risk and maintaining service performance, which is informed by asset health scores taking into account asset condition and consequences of asset failure.
- 3.236 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 a relay life expectancy of 20-25 years is assumed.
- 3.237 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".⁷⁶
- 3.238 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.
- 3.239 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.

⁷⁵ GHD Advisory and Castalia, [IV Report](#), p 208-215 section 9.3.16.

⁷⁶ GHD Advisory and Castalia, [IV Report](#), p 212 section 9.3.16.4.

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

- 3.240 We have considered the Verifier report, and reviewed Transpower’s proposal for protection systems, revenue meters, batteries, and DC systems.
- 3.241 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.
- 3.242 In our review we were interested to understand what was driving the expenditure increase since verification and Transpower’s proposed new protection design standard.
- 3.243 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”.⁷⁷
- 3.244 We sought additional information from Transpower about its new protection systems standard design strategy asking Transpower:
- 3.244.1 to provide us with more information about the drivers of the new protection systems standard design strategy;
 - 3.244.2 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
 - 3.244.3 the approximate cost impact of the new protection design strategy when compared with the previous standard protection system designs.

⁷⁷ Transpower RCP4 proposal Portfolio Management Plan (PMP014) – Protection and Revenue Metering Assets (October 2023), section 5.3.

3.245 Transpower responded that:⁷⁸

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.

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

3.247 Transpower noted that its upgraded design standards, while more costly in the near term, “efficiencies in average costs of implementing a standard transformer or capacitor protection scheme”⁷⁹ should be realised 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.

3.248 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; so this is largely out of Transpower’s control.

3.249 Since verification, Transpower states that it refined its proposed expenditure due to minor timing, scope and volume changes.⁸⁰

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

⁷⁸ Transpower, Secondary systems - protection RFI021.

⁷⁹ Transpower response to RFI021 – Secondary systems - protection, 29 February 2024.

⁸⁰ Transpower New Zealand Limited, “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 118 section 8.2.5.

3.251 In its Protection and Revenue Metering Assets PMP Transpower notes that:⁸¹

3.251.1 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)”;

3.251.2 building block cost estimates continue to be updated as actual cost data is received;

3.251.3 asset data quality is being constantly improved for protection and metering portfolios. Several workstreams to fill in gaps in data are ongoing;

3.251.4 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”.

3.252 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 have accepted Transpower’s modelling process as being mature, and we accept that more up to date asset condition data will calibrate asset health models and modify forecasts.

3.253 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.

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

3.254 Following our review of the Verifier report and Transpower’s proposal, we consider that 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.

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

⁸¹ Transpower RCP4 proposal Portfolio Management Plan (PMP014) – Protection and Revenue Metering Assets, (Oct 2023), p 8 section 5.3.

Substation management systems

- 3.256 Transpower is proposing to spend \$25.6 million in this asset class which includes lifecycle replacements and telemetry data standard improvements.
- 3.257 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).
- 3.258 Transpower describes substation management systems as:⁸²

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*⁸³

- 3.259 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”.⁸⁴
- 3.260 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.
- 3.261 Following its review, the Verifier concluded that the proposed substations management systems expenditure of \$23.5 million (\$ constant 2021/2022) was prudent and efficient, having regard to GEIP, and consistent with the evaluation criteria in the Capex IM.

Our review – Substation management systems

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

⁸² Transpower New Zealand Limited, “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 115 section 8.2.5.

⁸³ GHD Advisory and Castalia, [IV Report](#), p 215-221 section 9.3.17.

⁸⁴ GHD Advisory and Castalia, [IV Report](#), p 218 section 9.3.17.3.

- 3.263 We agree with the Verifier view 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.
- 3.264 The cost estimation process appears reasonable and 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.
- 3.265 In conclusions we consider Transpower has demonstrated a reasonable approach to identifying prudent and efficient need for investment.

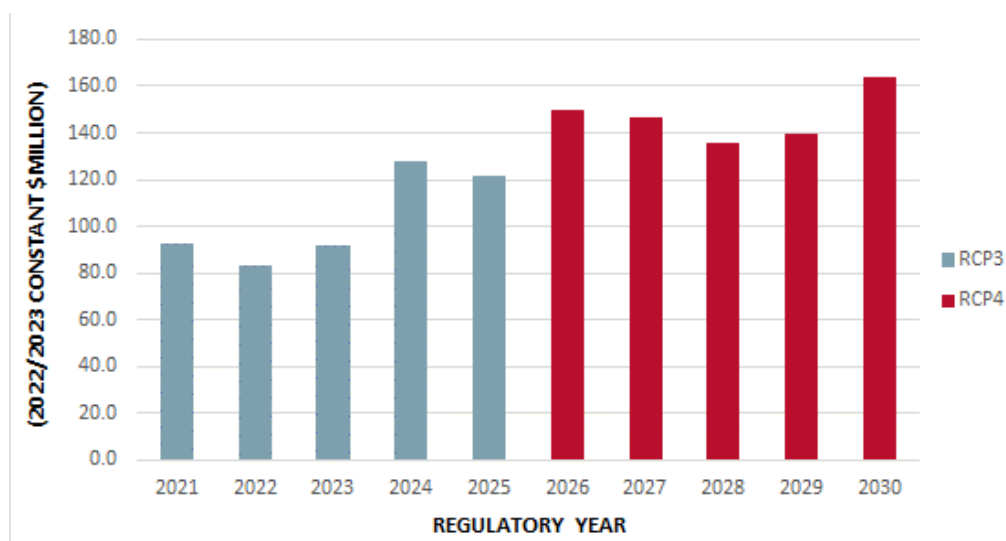
Our draft decision – Substation management systems

- 3.266 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.
- 3.267 Our draft decision is to approve \$25.6 million over RCP4 in the substations management system asset class.

Transmission lines structures

- 3.268 Transpower is proposing 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).⁸⁵
- 3.269 The proposed expenditure is an increase of 49% when compared with Transpower's forecast of what it predicts it will spend by the end of RCP3.

⁸⁵ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)" (21 November 2023), p 108 section 8.2.3.

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

3.270 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.

3.271 Transpower state that:⁸⁶

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

3.271.2 asset risk and criticality are considered when prioritising work.

3.272 Over RCP3 Transpower has also been carrying out some tower to pole conversions as an alternative to tower painting, notes that 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 lines structures: towers and poles

3.273 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”.⁸⁷

⁸⁶ Transpower New Zealand Limited, “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 107 section 8.2.3.

⁸⁷ GHD Advisory and Castalia, [IV Report](#), p 161 section 9.3.9.1.

Verifier review - Transmission line structures: towers and poles⁸⁸

- 3.274 The Verifier identified that 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”.⁸⁹ Life extension strategies are applied to most transmission line towers through tower painting to manage corrosion.
- 3.275 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 observed that strategy to decide on life extension, partial replacement or complete replacement was reasonable and appropriate.
- 3.276 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.
- 3.277 Intervention and replacement volumes were tested using the asset health models with and without interventions, confirming that forecasts were reasonable.
- 3.278 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.

Our review - Transmission line structures: towers and poles

- 3.279 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.
- 3.280 We agree with the Verifier that Transpower has reasonably demonstrated that the proposed investment in transmission line structures – poles and towers is prudent and consistent with GEIP, and that Transpower has reasonably estimated costs.
- 3.281 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%.

⁸⁸ GHD Advisory and Castalia, [IV Report](#), p 160-167 section 9.3.9.

⁸⁹ GHD Advisory and Castalia, [IV Report](#), p 163 section 9.3.9.3.

- 3.282 In its proposal Transpower note that the change in proposal amounts for this asset category are due to unit cost increases, rather than volume increases, and that \$27.9 million attachment point expenditure has been recategorized from maintenance opex to capex following auditor review.⁹⁰

Our draft decision - Transmission line structures: towers and poles

- 3.283 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.
- 3.284 Our draft decision is to approve \$112.7 million over RCP4 in the outdoor switchgear asset class for investment in transmission line poles, towers, and attachment points.

Verifier review – Transmission line structures: tower painting⁹¹

- 3.285 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”.⁹²
- 3.286 At the time of its review, the Verifier noted that Transpower is proposing 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.
- 3.287 Tower painting expenditure and quantities will grow until 2028. Expenditure should then stabilise near the end of RCP4 is because a greater proportion of painting is for recoating which is less costly.
- 3.288 The investment need for tower painting relies heavily corrosion zone analysis and tower failure risk with forecast expenditure volumes based on asset health estimates.
- 3.289 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.

⁹⁰ Transpower New Zealand Limited, “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 108 section 8.2.3.1.

⁹¹ GHD Advisory and Castalia, [IV Report](#), p 167-174 section 9.3.10.

⁹² GHD Advisory and Castalia, [IV Report](#), p 167 section 9.3.10.1

- 3.290 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.
- 3.291 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.
- 3.292 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

- 3.293 We have considered the Verifier report, and reviewed Transpower's proposal for transmission line structures: tower painting.
- 3.294 We investigated Transpower's view that tower painting has a lower lifecycle cost than replacement and reviewed its tower painting portfolio management plan.⁹³ We also tested Transpower's decision making framework regarding investment need and the use of corrosion zones.
- 3.295 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.⁹⁴
- 3.296 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.
- 3.297 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."⁹⁵ 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".

⁹³ Transpower RCP4 proposal Portfolio Management Plan (PMP010) – TL Paint Oct 2023.

⁹⁴ Transpower RCP4 proposal Portfolio Management Plan (PMP010) – TL Paint Oct 2023, p 13 table 5.

⁹⁵ GHD Advisory and Castalia, [IV Report](#), p 171 section 9.3.10.4

- 3.298 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):⁹⁶

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.

- 3.299 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.

Our draft decision - Transmission line structures: tower painting

- 3.300 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.
- 3.301 Our draft decision is to approve \$324.2 million over RCP4 in the transmission line structures – tower painting asset class.

Transmissions lines structures: insulators

Verifier review - Transmission line structures: insulators⁹⁷

- 3.302 This asset portfolio includes transmission line insulators and fittings and earthwire hardware, with approximately 53,000 glass, porcelain or composite insulators installed in the transmission network.
- 3.303 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.

⁹⁶ Transpower New Zealand Limited – TL Paint, Portfolio Management Plan, p14

⁹⁷ GHD Advisory and Castalia, [IV Report](#), p 174-180 section 9.3.11.

- 3.304 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.
- 3.305 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.
- 3.306 Intervention and replacement volumes were tested using the asset health models with and without interventions, confirming that forecasts were prudent.
- 3.307 The Verifier noted that the increase in building block unit costs between RCP3 submission and RCP4 submission was due to unit rate increases due to material costs and concluded Transpower's cost estimates were reasonable.
- 3.308 Following its review, 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.⁹⁸

Our review - Transmission line structures: insulators

- 3.309 We have 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.
- 3.310 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.
- 3.311 While the proposed RCP4 forecast expenditure is a significant increase when compared to RCP3, the Verifier notes that this can be explained by insulator cost increases. Additionally, Transpower has been maturing its asset health and risk modelling processes which give greater confidence it is reasonably forecasting investment volume need.

Our draft decision - Transmission line structures: insulators

- 3.312 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.

⁹⁸ 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.

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

Transmission lines structures: foundations and accessways

*Verifier review – Transmission line structures: foundations and accessways*⁹⁹

- 3.314 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”.¹⁰⁰
- 3.315 At the time of its review, the Verifier noted that Transpower proposed to
- 3.315.1 decrease foundations capex from \$68.7 million (\$ constant 2021/2022) by the end of RCP3 to \$59.6 million (\$ constant 2021/2022) over RCP4,
- 3.315.2 increase accessways capex from \$8.9 million (\$ constant 2021/2022) by the end of RCP3 to \$10.3 million (\$ constant 2021/2022) over RCP4.
- 3.316 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 used to develop them was appropriate.
- 3.317 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 observed that strategy to decide on life extension, partial replacement or complete replacement was reasonable and appropriate.
- 3.318 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”.¹⁰¹
- 3.319 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”.¹⁰²

⁹⁹ GHD Advisory and Castalia, [IV Report](#), p 188-195 section 9.3.13.

¹⁰⁰ GHD Advisory and Castalia, [IV Report](#), p 188 section 9.3.13.1.

¹⁰¹ GHD Advisory and Castalia, [IV Report](#), p 193 section 9.3.13.4.

¹⁰² GHD Advisory and Castalia, [IV Report](#), p 193 section 9.3.13.4.

- 3.320 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".¹⁰³
- 3.321 The Verifier concluded that Transpower's forecast volumes were considered reasonable.
- 3.322 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.

Our review – Transmission line structures: foundations and accessways

- 3.323 In its proposal Transpower is proposing \$70.3 million foundations and accessways expenditure comprising \$43.6 million for grillage foundation works and \$26.7 million for other foundations and accessways.
- 3.324 We have 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.
- 3.325 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.

Our draft decision – Transmission line structures: foundations and accessways

- 3.326 We consider the transmission line structures – foundations and accessways programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.
- 3.327 Our draft decision is to approve \$70.3 million over RCP4 in the transmission line structures – foundations and accessways asset class.

¹⁰³ GHD Advisory and Castalia, [IV Report](#), p 194 section 9.3.13.4

Conductors and hardware

- 3.328 Transpower is proposing 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.¹⁰⁴
- 3.329 The proposed expenditure is an increase of 50% compared with what Transpower predicts it will spend by the end of RCP3, that being \$93.0 million.
- 3.330 In its Transmission line conductor PMP, Transpower state 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:¹⁰⁵

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*¹⁰⁶

- 3.331 The Verifier reviewed and verified \$155.8 million (\$ constant 2021/2022) of conductors and hardware expenditure.
- 3.332 The Verifier concluded that Transpower's asset management system is directed towards identifying and developing prudent and efficient solutions.
- 3.333 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 off the tower condition assessments for 100% of the network.
- 3.334 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."¹⁰⁷ Following its review of Transpower's process, it considered it was reasonable and appropriate.

¹⁰⁴ 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.

¹⁰⁵ Transpower RCP4 proposal Portfolio Management Plan (PMP006) – TL conductors (October 2023).

¹⁰⁶ GHD Advisory and Castalia, [IV Report](#), p 181-187, section 9.3.12.

¹⁰⁷ GHD Advisory and Castalia, [IV Report](#), p 185 section 9.3.12.4

- 3.335 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.
- 3.336 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. CPI is considered.
- 3.337 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

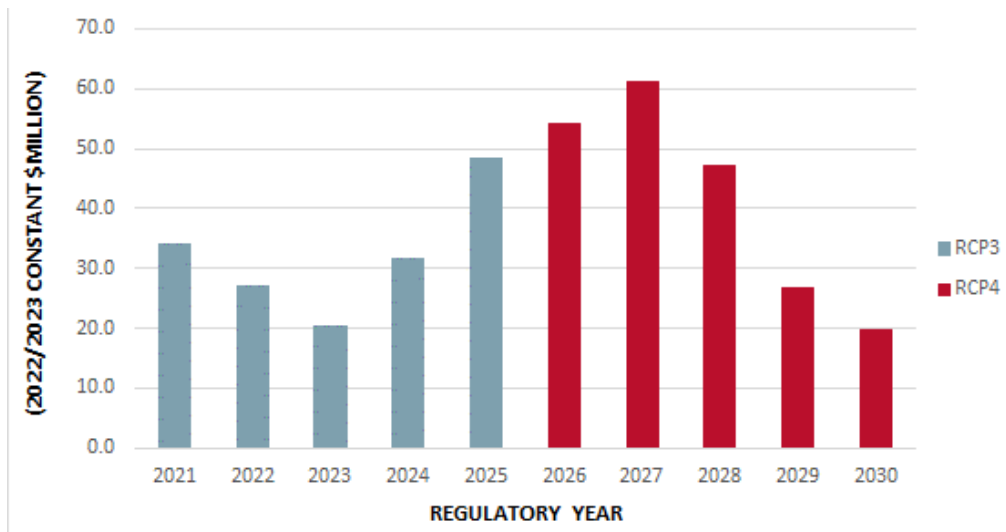
- 3.338 We have considered the Verifier report, and reviewed Transpower's proposal for conductors and hardware.
- 3.339 We consider Transpower has a robust planning process and strategy to identify the replacement volumes, and where those replacements are likely to be needed, largely driven by modelling, and confirmed by improved aerial survey inspection processes. Costs appear reasonable and compare with those estimates from the RCP3 submission when CPI is factored.
- 3.340 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.
- 3.341 In its original proposal Transpower proposed \$168.1 million for AC transmission lines conductors and hardware. Transpower has decreased this by \$29.0 million in response to a request for information, where it has re-categorised the Otahuhu-Whakamaru A&B line reconductoring as a future listed project.

Our draft decision – Conductors and hardware

- 3.342 We consider the conductors and hardware programme is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.
- 3.343 Our draft decision is to approve \$139.0 million over RCP4 in the conductors and hardware asset class.

ICT expenditure

- 3.344 Transpower forecast \$209.4 million for ICT capex (excluding SaaS opex) over RCP4. This is a 30% increase compared to the \$160.9 million it predicts it will spend by the end of RCP3. ICT capex in RCP3/RCP4 (\$ million constant 2022/2023).

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

- 3.345 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 note 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 is proposing the low incentive rate for base capex apply to this expenditure to better balance the risk of under/overspend.
- 3.346 Since submitting its proposal in November 2023, Transpower requested for proposal for its TransGO Refresh project, which lead to the price firming and an increase of \$0.3 million capex.¹⁰⁸

¹⁰⁸ Transpower's response to RFI025 -TransGO further information, 27 February 2024.

- 3.347 To improve its ICT investment justification process following the issues identified during our assessment of the RCP3 proposal, Transpower engaged external expertise, noting:¹⁰⁹

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.

- 3.348 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.
- 3.349 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.
- 3.350 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 2022/2023.¹¹⁰

Verifier review – ICT expenditure

- 3.351 In its review, the Verifier noted the ICT investment business cases:¹¹¹

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.

- 3.352 The Verifier review focussed on the content of the ICT investment business cases and because 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.¹¹²

¹⁰⁹ Transpower NZ limited, 'ICT Investment Framework' (24 February 2023).

¹¹⁰ All values mention in the eight investment business cases below, are in constant 2021/2022 dollars.

¹¹¹ GHD Advisory and Castalia, [IV Report](#), p 232 section 11.2.

¹¹² GHD Advisory and Castalia, [IV Report](#), p 232 section 11.2.

- 3.353 At the time of its review, the Verifier noted that Transpower was in the process of refining its cloud migration strategy. Transpower's cloud migration strategy is to assess how much server capital expenditure could be feasibly migrated to cloud based opex solutions.
- 3.354 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.
- 3.355 Consequently, the Verifier carried out a combined ICT capex and opex (**totex**) review of the ICT capex investment business cases.
- 3.356 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.
- 3.357 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 RCP3.¹¹³
- 3.358 The Verifier reviewed and accepted \$180.3 million of ICT capex, and did not review \$18.2 million related to the following three ICT investment business cases:¹¹⁴
- 3.358.1 ICT Corporate forecast expenditure of \$2.1 million (\$ constant 2021/2022);
- 3.358.2 ICT Asset management forecast expenditure of \$8.1 million (\$ constant 2021/2022); and
- 3.358.3 ICT Digital switch management forecast expenditure of \$8.0 million (\$ constant 2021/2022).
- 3.359 We have reviewed these remaining three investment business cases for prudence and efficiency, having regard to GEIP, and whether the expenditure was consistent with the Capex IM evaluation criteria.
- 3.360 The Verifier also 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.
- 3.361 The Verifier confirmed that SOSPA costs are not included in the RCP4 proposal.

¹¹³ GHD Advisory and Castalia, [IV Report](#), p 240.

¹¹⁴ GHD Advisory and Castalia, [IV Report](#), p 231, c 11.

- 3.362 The Verifier noted Transpower is aware of ICT project under-delivery in the first three years of RCP3. Transpower commented that global challenges in acquiring expertise and supply chain problems are the contributing issues. 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.
- 3.363 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.¹¹⁵
- 3.364 RCP4 average annual forecast ICT capex would be \$21.0 million without the TransGO Refresh project, instead of \$39.7 million per year with the TransGO Refresh project included.
- 3.365 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.
- 3.366 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.
- 3.367 The Verifier stated its evaluation of investment prudence 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.

¹¹⁵ GHD Advisory and Castalia, [IV Report](#), section 11.4.1, p 236.

3.368 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:

3.368.1 ICT Maintain services;

3.368.2 ICT TransGO Refresh;

3.368.3 ICT Transmission systems;

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

3.368.5 ICT Digital workplace; and

3.368.6 ICT Cybersecurity.

3.369 We have summarised the Verifier findings for the ICT investment business cases it reviewed, and our consideration of the three it did not review.

ICT Maintain services

3.370 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 RCP3.¹¹⁶

3.371 The proposed expenditure relates to:¹¹⁷

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

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

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

¹¹⁶ Transpower NZ Limited, 'IC01 Maintain Services, ICT Investment Case', p 13.

¹¹⁷ Transpower NZ Limited, 'IC01 Maintain Services, ICT Investment Case'.

Verifier review – ICT Maintain services¹¹⁸

- 3.372 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:
- 3.372.1 identify the asset/application that needs replacing;
 - 3.372.2 review if the asset/application crosses over into another investment case; and
 - 3.372.3 confirm the solution is appropriate.
- 3.373 The Verifier noted “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”.
- 3.374 The Verifier concluded Transpower had prudently identified the investment need.
- 3.375 Alternative investment options are considered and the interaction with opex costs and other programmes, factored into the investment decision making.
- 3.376 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.
- 3.377 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”.
- 3.378 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.
- 3.379 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.

¹¹⁸ GHD Advisory and Castalia, [IV Report](#), p 241-251 section 11.5.2.

- 3.380 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

- 3.381 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.
- 3.382 The Verifier also noted which expenditure items were shifted from capex to opex as Transpower utilises more cost-effective cloud-based solutions.
- 3.383 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.

Our draft decision – ICT Maintain services

- 3.384 Our draft 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

- 3.385 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.¹¹⁹
- 3.386 Transpower's TransGO Refresh programme started during RCP3, and it predicts it will spend \$19.0 million on the project by the end of RCP3.
- 3.387 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.

¹¹⁹ 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.

- 3.388 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.¹²⁰
- 3.389 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

- 3.390 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.¹²¹
- 3.391 The Verifier considered the ICT TransGO Refresh capex of \$93.7 million (\$ constant 2021/2022) that it reviewed, is prudent and efficient, consistent with GEIP, and satisfies the Capex IM evaluation criteria.
- 3.392 To verify that the costing approach was producing reasonable results, 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
- 3.393 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.¹²²
- 3.394 Despite this reservation, the Verifier concluded the cost evaluation and methodology were reasonable, and cost estimates reasonably accurate.
- 3.395 The Verifier also reviewed the extra staff requirement for the TransGO Refresh project and concluded that the additional staff for the period of the project was reasonable.
- 3.396 The Verifier also noted Transpower is proposing the TransGO Refresh programme be subject to the base capex low incentive rate due to cost uncertainty.

¹²⁰ Transpower NZ Limited, 'TransGO Refresh, ICT Investment Case'.

¹²¹ GHD Advisory and Castalia, [IV Report](#), p 255 section 11.5.3.

¹²² GHD Advisory and Castalia, [IV Report](#), p 256 section 11.5.3.

- 3.397 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.
- 3.398 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.
- 3.399 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.¹²³

Our review – ICT TransGO Refresh

- 3.400 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.
- 3.401 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”.¹²⁴
- 3.402 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:¹²⁵
- 3.402.1 the TransGO Refresh Programme has progressed to the Request for Proposal (**RFP**) procurement stage; and
- 3.402.2 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.
- 3.403 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.

¹²³ GHD Advisory and Castalia, [IV Report](#), p 260 section 11.5.3.

¹²⁴ Transpower New Zealand Limited, [“Regulatory control period 4 proposal April 2025 – March 2030”](#), (21 November 2023), p 128 section 8.3.3.

¹²⁵ Transpower, TransGO cost update RFI025.

- 3.404 While the capex cost increase of \$0.3 million (\$ constant 2021/2022) 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.
- 3.405 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.
- 3.406 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.
- 3.407 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.

Our draft decision – ICT TransGO Refresh

- 3.408 Our draft 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.

ICT Transmission systems

- 3.409 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.^{126, 127}
- 3.410 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.¹²⁸

Verifier review – ICT Transmission systems

- 3.411 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.

¹²⁶ Transpower also want to spend \$1.5 million of related opex and \$0.9 million of related invex.

¹²⁷ Transpower NZ Limited, 'Transmission Systems, Transmission Systems IC04 – ICT Investment Case'.

¹²⁸ GHD Advisory and Castalia, [IV Report](#), section 11.5.4 p 262.

- 3.412 Transpower has chosen the proactive investment approach because it “enhances resiliency and enables proactive response to change and complexity (including ability to adapt)”.¹²⁹
- 3.413 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”.¹³⁰
- 3.414 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

- 3.415 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.
- 3.416 We reviewed the ICT Transmission systems investment business case. Transpower state 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.
- 3.417 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”.
- 3.418 Appendix 2 of the ICT Transmission systems business case sets out the various quantified benefits of the proactive strategy. Some key benefits include:¹³¹
- 3.418.1 the expectation that the proposed investments will be able to avoid incidents when load was lost and restored within under 20 mins;
 - 3.418.2 project efficiency improvements by automating manual tasks at substations to increase productivity/utilisation, and improve quality;

¹²⁹ Transpower NZ Limited, ‘Transmission Systems, Transmission Systems IC04 – ICT Investment Case’, March 2023, p 5.

¹³⁰ GHD Advisory and Castalia, [IV Report](#), p 264 table 11-23.

¹³¹ Transpower NZ Limited, ‘Transmission Systems, Transmission Systems IC04 – ICT Investment Case’ (March 2023), p 17-18.

- 3.418.3 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
- 3.418.4 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).
- 3.419 We consider that Transpower has made the case for its proactive investment strategy and has attempted to quantify the benefits that may accrue from it.
- 3.420 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.

Our draft decision – ICT Transmission systems

- 3.421 Our draft 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.

ICT Data centre service modernisation

- 3.422 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.
- 3.423 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.¹³²
- 3.424 Transpower considered two strategic 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.
- 3.425 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 \$2.2 million (\$ constant 2021/2022) lower totex cost, and a lower NPV cost over a 10-year period than the existing strategy.

¹³² Transpower NZ Limited, 'Data Centre Service Modernisation, IC05 – ICT Investment Case'.

- 3.426 While migrating to a cloud-based solutions increase opex needs, 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 DCSM¹³³

- 3.427 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.
- 3.428 The ICT DCSM business case forecast a totex of \$39.5 million (\$ constant 2021/2022) and the RCP4 expenditure forecast schedule, forecast totex of \$25.4 million (\$ constant 2021/2022).¹³⁴ This compares with the \$34.0 million (\$ constant 2021/2022) totex that Transpower estimates it will spend by the end of RCP3.
- 3.429 The Verifier noted the expenditure drivers are:¹³⁵
- 3.429.1 capitalised leases that refer to expenditure associated with the lease of current data centre hardware;
 - 3.429.2 recurrent maintenance that relates to maintaining the core systems in operation, and mitigating risk related to non-support in the future; and
 - 3.429.3 opex that is the ongoing expenses to operate the data centre facilities.
- 3.430 The Verifier investigated the two strategic investment options, and noted that regardless of the option, Transpower needed to invest.
- 3.431 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**).
- 3.432 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.

¹³³ GHD Advisory and Castalia, [IV Report](#), p 270-276 section 11.5.5.

¹³⁴ GHD Advisory and Castalia, [IV Report](#), p 275 section 11.5.5.

¹³⁵ GHD Advisory and Castalia, [IV Report](#), p 272 section 11.5.5.

3.433 After reviewing the information provided by Transpower the Verifier concluded:¹³⁶

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

3.433.2 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.

3.434 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

3.435 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 suggest this is the case, and this was confirmed by the Verifier review.

3.436 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.

3.437 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.

Our draft decision – ICT DCSM

3.438 Our draft 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

3.439 Transpower's ICT Cybersecurity business case details its plan to spend capex of \$7.3 million (\$ constant 2021/2022), and totex of \$17.7 (\$ constant 2021/2022), that includes step opex, SaaS opex, and invex.

¹³⁶ GHD Advisory and Castalia, [IV Report](#), p 270-275 section 11.5.5.

- 3.440 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.
- 3.441 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.

*Verifier review – ICT Cybersecurity*¹³⁷

- 3.442 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.

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

3.443.1 ISO2700:2002-Information security management; and

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

- 3.444 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.

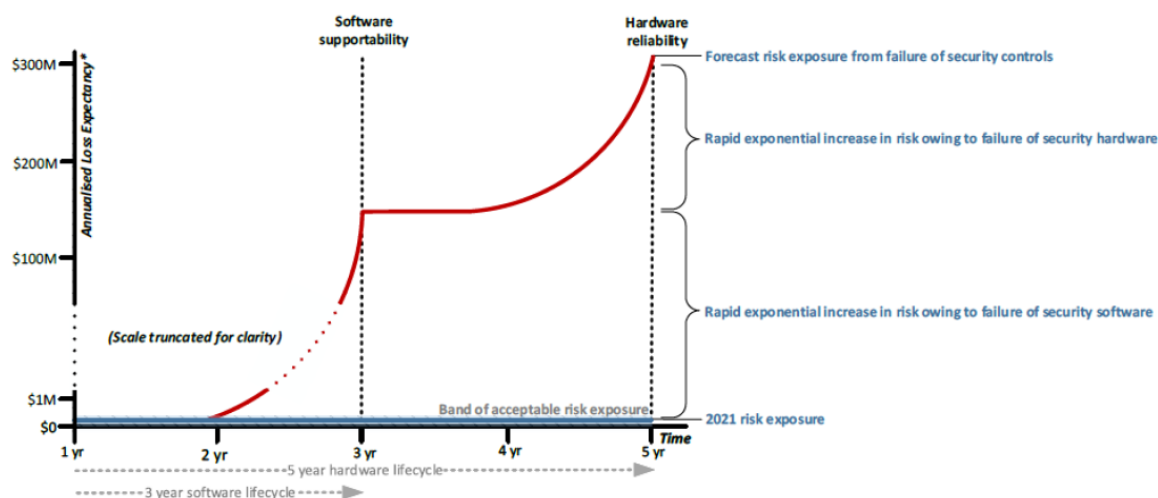
- 3.445 The Verifier also noted that should security be breached through a high-impact cybersecurity event, the estimated cost-of-consequence could be in the region of \$320 million to Transpower and consumers.¹³⁸

- 3.446 Figure 3.7 shows Transpower's estimated loss expectancy if 'do nothing' scenario is followed, and no continuing cybersecurity investment is made.

¹³⁷ GHD Advisory and Castalia, [IV Report](#), p 281-288 section 11.5.7.

¹³⁸ GHD Advisory and Castalia, [IV Report](#), p 284 section 11.5.7.

Figure 3.7 Transpower's cybersecurity risk profile for 'do nothing' investment scenario¹³⁹



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

3.447.1 maintain and modernise existing capabilities;

3.447.2 sustain security control effectiveness;

3.447.3 new capabilities in response to threats;

3.447.4 new capabilities in response to business change; and

3.447.5 new capabilities in response to technology change.

3.448 The Verifier noted that the proposed expenditure increase was not new expenditure rather 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”.¹⁴⁰ This largely explains the increase in proposed RCP4 expenditure when compared to RCP3.

3.449 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.

3.450 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.¹⁴¹

¹³⁹ IV Report, figure 5.1.

¹⁴⁰ GHD Advisory and Castalia, [IV Report](#), p 281 section 11.5.7.

¹⁴¹ GHD Advisory and Castalia, [IV Report](#), p 286 section 11.5.7.

- 3.451 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.
- 3.452 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 that that risk exposures have increased.
- 3.453 The Verifier concluded \$7.3 million (\$ constant 2021/2022) of capex, and a totex of \$17.7 million (\$ constant 2021/2022) was prudent and efficient, consistent with GEIP, and met the Capex IM evaluation criteria.

Our review – ICT Cybersecurity

- 3.454 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.
- 3.455 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.
- 3.456 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.
- 3.457 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.

Our draft decision – ICT Cybersecurity

- 3.458 Our draft decision is to approve \$7.3 million capex (\$ constant 2021/2022), and totex of \$16.4 million (\$ constant 2021/2022), that includes step opex, and invex, in the ICT Cybersecurity portfolio.

ICT investment cases not reviewed by the Verifier

- 3.459 We carried out a limited review of the three ICT investment business cases that were not reviewed by the Verifier.

ICT Corporate systems

- 3.460 Transpower propose to spend \$3.1 million (\$ constant 2021/2022) capex for ICT Corporate systems, and a totex of \$48.8 million (\$ constant 2021/2022) including SaaS opex, step opex, and invex.¹⁴²
- 3.461 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.
- 3.462 Transpower comment 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.
- 3.463 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.
- 3.464 Project costs have been estimated based on historical costs, experience from similar projects, and supported cost estimates.
- 3.465 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.

ICT Asset management systems

- 3.466 Transpower propose to spend \$8.2 million (\$ constant 2021/2022) capex for ICT Asset management systems, and a totex of \$17.7 million (\$ constant 2021/2022) including SaaS opex, step opex, and invex.¹⁴³
- 3.467 In its ICT Asset management systems business case Transpower note, with reference to its **AHNR** roadmap, the first stage execution has been a success, and the related expert opinion was favourable regarding implementation.
- 3.468 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.¹⁴⁴

¹⁴² Transpower Corporate Systems, IC06 – ICT Investment Case.

¹⁴³ Transpower Asset Management Programme, IC07 – Investment Case.

¹⁴⁴ Transpower Digital Switch Management, IC11 – Investment Case.

- 3.469 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.¹⁴⁵
- 3.470 Project costs have been estimated based on experience from similar projects.
- 3.471 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.

ICT Digital switch management

- 3.472 Transpower propose to spend \$6.5 million (\$ constant 2021/2022) capex for ICT Asset management systems.¹⁴⁶
- 3.473 The digital switch management programme is designed to reduce dependence on manual paper-based processes. Since Transpower carry 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.
- 3.474 Transpower considered two investment options, namely:
- 3.474.1 Option 1 – to fully digitise all planning and control room execution functions for digital switch management; and
 - 3.474.2 Option 2 – to fully digitise all field execution functions for digital switch management.
- 3.475 Transpower's preference is Option 2 because it mitigates safety risk more fully and ensures switching event errors will be reduced.
- 3.476 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.
- 3.477 Project costs have been estimated based on historical costs for the ongoing project over RCP3, and experience from similar projects.

¹⁴⁵ Transpower Digital Switch Management, IC11 – Investment Case. p 13.

¹⁴⁶ Transpower Asset Management Programme, IC07 – Investment Case.

- 3.478 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.

Capitalised leases

- 3.479 Since 2019/2020 operating leases have been capitalised by Transpower to align with GAAP, and the change in accounting treatment under NZ IFRS 16.
- 3.480 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.
- 3.481 Transpower provided a summary of the \$58.7 million lease payments by category, and this set out in Table 3.1.¹⁴⁷

¹⁴⁷ Transpower's reply to RFI09 and RFI25.

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 ¹⁴⁸	7.3
Total capex		58.7

- 3.482 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.
- 3.483 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.
- 3.484 Given that most proposed capitalised lease costs are a continuation of existing leases, and these align with RCP3 lease costs, we are willing to accept the proposed \$58.7 million for capitalised leases is prudent and efficient, and consistent with the Capex IM evaluation criteria.
- 3.485 Based on our review our draft decision is to approve \$58.7 million for capitalised leases.

Enhancement and Development (E&D) expenditure

- 3.486 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.¹⁴⁹

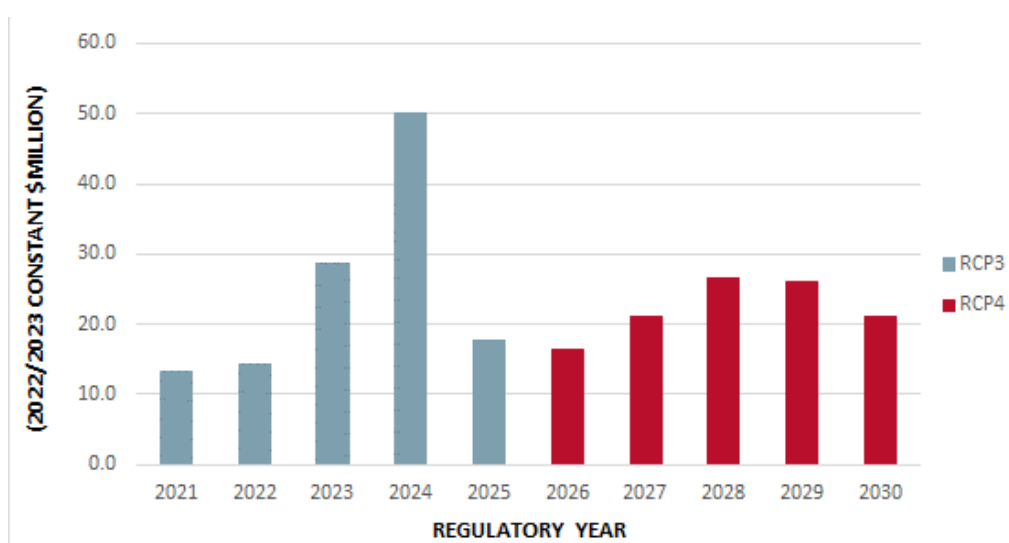
¹⁴⁸ When we sought additional information from Transpower about the most recent TransGO Refresh project costs, it notified us that the capitalised lease costs had increased by \$2.3 million. Transpower stated that this increase is due to 24-month temporary fibre leases and other associated services leases during the project.

¹⁴⁹ 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.

3.487 Transpower is proposing E&D expenditure of \$111.7 million, and describes its E&D portfolio as investments that:¹⁵⁰

- 3.487.1 provide more capacity to generators or connected loads;
- 3.487.2 match reliability or security of supply to the required standard or agreed service level;
- 3.487.3 maintain or improve power quality measures; and
- 3.487.4 manage the dynamic response of the power system to disturbances.

**Figure 3.8 Enhancement and development capex in RCP3/RCP4
(\$million constant 2022/2023)**



3.488 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.¹⁵¹

3.489 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.

¹⁵⁰ Transpower New Zealand Limited, [“Regulatory control period 4 proposal April 2025 – March 2030”](#), (21 November 2023), p 191 section 10.3.

¹⁵¹ [Commerce Commission Transpower IPP RCP3 Decisions and reasons paper \(29 August 2019\) \(RCP3 Decisions paper\)](#) Attachment G.10, p 267-273.

- 3.490 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.¹⁵²
- 3.491 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”.¹⁵³ This planning approach links to Transpower’s 2023 Transmission Planning Report.¹⁵⁴
- 3.492 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 RCP4¹⁵⁵

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 ¹⁵⁶

- 3.493 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.

¹⁵² Transpower "Submission on IM Review 2023 Draft Decisions" (19 July 2023), para 106.

¹⁵³ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 192 section 10.3.

¹⁵⁴ 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](#)

¹⁵⁵ Transpower New Zealand Limited, "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 192 section 10.3, table 54.

¹⁵⁶ GHD Advisory and Castalia, [IV Report](#), p 222-230 section 10.

- 3.494 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:¹⁵⁷

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.

- 3.495 To test the prudence of the proposed investments, the Verifier scrutinised a sample of E&D projects to "to corroborate the network planning approach undertaken, the details of system need, and proposed solution, scope and costs of those projects".¹⁵⁸ The Verifier concluded the proposed investment solutions were prudent and reasonable, and consistent with the Grid Reliability Standards, and the Grid Planning Technical Guideline.
- 3.496 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".¹⁵⁹
- 3.497 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".¹⁶⁰
- 3.498 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".¹⁶¹
- 3.499 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",¹⁶² and this was consistent with its observations regarding Transpower's cost estimation framework.

¹⁵⁷ GHD Advisory and Castalia, [IV Report](#), p 226 section 10.4.

¹⁵⁸ GHD Advisory and Castalia, [IV Report](#), p 228 section 10.5.1.

¹⁵⁹ GHD Advisory and Castalia, [IV Report](#), p 228 section 10.5.1.

¹⁶⁰ GHD Advisory and Castalia, [IV Report](#), p 229 section 10.5.1.

¹⁶¹ GHD Advisory and Castalia, [IV Report](#), p 226 section 10.

¹⁶² GHD Advisory and Castalia, [IV Report](#), p 228 section 10.5.2.

- 3.500 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

- 3.501 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.
- 3.502 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.
- 3.503 Transpower amended the E&D funding quantum it is seeking approval for since verification.¹⁶³ This followed stakeholder consultation over 2023, that took account of feedback about projects driven by step-change demand or generation. The proposal ‘extremely likely’ and ‘very likely’ E&D projects and programmes are summarised in the 2023 Transmission Planning Report.¹⁶⁴
- 3.504 We carried out our own sample bottom-up review of E&D project investment need, any alternatives considered, and proposed solutions, namely:
- 3.504.1 Otahuhu–Penrose transmission capacity (\$15.5 million) – demand driven need based on outage of a 220kV between Otahuhu, Southdown and Henderson, overloads the 220 kV Hobson Street–Wairau Road circuit from 2025 at peak. Solution is to 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);

¹⁶³ The verified amount of \$93.5 (\$ constant 2021/2022) inflates to \$99.9 million in \$ constant 2022/2023 using Transpower expenditure model inflator.

¹⁶⁴ 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.

- 3.504.2 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 identifying 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
- 3.504.3 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 not possible post-2028. Special protection scheme is an interim solution but its complex and results in N-1 issues elsewhere. Long term solution to reconductor circuits with higher rated conductor. Resolves many operational issues in the region (highly likely).
- 3.505 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 off building block models and regularly updated unit rates, to judge that the proposed investments are likely to be efficient.
- 3.506 We also top-down reviewed the 2023 TPR that 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 for the projects that we reviewed, supports the proposed investments.
- 3.507 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.
- 3.508 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 opex for corridor management which the Verifier concluded should be re-categorised as opex.
- 3.509 Transpower, in its proposal has included this corridor management opex in its E&D proposal and considers that these costs should be capitalised after obtaining external advice that this treatment is consistent with GAAP.¹⁶⁵

¹⁶⁵ GAAP means ‘generally accepted accounting practice’ is a business accounting standard that sets out financial reporting principles.

- 3.510 The corridor management opex is 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”.¹⁶⁶
- 3.511 We reviewed the proposed corridor management expenditure and tested whether this met the definition of ‘electricity transmission services’. We conclude that unless the corridor management opex is related to costs for a specific E&D project, it cannot be included as E&D expenditure. Transpower has not demonstrated that this is the case.
- 3.512 We are also unclear why Transpower is seeking additional opex for the purpose of meeting its current corridor management regulatory compliance. The Verifier report noted that this opex is for an ongoing programme where costs are being incurred over RCP3.¹⁶⁷ As such these ongoing costs will already be accounted for in the proposal base opex.
- 3.513 We consider the E&D proposal is mostly prudent and efficient. The exception is the \$5.0 million opex for corridor management which the Verifier concluded should be re-categorised as opex.

Conclusions and our draft decision

- 3.514 In conclusion, we consider the majority of the proposed E&D expenditure is prudent and efficient in meeting the requirements of the Capex IM. Transpower has amended its proposal amount following stakeholder consultation over 2023 which has resulted in a slightly higher forecast E&D expenditure than the Verifier reviewed.
- 3.515 However, the proposed corridor management opex of \$5 million does not meet this definition of ‘electricity transmission services’ and can’t be included as E&D capex and relates to opex costs already being incurred as base opex.
- 3.516 Our draft decision is to accept that \$106.7 million in the E&D expenditure portfolio is prudent and efficient, consistent with GEIP, and meets the Capex IM evaluation criteria.

¹⁶⁶ GHD Advisory and Castalia, [IV Report](#), p 226, table 10.3.

¹⁶⁷ GHD Advisory and Castalia, [IV Report](#), p 228 section 10.5.1.

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.
- 4.2.1 In the resilience expenditure tranche, Transpower is seeking approval for \$87.0 million of expenditure to address major event issues it considers are sufficiently well understood and with developed solutions to be approved now.¹⁶⁸
- 4.2.2 In the resilience UM expenditure tranche, Transpower is seeking \$126.7 million of expenditure in a pre-approved expenditure cap in a UIOLI funding arrangement. Transpower considers that these projects and programmes are less well-developed and that a UIOLI approach is favoured.¹⁶⁹
- 4.3 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.
- 4.4 Following our review our draft decision is to approve:
- 4.4.1 \$67.2 million of the proposed \$74.8 resilience capex and \$3.8 million of the proposed \$12.2 million resilience opex; and
- 4.4.2 \$64.4 million of resilience UM capex and \$3.8 million of resilience UM opex.
- 4.5 We discuss these two packages of work separately in our analysis below.

¹⁶⁸ Transpower New Zealand Limited “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 177 table 50.

¹⁶⁹ Transpower New Zealand Limited “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 177 section 9.3, table 50.

Verifier view of Transpower's resilience programme

- 4.6 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.¹⁷⁰
- 4.7 At the draft proposal stage Transpower also forecast it needed \$53.2 million (\$ constant 2021/2022) resilience uncertainty mechanism expenditure as a UIOLI fund for resilience projects and programmes it was less certain of.
- 4.8 The Verifier concluded that \$60.8 million (\$ constant 2021/2022) of Transpower's proposed resilience expenditure and \$53.2 million of the resilience uncertainty mechanism expenditure met the requirements of the Capex IM and was verified.
- 4.9 The Verifier in its report noted that:¹⁷¹
- 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.
- 4.10 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.
- 4.11 The Verifier also reviewed the proposed resilience UM expenditure and concluded that:¹⁷²
- 4.11.1 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;
- 4.11.2 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

¹⁷⁰ Transpower New Zealand Limited "Regulatory control period 4 proposal April 2025 – March 2030", (21 November 2023), p 179 table 51.

¹⁷¹ GHD Advisory and Castalia, [IV Report](#), p 12 section 2.4.2.

¹⁷² GHD Advisory and Castalia, [IV Report](#), p 421 section 19.1.3.

- 4.11.3 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

- 4.12 Transpower has matured and developed its resilience planning in recent years as a response to recent major events and following customer feedback.¹⁷³ Transpower considers that, relative to its international peers, a large proportion of its infrastructure is exposed to natural hazards and climate change effects.
- 4.13 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.
- 4.14 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.

Our analysis approach

- 4.15 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:
- 4.15.1 proposed investment need and the assumptions that underpin that need;
 - 4.15.2 the options that have been considered;
 - 4.15.3 whether prioritisation has been carried out;
 - 4.15.4 whether project and programme capital costs can be relied upon; and
 - 4.15.5 the economic case for investment is reasonable for the assumptions made.

¹⁷³ Transpower New Zealand Limited "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 165 section 9.1.

- 4.16 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.
- 4.17 During our 2023 IM Review process Transpower proposed that we include UIOLI funding IM 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.
- 4.18 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.
- 4.19 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.¹⁷⁴
- 4.20 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.
- 4.21 There are three resilience UM expenditure investment programmes, in particular that we focussed our review on, namely:
- 4.21.1 HVDC tower strengthening due to wind exposure (\$14.1 million of capex);
 - 4.21.2 HVAC and HVDC tower strengthening due to flood exposure (\$27.3 million of capex and \$2.9 million of opex); and
 - 4.21.3 flood resilience at substation sites (\$45.9 million of capex).
- 4.22 Two of these proposed UIOLI mechanism expenditures are related to actual events that have occurred in the recent past, namely:
- 4.22.1 the Rangitata River flood event in December 2019, damaged nine towers on the Islington-Livingstone HVAC transmission line resulting in a 220kV circuit outage; and

¹⁷⁴ [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.

- 4.22.2 the substation flood event following Cyclone Gabrielle 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.
- 4.23 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.
- 4.24 In many cases, the programmes have advanced to the point where need has been clearly identified, alternative options considered, and a top-down economic analysis carried out, to demonstrate that the wider programme will be economic. However, specific mitigation designs and costings had yet to be fully developed.
- 4.25 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.
- 4.26 However, some of this expenditure is directed towards mitigating high-priority exposures that Transpower need 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.
- 4.27 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.
- 4.28 For the resilience UM expenditure, 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 it is more certain of investment need, solution, economic viability, and/or cost.

Resilience expenditure assessment

Seismic strengthening of buildings

- 4.29 Transpower has identified it needs \$29.5 million to complete seismic strengthening on 34 buildings.¹⁷⁵

¹⁷⁵ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 47 Appendix 1 – Workstream Details.

4.30 Transpower state:¹⁷⁶

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 Code¹⁷⁷, 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)¹⁷⁸ 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.

- 4.31 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.¹⁷⁹
- 4.32 Transpower considered several investment strategies, including whether the buildings were required long-term, or could be dismantled. Mitigation costs per site varied from \$300,000 to \$1.5 million, depending on the complexity of the site.
- 4.33 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)”.¹⁸⁰
- 4.34 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.

¹⁷⁶ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 47 Appendix 1 – Workstream Details.

¹⁷⁷ Building Code (Schedule 1 to the Building Regulations 1992).

¹⁷⁸ NBS is the earthquake rating of a building when built to meet the Building Code.

¹⁷⁹ 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.

¹⁸⁰ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 48.

4.35 The Verifier reviewed Transpower's building seismic strengthening programme and concluded.¹⁸¹

4.35.1 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;

4.35.2 the prioritisation of the proposed seismic strengthening work is based on risk, and aligned with the Transpower asset investment and decision framework; and

4.35.3 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.

4.36 The Verifier concluded 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.

4.37 Our view is, given Transpower has been carrying out building seismic strengthening work since RCP1,¹⁸² it 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.

4.38 In conclusion, we consider the resilience expenditure for seismic strengthening of buildings meets the requirements of the Capex IM evaluation criteria and should be approved.

4.39 Our draft decision is to approve \$29.5 million of resilience capex for seismic strengthening of buildings.

Land stability works for towers and poles

4.40 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.¹⁸³

¹⁸¹ GHD Advisory and Castalia, [IV Report](#), p 158 section 9.3.8.5.

¹⁸² [Transpower Expenditure proposal for Regulatory Control Period 2 \(December 2013\) \(RCP2\)](#), p 23.

¹⁸³ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 62.

4.41 Transpower notes 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”.¹⁸⁴

4.42 The investment need is described as:¹⁸⁵

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.

4.43 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 been approximately \$1 million per year on ‘reactive’ land stability mitigations.

4.44 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.

4.45 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.

4.46 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.¹⁸⁶

4.47 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.

¹⁸⁴ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 33.

¹⁸⁵ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 33 Appendix 1 – Workstream Details.

¹⁸⁶ 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.

- 4.48 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.
- 4.49 These cost estimation processes are reviewed in Chapter 4 of the Verifier report, where it concluded:¹⁸⁷
- 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.
- 4.50 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.¹⁸⁸
- 4.51 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.
- 4.52 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.
- 4.53 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, should ensure cost estimates are efficient.
- 4.54 In conclusion, we consider the resilience expenditure for land stability works for towers and poles meets the requirements of the Capex IM evaluation criteria and should be approved.
- 4.55 Our draft 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

- 4.56 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.¹⁸⁹

¹⁸⁷ GHD Advisory and Castalia, [IV Report](#), p 316-324 section 14.8.

¹⁸⁸ GHD Advisory and Castalia, [IV Report](#), p 49 section 4.2.3.

¹⁸⁹ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 56.

- 4.57 Needs analysis performed by Transpower concluded its substation building fire risk management is below standard, leaving many substation buildings vulnerable to this hazard.
- 4.58 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.
- 4.59 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.
- 4.60 The Verifier noted:¹⁹⁰
- We reviewed the building fire detection and fire stopping upgrade programme as part of the resilience driven base R&R programme.¹⁸⁶ 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.
- 4.61 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.
- 4.62 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.
- 4.63 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.

¹⁹⁰ GHD Advisory and Castalia, [IV Report](#), p 158 section 4.2.3.

- 4.64 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”.¹⁹¹
- 4.65 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.
- 4.66 In conclusion, we consider that the resilience expenditure for substation building fire mitigation works meets the requirements of the Capex IM evaluation criteria and should be approved.
- 4.67 Our draft 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

- 4.68 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.¹⁹²
- 4.69 Transpower states the need for these mobile and portable substation solutions is:¹⁹³

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.

- 4.70 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.

¹⁹¹ 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.

¹⁹² Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 56.

¹⁹³ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 82.

4.71 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”.¹⁹⁴

4.72 Transpower describes the portable solutions as:

4.72.1 **portable protection** – a set of substation protection units that can be relocated by air or road within 3 days following an event;

4.72.2 **portable control room** – transportable control room that can provide the functionality of a standard substation control room; and

4.72.3 **portable switchroom** – similar to the existing portable switchroom (located at Bunnythorpe in the North Island), to be located in the South Island.

4.73 Transpower notes:¹⁹⁵

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.

4.74 Transpower considers its cost estimates for the portable substation equipment are dependable, based on previous projects and refined building block unit rates.

4.75 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.

4.76 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.¹⁹⁶

¹⁹⁴ Transpower “RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0” (October 2023), Appendix 1 – Workstream Details, p 83.

¹⁹⁵ Transpower “RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0”, (October 2023), p 36 section 7 – Resilience Workstreams.

¹⁹⁶ Transpower, Resilience programme - portable/mobile substation programme, RFI026.

- 4.77 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, that sets out:¹⁹⁷
- 4.77.1 emergency event scenarios and responses based on historical events, and identification of portable solutions that might reduce loss of supply in an emergency;
 - 4.77.2 how a deployment exercise could be developed and undertaken to test emergency event preparedness;
 - 4.77.3 capital cost and deployment exercise cost estimation; and
 - 4.77.4 a cost benefit analysis.
- 4.78 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.
- 4.79 Transpower identified a range of features and potential benefits of the investments in this resilience package, including:
- 4.79.1 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;
 - 4.79.2 a portable control room to reduce substation site wide outage duration by at least five days;
 - 4.79.3 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

¹⁹⁷ Transpower, *Resilience Programme Workstream Report - Substation Portable Emergency Assets and Deployment Exercise for Response and Restoration*, December 2023.

- 4.79.4 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.
- 4.80 Cost-benefit analysis was carried out for all four investment packages in the programme based on the following assumptions:
 - 4.80.1 for every third flood, either protection in a box, portable control room or a portable switchboard will be required;
 - 4.80.2 for every fifth flood the mobile substation will be required; and
 - 4.80.3 for fire and seismic events, a portable solution would be required for every event.
- 4.81 In all cases, Transpower has calculated benefit cost ratios (**BCR**) of greater than 1, with the minimum BCR of 5 for the portable switchroom.
- 4.82 While capital costs are not at a design level of accuracy, we consider Transpower has demonstrated the proposed capex solutions in this programme are prudent and efficient.
- 4.83 Transpower has also set out the costs and plan for emergency deployment exercises noting:
 - 4.83.1 there will be a deployment exercise involving each portable solution every five years, with costs estimated to total \$0.8 million over the RCP4 period;
 - 4.83.2 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;
 - 4.83.3 known challenges to deployment are site-specific logistics, including location and placement constraints, feeder cable connections and customer expectations; and
 - 4.83.4 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.

- 4.84 Transpower has not formally quantified the benefits of the proposed deployment expenditure, but 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, namely:

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.

- 4.85 We note developing plans, and understanding deployment issues, will have benefit and this 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.
- 4.86 Finally, Transpower note 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.
- 4.87 In conclusion, we consider this proposed resilience expenditure meets the requirements of the Capex IM evaluation criteria and can be approved.
- 4.88 Our draft 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

- 4.89 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”.¹⁹⁸
- 4.90 Following our review of the Verifier report we noted several information systems resilience expenditures such as:

¹⁹⁸ Transpower New Zealand Limited “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 176 section 9.3.

- 4.90.1 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”;¹⁹⁹
 - 4.90.2 \$1.1 million for a step change in predictive maintenance opex for a range of HVDC and resilience opex increases;²⁰⁰
 - 4.90.3 \$7.0 million for capex investigations for major capital project, base capex, resilience & sustainability;²⁰¹ and
 - 4.90.4 \$1.4 million for the Transmission Systems Grid Operator Role Flexibility and Work Distribution (Resilience) initiative.²⁰²
- 4.91 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.
- 4.92 In summary our draft decision is that we do not approve this expenditure because there is no explanation for why the investment is needed, no demonstration that it is prudent and efficient, and no explanation about how it is consistent with the Capex IM.

Resilience expenditure assessment of minor projects and programmes

- 4.93 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.

¹⁹⁹ Transpower RCP4 proposal Transmission Systems IC04 – ICT Investment Case, January 2023, p 25.

²⁰⁰ GHD Advisory and Castalia, [IV Report](#), p 328 section 14.9.3.

²⁰¹ GHD Advisory and Castalia, [IV Report](#), p 353 section 15.4.2.

²⁰² Transpower RCP4 proposal Transmission Systems IC04 – ICT Investment Case, January 2023, p 27.

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. ²⁰³	<ul style="list-style-type: none"> • 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. • draft decision is <u>we approve</u> this expenditure as justification appears consistent with the Capex IM.
\$1.1 million capex Hardening transmission lines for a volcanic ash event. ²⁰⁴	<ul style="list-style-type: none"> • 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. • draft decision is <u>we approve</u> 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. ²⁰⁵	<ul style="list-style-type: none"> • 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. • draft decision is <u>we approve</u> this expenditure as justification appears consistent with the Capex IM.

²⁰³ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 59.

²⁰⁴ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 59.

²⁰⁵ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 73.

Resilience project or programme	Our analysis
<p>\$1.9 million capex</p> <p>Pre-enabling works for faster connection of a spare transformer with air bushings to the Wilton substation.²⁰⁶</p>	<ul style="list-style-type: none"> • 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. • 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. • draft decision is <u>we approve</u> this expenditure as justification appears to be prudent and efficient, consistent with GEIP, and meets Capex IM evaluation criteria.
<p>\$3.4 million capex</p> <p>Equipment spares for the new seismic hazard model risk (sites exceeding IEEE693 'high').²⁰⁷</p>	<ul style="list-style-type: none"> • 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 • draft decision is <u>we do not approve</u> this expenditure at this time, due to uncertainties of cost and scope, and supporting business cases have yet to be completed.
<p>\$1.2 million opex</p> <p>Emergency exercises for tower restoration.</p>	<ul style="list-style-type: none"> • 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 state 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 state 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.

²⁰⁶ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 71.

²⁰⁷ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p 81.

Resilience project or programme	Our analysis
Contd...	<ul style="list-style-type: none"> • 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. • draft decision is <u>we do not approve</u> this expenditure - there is no supporting information to justify the increase above existing expenditure. Following our decision \$0.24 million p.a. will be removed from Transpower's proposed RCP4 opex.
\$2.2 million opex Development of new cybersecurity capability ²⁰⁸	<ul style="list-style-type: none"> • following our decision \$0.44 million p.a. will be removed from Transpower's proposed RCP4 opex.

Resilience expenditure draft decision

- 4.94 We have 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.
- 4.95 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.
- 4.96 Our draft 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.

²⁰⁸ Transpower New Zealand Limited "[Regulatory control period 4 proposal April 2025 – March 2030](#)", (21 November 2023), p 176 section 5.3.6.

Resilience UM expenditure assessment

Our analysis approach to resilience UM expenditure

- 4.97 We reviewed the resilience UM expenditure, taking a similar approach Transpower takes in judging the likelihood of projects in its proposed E&D capex programme.²⁰⁹
- 4.98 We consider that the following resilience UM capex project and programme expenditures are sufficiently certain and well developed that likely expenditure can be approved as E&D base rather than under a UIOLI funding approach.
- 4.99 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.

HVDC tower strengthening due to wind exposure

- 4.100 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.
- 4.101 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.²¹⁰
- 4.102 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).
- 4.103 The tower modelling analysis suggested that at a 50-year return period wind speed withstand capability, that 375 HVDC towers required mitigation, with 14 requiring major works or replacement.
- 4.104 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 based on the assumptions it has made.

²⁰⁹ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, (October 2023), section 8.3 p 42-45, and Appendix 1 – Workstream Details, p 47-86.

²¹⁰ 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.

- 4.105 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.
- 4.106 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 benefit cost ratios for the investment strategies investigated.
- 4.107 While we consider the analysis approach Transpower has taken is a sound basis for this resilience programme, it has assumed that all locations are equally affected by the extreme wind gusts it has modelled. 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.
- 4.108 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.
- 4.109 Our draft 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

- 4.110 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".²¹¹
- 4.111 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"²¹².
- 4.112 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.

²¹¹ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 50-52.

²¹² Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 50 Appendix 1 – Workstream Details.

- 4.113 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.

- 4.114 Transpower needs assessment:
- 4.114.1 identified towers near braided rivers vulnerable to flood damage;
 - 4.114.2 assessed and rated the risk levels for those towers;
 - 4.114.3 estimated the return period of a significant event for the highest-risk locations; and
 - 4.114.4 identified the locations of relatively high probability.
- 4.115 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”.²¹³
- 4.116 The needs assessment identified a shortlist of 61 towers that required some form of flood mitigation based on a comprehensive risk analysis.
- 4.117 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.”.²¹⁴
- 4.118 Cost estimates vary depending on the solution and a range of investment scenarios has been considered in the supporting analysis. Transpower preferred option was to mitigate flood risk for 51 HVAC towers and 10 high-risk HVDC towers in the work programme.
- 4.119 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:
- 4.120 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).

²¹³ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), p 50 Appendix 1 – Workstream Details.

²¹⁴ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), p 47 Appendix 1 – Workstream Details.

- 4.121 Finally, based on these inputs, Transpower carried out cost-benefit analyses to test the economic reasonableness of this investment programme. While 46 towers had cost benefit ratios (CBRs) ranging from 2,742 to 1.1, 15 tower locations had a CBR below 1.0 but greater than 0.4.
- 4.122 We applied the E&D expenditure approval criteria to our consideration of 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 expenditure.
- 4.123 While 15 tower locations have a strict CBA outcome of less than 1.0, 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.
- 4.124 Our draft 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

- 4.125 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.²¹⁵
- 4.126 To mitigate the effect of GIC on the transmission network Transpower is proposing the following expenditure as UM capex:
- 4.126.1 \$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”²¹⁶; and
- 4.126.2 \$18.1 million to invest in ten neutral blocking devices to protect the highest priority seven transformers.

²¹⁵ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 68.

²¹⁶ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (Oct 2023), p 68 Appendix 1 – Workstream Details.

- 4.127 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.
- 4.128 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.
- 4.129 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 that took 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.²¹⁷
- 4.130 Transpower 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:
- 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.
- 4.131 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.
- 4.132 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”.
- 4.133 We applied the E&D expenditure approval criteria to our consideration of space weather mitigation resilience capex programme. Our view is that Transpower has not fully demonstrated all the proposed expenditure is at least very likely to be needed over RCP4.
- 4.134 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.

²¹⁷ <https://www.transpower.co.nz/news/transpower-restores-electricity-transmission-circuits-after-solar-storm-subsides>

- 4.135 Following the result of its investigations Transpower can utilise the E&D mid-period reopener when it better develops its plans for this programme of work.
- 4.136 Our draft 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

- 4.137 Transpower has identified it may need \$45.9 million to undertake site-wide mitigations to improve flooding resilience for 11 substation sites.
- 4.138 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”.²¹⁸
- 4.139 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.²¹⁹
- 4.140 As a consequence of this Transpower has accelerated its resilience plan for substation site flood exposures.
- 4.141 A desktop study identified 34 substations that are susceptible to flooding with the potential for service loss risk. It has prioritised the 12 highest priority substations sites based on a risk-consequence analysis.
- 4.142 While it has identified the highest risk sites it has yet to fully carry out site specific surveys to determine the extent of flood height risk and likely damage estimates.
- 4.143 Transpower notes that each site is different and unique solutions will be required at each. Estimated costs will vary but could range from \$500,000 to \$8 million per site, perhaps more if site relocation is deemed necessary in extreme circumstances.
- 4.144 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:

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.

²¹⁸ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 53.

²¹⁹ <https://www.transpower.co.nz/news/transpower-expects-complete-bypass-flooded-substation-today>

- 4.145 Transpower anticipates that it will address the highest priority substation sites over RCP4, and that the work will continue into RCP5 and RCP6.
- 4.146 A preliminary cost benefit analysis was carried out for the 12 high priority sites indicating that seven sites have benefit cost ratios (**BCR**) 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 solution costs are uncertain, this initial BCR demonstrates that the mitigations are very likely to be cost effective.
- 4.147 While Transpower has yet to carry out site specific surveys to determine the extent of flood height risk and likely damage estimates, we consider it has made the case that expenditure is extremely likely to be required to mitigate flood exposure at high-risk sites.
- 4.148 Transpower is unsure about the extent of the expenditure it needs currently but has clearly demonstrated the prudence 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.
- 4.149 We consider that it would be unreasonable to deny Transpower funding for this programme of work now, but also a risk that we accept its preliminary funding estimate.
- 4.150 Our view is that we should 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.
- 4.151 Our draft decision is to:
- 4.151.1 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;
 - 4.151.2 approve \$23.0 million for Transpower to carry out mitigation works for flood resilience at substation sites over RCP4.

Mobile substations

- 4.152 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.²²⁰ This investment would contain the transformer, switchgear, protection and control equipment in a single mobile unit.
- 4.153 Our view is that we cannot approve this proposed expenditure as E&D expenditure due to these uncertainties. 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

- 4.154 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”.²²¹
- 4.155 Transpower 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”.
- 4.156 As an example, Transpower discuss 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 incorporated into the TransGo project procurement process.
- 4.157 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”.
- 4.158 Our view is that we cannot approve this proposed expenditure as E&D expenditure due to these uncertainties. We encourage Transpower to utilise the E&D mid-period reopener if it sufficiently matures its economic justification for this project.

Resilience UM expenditure draft decision

- 4.159 We have reviewed all resilience UM expenditure projects and programmes. We consider that a number of these projects and programmes are sufficiently well-developed that some, or all, of the expenditure meets the Capex IM evaluation criteria and can be approved now.

²²⁰ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0 (October 2023), Appendix 1 – Workstream Details, p 83-84.

²²¹ Transpower RCP4 proposal Portfolio Management Plan (PMP013) – Resilience v.2.0, Oct 2023, Appendix 1 – Workstream Details, p. 9.

- 4.160 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.
- 4.161 Our draft decision is to approve \$64.4 million of resilience UM capex and \$3.8 million of resilience UM opex.

Chapter 5 Uncertainty mechanism expenditure

Purpose

- 5.1 This chapter discusses Transpower’s proposed uncertainty mechanism (**UM**) capex and how we have considered this capex.

Background

- 5.2 In this chapter we discuss:
- 5.2.1 Transpower’s proposal and reasoning for including UM capex;
 - 5.2.2 the Verifier review of Transpower’s proposed UM capex;
 - 5.2.3 the changes we have made in the 2023 IM Review that affect our consideration of UM capex; and
 - 5.2.4 our analysis of Transpower’s proposed UM capex and our draft decision.
- 5.3 We have already considered Transpower’s proposed resilience UM expenditure in the resilience chapter and our focus is on Transpower’s proposed UIOLI funding for what it terms enabling customer capacity.
- 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 this 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 spends 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”.²²²

²²² 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:²²³
- 5.8.1 undertake specific resilience workstreams (\$126.7 million);
 - 5.8.2 enabling customer capacity by adding anticipatory capacity at connection points (\$25 million); and
 - 5.8.3 enabling 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 draft 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;²²⁴ 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.²²⁵

²²³ Transpower New Zealand Limited “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 59 section 5.3.6.

²²⁴ Commerce Commission “[Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision](#)” (13 December 2023), p 150-152.

²²⁵ Commerce Commission “[Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision](#)” (13 December 2023), p 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 it could follow the economic approach it had taken in the past in proposing resilience expenditure as base capex or major capex.²²⁶
- 5.14 We further explained that:²²⁷

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)"²²⁸; 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)".²²⁹
- 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 2023.²³⁰

²²⁶ [Upper South Island Grid Upgrade Stage 1 Aug 2012](#) and Transpower ["Regulatory Control Period Expenditure Proposal"](#) (2 December 2023) p 68.

²²⁷ Commerce Commission ["Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision"](#) (13 December 2023), p 150 para 11.47.

²²⁸ Transpower New Zealand Limited, ["Regulatory control period 4 proposal April 2025 – March 2030"](#), (21 November 2023), section 10.4, p 195.

²²⁹ Transpower New Zealand Limited, ["Regulatory control period 4 proposal April 2025 – March 2030"](#), (21 November 2023), section 10.4, p 195.

²³⁰ 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.²³¹

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.²³²
- 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 being upgraded when the RCP4 proposal was submitted to us.²³³

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 made this conclusion by testing Transpower electrification scenarios that are used as inputs into the Whakamana i Te Mauri Hiko report, last published in March 2020.²³⁴
- 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”.²³⁵

²³¹ Transpower New Zealand Limited, “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 195 section 10.4.1.

²³² Transpower New Zealand Limited, “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 196 section 10.4.2.

²³³ Transpower New Zealand Limited, “[Regulatory control period 4 proposal April 2025 – March 2030](#)”, (21 November 2023), p 196 section 10.4.2.

²³⁴ 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](#).

²³⁵ 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”.²³⁶
- 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 prudence.²³⁷

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.
- 5.28 Prior to the TPM change, the Electricity Authority (**the Authority**) described the Type 2 FMD issue as:²³⁸

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

²³⁶ GHD Advisory and Castalia, [IV Report](#), p 444-445 section 19.3.3.

²³⁷ GHD Advisory and Castalia, [IV Report](#), p 444 section 19.3.3.

²³⁸ Electricity Authority “[Transmission Pricing Methodology 2022 Decision Paper](#)” (12 April 2022), para 4.22.

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.²³⁹
- 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.²⁴⁰ 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:²⁴¹
- 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;
 - 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

²³⁹ Electricity Authority “[Transmission Pricing Methodology 2022 Decision Paper](#)” (12 April 2022), para 4.22.

²⁴⁰ Commerce Commission “[Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision](#)” (13 December 2023), p 9 para X19.

²⁴¹ Commerce Commission “[Transpower investment topic paper – Part 4 Input Methodologies Review 2023 – Final decision](#)” (13 December 2023), chapter 6, p 79-98.

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”.

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.

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.²⁴²

²⁴² <https://www.transpower.co.nz/connect-grid/connection-enquiry-information>

- 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 part 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 is 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.
- 5.46 We sought additional information from Transpower, about how upgraded early replacement connection assets are cost allocated, using an RFI.²⁴³ 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;

²⁴³ RFI002 - Replacement of NIC connection assets (14 December 2023).

- 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”.²⁴⁴
- 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 its end of its useful life (i.e. 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.
- 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 repurpose as a spare then it will be written off the remaining asset value will enter the EV account and be recovered via the residual charge component of the TPM;

²⁴⁴ RFI002 - Replacement of NIC connection assets – 14 December 2023.

- 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 UIOIL 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 On this basis our draft decision is that the proposed \$75 million electrification UIOLI fund driven by bringing forward connection asset replacements is 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.

Appendix A Submissions to Issues paper

A1 In this appendix, we summarise submitter views and our response to those submissions.

General submission views

- A2 The Consumer Advocacy Council (**CAC**) agreed with our “identification of the areas where further investigation is required, or additional information is needed from Transpower, before decisions can be made on the proposals, and determine whether the proposed increase reflects necessary spending”.²⁴⁵
- A3 Mercury agreed that the RCP4 proposal should be “consistent with an expenditure outcome that represents the efficient costs of a prudent supplier of electricity transmission services, and best promotes the long-term benefit of consumers”.²⁴⁶
- A4 The Major Electricity Users Group (**MEUG**) welcomed the proposal being supported by independent verification as it would provide “an additional level of assurance that the forecast expenditure is efficient and well justified”.²⁴⁷
- A5 MEUG also noted that Transpower had “set out a clear case for what is driving this increased expenditure: the need to meet increased demand from increased electrification of our economy, the replacement and maintenance of aging assets, the need to build greater resilience into the system, as well as input cost pressures, and growth in its workforce”.²⁴⁸

Asset management and asset health modelling

- A6 The CAC supported our intention to focus on Transpower’s asset health and the risk modelling that underpin expenditure forecasts. CAC’s view is that “Robust assessment of the state of existing assets is essential to reliably forecast when these assets need to be replaced or refurbished. We agree this is an area that warrants the commission’s attention”.²⁴⁹

²⁴⁵ [Consumer Advocacy Council “Submission on RCP4 Issues paper” \(21 February 2024\) \(CAC’s submission on Issues paper\)](#), p 1 para 5.

²⁴⁶ [Mercury “Submission on RCP4 Issues paper” \(21 February 2024\) \(Mercury’s submission on Issues paper\)](#) p 1.

²⁴⁷ [Major Electricity Users’ Group \(MEUG\) “Cross-submission on RCP4 Issues paper” \(13 March 2024\) \(MEUG’s cross-submission on Issues paper\)](#), p 3-13, para 13 and p. 5, para 21.

²⁴⁸ [MEUG’s cross-submission on Issues paper](#), p 2.

²⁴⁹ [CAC’s submission on Issues paper](#), p 2, para 7.

- A7 CAC also agreed with the view that greater scrutiny should be applied to “expenditure categories derived from less mature asset health models”.²⁵⁰
- A8 Transpower submitted on its asset management process and approach and how the proposed expenditure is to at least maintain existing levels of risk, stating that:²⁵¹
- Our risk-based approach involves assessing the health of our assets and intervening at the optimal time, rather than merely replacing assets deterministically. This approach allows us to consider the system as a whole (i.e. how enhancement and development, and customer work feed in) to identify opportunities to consolidate work and realise efficiencies.
- A9 Transpower further note that even with the proposed increase in expenditure, it was renewing a relatively small proportion of its assets, and that the average age profile of its asset base is still increasing over RCP4 compared to RCP3.²⁵²
- A10 Transpower also commented on our view that we may set additional Information Disclosure (**ID**) requirements over RCP4 that would be a continuation of the asset health and risk modelling improvement initiatives we set in our RCP3 decision. Transpower’s view is that this increases costs with no discernible benefit.²⁵³
- A11 As part of our RCP3 decision, we required Transpower to report on its asset health and risk model development process. This was in response to the RCP3 Verifier identifying asset management as a key area where Transpower could improve.
- A12 Mature asset health and risk modelling should be the foundation of a well-run infrastructure organisation, as these models indicate the level of risk the business is carrying, and the likely interventions it needs to make. These models help ensure that expenditure forecasts are more reliable, and where expenditure can be prioritised.
- A13 Transpower rightly note that the RCP4 Verifier “reviewed our analytical models and concluded that almost all our forecast expenditure is prudent and efficient”, and we consider Transpower has made significant progress in this area. We have relied on this modelling in our review of the proposal, as it underpins the forecast expenditure Transpower has proposed. In most cases, Transpower has progressed to a high level of modelling maturity.

²⁵⁰ [CAC’s submission on Issues paper](#), p. 2, para 8

²⁵¹ [Transpower “Submission on RCP4 Issues paper” \(21 February 2024\) \(Transpower’s submission on Issues paper\)](#), p. 3, para 4.

²⁵² [Transpower’s submission on Issues paper](#), p. 6, para 6.

²⁵³ [Transpower’s submission on Issues paper](#), p. 10-11, para 51-54.

- A14 However, the RCP3 Expert Opinion report noted that there were areas of potential improvement. As part of our discussion on RCP4 deliverability, we explore the possibility of requiring additional ID requirements on Transpower.
- A15 We consider Transpower should continue with this progress, and we propose seeking reporting on this in our RCP4 Annual Delivery Report (**ADR**). This reporting will include asset health and risk model development, in line with the RCP3 Expert Opinion report, and how models are being actively calibrated using replaced asset condition information, and asset outage data.

Resilience

- A16 MEUG submitted that it supports Transpower's proposed expenditure to address resilience issues, noting the scale of the expenditure increase when compared to RCP3, further stating that we should focus our attention "on the proposed expenditure in this category, and look at how this type of work was previously considered in RCP3".²⁵⁴
- A17 Vector's submission focused on the use of UIOLI allowances to address resilience issues, stating that these were "an appropriate mechanism to manage resilience expenditure".²⁵⁵
- A18 Vector considers UIOLI allowances have an advantage over reopeners as they provide "suppliers and consumers greater certainty that funding for resiliency investment", and if these are made available to Transpower, they should be available to EDBs.²⁵⁶
- A19 In its RCP4 draft proposal consultation process, Transpower received extensive feedback of its renewed focus on resilience after an RCP3 proposal that did not address major event exposure issues. Meridian noted that it expected Transpower should take a "risk-based assessment" approach that "should inform the priorities for proactive investment in resilience. The assessment should consider the likelihood and severity of potential impacts (in terms of hazard risk and consumer impact if the asset is not available)".²⁵⁷

²⁵⁴ [MEUG's submission on Issues paper](#), p 4, para 18.

²⁵⁵ [Vector "Submission on RCP4 Issues paper" \(21 February 2024\) \(Vector's submission on Issues paper\)](#), p. 2, para 15.

²⁵⁶ [Vector's cross-submission on Issues paper](#), p. 2, para 16-17.

²⁵⁷ Meridian, RCP4 and Grid Service Measures consultations (3 November 2022) p 5, available at <https://www.transpower.co.nz/our-work/industry/regulation/rcp4/consultation-our-draft-rcp4-proposal>

- A20 As we noted in our 2023 IM Review Transpower investment topic paper, we considered Transpower needed to take a “pro-active resilience investment approach, and that this approach should be underpinned by sound economic analysis to identify the high-impact, low-probability (**HILP**) exposures on the grid”.²⁵⁸
- A21 We have carried out a detailed analysis of Transpower’s proposed resilience expenditure, including resilience projects and programmes, that it had proposed under the UIOLI funding approach. This analysis is set out in Chapter 4 and demonstrates that Transpower has significantly advanced how it addresses resilience issues, and how it justifies expenditure.

Other matters

- A22 New Zealand Aluminium Smelters (**NZAS**) noted that it “the industry would take more comfort in Transpower’s cost projections, in the absence of other transmission investors in the NZ market, through comprehensive cost benchmarking with transmission owners in other jurisdictions such as Australia”.²⁵⁹
- A23 In its cross submission Transpower noted that the RCP4 Verifier had carried out cost benchmarking when it reviewed the draft proposal.²⁶⁰
- A24 Vector noted that “caution should be exercised comparing expenditure between jurisdictions given differences in operating environment” and that the Commerce Act prohibits the Commission from “using comparative benchmarking on efficiency in order to set starting prices, rates of change, quality standards, or incentives to improve quality of supply”.²⁶¹
- A25 In our review of the proposal capex forecast, we note where the Verifier has compared Transpower’s proposed asset unit costs against historical data, supplier quotations, and international peer information, particularly Australian Transmission Network Service Providers (**TNSPs**) and Distribution Network Service Providers (**DNSPs**) asset cost data.

²⁵⁸ [Input Methodology Review Final decision Transpower investment topic paper \(13 December 2023\) \(IM review\)](#), p 47-48, para 3.144-3.149.

²⁵⁹ [NZAS’s submission on Issues paper](#), p 3.

²⁶⁰ [Transpower’s cross-submission on Issues paper](#), p 3.

²⁶¹ [Vector’s cross-submission on Issues paper](#), p 3, para 12.

- A26 NZAS also commented on the “shift towards anticipatory investment to support the transition to an electrified electricity sector” and that “Transpower should have a clear set of gating criteria, and prioritisation, to provide industry with confidence that this investment will be appropriately selected, sequenced, utilised and not stranded, and ultimately becoming a cost that grid users bear”.²⁶²
- A27 In our 2023 IM Review decision we made significant changes to the Capex IM to ensure that Transpower can economically justify, and cost recover, expenditure for different levels of anticipatory connection asset (**ACA**) capacity investment. This change was in response to Transmission Pricing Methodology changes to resolve the type 2 first mover disadvantage issue.²⁶³
- A28 We received one submission on Transpower’s proposal to include what it terms Use-It-Or-Lose-It funds for projects and programmes that are less certain of or are not sufficiently developed at the time it makes a proposal.
- A29 The ENA suggested a UIOLI funding approach could be used to address deliverability concerns in conjunction with “delivery reporting that strikes the balance between providing useful information for interested parties and increasing Transpower’s already heavy regulatory burden”.²⁶⁴
- A30 We note that there was considerable support for UIOLI funds in response to Transpower’s draft proposal consultation in October 2022.²⁶⁵
- A31 We considered making an IM change to include additional uncertainty mechanisms to allow UIOLI funds in our 2023 IM Review decision, particularly for ACA capacity and resilience investments. We addressed both issues with IM changes.

²⁶² [NZAS’s submission on Issues paper](#), p. 3.

²⁶³ [Transpower Capital Expenditure Input Methodology \(IM Review 2023\) Amendment Determination 2023 \[2023\] NZCC 39](#), (13 December 2023), c 6 p. 79-98.

²⁶⁴ [ENA’s submission on Issues paper](#), p. 2.

²⁶⁵ <https://www.transpower.co.nz/our-work/industry/regulation/rcp4/consultation-our-draft-rcp4-proposal>