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Public version

Assessing Transpower's Bunnythorpe-Haywards Lines A and B major capex proposal

Draft decision and reasons paper

Date: 27 March 2014

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Executive Summary

X1 This paper seeks your views on our draft decision to approve Transpower New Zealand Limited's major capex proposal to re-conductor and upgrade the capacity of transmission lines A and B between Transpower's Bunnythorpe substation near Palmerston North and Haywards substation in Wellington.

X2 The paper sets out the reasons for our draft decision.

X3 Submissions on our draft decision are due by 5:00 pm on 16 April 2014. Cross submissions are due by 5:00 pm on 28 April 2014. We expect to publish our decision on the proposal by 9 May 2014.

The major capex proposal

X4 Transpower New Zealand Limited has submitted a major capex proposal seeking approval for funding to increase the capacity of its transmission lines A and B between Bunnythorpe and Haywards substations.

X4.1 Transpower is under taking this investment because it needs to replace the conductors (wires) on these two transmission lines due to the poor condition of the conductors.

X4.2 Transpower has determined that it is economical to replace the conductors with larger ones and proposes to use this opportunity to do so. The larger conductors will increase the capacity of the lines.

X5 The Commerce Commission must approve this major capex project before Transpower New Zealand Limited is able to recover the capital expenditure for its investment. This requirement is set out in the *Transpower Capital Expenditure Input Methodology Determination [2012] NZCC 2.*

Our draft decision

X6 Our draft decision is to approve Transpower's proposal. We are satisfied that, on the balance, Transpower's proposal meets the evaluation criteria set out in the *Transpower Capital Expenditure Input Methodology Determination [2012] NZCC 2*. In particular, the benefits of upgrading the lines far outweigh the costs, and Transpower's preferred investment option is thought to provide the highest net benefits. In approving this proposal, we are allowing Transpower to recover up to $161 million in 2020 prices for the investment. Transpower estimates that once completed, this project will add about 0.041 cents per unit to the consumers' bills.

X7 Transpower plans to start construction in summer of 2014/15 and complete the project by 2020.

1. Introduction

Purpose of this paper

1.1 This paper explains our draft decision to approve a proposal for major capital expenditure by Transpower New Zealand Limited (Transpower). Transpower seeks our approval to recover the costs of an investment of up to $161 million to upgrade two of its transmission lines between Bunnythorpe and Haywards substations.

1.2 We invite you to provide your views on our draft decision. By providing your views, you will help inform our decision on this proposal. Table 1.1 below sets out the timeframes for submissions and cross submissions and our expected date of decision. Details of how to provide your views are outlined in paragraph 1.22 below.

Why Transpower needs our approval to amend the outputs for the project

1.3 Transpower must seek our approval to recover the costs for major capital investments it undertakes. Major capital investments are those to enhance or develop the transmission grid and that have an expected cost greater than $5 million and are for new investments or asset upgrades, rather than asset replacements.[1,2]

1.4 Transpower's proposed investment exceeds the $5 million threshold, and the proposed investment is to upgrade the existing lines between Bunnythorpe and Haywards substations. The investment meets the criteria for individual approval of the proposal.

The regulation that currently applies to Transpower

1.5 The price and quality of the service that Transpower supplies to consumers is regulated under Part 4 of the Commerce Act 1986 (Act). The Commerce Commission (Commission) is responsible for regulating Transpower under the Act.

1.6 This service that Transpower provides is the transport of electricity through the national grid.[3] The national grid connects large generators of electricity to large electricity consumers and electricity distribution businesses, who then connect to smaller electricity consumers.

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1 Capital investments that do not meet these criteria are not individually approved. We set Transpower an allowance for this work at the start of each regulatory period. From the next regulatory period, starting on 1 April 2015, the threshold for projects that will require individual approval will increase to $20 million.

2 Commerce Commission, "*Re Transpower Capital Expenditure Input Methodology [2012] NZCC 2"*. Capex IM, clause 1.1.5, definition of major capital expenditure; page 12.

3 The national grid is also called the Transmission network.

1.7 The rules relating to Transpower's major capital investments are explicitly addressed in the Transpower Capital Expenditure Input Methodology Determination (Capex IM).[4]

1.8 The Capex IM requires Transpower to seek approval for major capital projects in the national grid, and to deliver these projects to a set of approved components to recover the full cost of its major capital investments from consumers.[5]

1.9 When seeking approval, Transpower must outline its proposed investment, justification for the investment, the options Transpower has considered, the costs and benefits of the investment options, and demonstrate that its proposal meets all the requirements set out in the Capex IM.[6]

1.10 Transpower may submit major capex proposals (MCPs) for major capital investments in the transmission network at any time during a regulatory period.[7]

Transpower's major capex proposal

1.11 On 8 November 2013, Transpower submitted a proposal seeking approval for funding to upgrade two of the 220 kV transmission lines between Transpower's Haywards substation north of Wellington and Bunnythorpe substation north of Palmerston North (Proposal).[8] Figure 1.1 shows these two substations and the route of the two lines.

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4 Commerce Commission *Transpower Capital Expenditure Input Methodology Determination* [2012] NZCC 2, 31 January 2012. Henceforth this document will be footnoted as "Capex IM".

5 Capex IM, clause 3.3.3(1). Transpower could face penalties if it does not deliver the approved outputs.

6 The information we require is set out in Schedule G of the Capex IM.

7 Capex IM, clause 3.3.2(3).

8 Transpower, "*Bunnythorpe Haywards Conductor Replacement Major Capex Proposal*", November 2013. Transpower proposal and supporting documents are available on our website http://www.comcom.govt.nz/regulated-industries/electricity/electricity-transmission/transpower-major-capital-proposal/bunnythorpe-haywards-a-and-b-lines-conductor-replacement-investment-proposal/.

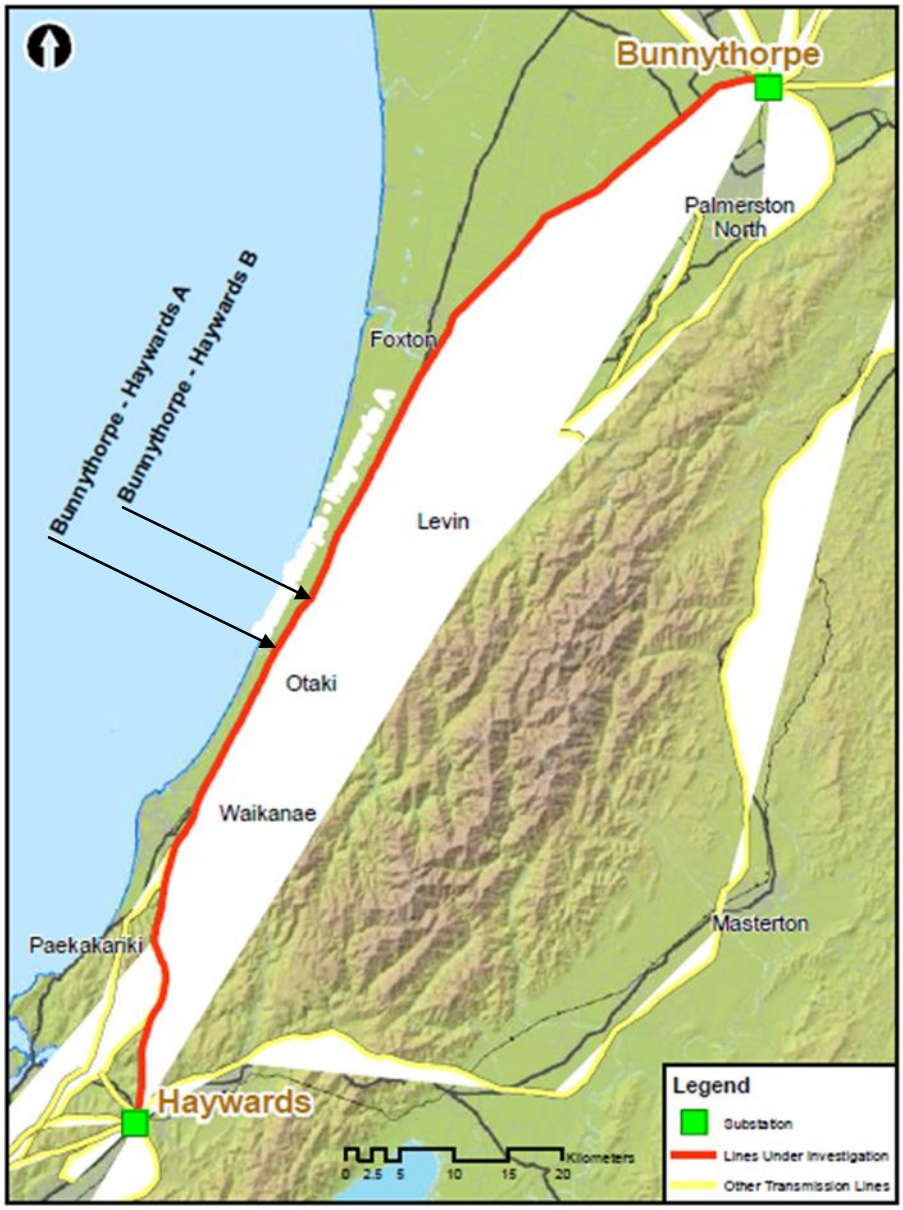

Figure 1.1 Bunnythorpe-Haywards A and B line route

1.12 The main features of the proposal are set out below.

1.12.1 Transpower will replace the existing conductors (wires) of these lines, which are in poor condition, with larger ones. The larger conductors, known as Zebra, are the current standard conductor Transpower uses for these types of transmission lines.[9]

1.12.2 Transpower seeks approval for funding of up to $161 million (2020 prices) to complete the project.[10] The larger conductors will increase the maximum capacity of these lines to about 112% of the current capacity providing up to 33 MVA of additional capacity.[11]

1.12.3 The estimated additional capital cost of increasing the capacity is $10.5 million in 2013 prices.[12]

1.12.4 Retaining and upgrading these lines will provide an expected electricity market benefit of over $1,000 million in 2013 prices.[13]

1.12.5 Transpower estimates that this project will increase the interconnection charge rate by 2.8% and add 0.041 cents per unit to the consumers' bills.[14]

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9 This type of conductor is known as Zebra. Overhead line conductors (wires) are often named after animals, birds, elements etc. The name represents attributes of the conductors such as the material used, its physical size, and type of construction. The conductor type is often followed by a reference to a temperature such as 80^{o}C. The temperature indicates the maximum temperature that the conductor can be operated at without violating the ground to conductor clearance requirements.

10 Transpower New Zealand Limited, "*Bunnythorpe Haywards Conductor Replacement Major Capex Proposal",* November 2013, page 3. For the remainder of this paper, Transpower's Proposal is footnoted as Transpower, *"Proposal"* and all Attachments to the Proposal are footnoted as Transpower, "*Proposal Attachment [X]"* etc.

11 Transpower, "*Proposal Attachment C",* Table 2-2 page 5.

Transmission lines have different ratings depending on the ambient temperature. After the upgrade, the summer/winter rating of these lines will increase from 319/348 MVA to 354/390 MVA.

12 Transpower, *"Proposal",* Table 4-1 page 13.

13 Transpower, "*Proposal",* Table 4-2 page 13.

14 Transpower, "*Proposal",* Table 7-2 page 23.

1.13 Transpower considered the following alternatives in developing its Proposal:

1.13.1 Dismantle the lines;

1.13.2 Replace with the similar conductor (Goat at 80°C). This option is more expensive than the modern equivalent option;

1.13.3 Replace with Transpower's current standard conductor but retain equivalent capacity (Zebra at 65 °C). This is the modern equivalent option;

1.13.4 Replace with Transpower's current standard conductor and increase capacity to the most economical level for this line design (Zebra at 75 °C); and

1.13.5 Replace with Transpower's current standard conductor and increase capacity to a higher level for this line design (Zebra at 85 °C).

1.14 Transpower's analysis sets out that the proposed investment, Zebra at 75 °C, provides the highest net electricity market benefits, after taking all relevant and required factors into account.

1.15 Transpower's Proposal and supporting attachments are available on our web site.[15] In response to our requests, Transpower has also supplied additional information to assist our evaluation. A list of the documents provided by Transpower is included in Attachment E of this paper.

We can only approve or reject the proposed investment

1.16 In accordance with the Capex IM, we can either approve or reject Transpower's Proposal. We cannot change any of the components that Transpower has proposed. Our decision to approve or reject the Proposal is based on an evaluation against the requirements of the Capex IM.[16] We can approve the Proposal if we are satisfied that the Proposal meets the criteria for approval set out in the Capex IM.

1.17 Our evaluation of the Proposal against the required criteria is summarised in Chapter 3, with further details provided in Attachments C, D and E.

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15 http://www.comcom.govt.nz/regulated-industries/electricity/electricity-transmission/transpower-major-capital-proposal/bunnythorpe-haywards-a-and-b-lines-conductor-replacement-investment-proposal/.

16 Capex IM, clause 3.3.3(1).

Why we want your views

1.18 Before approving the Proposal, we are required to consult with interested persons and consider their views on our draft decision.[17]

1.19 Before making our decision, we seek your views on:

1.19.1 Transpower's proposed investment;

1.19.2 our draft decision, in particular our evaluation of Transpower's Proposal and the matters of interest that we have identified; and

1.19.3 whether there is any further information that we should consider before making our decision.

1.20 We will take account of all submissions and cross submissions in reaching our decision.

1.21 The timeframes for you to provide your submissions, and our expected decision, are set out in Table 1.1.

Table 1.1 Dates for responses and process from here

Date	Event
16 April 2014	Submissions due on this paper
28 April 2014	Cross submissions due
9 May 2014	Expected decision

1.22 Submissions should be sent by email to regulation.branch@comcom.govt.nz. Please title your submission '[your organisations name] submission on Bunnythorpe - Haywards Lines A and B investment proposal.'

1.23 We will publish all submissions on our website. Please provide your submissions in a form that readily enables us to do this, and allows us to copy and paste submissions for our analysis.

1.24 If your submission or cross-submission does not appear on our website, please contact us as soon as possible.

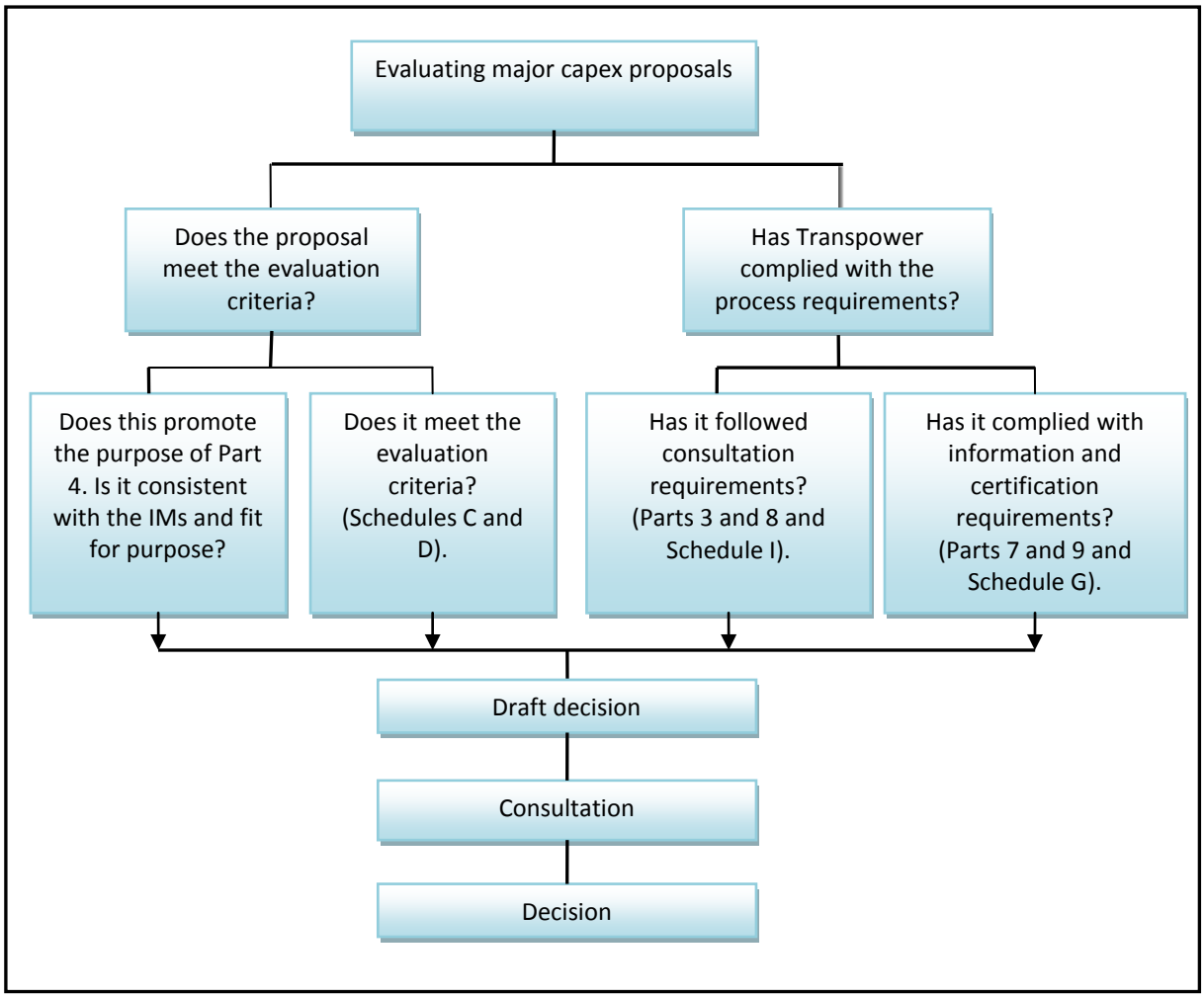
[17] Capex IM, clause 8.1.1(3).

2. Our draft decision and components of the project

Our draft decision is to approve the proposed investment

2.1 Our draft decision is to approve the proposed investment contained in the Proposal. We are satisfied that Transpower's Proposal meets the criteria for approving this major capex project. Figure 2.1 shows the framework for our evaluation, and the process set by the Capex IM.

Figure 2.1 Processes for assessing major capex proposals



2.2 In approving the Proposal the following components proposed by Transpower apply.

2.2.1 The P50 estimate of costs.

2.2.2 The major capex allowance (based on the P90 estimate of costs).

2.2.3 The major capex project outputs.

2.2.4 The approval expiry date.

2.2.5 The commissioning date assumption.[18]

The components of the project we intend to approve

P50 estimate of cost

2.3 The P50 is the estimated cost of the project, where the probability that the actual cost will not exceed this figure is 50%. The P50 is $151 million (in 2020 prices).

2.4 The P50 is used in the investment test to determine the investment option with the highest net electricity market benefits.

2.5 Figure 2.1 below summarises Transpower's cost estimates for the proposed investment and investment options.[19]

Major capex allowance

2.6 The major capex allowance (MCA) for the project is $161 million in 2020 dollars; this is the maximum amount that Transpower can recover from consumers.[20] Transpower can only recover actual costs incurred for the project up to this value. Any amount Transpower spends above the MCA is at Transpower's risk. Transpower proposed an MCA based on the P90 estimate of cost.[21] The MCA includes the P90 estimates of uncertainties in the scope of the project and rate of inflation between the approval and project end dates.

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18 These components are defined in the Attachment A of this paper.

19 Transpower New Zealand Limited, "*BPE HAY MCP Data File - MCA Final.Xlxs", 12* November 2013.

20 Transpower may ask the Commission to amend the MCA, if actual efficient cost of the project exceeds the MCA. Capex IM, clause 3.3.4.

21 P90 uncertainties reflect Transpower's estimate that there is a 90% chance scope uncertainties will be below this value.

2.7 Table 2.1 also shows the breakdown of the MCA Transpower is seeking.[22]

Table 2.1 A breakdown of the P50 cost and MCA for the project

Cost component	P50 costs ($million)	P90 costs and MCA ($million)	Description
Base cost in 2013 prices.	127.8	127.8	Engineering cost estimate based on the scope of works that Transpower identified during investigations.
Estimated cost in 2013 prices.	134.6	144.0	Includes Transpower's estimated 50 and 90 percentiles uncertainties in scope respectively.
Estimated cost inflated to 2020 prices.	146.6	156.3	Estimated cost adjusted by 50 and 90 percentile assumed rate of inflation.
Cost including interest in 2020 prices.	151.0	161.0	This includes interest during construction. The P90 estimated cost is the MCA.

Major capex project outputs

2.8 The major capex project outputs are specific items to be delivered by the project. Transpower is subject to penalties under the Capex IM if it does not deliver the major capex project outputs. The major capex project outputs are set out below.

2.8.1 Procuring, installing and commissioning Zebra ACSR conductor on the Bunnythorpe – Haywards A and B lines and decommissioning the existing conductor.

2.8.2 Works on the foundations and towers to enable the Zebra conductor to be operated at 75^{o}C.

2.8.3 Procuring, constructing and commissioning substation facilities to facilitate the above connections and equipment.

2.8.4 Obtaining property rights and environmental approvals required for these works.

2.8.5 Installing alternative conductor technologies on a short section to evaluate its performance in coastal climatic conditions.[23]

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22 Transpower New Zealand Limited, "*BPE_HAY MCP data File, MCA Final",* 12 November 2013 and replicated in Transpower, *"Proposal"*, page 23, Table 7-1.

23 Transpower, *"Proposal"*, page 6.

Approval expiry date

2.9 The approval expiry date is the last working day of 2025.[24]

2.10 The approval expiry date is the date past which Transpower cannot recover costs from consumers for any work not commissioned by this date; unless Transpower obtains the Commission's approval to amend the expiry date.[25]

Commissioning date assumption

2.11 Transpower plans to replace the last sections of the conductor by December 2020.[26]

2.12 The commissioning date assumption is the date when Transpower assumes that the last asset of the project will start to be in use. Transpower plans to implement the project from Summer 2014 to Summer 2020. Transpower will commission the completed sections of the lines as it returns the lines to service at the end of each construction period.

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24 Transpower, "*Proposal Attachment A"*, page 7.

25 Capex IM, clause 3.3.4.

26 Transpower, "*Proposal Attachment A"*, page 26. Transpower states Q4 in the calendar year.

3. Reasons for our decision

3.1 In this chapter we summarise the reasons for our draft decision to approve Transpower's Proposal, summarise some of our concerns with the Proposal and recommend actions for improvements for future projects.

3.2 In assessing this Proposal, we evaluated:

3.2.1 the extent that the proposed investment promotes the purpose of Part 4 of the Act;[27]

3.2.2 whether the proposed investment satisfies the investment test set out in Schedule D of the Capex IM;[28]

3.2.3 whether the Proposal meets the evaluation criteria set out in Schedule C of the Capex IM;[29]

3.2.4 whether the data, analysis and assumptions underpinning the Proposal is fit for purpose of the Commission exercising its powers under Part 4 of the Act;[30]

3.2.5 whether the Proposal is consistent with the Input Methodologies that apply to Transpower;[31] and

3.2.6 whether the Proposal meets the consultation, information and certification requirements.[32]

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27 Capex IM, clause 6.1.1(2)(b).

28 Capex IM, clause C1(2)(c).

29 Capex IM, clause C1(2)(a).

30 Capex IM, clause 6.1.1(2)(c).

31 Capex IM, clause 6.1.1(2)(a).

32 Capex IM, Schedules I, G and Part 9 respectively.

We considered the Proposal in two parts

3.3 We considered the Proposal in two parts.

3.3.1 The first part was to establish whether Transpower should keep these lines or dismantle them. Transpower's analysis shows that keeping the lines provide $977.4 million of benefits to the electricity market in 2013 prices.[33] Therefore we are satisfied with Transpower's decision to keep the lines. In keeping these lines, Transpower's base case is to reconductor the line to Zebra at 65°C.

3.3.2 The second part concerns Transpower's decision to take advantage of this work to upgrade the capacity of these lines. Transpower has considered two upgrade options – Zebra at 75°C and Zebra at 85°C. Table 3.1 shows the relative increase in capacity, increase in HVDC south transfer, market costs and the expected net electricity market benefits for the two Zebra options compared with the proposed investment.

Table 3.1 Relative capacity, expected costs and benefits of the Zebra investment options

Investment options	Relative change in capacity (Summer/winter MVA)[34]	Relative change in HVDC south transfer (Summer/winter MVA)[35]	Relative expected capital costs ($million in 2013 prices)[36]	Relative expected gross electricity market benefits (PV $million in 2013 prices)[37]
Zebra at 65°C	-38/-33	-88/-111	-10.5	-11.4
Zebra at 75°C[38]	0/0	0/0	0	0
Zebra at 85°C	29/33	72/88	9.3	2.7

3.4 In summary, Transpower's proposal shows, and we agree, that the proposed investment, Zebra at 75°C, provides a good balance between increases in capacity, capital costs and expected net electricity market benefits.

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33 Transpower, "*Proposal",* page 13, Table 4-2.

34 Calculated from Transpower, "*Proposal Attachment C"*, page 5, Table 2-2.

35 Calculated from Transpower, "*Proposal Attachment D",* page 12, Table 5-1.

36 Calculated from Transpower, "*Proposal Attachment E",* page 8, Table 3-1.

37 Calculated from Transpower, "*Proposal Attachment E",* page 9, Table 3-2.

38 Zebra at 75°C is Transpower's proposed investment and the base case in this table.

The Proposal promotes the purpose of Part 4 of the Act

3.5 We consider that Transpower's proposed investment will promote the purpose of Part 4 of the Act, and as such is in the long term interest of consumers.

3.5.1 In particular, upgrading the Bunnythorpe-Haywards Lines A and B provides significant benefit to the electricity market. The preferred option provides approximately $24.2 million in net market benefits relative to the option of replacing with the modern equivalent or like for like. Transpower estimates the present value of the net electricity market benefits of the upgraded lines as $854 million in 2013 prices.[39]

3.5.2 Transpower's proposed investment also reflects an appropriate trade-off between risk and cost. For future proposals, however, we recommend Transpower provide developed consideration of any risk-cost trade-off.[40]

The Proposal satisfies the investment test

3.6 In order for us to approve Transpower's proposed investment, it must first satisfy the investment test set out in Schedule D of the Capex IM. To satisfy the investment test, the proposed investments must have the highest expected net electricity market benefit of all investment options and be sufficiently robust under sensitivity analysis.[41]

3.7 We are satisfied that Transpower has shown that the proposed investment has the highest net electricity market benefits. The expected electricity market benefit of the proposed investment is more than six times the cost.[42]

3.8 Table 3.2 shows the expected benefits and cost of the investment options and the proposed investment.

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39 *Transpower's Proposal*, Table 4-2, p.11.

40 We discuss this in paragraph 3.27.

41 Capex IM, clause D1(1).

42 We discuss our evaluation of the investment test in Attachment C.

Table 3.2 Summary of electricity market costs and benefits (PV $million in 2013 prices)

Proposed investment and investment options	Expected electricity market benefit[43]	Expected market costs[44]	Expected net electricity market benefit[45]
Goat at 80°C	977.4	147.2	830.2
Zebra at 65°C	993.3	142.7	850.6
Zebra at 75°C	1004.7	150.3	854.4
Zebra at 85°C	1007.4	156.9	850.5

3.9 As shown in Table 3.2, the quantifiable expected net electricity market benefits of the three Zebra conductor options are very similar. Where two or more investment options have similar quantifiable expected net electricity market benefits, the rules allow Transpower to also consider the unquantifiable benefits of the investment options when selecting the proposed investment.[46] In this case, Transpower has considered both quantifiable and unquantifiable benefits.

3.10 We note that more than 97% of the electricity market benefits are due to Transpower keeping the lines. That is, for the proposed investment, the total present value of benefits is $1004.7 million, of which $977.4 million is the benefit of keeping the lines in 2013 prices. The remaining $27.3 million of gross benefits are due to a reduction in transmission losses due to larger conductor size, and savings in the cost of generation dispatch due to the increase in capacity. Transpower refers to the latter two sources of benefits as the 'system benefits'.

3.11 Taking all relevant matters into account, we are satisfied that the proposed investment is the investment with the highest expected net electricity market benefits.

3.12 We consider that the proposed investment is sufficiently robust under sensitivity analysis. We have analysed the parameters used by Transpower in its sensitivity analysis of the investment test. We are satisfied that the variables and ranges it has used are reasonable. We are also satisfied, based on these inputs, that the outputs of the sensitivity analysis are reasonable. While the results show some changes in the ranking of the investment options, we consider that the proposed investment is, on balance, sufficiently robust.[47] Transpower also stated that the Zebra at 75°C

43 Transpower, *"Proposal Attachment C"*, page 10.

44 Transpower, *"Proposal Attachment E"*, page 19.

45 Transpower, *"Proposal Attachment E"*, page 9.

46 Capex IM, clause D1(1)(c).

47 We discuss the results of our analysis in Attachment C of this paper.

provides a good balance between the level of works required on the lines, electricity efficiency of the solution and future options.[48]

The Proposal meets the major capex proposal evaluation criteria

3.13 We consider that the Proposal meets the MCP evaluation criteria set out in Schedule C of the Capex IM. We are required to evaluate the against these criteria before we reach our decision.[49] Schedule C requires us to evaluate:

3.13.1 the MCA;

3.13.2 the major capex project outputs;

3.13.3 the approval expiry date;

3.13.4 the P50 cost estimate of the project; and

3.13.5 the commissioning and completion date of the investment option.

3.14 We also need to evaluate whether the proposed investment and investment options:

3.14.1 reflect good electricity industry practice;

3.14.2 are technically feasible;

3.14.3 can be integrated into the system and market operations; and

3.14.4 can be reasonably constructed within the estimated timeframes for construction and obtaining all statutory approvals, property rights and access.

3.15 We discuss our evaluation of the proposal against these criteria in Attachment C of this paper.

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48 Transpower, "*Proposal*", page 16.

49 Capex IM, clause 6.1.1(4).

Data, analysis and assumptions in the Proposal are fit for purpose

3.16 We are satisfied that the data, analysis and assumptions provided by Transpower are fit for the purpose. We are required to consider the data, analysis and assumptions provided by Transpower in making our decision.[50] We have relied on this information in making our draft decision.[51]

3.17 In addition to the information Transpower included in its Proposal, it also provided clarifications and additional information to support its Proposal. Attachment E of this paper lists the supplementary information that Transpower provided.

3.18 Much of the information Transpower provided was to clarify its Proposal to upgrade the Bunnythorpe-Haywards Lines A and B to the current transmission line design standard. We needed to be satisfied that strengthening the line to Transpower's current transmission line design standards reflects good electricity industry practice and that the additional cost of the strengthening can be justified.[52]

3.19 While this took an extended period of time to resolve, we are satisfied that Transpower has demonstrated that its proposal to upgrade is consistent with practices by electricity transmission network operators in Australia, United Kingdom, and France.[53]

The Proposal is consistent with Input Methodologies

3.20 We are required to consider the consistency of the proposal with the relevant Input Methodologies in making our decision.[54] In analysing the Proposal we have not seen any evidence that it is inconsistent with the Transpower Input Methodology[55] or the Capex IM.

The Proposal meets consultation, information and certification requirements

3.21 We consider that Transpower has met the consultation, information and certification requirements of the Capex IM.[56]

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50 Capex IM, clause 6.1.1(2)(c).

51 Paragraph E2 of this paper.

52 The cost of upgrading to current design standards and rectifying some of the design defects is about $20 million.

53 Transpower New Zealand Limited, "*Bunnythorpe -Haywards Conductor replacement Major Capex Proposal Clarification",* February 2014, page 3.

54 Capex IM, clause 6.1.1(2)(a).

55 Commerce Commission, *Transpower (Input Methodologies) Determination [2012] NZCC 17, 29 June 2012.*

56 We discuss this in Attachment D of this paper.

Our concerns with the proposal

3.22 While we are satisfied that the Proposal meets the relevant criteria in the Capex IM, our analysis of the Proposal has raised some concerns. We consider it prudent to highlight these concerns alongside certain (non-binding) recommendations that relate to them.

3.23 The Capex IM recognises the difference in expertise and role between us as the economic regulator and Transpower as the grid planner, owner and operator. As such, our role is to analyse Transpower's Proposal against the relevant criteria in the Capex IM, determine whether what is proposed meets the criteria, and, as an overarching consideration, the extent to which what is proposed will promote the purpose of Part 4 of the Act (and thus be in the long term interest of consumers).

3.24 We cannot alter any individual components in Transpower's proposal, and have to make our decision in relation to the proposal as a whole. It is Transpower's role as the grid planner, owner and operator to determine the operational details of each proposed investment.

3.25 In light of the above, we have identified some areas of concern.

- 3.25.1 The trade-off between costs and event risks.
- 3.25.2 Allowance for uncertainty in scope.
- 3.25.3 The demand forecast used for this Proposal is higher than the current forecast.
- 3.25.4 The assumptions used to prepare the cost estimates.

3.26 We also consider that, in light of these concerns, it is useful to provide a series of suggestions for Transpower to improve outcomes for this project and future MCPs. These include:

- 3.26.1 monitoring project scope, foundation costs and construction strategies;
- 3.26.2 refining other similar projects to take account of learnings on this project; and
- 3.26.3 refining design inputs by calibrating models.

The trade-off between costs and event risks

3.27 Transpower does not appear to have considered the trade-off between costs and event risks when applying its transmission line design standard to existing lines. We note that Transpower initially proposed to upgrade the lines to its highest level of criticality and later downgraded it to a lower wind loading level.[57]

3.28 We recommend that Transpower adequately consider the relevant cost-risk trade-offs when setting the design standard for future projects. Transpower's consultant, Sinclair Knights Merz, also recommended that Transpower undertake worked examples for different wind regions and types of structures to gain further insights into the impact of its revised design standard:[58]

> It is noted that no worked examples is included on Appendix L of TP 2011, as it was in TP2002. We recommend that worked examples should be undertaken for different wind regions in NZ and types of structures as these would provide further insights as to the practical differences between the codes.

Allowance for uncertainty in scope

3.29 The uncertainty in scope for a P50 estimate of costs is 5%, and for the P90 estimate of costs is 13%. We expected a higher level of uncertainty in scope at this stage of the project. Transpower has clarified that one of the reasons for the low level of uncertainty in scope is because it has included some uncertainty in the base estimate.[59]

3.30 We are satisfied that, for this Proposal, Transpower's treatment of uncertainties does not affect the ranking of the investment options. Table 3.3 below shows the results of sensitivity studies on cost.[60] Zebra at 75°C remains the option with the highest relative expected net electricity market benefits for up to a 20% increase and decrease in project costs.

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57 Transpower New Zealand Limited, "*Bunnythorpe -Haywards Conductor replacement Major Capex Proposal Clarification", February 2014*, pages 1 and 3.

58 Sinclair Knights Merz, "*Review of TP.DL 12.01*", page 5.

59 Transpower New Zealand Limited, "*Bunnythorpe - Haywards Conductor Replacement – Major Capex Proposal Response to Commission Questions issued 27 November 2013*" page 7.

60 Transpower, "*Proposal Attachment E",* page 13, Table 3-8.

Table 3.3 Sensitivity of relative expected net electricity market benefits to project costs

Cost sensitivity	Zebra at 65°C	Zebra at 75°C	Zebra at 85°C
P50 cost	20.4	**24.2**	20.2
120% of P50	21.4	**23.6**	18.2
80% of P50	19.4	**24.8**[61]	22.3

Note: Sensitivity measured relative to Goat at 80°C option.

3.31 In some MCPs, the manner in which uncertainties are treated can affect the ranking of the investment options. We highlight that the Commission must be satisfied with a proposed investment in whole and in part in order to approve it.[62] It is strongly recommended that, in future cost estimates, Transpower clearly distinguishes between the cost based on identified scope and the corresponding level of uncertainty in scope to determine the P50 and P90 estimates of costs.

The demand forecast used for this Proposal is higher than the current forecast

3.32 Transpower prepared this proposal using a forecast of growth in energy demand that is higher than the draft forecasts by Transpower and Ministry of Business, Innovation and Employment (MBIE). Since the demand forecasts Transpower used were the latest at that time and MBIE's forecast is a draft, we are satisfied that Transpower acted within the rules.

3.33 However, Transpower's sensitivity analysis shows that the upgrade options are sensitive to demand. For a lower demand forecast, the Zebra at 65°C investment option has the highest expected net electricity market benefits as shown in Table 3.4 below.[63]

Table 3.4 Sensitivity of relative expected net electricity market benefits to demand

Demand sensitivity	Zebra at 65°C	Zebra at 75°C	Zebra at 85°C
Base demand	20.4	**24.2**	20.2
High demand	25.3	**34.4**	30.4
Low demand	**17.1**	14.0	7.8

Note: Sensitivity measured relative to Goat at 80°C option.

61 The numbers in **bold** are the ones with the highest expected net electricity market benefits in their respective sensitivity tests.

62 Capex IM, clause C1(2)(b).

63 Transpower, *Proposal Attachment E,* page 13, Table 3-8.

3.34 Because the proposed investment is sensitive to demand, we recommend that, throughout the construction period, Transpower regularly reviews the suitability of the investment option against any changes in the forecast demand. This should be done to ensure that the investment continues to provide the highest benefits, taking into account long term projections in demand. This approach could result in sections of the line being built to different capacities, but would provide a more efficient investment.

Recommendations to actively monitor cost, scope and outcomes

3.35 We expect Transpower to follow good electrical industry practice throughout this project. Transpower should be able to demonstrate recognised project management disciplines are in place and effectively used. This includes staged approvals at appropriate intervals, internal challenges and independent external review of decisions and processes. Where Transpower makes material decisions affecting the project, robust cost benefit analysis in support of these decisions should be available as evidence.

3.36 We recommend that Transpower undertakes a review after completing phase one of the project to assess the accuracy of its estimates. In particular, we recommend that the review considers:

3.36.1 Foundation strengthening costs - we consider that the unit cost of foundation strengthening is high compared to Transpower's average cost for strengthening foundations. Transpower has advised that the reason for this is due to the condition of the ground through which these lines traverse, defects in original design or construction, and natural age related decline condition since construction. We expect that Transpower will ensure that the foundation upgrades are undertaken in the most efficient and cost effective manner, and that these defects and the general degradation are identified as part of Transpower's routine maintenance programme in the future.

3.36.2 Rail and road crossings – Transpower has advised that it will trial alternative construction methods that could reduce the cost of stringing conductor across major roads and railway lines. We will be interested in the outcome of this trial and its potential to save costs during the project and in future line projects.

3.36.3 Lessons learned – Transpower should be able to demonstrate a process of business improvement to other similar projects as a result of learnings it encounters throughout the project. This includes process improvements and discovered cost learnings. It would be advantageous if learnings were continuously implemented, rather than waiting until an end of project workshop when many opportunities would be lost.

3.37 We recommend that Transpower measures the wind speeds at critical sites to confirm the accuracy of the simulated wind speed data it uses to design its towers.[64] Transpower has advised us that the current design practice is to individually design each tower to withstand its expected wind loading. The wind loading for each tower is individually simulated using wind data from a few sites in the region and the terrain in which the tower is located. Wind data has been gathered from sites some distance from tower locations, and Transpower does not appear to have confirmed the accuracy of its simulated results.

3.38 We consider that the simulated wind speed results for towers with critical loading need verifying. More accurate data may affect the design assumptions, and therefore the cost of strengthening the towers and the foundations. While the strengthening costs are comparatively low in this case, they can be higher for other projects. More accurate data may allow Transpower to calibrate the models used to the observed conditions. This may provide more accurate results, especially at sites where the topology could substantially enhance the wind loading on towers.

64 We note that wind farm developers obtain wind data from the sites they propose to install the turbines. This shows that it is feasible to obtain actual site data.

Attachment A: Acronyms, abbreviations and terms

A1 This attachment provides an explanation of the acronyms, abbreviations and terms used in this paper in Table A1.

Table A1 Acronyms, abbreviations and terms

Abbreviation	Definition
Act	The Commerce Act 1986.
ACSR	Aluminium conductor steel reinforced. A type of electrical conductor.
Capex IM	Transpower capital expenditure input methodology (Commerce Commission, Re Transpower Capital Expenditure Methodology Determination [2012] NZCC 2, 31 January 2012) available at http://www.comcom.govt.nz/assets/Pan-Industry/Input-Methodologies/Transpower-Capital-Expenditure-IM/Capex-IM-Final-Determination-and-Reasons-Paper/Transpower-Capital-Expenditure-Input-Methodologies-Determination-2012.pdf.
Commission	The Commerce Commission.
EGR	Electricity Governance Rules 2003, now revoked and replaced by the Electricity Industry Participation Code (EIPC) and the Capex IM.
EIPC	Electricity industry participation code - This code sets out the rules for all participants in the electricity industry. The code is available at http://www.ea.govt.nz/act-code-regs/code-regs/the-code/.
GEM	GEM is a generation capacity planning model that Transpower and other industry participants use. GEM produces least cost 'build schedules' for new generation plant. A build schedule is a chronological list of new plant that the model anticipates will be built depending on the assumptions in demand and generation scenarios.
Goat	In this paper, a type of wire (conductor) for transmission lines.
GRS	Grid reliability standard - A standard for the reliability of the transmission grid developed by the Electricity Authority (EIPC clause 12.55).
GWh	Means gigawatt-hours and is a measure of energy.
GUP	Grid Upgrade Plans - means the plans that Transpower used to propose to the former Electricity Commission for approval of its MCPs.
HVDC	High Voltage Direct Current. The system used to transmit electricity between the North and South Islands.
Investment option	Means all options considered by Transpower in an MCP. Investment option is defined in clause D2 of the Capex IM.
Investment test	Means the tests specified in Schedule D, Division 1 of the Capex IM.
MCA	Means major capex allowance. MCA is the amount of major capex approved by the Commission for a major capex project.
MCA	Major capex allowance.
MCP	Major capex proposal.

Abbreviation	Definition
Major capex outputs	Means the grid outputs approved by the Commission for a major capex project.
MDS	Market development scenarios. A prediction of the demand and generation developments within the electricity industry.
MBIE	Ministry of Business, Innovation and Employment. It incorporates the former Ministry of Economic Development.
Modelled project	Assets other than the investment option which are likely to be installed during the calculation period of the investment option. Refer to clause D9(4) of the Capex IM.
MW	Means megawatt, a measure of active power.
MWh	Means megawatt-hours and is a measure of energy.
MVA	Means mega voltage ampere, a measure of active and reactive power.
NPV	Net present value.
NTS	Non-transmission solution.
P50 cost estimate	The 50th percentile cost. There is 50% probability that Transpower will complete the project within the P50 cost.
P90 cost estimate	The 90th percentile cost. There is 90% probability that Transpower will complete the project within the P90 cost.
Proposed investment	Means the investment option that Transpower seeks approval for in an MCP.
PV	Present value.
Rules	The rules related to MCPs set out in the Capex IM.
SDDP	Stochastic Dual Dynamic Programming. A programme that optimises hydro-thermal dispatch. Transpower used this programme to calculate the benefits of the investment options and proposed investment.
SoO	The Statement of Opportunities 2010, published by the former Electricity Commission in September 2010. This document forecasts electricity demand and generation builds for a number of scenarios predicting the manner in which the electricity market could develop, known as market development scenarios. SoO is available at http://www.ea.govt.nz/industry/ec-archive/soo/2010-soo/.
SRMC	Short run marginal cost.
Transpower	Transpower New Zealand Limited.
Transpower IM	Transpower (Input Methodologies) Determination [2012] NZCC 17 (29 June 2012). Available at http://www.comcom.govt.nz/assets/Pan-Industry/Input-Methodologies/TPIM-Final/NZCC-17-Transpower-IM-Determination-29-June-2012.pdf.
Voll	Value of loss load or cost of expected unserved energy.
WACC	Weighted Average Cost of Capital.
Zebra	In this paper, a type of wire (conductor) for transmission lines.

Attachment B: Evaluation under Schedule C of the Capex IM

Purpose of this attachment

B1 In this attachment we present some details of our review of Transpower's Proposal against the evaluation criteria set out in Schedule C of the Capex IM. Schedule C sets out the criteria to evaluate the proposed investment components.[65] It also provides criteria for a general evaluation of the Proposal[66] and sets out the evaluation techniques the Commission can use.[67]

The major capex proposal requirements are satisfied

B2 The Capex IM requires that, in order to approve this proposal, the Commission is satisfied:

B2.1 with the proposed investment as a whole;[68]

B2.2 with each of the proposed components that the MCP contains;[69] and

B2.3 that the proposed investment passes the investment test.[70]

We are satisfied with the Proposal as a whole

B3 We are satisfied with the Proposal as a whole, although we are concerned with the aspects of the Proposal we listed in Chapter 3. This is due to our analysis of the general evaluation criteria for MCPs[71], and as a result of the other analysis in this paper.

B4 To reach our view on general evaluation criteria for MCPs, we examined whether the proposed investment and the investment options:

B4.1 reflect good electricity industry practice;

B4.2 are technically feasible;

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65 Capex IM, clauses C1, C3 to C5.

66 Capex IM, clause C3.

67 Capex IM, clause C6.

68 Capex IM, clause C1(2)(b).

69 Capex IM, clause C1(2)(a).

70 Capex IM, clause C1(2)(c).

71 Capex IM, clause C2.

B4.3 are able to gain consents and construct within the estimated time; and

B4.4 are reasonable in terms of assumptions around any outages planned.[72]

The Proposal reflects good electricity industry practice

B5 Based on the explanations provided by Transpower, we are satisfied that the Proposal reflects good electricity industry practice. Our main concern was whether Transpower's policy of strengthening existing lines to current design standards reflected good electricity industry practice.

B6 Transpower proposes to strengthen these lines to its current transmission line design standards. The design standard specifies a much higher wind loading on the structures (towers) and conductors than was used when they were designed. The use of this standard requires Transpower to strengthen the towers and foundations. Even for like for like replacement, significant strengthening of these lines is required due to the effect of the current design standard and the need to rectify original design defects.

B7 As seen in Table B1 below, Transpower's estimated cost of strengthening is about $20 million, some of which is due to the new design standard. We therefore asked Transpower to confirm that applying the current design standard to lines that are being re-conductored reflects good electricity industry practice.

Table B1 Strengthening costs ($million in 2013 prices)

Work package	Strengthen towers	Strengthen foundations	Total
Rectify towers to original design standard	5.5		5.5
Strengthen towers		3.9	3.9
Strengthen to 500-year wind return period and Zebra conductors	5.4	9.1	14.5
Strengthen to 300-year wind return period and Zebra conductors	-2.8		-2.8
Total	8.1	13.0	21.1

72 Capex IM, clause C2.

B8 The EIPC defines good electrical industry practice as:[73]

> In relation to transmission, as the exercise of that degree of skill, diligence, prudence, foresight and economic management, as determined by reference to good international practice, which would reasonably be expected from a skilled and experienced asset owner engaged in the management of a transmission network under conditions comparable to those applicable to the grid consistent with applicable law, safety and environmental protection. The determination is to take into account factors such as the relative size, duty, age and technological status of the relevant transmission network and the applicable law.

B9 While Transpower provided adequate information to support that its design standard reflects good international practice, it was not able to economically justify strengthening the Bunnythorpe-Haywards Lines A and B to a 500 year wind return period. Consequently, Transpower re-assessed the criticality of these lines using the criticality criteria framework it developed for its expenditure proposal for the next regulatory control period.[74]

B10 Using this framework, Transpower concluded that it can apply the lower wind loading standard of a 300 year wind return period on some sections of the lines. These sections are where the physical separation between these lines and the other transmission line between Bunnythorpe and Wellington (the Bunnythorpe to Wilton Line A) is such that all three lines are unlikely to be simultaneously affected by a high wind or other extreme event.[75]

B11 Transpower has also indicated that most Australian transmission line owners, as well as those in Northern Ireland, UK and France, reference, refurbish, or enhance their core grid transmission lines to the modern standards that Transpower is using.

> Our design standards (revised in 2011) specify the use of 500-year return period wind speeds for “core grid” tower design, consistent with the international line loading standards IEC60826 and EN503415. The Bunnythorpe-Haywards A&B lines are core grid lines.
>
> We note that most Australian states as well as Northern Ireland, UK and France reference the above standards in the development of their own core grid transmission towers.[76]

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73 Electricity Authority, "*Electricity Industry Participation Code*", page.38.

74 We are evaluating this expenditure proposal under a separate project, see http://www.comcom.govt.nz/regulated-industries/electricity/electricity-transmission/transpower-individual-price-quality-regulation/transpowers-price-quality-path-from-2015-to-2020/.

75 Transpower *"Bunnythorpe - Haywards Conductor Replacement Major Capex Proposal clarification”,* February 2014, pages 1 and 3. There are three 220 kV lines between Bunnythorpe and Wellington. The Bunnythorpe-Haywards Lines A and B and the Bunnythorpe-Wilton Line A.

76 Transpower *"Bunnythorpe - Haywards Conductor Replacement Major Capex Proposal clarification”,* February 2014*,* page 3.

B12 Based on the above, we are satisfied that upgrading the existing lines to current standards reflect good electricity industry practice, within the bounds of prudent economic management.

The proposed investment is technically feasible

B13 We are satisfied that the proposed investment is technically feasible. The main scope of this project is to strengthen the towers and the tower foundations and replace the conductors on the line. Transpower has carried out a number of similar projects in the recent past.

The Proposal is able to be implemented in terms of planning, consents and property rights

B14 We have seen no evidence to suggest that the proposed project plan is unable to be implemented and are satisfied with this aspect of the general evaluation. Transpower has confirmed that the work complies with the Resource Management National Environmental Standard for Electricity Transmission, and that property risks are not considered to be high over the majority of the lines. Transpower states: [77]

> The engineering rectification options for Zebra at 75 have been designed so that the work required largely complies with the Resource Management National Environmental Standard for Electricity Transmission. Some consent will be required but we believe that these can be obtained in the timeframes available.

And further: [78]

> Property risk issues broadly fall into two categories. Firstly risk around gaining access to the lines to undertake the re-conductoring and associated enabling work, and secondly the process of acquiring property rights where our activities are shown to cause an 'injurious affection' to the underlying land. Property risk issues are not considered to be high over the majority of the line due to the reasonably limited extent of activities required to deliver the line work.

The outage assumptions used are reasonable

B15 We are satisfied with the outage assumptions, having seen no evidence to suggest that the outage assumptions used in the proposal are unreasonable.

B16 Transpower proposes to carry out the works during the summer months over a period of six years.

B17 Transpower will be seeking outages for these lines during the site works and return the lines to service after the end of the planned works for the year.

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77 Transpower, email *"Supplementary information: Bunnythorpe-Haywards Property, consents",* 29 October 2013.

78 Transpower, "BPE HAY A & B Line Property Commentary", 25-10-2013.

B18 Transpower has stated that it does not see any major issue with obtaining outages for site works over the summer months.

B19 We note that outages on these circuits are normally available outside the winter period of May to August, unless it is exceptionally dry in the South Island. During dry periods in the South Island these lines may be required to transfer power from the North Island to the South Island and outages may not be available. During exceptionally wet summers, the ability to do sites works may be restricted which may defer the outage assumptions.

B20 Overall, we are satisfied that Transpower has allowed for constraints concerning site access due to weather and outage constraints due to market conditions when planning the duration of the works.

We are satisfied with the components of the proposal

B21 The Commission is satisfied with the components of the Proposal.

B22 The components of the proposal that we must assess are listed below.

- B22.1 P50: the estimated cost of the project, where the probability that the actual cost will not exceed this figure is 50%.
- B22.2 MCA: the maximum amount that Transpower can recover from consumers.
- B22.3 Approved major capex project outputs: specific items to be delivered by the project.
- B22.4 Approval expiry date: the date past which Transpower will not be able to recover costs of any assets commissioned from consumers.
- B22.5 Commissioning date assumption: the date when Transpower assumes that the last asset of the project will start to be in use.
- B22.6 Completion date assumptions.

B23 We discuss our assessment of the proposed components in the sections below.

Evaluation of the P50 estimate of costs

B24 We are satisfied with the P50 estimate of costs proposed by Transpower. The P50 and other cost components are summarised in Table B2 below.[79]

[79] Transpower, *"BPE-HAY MCP Data File - MCA Final.xlxs".*

Table B2 Calculation of the P50 estimate of costs ($million)

Base capital cost (2013 prices)	P50 scope and construction uncertainties (2013 prices)	P50 expected cost (2013 prices)	Inflation – P50	Financing costs	P50 estimate of cost (2020 prices)
127.8	6.8	134.6	12.0	4.4	151.0

B25 In reviewing the P50 estimate of costs we have considered, and are satisfied with, the calculations and appropriateness of the foreign exchange, inflation and financing cost forecasts.

B26 We consider there is scope to save cost in the base capital costs of the project. Base capital cost is the main cost going into the P50 and MCA calculations. We discuss the results of our review of capital costs and the scope to save costs in in the section "Assessment of project costs" in Attachment C.

B27 To maximise the potential savings in the cost of the project, we have recommended that Transpower reviews its cost and construction techniques at the end of the first phase of the project; this is expected to be in 2015.

Evaluation of the major capex allowance

B28 Transpower has requested approval to recover actual costs up to a maximum of $161 million (in 2020 prices).

B29 The Capex IM requires us to evaluate the MCA proposed by Transpower and sets the criteria we must use.[80]

B30 We have evaluated the MCA component of the MCP and are satisfied with the value Transpower has proposed, except for our view that Transpower has the opportunity to reduce capital cost through improved design assumptions and construction techniques. We are also satisfied with the reasonableness of the underlying calculations and assumptions based on the evidence before us and given the size of the expenditure being considered.

B31 B31 summarises Transpower's calculation of the MCA.[81]

80 Capex IM, clause C3.

81 Transpower, *"BPE-HAY MCP Data File - MCA Final.xlxs"*.

Table B3Transpower's calculation of MCA ($million)

Base Capital cost (2013 prices)	P90 scope and construction uncertainties (2013 prices)	P90 expected cost (2013 prices)	Inflation (2013 to 2020 prices) – P90	Financing cost P90	MCA (2020 prices)
127.8	16.2	144.0	12.3	4.7	161.0

B32 The P90 estimate includes forecasted movements in exchange rates and inflation, an allowance for scope changes, price changes and financing costs.[82]

B33 The exchange rate and general inflation elements of the approval amount are washed-up. The underlying assumptions have been identified so that an accurate wash-up can occur.

B34 Transpower has used the P90 estimate of costs to determine the MCA. We approve this approach.

B35 We considered the appropriateness of using the P90 standard as the MCA. Using a P90 standard, 10% of projects can be expected to exceed their estimated costs. A large difference between the P90 and P50 would require further examination into the P90.

B36 The difference between the P50 and P90 standard is small for this Proposal, so we have not needed to examine more closely the issue of whether the P90 standard is appropriate. The difference between the P50 and P90 standard is shown in B31 below.

Table B4 Extent of potential cost over-runs without re-approval ($million)

P50-P90 difference in 2013 prices	P50-P90 difference in 2020 prices
9.3	10.0

B37 Our view is that the financing cost has been accurately calculated using reasonable assumptions.

B37.1 The spread of capital expenditure over the construction period has little impact for the Proposal.

B37.2 The financing cost is set at Transpower's current WACC.

B37.3 Expenditure occurs at the end of the month.

82 For inflation and exchange rate changes, the approval amount is subject to a 'wash-up' which means these assumptions do not impact on the final amount of revenue Transpower is allowed to recover.

B38 We have no reason to believe that the capital expenditure profile Transpower provided is unreasonable. Due to the value of the capital costs of this proposal, the effect of the cost of financing on the capital expenditure profile is negligible.

B39 Transpower has also accounted for several risks within their estimation of P50 and P90 costs. These include scope, price and timing risk.

B40 Transpower has estimated scope, price and timing risk based on expert internal knowledge using a triangular distribution. These appear reasonable based on the evidence before us and given the size of the expenditure being considered.

Evaluation of the major capex outputs

B41 We are satisfied with the major capex outputs proposed by Transpower.

B42 The Capex IM requires us to evaluate how the major capex outputs specified by Transpower match the purpose of the investment it proposed. The Capex IM sets the criteria the Commission must use for this evaluation.[83]

B43 The major capex outputs put forward by Transpower are set out below.

B43.1 Procuring, installing and commissioning Zebra ACSR conductor on the Bunnythorpe–Haywards A and B lines and decommissioning the existing conductor.

B43.2 Works on the structures and foundations to enable the Zebra conductor to be operated at 75^{o}C.

B43.3 Procuring, constructing and commissioning substation facilities to facilitate the above connections and equipment.

B43.4 Obtaining property rights and environmental approvals required for these works.

B43.5 Installing alternative conductor technologies on a short section to evaluate its performance in coastal climatic conditions.

83 Capex IM, clause C5.

B44 We consider that the grid outputs proposed by Transpower:

B44.1 adequately reflect the nature and functional capability of the proposed investment;

B44.2 are consistent with the change in the functional capability of the grid as a result of this investment;

B44.3 are consistent with the key assumptions used to determine the MCA; and

B44.4 are likely to provide the expected electricity market benefits related to transmission services.

Evaluation of the approval expiry date

B45 We are satisfied with the approval expiry date proposed by Transpower. Transpower has proposed an expiry date of 2025. We interpret this to be the last working day of 2025 calendar year.

B46 The Capex IM requires us to evaluate the effect of the proposed approval expiry date and sets factors we must use.[84] The factors include an assessment of the effect of the proposed approval expiry date on the costs and benefits under the investment test, commissioning date assumptions, completion date assumptions and sensitivity of the expiry date to the key assumptions used in the Proposa.

B47 Since most of the benefits of the lines will be on-going during the construction period, we are satisfied that expiry date does not have a significant effect on the benefits of the projects and the key assumptions used in the Proposal.[85]

B48 Transpower states it reasons for the proposed expiry date as:[86]

> An approval expiry date should not be close enough to the completion date assumption that it is triggered by reasonable commission delays.
>
> We feel that 2025, as an approval expiry date, is a point where it is clear that should the project still be incomplete at this time, something has changed and we should reassess.

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84 Capex IM, clause C4.

85 These benefits results because the lines will be available to the market over the winter months, when they are required the most. The System Operator can also defer outages or ask for the lines to be returned to service earlier than planned if the lines are required for market reasons.

86 Transpower, "*Proposal Attachment A*, page 27.

B49 The effect of an approval expiry date is that Transpower cannot recover the costs of any assets commissioned after this date. This incentivises Transpower to complete the works within the required time. Alternatively, Transpower can review the need for the work or seek to amend the terms of its approval in response to changes in the electricity market.[87]

B50 We are satisfied with the expiry date Transpower has proposed. We consider that Transpower should be able to commission the works before the approval expiry date, provided it can get all the necessary outages. Should events turn out significantly differently to what Transpower has planned, there is sufficient time to amend or adjust the approval given under the Capex IM.

Evaluation of the commissioning date assumptions

B51 We are satisfied with the commissioning date assumptions proposed by Transpower.

B52 In planning the delivery timeframe, Transpower has considered available outage windows, disruption to the electricity market and construction resource.[88] In addition Transpower has also taken into consideration the complexity of, and the need for, the works associated with this project.[89]

B53 We consider that the factors Transpower considered when setting the commissioning date are reasonable. Outages, land access, site conditions, construction resource, weather and commissioning constraints will affect completion date of this project. On this basis, a seven year target is reasonable.

We are satisfied that the Proposal passes the investment test

B54 We are satisfied that the:

B54.1 results of the investment test are satisfactory; and

B54.2 proposed investment is sufficiently robust to sensitivity analysis.

B55 We discuss our evaluation of the investment test in Attachment C.

87 Capex IM, clause 3.3.4.

88 Transpower, *Proposal Attachment F,* page 9.

89 Transpower, *Proposal Attachment A*, page 7.

Attachment C: Our evaluation of the investment test

Purpose of this attachment

C1 This attachment provides a summary of our evaluation of the investment test using the criteria set out in Schedule D of the Capex IM. We present our review of how Transpower applied the investment test and why we consider that it complies with the requirements of the Capex IM. We discuss our evaluation of:

C1.1 the assumptions and parameters used in the investment test;

C1.2 the electricity market costs;

C1.3 the electricity market benefits;

C1.4 the expected net electricity market benefits;

C1.5 the selection of the proposed investment; and

C1.6 Transpower's sensitivity analysis.

Criteria for satisfying the investment test

C2 The investment test is an economic test that compares the expected net electricity market benefits of all the investment options. The proposed investment satisfies the investment test if:

C2.1 it has the highest expected net electricity market benefit compared to the other investment options including a qualitative assessment of unquantifiable electricity market benefit benefits;

C2.2 its expected net electricity market benefit is positive; and

C2.3 it is robust to sensitivity analysis compared with other investment options.[90]

[90] Capex IM, clause D1(1). For this proposal the expected net electricity market benefits needs to be positive. For proposals required to meet the grid security standards, the expected net electricity market benefits does not need to be positive.

We are satisfied with the investment test

C3 We are:

C3.1 satisfied with the proposed investment test parameters;

C3.2 satisfied that the results of the investment test are satisfactory; and

C3.3 satisfied that the proposed investment is sufficiently robust under sensitivity analysis.

C4 In considering the benefits, we noticed that more than 97% of the electricity market benefits are due to Transpower keeping the lines. For example, for the proposed investment, total benefits are $1004.7 million of which $977.4 million is the benefit of keeping the lines (in 2013 prices). The remainder of the benefits are due to a reduction in losses and increase in capacity. We are satisfied that Transpower's estimated benefits of keeping the lines are reasonable.

C5 When assessing how Transpower selected the proposed investment we note that the difference between the expected net electricity market benefits between options is very similar and likely within the margin of error of the calculations. For example, the difference between the expected net electricity market benefits of the proposed investment and the least cost option (Zebra at 65^{o}C) is $11.4 million and the difference in costs is $10.5 million.

C6 Rather than relying solely on the quantum of the expected costs and benefits and the accuracy of the estimated net market benefits, we focused on forming a view as to whether Zebra at 75 ^{o}C is a better investment option over Zebra at 65^{o}C. We discuss this under the section "Transpower selected the investment option reasonably" below.

C7 We investigated the estimated cost of the project in detail. We note that Transpower proposes to invest approximately $20 million to strengthen these lines to its current design standards. We are satisfied that Transpower's decision to strengthen reflects good electrical industry practice.[91] This is based on practices by other transmission system operators in Australia and United Kingdom and Ireland who also strengthen their lines to their current standards when undertaking major refurbishments.

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91 Transpower uses a criticality framework to assess that the lines are strengthen to the appropriate level based on the importance of the line to the transmission network as discussed in paragraphs B9 to B12 above.

C8 We sought to verify with Transpower that its current design standard reflected 'good electrical industry practice' as defined in the EIPC. Based on the information provided by Transpower we are satisfied that Transpower's design standards are based on recognised international standards applied appropriately to New Zealand in accordance with GEIP.[92] However, we have noticed that when applying the standard Transpower does not necessarily consider the defined economic aspect of GEIP. Through the initiatives set for the next regulatory period, we will recommend that Transpower reviews its policies in terms of sound economic management.

How the investment test is performed

C9 The investment test requires Transpower to assess the electricity market costs and benefits of a number of options for each market development scenario (MDS).[93] Transpower needs to:

C9.1 estimate the electricity market costs elements and project costs for each investment option under relevant generation and demand scenarios;

C9.2 estimate the electricity market benefits for each investment option under relevant generation and demand scenarios;

C9.3 calculate the net electricity market benefits for each investment option. Net electricity market benefit is the aggregate sum of each electricity market benefit or cost element less the total of each project cost;

C9.4 calculate the expected net electricity market benefit, which is the weighted average of the net electricity market benefits under each demand and generation scenarios; and

C9.5 select the investment option with the highest net market benefits as the proposed investment. In selecting the proposed investment, Transpower may consider unquantifiable benefits if the difference in expected net electricity market benefits between two or more investment options is within 10% of the aggregate project costs. [94]

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92 Transpower, "*Bunnythorpe - Haywards Conductor Replacement Major Capex Proposal Clarification",* February 2014, Page 2.

93 Market development scenarios are the demand and generation scenarios outlined in the Statement of Opportunities 2010 (SoO). Transpower amended the scenarios in the SoO to reflect the current state of the industry.

94 Capex IM, clauses D1 and D2.

How we reviewed the application of the investment test

C10 In reviewing Transpower's application of the investment test, we considered whether Transpower:

C10.1 made reasonable assumptions when selecting the parameters used in the investment test;

C10.2 reasonably estimated the project costs and all other expected cost elements that may occur during the calculation period under the relevant demand and generation scenarios;

C10.3 reasonably calculated the electricity market benefit under the relevant demand and generation scenarios;

C10.4 reasonably estimated the expected net electricity market benefits;

C10.5 selected the proposed investment using the criteria set out in the Capex IM;[95] and

C10.6 demonstrated that the proposed investment is robust to sensitivity analysis.

Evaluation of the investment test parameters

C11 We are satisfied that Transpower has reasonably selected the parameters used in the investment test.

C12 The Capex IM allows Transpower some discretion in selecting the parameters of the investment test. These parameters are listed below.

C12.1 Calculation period[96]

C12.2 Demand forecasts and generation development scenarios[97]

C12.3 Discount rate[98]

C12.4 Investment options[99]

C12.5 Value of expected unserved energy.[100]

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95 Capex IM, clauses D1 and D2.

96 Capex IM, clause G4(5)(b).

97 Capex IM, clause D4(1)(ii).

98 Capex IM, clause D7(3)(b).

99 Capex IM, clause 7.4.1(2).

100 Capex IM, clause G4(5)(c).

Calculation period is reasonable

C13 Transpower used the calculation period of 30 years from the expected date of commissioning to the year 2050.[101] Transpower's reason for the longer period is that transmission lines have an expected life of 30 or more years and Transpower considers that there will be significant benefits arising from this investment beyond 20 years.[102]

C14 We consider that the 30 year calculation period is appropriate for this proposal.

Amended generation scenarios are appropriate

C15 Our evaluation of Transpower's modified generation scenario indicates that the modified scenario may have biased investments in generation towards the North Island. We consider that this has not affected the ranking of the options proposed by Transpower, although it slightly changed the value of the expected net electricity market benefits.

C16 A generation scenario is a prediction of a set of generation developments based on MDS. The Capex IM requires Transpower to use generation scenarios because the manner in which future generation will develop is uncertain. A set of scenarios reduces the effect of this uncertainty when estimating the expected benefits of a transmission investment.

C17 To assess the benefit of this proposal, Transpower used and consulted on a modified generation scenario.[103] The modifications reflect the changes in the electrical industry since 2010 when the current scenarios were published by the former Electricity Commission. The modification includes generators that have been commissioned since the 2010 and generation projects that were committed by 2013. Transpower also re-assigned new build dates for generation projects that have been deferred since 2010.

C18 The key changes are shown in Table C1.[104]

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101 Capex IM, clause G5(11)(b). The Capex IM indicates 20 years, unless there is reason to use a different value.

102 Transpower, "*Proposal Attachment E"*, page 6. The Capex IM recommends 20 years, unless there is reason to use a different value.

103 Capex IM, clause D4(1)(a)(ii). The rules require Transpower to use wither the demand and generation forecasts in the SoO or reasonable variations. If Transpower modifies the demand or generation scenarios, the Commission needs to be satisfied that the modifications are appropriate.

104 Transpower, "*Proposal Attachment E"*, page 19.

Table C1 Transpower's changes to the 2010 SoO generation scenarios

Plant name	Type	Capacity (MW)	Planned commissioning	
Committed projects[105]				
Ngatamariki	Geothermal	80	2013	
Norske Skog	Geothermal	25	2013	
Te Mihi	Geothermal	160	2013	
Wairakei[106]	Geothermal	-44	2013	
Mill Creek	Wind	60	2015	
Projects on hold			**Earliest build in 2010 SoO**	**Transpower's modified build forecast**
Project Hayes	Wind	630	2020	2030
North Bank Tunnel	Hydro	280	2020	After 2035
Mokihinui	Hydro	85	2025	2026
Clutha River	Hydro	816	2018	2025

C19 On 19 January 2012, Meridian announced that it was withdrawing its applications that are before the Environment Court for resource consents for Project Hayes. Meridian also indicated that it would give priority to other projects instead: [107]

> "Our portfolio has developed considerably and our review showed us that other projects now are a higher commercial priority than Project Hayes," said Mark Binns, Meridian Chief Executive.

C20 We note that the Transpower's modified generation schedule forecasts stage 1 for Project Hayes in 2030 for MDS2 (South Island renewables scenario). We consider that this is not unreasonable.

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105 Note that in Transpower, "*Proposal Attachment E*", Table 7-1 the titles are incorrect. Transpower had correctly modelled the committed project in the SoO as presented in Appendix 2 of Transpower, "*Proposal Attachment E*".

106 After Te Mihi power station is commissioned, Contact will gradually decommission parts of the Wairakei power station. Initially, the combined output of Wairakei and Te Mihi will be 114 MW. Source: http://www.contactenergy.co.nz/web/ourprojects/temihi?vert=au as at 30 November 2013.

107 http://www.meridianenergy.co.nz/about-us/media-centre/media-releases/community/meridian-withdraws-resource-consents-for-project-hayes/ on 30 November 2013.

C21 In May 2012, Meridian withdrew its resource consents application for Mokihinui hydro development, but indicated that the project had positive economics.[108] Therefore, we consider that it is not unreasonable for Transpower to allocate an earliest build date of 2025 for this power station. Transpower's generation build scenario forecasts that Mokihinui could be built in 2026 under MDS2.[109]

C22 Meridian Energy suspended the North Bank Tunnel project in January 2013. Meridian stated its reason for suspending this project as: [110]

> We made a decision to suspend the land negotiations only because of the current flat demand for electricity, which means fewer new generation projects will be required in the short to medium term.

Transpower's generation build schedule does not include North Bank Tunnel project until 2035. We consider that Transpower's deferral date is reasonable.

C23 Contact Energy announced that it has withdrawn plans for further hydro development on the Clutha River. Contact also indicated that it the project remained open: [111]

> Contact has decided not to proceed with any of the options being investigated for hydro generation development on the Clutha at this time.

C24 Based on this Transpower's earliest build date of 2025 is optimistic. Transpower generation build schedule forecast that Clutha River hydro schemes may be built in 2025 or after for MDS2. We consider the impact of this below.

C25 Our main concerns with Transpower's generation scenarios are that under:

C25.1 MDS1, the build schedule forecasts three large new gas fired power stations in Auckland-Otahuhu C (407 MW in 2018), Rodney stage 1 (240 MW in 2019) and Rodney stage (240 MW in 2021); and[112]

C25.2 MDS2, the build schedule forecasts Clutha River hydro schemes in 2025 (716 MW in total).[113]

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108 http://www.meridianenergy.co.nz/about-us/generating-energy/our-generation-projects/hydro-projects/mokihinui/ on 30 November 2013.

109 Transpower, "*Proposal Attachment E"*, page 36.

110 http://www.meridianenergy.co.nz/about-us/generating-energy/our-generation-projects/north-bank-hydro-project/ on 30 November 2013.

111 http://www.contactenergy.co.nz/web/ourprojects/clutha-hydro on 30 November 2013.

112 Transpower, *Proposal Attachment E*, page 27.

113 Transpower, *Proposal Attachment E*, page 36.

C26 We consider that it is unlikely that such large power stations will be built as forecasted in Transpower's modified generation build scenarios. Transpower commented as follows: [114]

> You have identified an error here – there has been a copy and paste mistake when putting the tables together into word. The table called MDS1 had MDS5 build schedules. MDS5 also has MDS5 build schedules. We have corrected the tables in the attached document.
>
> A.1.1 This question is now relevant to MDS5: it is the high gas scenario and some of the build replaces decommissioning plant (Huntly, TCC, Southdown and OtahuhuB), so the build is not quite as extreme as it first appears. Almost all new generation in MDS5 is in the North Island and therefore requires the most north-South transfer during dry years. Should this generation be replaced with other North Island generation we expect little change to the order of options – and this is possibly the most likely situation under this scenario. However, should they be replaced with South Island plant, this would reduce the difference in benefits between Zebra@65 and Zebra@75 in dry years.
>
> A.1.2 Very little of the benefit between Zebra@65 and Zebra@75 in the investment test comes from MDS2. The lower North Island constraint for this scenario sometimes binds in the north direction, indicating that moving some of the proposed South Island generators to the North Island may reduce the benefit of Zebra@75 over Zebra@65, but it would not be big enough to change the order when averaged across all scenarios. If a significant amount of it was moved north, the southflow constraint would probably start to bind and you'd see benefits move back toward Zebra@75 again.

C27 In the light of Transpower's comments, we are satisfied with the build schedules in the amended MDS1 and MDS5. We agree with Transpower's conclusion that MDS2 forecasts will not significantly affect the ranking of the investment options. As shown in Table C2 below MDS1, MDS2 and MDS3 do not make significant contribution to the expected net electricity market benefits. [115]

Table C2 Expected net electricity market benefits by MDS (PV $million in 2013 prices)

Investment option	MDS1	MDS2	MDS3	MDS4	MDS5	Average
Dismantle lines	-25.3	-25.3	-25.3	-25.3	-25.3	-25.3
Goat at 80°C	99.0	48.9	38.0	818.1	3147.0	830.2
Zebra at 65°C	116.6	68.7	50.2	836.9	3180.7	850.6
Zebra at 75°C	114.4	64.6	43.6	838.7	3210.9	854.4
Zebra at 85°C	108.3	58.6	37.6	833.9	3213.9	850.5

[114] Transpower, email *"Re: BPE HAY MCP - generation and demand scenarios"* dated 13 December 2013.

[115] Transpower, *"Proposal Attachment E",* Table 3-5 page 11.

C28 Most of the benefits are from MDS4 and MDS5. These two MDSs predict significant investments in generation in the North Island some of which is to replace Huntly and Otahuhu C. In recent times, we are seeing generation developments in the North Island while developments in the South Island have been put on hold. Based on current observations, Zebra at 75^{o}C appears to a better choice than Zebra at 65^{o}C.

C29 In conclusion, we are satisfied that Transpower's modified generation build scenarios are reasonable and the results are appropriate for the investment test.

Demand forecast was higher than the current forecasts

C30 When Transpower prepared this Proposal, its demand forecast was higher than its current forecast. We discuss the impact of the demand forecast under the section "The electricity market benefits of the options are very similar" below.

C31 Transpower has used the demand forecast it prepared for the 2013 Annual Planning report.[116] This forecast is approximately 3,000 GWH less than that in 2010 SoO, but it still appears optimistic.

C32 We compared Transpower's forecast with the demand forecasts prepared by MBIE and found that Transpower's forecast is higher.[117] Since MBIE's forecast is based on Draft Electricity Demand and Generation Scenarios (EDGS) 2013, Transpower is not required to use MBIE's forecast until EDGS is finalised.[118] Therefore we are satisfied that Transpower used the best information it had at the time it prepared this proposal.

C33 Transpower's demand forecast is shown in Figure C1 and MBIE's forecast is shown in Figure C2 below.

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116 Transpower, *Proposal Attachment E*, page 18.

117 Ministry of Business, Innovation and Employment *"New Zealand's Energy Outlook Electricity Insight",* page 7. *A*vailable at http://www.med.govt.nz/sectors-industries/energy/energy-modelling/modelling/pdf-docs-library/electricity-insight/electricity-insight.pdf on 30 November 2013.

118 Capex IM, clause D4(1)(b).

Figure C1 Transpower's demand forecast

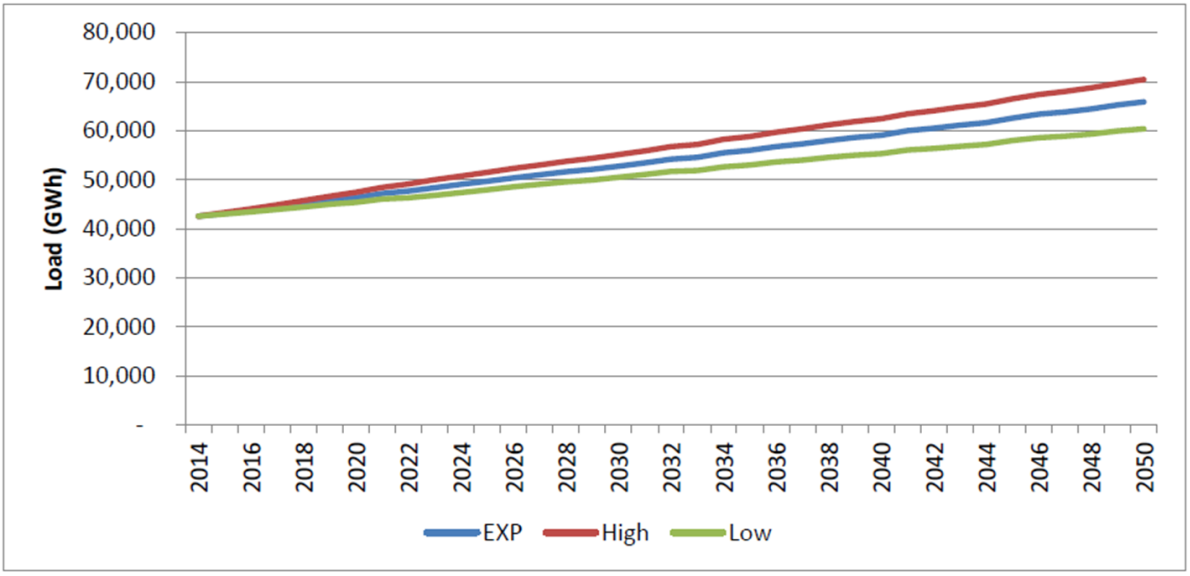
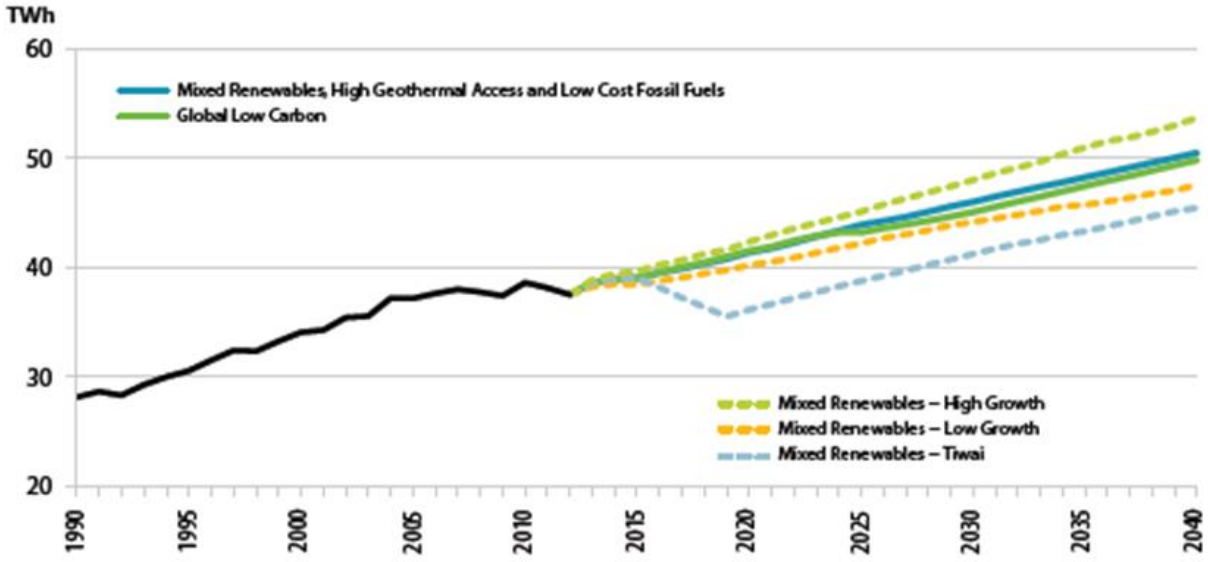


Figure C2 MBIE's electricity demand forecast



C34 We observe that MBIE's high growth forecast is similar to Transpower's low demand forecast. Transpower's expected and high demand forecasts are higher than the high growth forecasts of MBIE. By 2040, Transpower's forecast demand would be more than 60 TWh while MBIE's high growth forecast is closer to 50 TWh.

C35 We are also mindful that it is impossible to forecast electricity demand accurately. Instead of judging which of the two forecasts are more reasonable, we considered the impact of the two forecasts on the investment tests.

C36 A higher demand forecast will have the tendency to increase the market benefits of the two lines and including the benefits of keeping the lines. We are satisfied that the higher demand forecast has not significantly affected the benefits of the keeping the lines.

C37 However, Transpower sensitivity analysis shows that the investment options are sensitive to demand. The higher demand results in higher net electricity market benefits for investment with larger capacity, as shown in Table C3 below. Had Transpower used MBIE's forecast, Zebra at 65°C would have come out as the preferred investment.

Table C3 Sensitivity of relative expected net electricity market benefits to demand

Demand sensitivity	Zebra at 65°C	Zebra at 75°C	Zebra at 85°C
Base demand[119]	20.4	**24.2**	20.2
High demand	25.3	**34.4**	30.4
Low demand	**17.1**	14.0	7.8

Note: Sensitivity measured relative to Goat at 80°C option.

C38 Transpower advised that its demand forecast is different from MBIE's because Transpower's forecast also includes system losses and some demand historically is served by an embedded generator: [120]

> When running SDDP we add in some demand that historically is serviced by an embedded generator. We then model that generator explicitly in our GEM and SDDP modelling and we also model explicitly any new embedded generation. MBIE models some growth in embedded generation outside GEM and SDDP and subtracts it from its forecast of consumer electricity demand to get 'Grid level electricity demand'. Therefore the different treatment of embedded generation can lead to differences between Transpower's and MBIE's forecasts.
>
> A better comparison would be to compare MBIE's 'Consumer Electricity Demand' with Transpower's SDDP input with losses removed. In both cases demand that will be meet by embedded generation are included in the numbers. The graph showing the comparison is given below.
>
> The remaining difference relates to the difference in the underlying forecasts. Transpower's APR 2013 growth was ~1.2% out to 2050 and MBIE's is ~1.0% out to 2050. Our yet to be published APR 2014 forecast have come down a bit and have similar growth rates to MBIE's.

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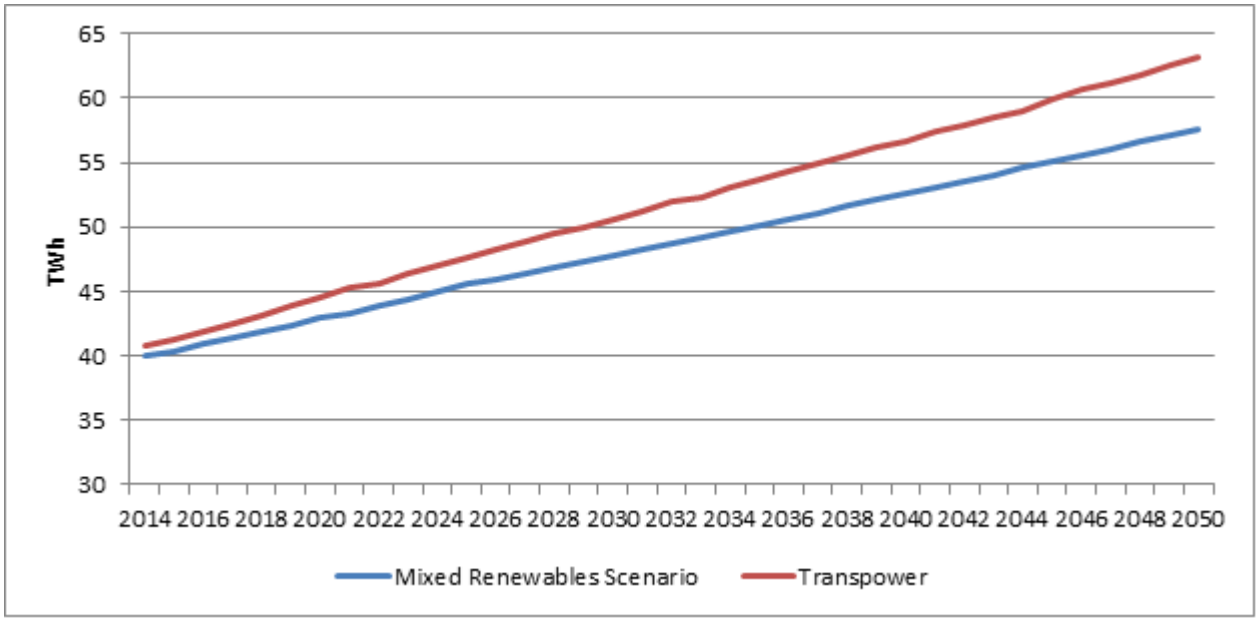
[119] This is the Transpower's expected demand forecast which it Transpower used to calculate the benefits of the project. The numbers on 'bold' are the ones with the highest relative net market benefits for the corresponding sensitivity variable.

[120] Transpower, email *"Re: BPE HAY MCP - generation and demand scenarios"* dated 13 December 2013.

And further: [121]

> The investment test takes into account a range of potential futures. At the time of conducting the analysis and preparing the MCP the APR 2013 forecast was the best available to us. The lower growth rate of MBIE and the TP APR 2014 has been accounted for in the investment test sensitivity analysis. While Zebra@65 is favoured under lower demand growth, the results of the investment test are still considered similar to that of Zebra@75. The qualitative benefits for Zebra@75 are higher than that of Zebra@65. Therefore taking unquantified benefits into consideration, Zebra@75 would still be the winning option. Further the investment test results show that if demand growth was to be high the margin between Zebra@65 and Zebra@75 and 85 options would increase significantly.

Figure C3 Demand forecast - MBIE's and Transpower's less loss and embedded demand



C39 While in this case, we consider that the demand forecast Transpower used is high, we are satisfied that it has acted within the requirements of the Capex IM. Our analysis highlights the need for MBIE to release the EDGS as soon as practical.

C40 As discussed earlier in this paper; we expect Transpower to act in accordance with good electrical industry practice, actively monitor demand and update its project plan appropriately. Costs should not be incurred without sufficient justification, challenge and assurance.

[121] Transpower, email *"Re: BPE HAY MCP - generation and demand scenarios"* dated 13 December 2013.

Discount rate for NPV complies with the Capex IM

C41 Transpower used 7% as the discount rate for the Proposal. This is in line with the Capex IM, although Transpower can propose other rates.[122]

Investment options considered by Transpower are adequate

C42 We consider that Transpower met the requirements of the Capex IM in terms of the number of investment options it is required to consider. The investment options are limited in variety due to the nature of the project. Transpower has considered five investment options, which we consider is adequate.

C43 The Capex IM requires Transpower to consider a number of investment options appropriate to the value of the estimated capital expenditure and the complexity of the investment need.[123] We consider that the options considered by Transpower during its consultation on the long list options, are appropriate for this investment need.

C44 We note that Transpower could have also considered the option of dismantling one line and keeping the other. We discussed this with Transpower but did not pursue it since this option was not raised by any stakeholders when Transpower consulted on its long list of options in October 2010, before the Commission took over the responsibility of approving Transpower's major capital expenditures.

C45 In October 2010, Transpower considered and consulted on the following options:

C45.1 Dismantle lines A and B

C45.2 "Like for like" conductor replacement

C45.3 Different capacity conductors

C45.4 A new line

C45.5 Underground cable instead of overhead lines

C45.6 HVDC runback option

C45.7 Non-transmission options such as generation and demand side alternatives.[124]

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122 Capex IM, clause D7(3) and Transpower*," Proposal Attachment E",* page 5.

123 Capex IM, clause 7.4.1(2).

124 Transpower *"Bunnythorpe Haywards A and B Transmission Line Investigation Assumptions Approach and Long list Options*" (October 2010). Available at https://www.transpower.co.nz/projects/bunnythorpe-haywards-and-b-transmission-line-investigation/bunnythorpe-haywards-and-b-0 as at 30 November 2013.

C46 Transpower shortened its long list of options to the following short list:

C46.1 Dismantle lines A and B

C46.2 "Like for like" conductor replacement

C46.3 Different capacity conductors.

C47 We are satisfied that Transpower has selected investment options that are appropriate for the investment need.

C48 Concerning other options in the long list of options, we consider that:

C48.1 a new line or undergrounding will add significantly to the project costs than re-conductoring the existing lines; and

C48.2 HVDC runback and non-transmission solutions are not viable options because the reason for this proposal is driven the need to replace deteriorating conductors on these lines. HVDC runback and non-transmission solutions options will not mitigate the need for this investment.

Value of expected unserved energy

C49 Value of expected unserved energy is not required for this Proposal. Unserved energy is not considered in this application of the investment test.

Our evaluation of the electricity market costs

The project costs are high but reasonably reflect the scope of works

C50 We consider that Transpower's estimates of the projects costs reasonably reflect the scope of works required to upgrade these lines and the standards to which these lines are being upgraded. There are two components of the cost that we consider are high and Transpower was asked for the basis of the costs. These are the costs:

C50.1 to bring the foundations to modern standards; and

C50.2 of protection of the road and rail crossings while re-conductoring over them.

C51 Concerning foundation strengthening costs, Transpower has stated that the reasons for the high foundation costs are that 50 per cent of the towers are located in poor ground conditions and the remainder of the towers are in remote locations with poor access: [125]

> Very few sites have had grillage replacements on these lines so there is no comparable cost based on the ground conditions along the lines. The first 100 towers (50 per cent) south of Bunnythorpe are atypical compared with other lines. In general, the majority of towers are located on, and in between, sand dunes, in swamps or areas with high water tables. The remainder of towers are mainly in remote locations with poor access. In addition the majority of sites require high volumes of concrete for foundation encasement and strengthening. Additional allowance is made for the shoring of holes to counter the weak and or wet soil conditions. Specialist plant such as helicopters and additional access works have been allowed for a number of remote sites.

C52 However, there is still a concern that the estimated costs may high so we recommend that Transpower reviews its cost estimate and construction strategy after completing the first phase of the construction in early 2015.

C53 Concerning the rail and road crossing costs, Transpower has indicated that it plans to trial alternative methods to protect the road and rail crossings and if these are successful then they could significantly reduce these costs. Transpower has advised that it has not tried the alternative methods for road and rail crossings of transmission lines and is therefore unsure that the methods will be successful.

C54 Based on the above explanations, we recommend that Transpower reviews of these costs after each stage of the project. This may help to identify ways of reducing the scope and costs for future stages of the project, and enable Transpower to produce more accurate forecasts for similar projects in the future.

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125 Transpower, " *Bunnythorpe - Haywards Conductor Replacement – Major Capex Proposal Response to Commission Questions issued 27 November 2013*" page 4.

C55 The Capex IM defines project cost as any of the following costs associated with a major capex project.

C55.1 Capital expenditure

C55.2 Testing costs

C55.3 Commissioning costs

C55.4 Operating and maintenance costs

C55.5 Statutory costs

C55.6 Costs for seeking approval of investments

C55.7 Other reasonable costs. [126]

C56 For this Proposal Transpower separated out operating and maintenance costs from capital expenditure, testing, commissioning and consenting costs. We refer to the former set of costs as the capital costs of the investment options. We have assessed the operating and maintenance costs and capital costs separately. Table C4 summarises Transpower's project costs for the investment options.[127] As seen the present value of the costs for four options of keeping the lines are very similar compared to the estimated total costs.

Table C4 Project costs (2013 prices $million)

Option	Investment option	P50 Capital cost	PV Capital cost	PV maintenance costs	PV total costs	PV relative total costs
1	Dismantle lines	30.0	25.3	0.0	25.3	-121.9
2	Goat at 80°C	130.5	96.3	50.9	147.2	0.0
3	Zebra at 65°C	124.1	91.3	51.3	142.7	-4.5
4	**Zebra at 75°C**	**134.6**	**99.4**	**50.9**	**150.3**	**3.1**
5	Zebra at 85°C	143.9	106.5	50.4	156.9	9.7

Assessment of project costs

C57 In the following sections we discuss our analysis of Transpower's expected capital cost of investment options.

126 Capex IM, clause D5(2).

127 Transpower, "*BPE HAY Data Files Investment Test Final.xlxs.* Worksheets *"Component Capital Summary"* and *"IT Test results and summary".*

C58 When reviewing Transpower's cost estimates, we have attempted to form a view on whether Transpower's cost estimates are reasonable rather than undertake the complete process of estimating costs. Estimating capital costs is a complex engineering process that requires producing conceptual designs, conducting site investigations, scoping the project and then deriving estimates of cost. Due to our high level approach, we recognise that actual costs may be different from that assessed by us or Transpower.

C59 A summary of Transpower's cost estimate broken down by cost categories is presented in Table C5.[128]

Table C5 Breakdown of project costs (2013 prices $million)

Cost Category	Goat 80 °C	Zebra 65 °C	Zebra 75 °C (proposed investment)	Zebra 85 °C	Goat 50 °C[129]
Conductor and other hardware	9.2	10.8	10.8	11.0	9.6
Steel for towers	1.3	0.9	1.3	1.6	0.6
Labour costs for tower work	24.2	17.3	24.2	29.8	13.2
Foundation strengthening	13.0	11.9	13.1	14.2	13.6
Cost of road and rail crossings	14.5	14.5	14.5	14.5	14.3
Labour for replacing the conductor	28.5	28.5	28.5	28.5	27.5
Construction overheads	20.7	19.7	20.7	21.4	18.5
Substation works	0.4	0.4	0.4	0.4	0.4
Design and project management	12.7	12.6	12.8	12.9	12.5
Environmental and property	3.0	4.6	5.4	6.5	1.4
Conductor trial	3.0	3.0	3.0	3.0	3.0
Total	**130.5**	**124.1**	**134.6**	**143.9**	**114.5**

C60 Our initial assessment was that the costs were high compared to those of similar projects recently completed by Transpower.

128 Transpower, "*BPE HAY Data Files Investment Test Final.xlxs*". Worksheet "*Component Capital Summary*".

129 Transpower, "*BPE HAY Cost Summary including Goat 50.xlxs*". Transpower has advised that the estimated cost of Goat 50 is less accurate than the estimated costs of the other investment options.

C61 Transpower agreed that the costs were comparatively high and explained the reasons for the high costs as the additional work required to:

C61.1 upgrade the lines to current loading design standards that Transpower uses. The current standard requires strengthening a number of towers and the tower foundations;[130]

C61.2 upgrade these lines to deliver reliable service for at least another 50 years;[131]

C61.3 increase the capacity of the lines by more than 160% of the lines initial design capacity.[132] Increasing the capacity by that magnitude requires increasing the heights of a number of towers to ensure safe ground clearances are maintained;

C61.4 that one of the transmission lines was of a much lighter construction than the other line, and consequently requires more strengthening; and

C61.5 there is $12 million of "additional work" included in the project cost. [133] The additional work is maintenance and development work that will be undertaken in the future and is unrelated to the re-conductoring project. The work has been brought forward as it is cost effective to undertake the work as part of the project. This additional cost has reduced the calculated expected net electricity market benefits of the investment options. For this reason, actual benefits are higher than those present in Transpower's and repeated in this paper.

Assessment of operating and maintenance costs

C62 We consider that the estimated operating and maintenance costs for each investment option are reasonable.

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130 Transpower New Zealand Limited, *"BPE-HAY A and B Strengthening Addendum".*

131 Transpower New Zealand Limited, *"BPE_HAY A and B Re-conductoring - Loading Standard Background",* page 1.

132 These lines were originally designed for Goat at 50°C which had a summer/winter capacity of 202/246 MVA. In 2006, Transpower thermally upgraded the lines and increased their capacity to 307/335 MVA. The current proposal will increase the capacity of the line to 366/402 MVA, which is approximately 180% and 160%, respectively for summer/winter, of the initial design capacity. Source Proposal Attachment D.

133 Transpower, *Proposal Attachment C"*, section 4.1.

C63 The present value of the operation and maintenance costs are in Table C4 above.[134] Transpower has based the present value of operation and maintenance cost on an average annual cost of $4 million which is 2.5% of the capital costs.[135] We consider that this amount of operating and maintenance costs is reasonable for refurbished transmission lines.

The electricity market benefits of the options are very similar

C64 We are satisfied with Transpower assessment of the electricity market benefits. Our review analysis supports Transpower's estimated value of the electricity market benefit of keeping the two lines.

C65 The Capex IM defines electricity market benefits as any benefits received by consumers during the calculation period under all relevant demand and generation scenarios that affect net electricity market benefits.[136]

C66 Transpower estimated electricity market benefits by considering the following elements.

C66.1 The benefits of keeping lines A and B.

C66.2 The benefits due to a reduction in losses and shortfall.[137] Shortfall cost arises when high cost generation has to run due to transmission constraints. The higher capacity of the Bunnythorpe-Haywards Lines will increase the amount of electricity that can be transferred between the North and South Islands and hence the incidence (cost) of any shortfall.

C67 Transpower has presented the electricity market benefits of the investment options in Table 4-2 of its Proposal. These are replicated in Table C6 below.

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134 Note that the maintenance costs in Table 4-1 of the proposal are the arithmetic sum of the annual costs. In the paper we have shown the present value of the maintenance costs as presented in Transpower's document *"BPE HAY MCP data File Investment Test Final.xlxs".*

135 Transpower, "*BPE-HAY MCP Datafile Investment Test Final.xlxs",* 28 November 2013.

136 Capex IM, clause D5(1).

137 Transpower collectively calls these two benefits 'system benefits'.

Table C6 Expected electricity market benefits (PV 2013 $million)

Option	Investment option	Benefit of keeping the lines	Benefits due to reduced losses and reduction in generation shortfall[138]	Total benefits	Relative total benefits – relative to Goat at 80 °C
1	Dismantle lines	0.0	0.0	0.0	-977.4
2	Goat at 80°C.	977.4	0.0	977.4	0.0
3	Zebra at 65°C	977.4	15.9	993.3	15.9
4	**Zebra at 75°C**	977.4	27.3	1004.7	27.3
5	Zebra at 85°C	977.4	30.0	1007.4	30.0

C68 Approximately 97% of the electricity market benefits are in keeping the lines. We assessed Transpower's estimate of these benefits. We did not replicate Transpower's calculations. Rather we used historical data[139] on power flows between Bunnythorpe and Wellington (Haywards and Wilton) to estimate the value of these lines to the market.[140]

C69 Based on our review, we are satisfied that Transpower's assessment of the benefits of keeping these lines is reasonable. The system benefits delivered by the investment options and proposed investment are approximately 3% of the benefits of keeping the lines.

C70 We focused on forming a view on the reasonableness of Transpower's assessment of system benefits, rather than undertake a comprehensive review of the underlying calculations. In particular, calculating shortfall benefits is a complex process that requires a specialised calculation tool, so we did not attempt to replicate the calculations.

C71 Transpower calculated systems benefits using the SDDP simulation package. SDDP uses a simplified model of the transmission system and considers demand in load blocks to calculate system benefits. SDDP is well known in the industry and is considered to be a good tool to assess system benefits.

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138 Benefits due to reduced losses and shortfall are relative to Goat at 80°C. Transpower calls this 'system benefits'.

139 Source Transpower *"BPE HAY historical loading".*

140 Using historical data we estimated the shortfall in least cost generation dispatch that would arise without lines A and B. we then used the difference in long run costs to estimate the value of the line over the calculation period.

C72 As seen in Table C6, for the three Zebra options, the NPV of the difference in system benefits between options is $14.1 million in 2013 prices.[141] This difference is likely to be within the margin of error of the calculations of benefits.

C73 We also found that Transpower's generation schedule showed a bias of generation build in the North Island compared to MBIE's schedule. We are satisfied that this difference does not significantly influence the net market benefits of keeping the lines.

C74 We considered the impact of the Transpower's demand forecast and generation scenarios on the relativity between options, in particular Zebra at 65°C and Zebra at 75°C. We note the following:

C74.1 Lower demand favours Zebra at 65°C, as is shown in Transpower's sensitivity analysis.[142] The change in benefits is less than $3.3 million.

C74.2 The optimistic forecast build date for the Clyde generation, under MDS2, does not have a significant impact on the ranking of the options, as shown in Table C2 above.

C75 We therefore consider that, based on the quantifiable benefits only, any of the options could have potentially been selected as the proposed investment. Transpower also recognised this and presented a qualitative evaluation of some unquantifiable benefits, which we discuss later in this attachment.

The estimated the expected net electricity market benefits are reasonable

C76 We consider that Transpower has reasonably calculated the project costs and expected electricity market benefits and hence the expected net electricity market benefits associated with each of the investment options.

C77 Table C7 shows the expected net electricity market benefits that Transpower provided.[143]

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141 $30.0 million – $15.9 million.

142 Transpower, "*Proposal*", Table 5-3 page 17.

143 Transpower, "*Proposal",* Table 5-1 page 14.

Table C7 Expected net electricity market benefits (PV $million in 2013 prices)

Option	Investment option	PV total cost	PV total benefits	Expected net electricity market benefit	Relative expected net electricity market benefits[144]
1	Dismantle lines	25.3	0.0	-25.3	-855.6
2	Goat at 80°C	147.2	977.4	830.2	0.0
3	Zebra at 65°C	142.7	993.3	850.6	20.4
4	Zebra at 75°C	150.3	1004.7	854.4	24.2
5	Zebra at 85°C	156.9	1007.4	850.5	20.2

C78 We consider that Transpower's estimate of expected net electricity market benefits is reasonable based on our conclusions on the electricity market costs and electricity market benefits above.

Our evaluation of Transpower's assessment of unquantifiable benefits

C79 We consider that unquantifiable benefits do not conclusively favour any of the investment options.

C80 When considering unquantifiable benefits of investment options, Transpower must demonstrate that:[145]

C80.1 the difference in expected net electricity market benefits between the investment options is within 10% of the aggregate project costs; and

C80.2 the electricity market benefits are unquantifiable either because the cost of calculating these benefits are disproportionally large compared to their value or the results have a high level of uncertainty.

C81 We are satisfied that the difference in expected net electricity market benefits between investment options 3, 4 and 5 is such that Transpower can consider unquantifiable benefits. The difference between the expected net electricity market benefits is within $4 million while 10% of the aggregate project cost is about $13 million.

144 Relative expected net electricity market benefits are with respect to Goat at 80°C.

145 Capex IM clause D1(2).

C82 Transpower discussed unquantifiable benefits in section 5.1 of the Proposal and summarised its analysis in Table 5-2 of the Proposal. Transpower considered the following variables.

C82.1 Option to further upgrade

C82.2 Consumer benefits through increased competition

C82.3 Minimises disruption

C82.4 Visual impact

C82.5 Operational benefits

C82.6 Alignment with long term grid development

C82.7 Asset life.[146]

C83 We agree with Transpower that the expected values of the benefits of all the above variables cannot be calculated with an appropriate level of certainty.[147] It can be argued that 'increased competition' is quantifiable. However, Transpower has indicated that previous attempts to estimate competition benefits have been difficult to complete with sufficient accuracy.

C84 We are satisfied that Transpower can consider unquantifiable benefits to compare investment options 3, 4 and 5.

C85 We discuss our views on Transpower's assessment of the unquantifiable benefits for options 3, 4 and 5 in the following paragraphs.

C86 'Option to further upgrade benefit' considers whether the investment options have the flexibility to be amended in the future if there are significant changes. We assess that Zebra at 75^{o}C provides a better option value-project cost trade-off than other options. It allows a margin for any short falls in generation and demand forecasts compared with the Zebra at 65^{o}C investment option.

C87 'Consumer benefits through enhanced competition' assesses if any of the investment options will enhance competition. Transpower assessed and we agree that the higher capacity lines will increase the scope for competition, particularly if there are capacity constraints.

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146 Transpower, "*Proposal"*, pages 15-16.

147 Capex IM clause D1(2)(b)(ii) states an electricity market benefit may be treated as unquantified where its expected value cannot be calculated with an appropriate level of certainty.

C88 'Minimisation of disruption' considers which investment will have the least disruption to the community and landowners. Transpower has assessed that options with larger capacity conductors provide higher level of disruption. We disagree on the basis that disruption to the community will be largely independent of investment option.

C89 Visual impact considers the extent to which this project will have a visual impact. Transpower has assessed that Zebra at 65^{o}C will have the most impact. We consider the impact between options is marginal and therefore this is not a significant consideration.

C90 'Operational benefits consider that extent there are operational benefits not reflected in the quantified benefits. Transpower has assessed that higher capacity lines provide additional benefits particularly if any section of the Bunnythorpe Wilton line is out of service. We consider that there are no significant benefits under normal operating conditions, unless both circuits on the Bunnythorpe Wilton line are out of service.

C91 Alignment with long term grid development considers if the investment option is consistent with Transpower's long term vision of the grid. Transpower assessed that higher capacity lines align with Transpower's long term grid development by allowing better utilisation of existing corridors. We consider the three options provide similar alignment with long term grid development.

C92 Asset life assesses the extent to which different options may affect asset life. Transpower considers that conductors operating at lower temperatures may have a better asset life than those operating at higher temperatures. We have no reason to disagree.

C93 We consider that assessment of unquantifiable benefits do not conclusively favour any of the options.

Transpower selected the investment option reasonably

C94 Transpower has selected Zebra at 75°C as the proposed investment after considering both quantified and unquantifiable benefits and concluding that Zebra at 75°C has the highest benefits. Transpower states:

> We have not been able to differentiate between Zebra at 85°C and Zebra at 75°C using unquantified benefits. However, taking the higher expected net electricity market benefit of Zebra at 75°C into account, we consider that Zebra at 75°C is preferred. Zebra at 75°C strikes a good balance between the level of works required on the lines, electrical efficiency of the solution and future options.[148]

[148] Transpower,*"Proposal*", page 16.

C95 We agree with Transpower that none of the options stand out as the most appropriate investment option based on the investment test. Expected net electricity market benefits between the options are close. In addition, the difference costs between the least cost option and the proposed investment is within 10%.

C96 Taking quantifiable and non-quantifiable benefits into account, we conclude that the proposed investment option of Zebra at 75°C is not unreasonable. Zebra at 75°C provides an appropriate option value:

C96.1 when allowing uncertainties in forecasting and assumptions used in calculations;

C96.2 when considering the disruptions to affected parties, land owners, if another major upgrade of these lines has to be undertaken;

C96.3 because the additional expected net market benefits of upgrading to Zebra at 75°C is similar to the expected additional cost. In comparison, upgrading to Zebra at 85°C produces diminishing returns where the additional benefit is less than the additional cost compared to Zebra at 75°C. These are shown in Table C8 below; and

C96.4 because Zebra at 75°C has higher expected net electricity market benefits than Zebra at 65°C for the two MDSs - MDS4 and MDS5 - that have the highest influence on the expected net electricity market benefits, as shown in Table C9 below.[149]

Table C8 Relative expected costs and benefits of the Zebra investment options

Investment options	Relative expected capital costs ($million in 2013 prices)[150]	Relative expected electricity market benefits (PV $million in 2013 prices)[151]
Zebra at 65°C	0	0
Zebra at 75°C compared to Zebra at 65°C	10.5	11.4
Zebra at 85°C compared to Zebra at 75°C	9.3	2.7

149 Both Transpower's updated MDS4 and MDS5 forecast that in the medium term most of the new generation builds will in the North Island. This appears to the case at the moment.

150 Calculated from Transpower, "*Proposal Attachment E",* page 8, Table 3-1.

151 Calculated from Transpower, "*Proposal Attachment E",* page 9, Table 3-2.

Table C9 Expected net electricity market benefits by MDS (PV $million in 2013 prices)

Investment option	MDS1	MDS2	MDS3	MDS4	MDS5	Average
Zebra at 65°C	**116.6**	**68.7**	**50.2**	836.9	3180.7	850.6
Zebra at 75°C	114.4	64.6	43.6	**838.7**	**3210.9**	**854.4**
Zebra at 85°C	108.3	58.6	37.6	833.9	3213.9	850.5

C97 Transpower has presented the electricity market benefits of the investment options in Table 5-1 of its Proposal. These are replicated in Table C10 below.

Table C10 Expected net electricity market benefits (PV $million in 2013)

Option	Investment option	Electricity market benefits	Project costs	Expected net market benefit	Relative expected net market benefits
1	Dismantle lines	0.0	25.3	-25.3	-856.5
2	Goat at 80°C	977.4	146.3	831.1	0.0
3	Zebra at 65°C	993.3	141.3	852.0	20.9
4	**Zebra at 75°C**	1004.7	148.6	856.1	24.9
5	Zebra at 85°C	1007.4	155.3	852.1	21.0

Proposed investment is robust to sensitivity analysis

C98 We are satisfied that the outputs of the sensitivity analysis, as presented by Transpower in Table 3-8 of the Proposal shows that the proposed investment is sufficiently robust under sensitivity analysis.[152]

C99 The Capex IM requires that the selected option be robust to sensitivity tests and lists the sensitivity test analysis parameters. The Capex IM also allows Transpower some discretion in selecting the values of these parameters.

C100 Table C11 sets out the sensitivity analysis parameters stated in the Capex IM, those applied by Transpower and our assessment of them.[153]

[152] Transpower, "*Proposal*", page 13.

[153] Capex IM, clause D8.

Table C11 Sensitivity analysis variables

Variable and clause in Schedule D	Included/not included in sensitivity analysis	Commission's assessment
D8(1)(a) forecast demand.	Considered low and high values to reflect uncertainties in demand forecasts.	Reasonable to consider low and high demand forecast since these affect the benefits of the investment options and proposed investment. As noted previously the base demand forecast is high than the current.
D8(1)(b) the size, timing, location, fuel costs and operating and maintenance costs, relevant to existing assets, committed proposals, modelled proposals and the investment option.	Transpower has considered changes in maintenance costs by +/- 20%.	Reasonable, since maintenance costs contribute significantly to project costs.
D8(1)(c) changes in the capital cost of the investment option and modelled projects.	Included costs +/- 20%.	Reasonable. +/- 20% is appropriate since uncertainties in the cost estimate are within 20%.
D8(1)(f) discount rate.	Included as 4% and 10%.	As required in the investment test.[154]
D8(1)(h) relevant demand and generation scenario probability weightings.	Tested the weightings of MDSs until Zebra at 65 ^{o}C becomes preferable.	Reasonable. Tested weightings until Zebra at 65 ^{o}C has the highest net electricity market benefits.
D8(1)(g) range of hydrological inflow sequences.	Not included.	Reasonable. Included in base analysis modelled within SDDP and therefore not included in the sensitivity analysis.
D8(1)(d) the timing of decommissioning, removing or de-rating decommissioned assets.	Not included.	Reasonable. Does not affect the proposal.
D8(1)(e) the value of unserved energy (Voll).	Not used.	Benefits are not related to unserved energy.
D8(1)(i) competition benefits.	Not included.	Not applicable.
D8(1)(j) Other variables cost of losses.	Not used.	

[154] Capex IM, clause D8(3).

C101 We consider that the variables used for the sensitivity test and their ranges are reasonable.

C102 Transpower has presented the results of its sensitivity analysis in Table 7-5 of the Proposal. Overall, the results show that the ranking between options does not change from Zebra at 75°C except for two sensitivity variables - low demand forecast and high discount rate of 10%.

C103 Zebra at 65°C is preferred in both of these scenarios, the lower increase in demand and higher discount. For all other sensitivity analysis variables, Zebra at 75°C remains the option with the highest expected net electricity market benefits. We consider that since any demand forecast is uncertain the proposed investment of Zebra at 75°C is sufficiently robust to sensitivity analysis.

Attachment D: Compliance with process requirements

Process requirements of the Capex IM

D1 The Capex IM requires that Transpower's Proposal meets the consultation, information and certification requirements.[155]

D2 The details of our evaluation of the individual requirements are shown below.

Consultation programme and approval timeframes

D3 We are satisfied that Transpower met its requirement to agree a "consultation programme and approval timeframes" with the Commission when the Transpower starts to plan an MCP.[156]

D4 The Capex IM requires that Transpower must meet notify the Commission of its intent to plan a major capex project. Transpower is required to agree on a consultation programme, an approach for considering non-transmission solutions and approval timeframes with the Commission. Transpower must publish, regularly review and update these matters.[157]

D5 On 27 August 2013, Transpower notified the Commission that it plans to submit an MCP for Bunnythorpe-Haywards Investment Proposal.[158] In that notification, Transpower also advised the Commission that it will withdraw its Grid Upgrade Plan (GUP) proposal "Bunnythorpe-Haywards Conductor Replacement investment proposal". Transpower had submitted Bunnythorpe-Haywards Investment Proposal as a GUP in December 2011. After undertaking a detailed solutions study, Transpower decided to withdraw its GUP and re-submit an MCP.[159]

D6 The Commission and Transpower agreed on a consultation programme and approval timeframes on 6 September 2013.[160]

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155 Capex IM, Schedule I, schedule G and Part 9.

156 Capex IM, clause 3.3.1.

157 Capex IM, clause 3.3.1.

158 Transpower letter "Bunnythorpe Haywards Investment Proposal" (27 August 2013).

159 Before the Capex IM, Transpower used to submit Grid Upgrade Plans under the Electricity Governance Rules. This document is available on our web site http://www.comcom.govt.nz/regulated-industries/electricity/electricity-transmission/transpower-major-capital-proposal/bunnythorpe-haywards-a-and-b-lines-conductor-replacement-investment-proposal/.

160 Commission's letter to Transpower "*Bunnythorpe Haywards Investment proposal - consultation programme and approval timeframes",* 6 September 2013.

Transpower's consultations met the requirements of the Capex IM

D7 We are satisfied that Transpower met its consultation requirements.

D8 The Capex IM requires that Transpower must consult on its investment need, variation to the MDS, key assumptions, a long list of options and a short list of investment options.[161]

D9 In October 2010, before the Commission determined the Capex IM, Transpower consulted on its long list of options under the now superseded Electricity Governance Rules.[162]

D10 The Commission agreed that since Transpower had met the requirements of the Capex IM when it consulted in October 2010, Transpower did not need to re-consult on its long list of options again in 2013.[163] The Commission also agreed that Transpower did not need to consider non-transmission solutions since these are not relevant to this project.[164]

D11 Transpower and the Commission met regularly during the time between the notification and submitting the MCP and discussed the progress of the consultation.

D12 Transpower consulted on its short list of investment options in September/October 2013.[165] We reviewed Transpower's programme and the short list consultation documents against the agreed programme and approach. As a result of this review we consider that Transpower consulted on the Proposal according to the requirements.

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161 Capex IM, Schedule I1.

162 Transpower New Zealand. Limited, "*Bunnythorpe Haywards A and B Transmission Line Investigation Assumptions Approach and Long list Options*" (October 2010). Available at https://www.transpower.co.nz/projects/bunnythorpe-haywards-and-b-transmission-line-investigation/bunnythorpe-haywards-and-b-0 as at 30 November 2013.

163 Capex IM, clause 8.1.3(2)(a) allows the Commission to consider the extent and nature of relevant prior consultations when agreeing to a consultation programme.

164 Capex IM, clause 8.1.3(2)(b).

165 These documents are available at https://www.transpower.co.nz/projects/bunnythorpe-haywards-and-b-transmission-line-investigation/bunnythorpe-haywards-and-b-0 as at 30 November 2013.

Information requirements

D13 The Capex IM requires that Transpower's Proposal meets the specified information requirements.

D14 Transpower provides a table mapping the information required by the Capex IM onto information provided within its MCP.[166]

D15 We have reviewed this table against the Capex IM and are satisfied that Transpower's Proposal has met the relevant information requirements.

Certification requirements

D16 The Capex IM requires that Transpower's Chief Executive Officer (CEO) certifies the Proposal.

D17 Transpower provided a certificate signed by the CEO.[167]

D18 We have reviewed this certificate against the Capex IM and are satisfied that it meets the relevant certification requirements.

166 Transpower, "*Proposal Attachment* A", section 7.

167 Transpower, "*Proposal Attachment F*", section 8.

Attachment E: Documents submitted by Transpower

E1 This attachment provides a list of the documents Transpower provided to support its application.

Table E1 Transpower's Proposal, Attachments and supporting documents[168]

Document title	Abbreviation used in this document
Documents supplied on 8 November 2013	
Bunnythorpe-Haywards Lines A and B investment Major Capex Proposal November 2013	Proposal
Bunnythorpe-Haywards Lines A and B investment Attachment A – Meeting the requirements of the Rules	Proposal Attachment A
Bunnythorpe-Haywards Lines A and B investment Attachment B – Condition assessment of the Bunnythorpe – Haywards A and B lines	Proposal Attachment B
Bunnythorpe-Haywards Lines A and B investment Attachment C – Options and Costing report	Proposal Attachment C
Bunnythorpe-Haywards Lines A and B investment Attachment D – Power Systems Analysis report	Proposal Attachment D
Bunnythorpe-Haywards Lines A and B investment Attachment E - Investment Test analysis	Proposal Attachment E
Bunnythorpe-Haywards Lines A and B investment Attachment F – Summary of submissions and reply to submissions	Proposal Attachment F
Supporting documents supplied on 12 November 2013	
BPE-HAY MCP Data File Investment Test Final.xlxs 8-11-2013	
BPE-HAY MCP Data File MCA Final.xlxs 8-11-2013	
BPE-HAY historical loading.xlxs 5-11-2013	
BPE-HAY Benefits Breakdown.xlxs 5-11-2013	
BPE-HAY Re-conductor Assumptions.xlxs 5-11-2013	
BPE-HAY high level and L2 cost reports for all investment options	

168 The proposal and attachments are available on the Commission's website at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-transmission/transpower-major-capital-proposal/bunnythorpe-haywards-a-and-b-lines-conductor-replacement-investment-proposal/ and on Transpower's website at https://www.transpower.co.nz/projects/bunnythorpe-haywards-and-b-transmission-line-investigation/bunnythorpe-haywards-and-b-0.

Table E2 Supplementary information supplied by Transpower

Date supplied and method	Document title	Description
Email 18 November 2013.	SDDP benefits breakdown.	Summary of breakdown of systems benefits.
Email dated 23 December 2013.	Bunnythorpe - Haywards Conductor Replacement – Major Capex Proposal Response to Commission Questions issued 27 November 2013.	Clarify the cost estimate and comment on the power transmission line design standards.
February 2014.	Bunnythorpe -Haywards Conductor replacement Major Capex Proposal Clarification.	Provide details on the cost of rectifying the towers and foundations due to construction defects or wear and the cost of bringing to modern design standards.

Table E3 Supplementary information supplied by Transpower

Date supplied and method	Document title	Description
Supplementary information supplied pre-proposal		
Email dated 6 September 2013.	BPE-HAY re-conductoring draft costs.	Summary of the cost estimates of Transpower of the investment options.
11 September 2013.	BPE-HAY A and B Lines re-conductoring SSR.	Solution Study Report investigating the re-conductoring of the Bunnythorpe to Haywards A and B transmission lines.
Email dated 26 September 2013.	BPE-HAY A and B - Design Standard.	Transpower standard DL 12.01 – Transmission Line Loading Code.
Email dated 29 October 2013.	Supplementary information: Bunnythorpe-Haywards Property, consents etc.	Transpower's confirmation that it believes that consents and property rights issues are not major.
Email dated 29 October 2013.	BPE-HAY Cost Summary including Goat 50.	Transpower's estimated of costs to re-conductor at Goat at 50.
Email dated 31 October 2013.	BPE-HAY A and B Strengthening Addendum.	BPE_HAY A and B Re-conductoring - Loading Standard Background.
Provided by email dated 4 November 2013.	Review of TP.DL-12.01.	SKM's comparison of Transpower's overhead line code TP.DL 12.01 (TP 2011) with earlier issues of the document.
Provided via the extranet.	BPE-HAY Historical loading.	Historical loading data on the transmission lines between Bunnythorpe and Wellington.

Table E4 Transpower's consultation material[169]

Document title
Request for Information and Options, Approach and Assumptions Document November 2010
Bunnythorpe-Haywards Draft Major Capex Proposal, September 2013.
Bunnythorpe-Haywards Draft Major Capex Proposal - Attachment B, September 2013. (Condition Assessment).
Bunnythorpe-Haywards Draft Major Capex Proposal - Attachment C, September 2013. (Investment Test).
Bunnythorpe-Haywards Draft Major Capex Proposal - Attachment D, September 2013. (Options and costing report).
Bunnythorpe-Haywards Draft Major Capex Proposal - Attachment E, September 2013. (Power system analysis).
Bunnythorpe-Haywards Draft Major Capex Proposal - Attachment F, September 2013. (Stakeholder engagement).

E2 After Transpower provided the information and data listed above, we were satisfied that the data, analysis and assumptions provided by Transpower are fit for the purpose.

169 These documents are available at https://www.transpower.co.nz/projects/bunnythorpe-haywards-and-b-transmission-line-investigation/bunnythorpe-haywards-and-b-0.