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RCP2 Project Overview Document

Project:	**Hororata and Kimberley Voltage Quality**
Expenditure Class:	**Base Capex**
Expenditure Category:	**Grid – Enhancement & Development**
As at date:	**June 2014**

Expenditure Forecast *Real 2012/13 NZ$ (m)*	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	**Total**
CAPEX	3.36					**3.36**

Need Identification

Describe the reason for proposing a project (i.e. **need or trigger**)	This project is to install 27 MVar of reactive support (3 x 9 MVar capacitors) on the Hororata 66 kV bus. The capacitor bank will avoid the need to manage load at Hororata or to constrain on Coleridge generation. Hororata and Kimberley are connected to the rest of the network from: • Islington via two 66 kV Hororata–Kimberley–Islington circuits, and • Coleridge and the West Coast via two 66 kV Coleridge–Hororata circuits. If Coleridge generation is low: • the voltage at Hororata and Kimberley will drop below acceptable limits (below 0.95 pu) with normal system configuration (i.e. all circuits in service) at times of high load; or • an outage of one of the 66 kV Hororata–Kimberley–Islington circuits will cause the voltage to drop below 0.9 pu at Hororata and overload the other Hororata–Kimberley–Islington circuit at times of high load. The magnitude of the voltage drop and circuit overload is dependent on the total combined Hororata and Kimberley load coupled with the amount of generation and number of generating units at Coleridge[1].

[1] The number of in service generating units at Coleridge will dictate the amount of reactive support Coleridge can provide to support the voltage at Hororata and Kimberley.

	We have entered into a Wider Voltage Agreement with Orion to allow the 66 kV voltage at Hororata and Kimberley to fall below the principal performance obligations limit of 0.95 pu (as defined in the Electricity Industry Participation Code). In addition, we have installed an Automatic Under Voltage Load Shedding (AUVLS) scheme at Hororata to shed up to 23 MW of load at Hororata if the 66 kV voltage drops below 0.9 pu. Orion has indicated that the dairy factory at Kimberley plans a third drier in 2017[2]. This additional load at Kimberley coupled with the forecast demand growth at Hororata will: • cause the 66 kV voltage at Hororata to drop below 0.95 pu from about 2014 and 0.9 pu for normal system configuration from about 2017, if Coleridge generation is unavailable. This will trigger the AUVLS scheme without requiring a contingent event; or • result in voltage collapse, possibly causing widespread loss of supply as far as the West Coast, if one of the circuits tripped. Subsequent re-dispatch of generation at Coleridge, if available, allows load to be restored post-event. As the load at Hororata and Kimberley increases, the generation required at Coleridge to compensate for the loss of a circuit increases. The ability of Coleridge generation to compensate for the loss of a circuit is limited by the capacity of the station and the availability of stored water. In recent years, it has been difficult to plan maintenance outages for assets over the wide area from the Islington–Hororata circuits to the West Coast due to the need to manage the low voltage issue at Hororata. Outage windows are limited in the area as they need to be co-ordinated with times of high Coleridge generation and low Hororata and Kimberley load[3]. The Islington–Kimberley–Hororata circuits are not part of the core grid as defined in the Electricity Industry Participation Code. Any investment to mitigate the effects of a circuit outages needs to show a net market benefit. We have carried out a high level estimate of the cost of lost load using the historical generation profile at Coleridge and the probability of one of the Hororata–Kimberley–Islington circuits tripping. This gave a conservative NPV cost of unserved load due only to the AUVLS scheme operating of approximately $4.0 million to $6.0 million, that could be saved by installing additional reactive support at Hororata.
What is the **timing** of the need and the **confidence level** that issue(s) will eventuate	The AM09 - Annual Planning Report (APR) 2013 prudent forecast indicated that the need date of this project is 2016 (2014, if Coleridge is not generating). We have a high level of confidence that this project will proceed during RCP2.

[2] Orion has advised additional load from a third drier is likely in 2017. Based on recent experience it is credible for the plant owner to accelerate planned expansion with little notice. The Kimberley plant was originally commissioned in 2012 with one drier connected at 33 kV into the Orion network. At that time provision was made for conversion to a 66 kV GXP when a second drier was planned to be added between 2017 to 2020. The plant owner plan's changed and the commissioning of this second drier and the conversion to a 66 kV GXP actually occurred in 2013. For this reason we have upgraded the confidence of this project occurring during RCP2 to high and will shortly begin an investigation to confirm the preferred option.

[3] Outage windows for the West Coast and Nelson-Marlborough are normally during the summer months.

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Generic assumptions underpinning the need – including any modelling used	DigSilent version 14.1.3 was used in this study. Planning assumptions included the following: • the AM09 - APR 2013 demand forecast (prudent regional peak demand) is used to identify the need date. See AM09 - Annual Planning Report 2013, Chapter 4 for the demand forecast methodology; • no new generation connection in the Canterbury region apart from that which is already committed. See AM09 - Annual Planning Report 2013, Chapter 5 for the generation assumptions; • addition of third drier at Kimberley dairy factory in 2017; and • low Coleridge generation.

Long list of options and high level assessment

Option Type	Option	Fit	Feasible	Practical	GEIP	Security	Cost	Short list
Demand side	a) Demand response (DR)	✓	✗	✗	✓	✓	✗	✗
Supply side	b) Generation grid support contract	✓	✓	✓	✓	✓	✓	✓
Transmission options	c) Extend Special Protection Scheme (SPS)	✓	✓	✓	✓	✓	✓	✓
	d) Install capacitor at Hororata 66 kV bus	✓	✓	✓	✓	✓	✓	✓
	e) Install dynamic reactive support at Hororata 66 kV bus	✓	✓	✓	✓	✓	✗	✗
	f) System Operator intervention/operational measures	✓	✓	✓	✓	✓	✓	✓

- Fit for purpose – will meet the transmission need.
- Technical feasibility – complexity of solution; reliability, availability and maintainability of the solution; future flexibility – Grid Development Strategy.
- Practicality of implementation – Solution implementable by required date (probability of proceeding); property and environmental risks; implementation risks.
- Good electricity industry practice (GEIP) – consistent with good international practice; ensure safety and environmental protection; accounts for relative size, duty, age and technological status.
- System security (additional benefit resulting from an economic investment) – improved system security; system operator benefits (controllability); Dynamic benefits (modulation features and improved system stability).
- Indicative cost – whether an option will clearly be more expensive than another option with similar or greater benefits.

Short list of options	
Option 1 – Do Nothing/System Operator intervention	'Do-nothing' – no network enhancement. System operator manages load at Kimberley and Hororata pre event, Coleridge generation will be constrained on to provide voltage support and/or the existing SPS will be used to manage voltages within the acceptable range.
Option 2 – Capacitor bank	Under this option we would install three 9 MVar capacitor banks at the Hororata 66 kV bus.
Option 3 – Extend SPS	Extend the existing SPS to include: • another load feeder for voltage control in the scheme; and • managing loading on the Islington–Kimberley–Hororata circuits (as well as low voltages).
Option 4 – Generation (grid support contract)	Generation support contract for Coleridge generation to supply both MW and MVar.

P50 option costs	
Brief description of the approach used to estimate capex, and, if applicable, opex	A desk-top assessment of a high level scope and 'building block' cost is used to estimate the cost for each option and determine the preferred option. The cost of the preferred option has been substituted with a detailed site specific estimate. This cost is +/- 30%. The approach and key assumptions used to compile the preferred option estimate are: • the project scope and likely location of the new assets have been determined from a desktop review of aerial photographs, site layout drawings, underground services drawings, and available cable ducts • the scope assessments have been used to estimate materials and work quantities • the component costs for material and work quantities have been taken from TEES (cost estimation software) • material and plant costs have been determined with reference to period supply contracts currently in place and historic installation costs respectively • civil and earthworks costs have been extrapolated from historic costs; and • installation costs are informed by similar historic projects and or current quotes from service providers and applied based on the requirements of the site. The total project cost is consistent with historic costs for similar types of projects completed in the past.

Option 1 – Do Nothing/System Operator intervention	We have made a conservative estimate of $4m to $6m NPV associated with the load shedding from the operation of the AUVLS system. This provides a lower boundary of the costs of this option. Our estimate assumed a Value of Lost Load (VOLL) of $20,000 and no load growth beyond 2017. The range reflects three different prudent load forecasts, the 2013 and 2014 APR forecasts and a forecast supplied by Orion. There would be significant additional costs from load management pre-event for voltage less than 0.90pu, without a fault.
Option 2 – Capacitor bank	$3.4m
Option 3 – Extend SPS	$300k+. The lower limit is the standard SPS cost, a higher cost more complex solution is likely to be required. Costs and technical feasibility will be refined during the investigation stage.
Option 4 – Generation (grid support contract)	To be determined as part of BC2 investigation.

Net benefits and outputs	
Option 1 – Do Nothing/System Operator intervention	• No investment is required. • Pre-event load management will be required from 2017 if insufficient Coleridge generation is dispatched. The existing under voltage SPS does not shed enough load to manage voltages post event. The cost of the post event load management from the AUVLS scheme operating is calculated at $4m to $6m (NPV).
Option 2 – Capacitor bank	• Provides voltage support pre and post event. • Does not depend on the ongoing provision of services by a third party. • Reduces cost of energy not served as demand does not need not be managed post or pre-event. The savings from avoiding load shedding from the operation of AUVLS are estimated at least $4m. There would be additional significant avoided costs of lost load from pre-event load management.
Option 3 – SPS	• Reduces cost of energy not served as some load does not need to be managed pre event. • Relatively quicker to implement compared to option 2.
Option 4 – Generation (grid support contract)	Provides real power (MW) and reactive support 66 kV reducing network loading.

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Option risk assessment	
Option 1 – Do Nothing/System Operator intervention	Post-event load management via the existing AUVLS scheme will be insufficient as demand increases, requiring pre-event load shedding or constrained on generation at Coleridge. There is a risk voltage support from generators is not available when it is needed (i.e. when machines are out of service due to scheduled maintenance or generation restricted due to low lake levels).
Option 2 – Capacitor bank	• Variation in demand forecast or new generation injection in the area would shift the need date, with a risk of an investment being made too early or not able to meet the need date. • Reasonable likelihood of cost variation – possible 66 kV bus extension, civil works, land and property issues, etc., however any variation is unlikely to exceed overall assessed NPV. • Not meeting the need date – delay in environment consent approval, tackling with land and property issues, if any.
Option 3 – Extend SPS	• Variation in demand forecast or new generation injection in the area would shift the need date, meaning there is the risk of an investment being made too early or not able to meet the need date. • Cost variation – higher cost if communication infrastructure upgrade is required for SPS to function correctly (new relays and cubicles, and potentially communication links). • Technical feasibility is not confirmed. Detailed investigation is required to determine if existing AUVLS can be extended to include the functionality required for managing loading of the Hororata-Kimberley-Islington circuits. It is not confirmed that an SPS is a viable option from 2017. • SPS can be complicated and difficult to coordinate which will increase the project cost.
Option 4 – Generation (grid support contract)	• It is not certain that a satisfactory long term agreement can be achieved. The agreement would need to have lengthy notice period provisions (2-3 years notice of termination to provide sufficient time to develop other options). • Cost likely to be greater than other options.

Preferred option(s)	
What is the currently preferred option / sequence of options / or short-listed options?	Our preference is for option 2 – to install three 9 MVar capacitor banks at Hororata. However the technical feasibility and cost of option 3 will be further explored in the BC2 investigations.
Set out the reasons for choosing the preferred **option(s)**.	The preferred option is not dependent on the availability of generation and the AUVLS SPS. It allows greater maintenance windows for other assets reducing the cost of maintenance, and is not dependent on the provision of services by a third party in the long term.

List key **assumptions** used in determining the preferred option(s).	Demand, generation and cost estimation assumptions used in studies to date, are set out above.
List any **interdependencies** which the preferred option is reliant upon for a successful outcome.	Ability to obtain sufficient outages, in both number and duration, to enable the work to be carried out.

Steps to completion	
What are the next step(s) in choosing the solution	The next step is BC2 investigation of the preferred solution. In accordance with our business case process (as described in section 3.6.1 of the AM03 - Planning Lifecycle Strategy) the next steps will be to: • carry out a detailed investigation (BC2) to formally select the preferred option; and • obtain internal approval to proceed with the project (BC3).
When did / will the steps in the internal approval process occur / take place and where were / will they be documented and described	We will follow the following processes for preparing investment proposals: • conduct BC2 investigation to confirm the preferred option, in Q3 2014; • complete consultation with affected stakeholders in Q3 2015; • submit the preferred solution for approval in Q4 2015; • complete the BC3 for project execution in Q2 2016; and • expected commissioning date – 2017.
Identify the key services and assets that will need to be procured to complete the preferred option	Depending on the preferred solution identified in the detailed assessment (BC2) phase, key assets to be procured are the capacitor banks and all associated works at Hororata. We expect to outsource the detailed design of the preferred solution. In accordance with our Procurement Policy, we will ensure that a robust and auditable purchase decision-making process is followed. We will complete a Procurement Plan to document the procurement process and for audit purposes. The plan helps us plan for the external procurement of goods and services in a way that ensures we are making the most appropriate purchasing decision for our stakeholders and ourselves.
Identify the key delivery risks	• Projects not properly scoped can lead to cost overruns and not meeting deadlines. During the planning process, we will ensure project scope is adequately defined and it can be implemented within the required timeframe and cost. • We will ensure the project is designed to its specification, the appropriate design reviews are conducted and detailed factory inspections are carried out to manage risks.

	• In the process of procurement, it is essential that we select a supplier that is able to consistently meet quality requirements. Quality must not be compromised in favour of other factors because of the critical influence of quality on risk to safety and the network. • If applicable, we will standardise specifications and procurement of primary equipment to limit diversity and increase inter-changeability. This also allows procurement efficiencies to be attained. • Safety is paramount, the design of all equipment installed must be safe to operate and maintain without compromising performance. Vendors are selected with great care to ensure safe installation and commissioning work and full compliance with all our safety requirements and expectations. • All works required on site will be carried out in full compliance with all of our safety requirements and expectations.

Supporting Documents and Models	
List of all relevant documents (including relevant policies and consultant reports) taken into account in estimating project costs and describing anticipated deliverability.	AM09 - Annual Planning Report 2013, refer: Chapter 4, Demand Forecasting Methodology; Chapter 17, Canterbury region AM03 - Planning Lifecycle Strategy
Provide a schedule of any models used (including descriptions of model operation and scope).	DigSilent version 14.1.3