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RCP2 Project Overview Document

Project Name:	**E&D Other**
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	0.21	0.05		0.21	0.38	**0.85**

Need Identification

Describe the reason for proposing a project (i.e. **need or trigger**)	This Project Overview Document (POD) provides an overview of three minor Enhancement and Development projects, totalling $0.85m. 1. **Christchurch reactive power controller (RPC):** The Christchurch RPC was commissioned in November 2011 as a "proof of concept" and the learnings from this RPC will be used to scope future RPCs around the country. This RPC currently coordinates and controls two local RPCs at Islington and Bromley substations and an Area RPC for Christchurch (installed at Islington). Any significant system configuration change at Islington or Bromley will require modifications to the RPC. The existing Bromley interconnecting transformers T5 and T6 have 30 MVar capacitor banks connected to each of their tertiary windings. These capacitor banks are currently not controlled by the Christchurch RPC as the Bromley transformers have off-load tap changers. The Bromley transformers are scheduled for replacement between 2018 and 2020 with on-load tap changers. The Christchurch RPC will require a modification to include the Bromley transformer tap changers and capacitors (post transformer replacement) to enhance the voltage management capability within the Christchurch region to enable faster response to events. The RPC was installed with a simplified simulator that had limited functions which allowed simulation of only one Area RPC Control and one Local RPC control with no redundancy. An upgrade of the simulator is required to allow full simulation of the network, full functional testing and implementation of any future modification to the RPC operation scheme due to network topology changes. 2. **Real Time Digital Simulator (RTDS) upgrade:** The prudent design and operation of a power system requires an understanding of the impact of electromagnetic transients. The RTDS is used to assess the system transient behaviour against different protection designs and control settings, and the system performance under disturbance and fault conditions. The present processor capability of the RTDS limits the level of detail that can be included in the model of the power system, and requires the use of simplified models. As a result, some aspects of the network are not represented, potentially hiding issues that could require mitigation when discovered. This project will enhance our RTDS capability by

	upgrading the simulator processor capability so the system can be more accurately modelled and understood. 3. **Supply transformer minor enhancement project:** The supply transformer capacity at Te Awamutu, Waipawa, and Opunake is constrained by the capacity of secondary equipment including metering and protection. These are three minor projects to enhance the secondary equipment to enable utilisation of installed transformer capacities.
What is the **timing** of the need and the **confidence level** that issue(s) will eventuate	The need dates of these projects fall within RCP2. We have a high level of confidence that all projects will proceed.
Generic assumptions underpinning the need – including any modelling used	DigSilent version 14.1.3 was used in the studies.

Proposed solutions	
Option 1	This section outlines the proposed solutions for each of the projects. Given the low cost, expenditure analysis of alternatives is not warranted. • Christchurch reactive power controller: Upgrade Christchurch RPC to include Bromley replacement transformers and capacitors. Expand the RPC simulator to include the full range of Islington local and area RPC control, Bromley local RPC control with redundancy. • Real Time Digital Simulator upgrade: Upgrade RTDS capability by replacing one GPC card in each rack with a PB5 card. A total of four PB5 processor cards will be installed. • Supply transformer minor enhancement project: Undertake work to increase protection limits (e.g. raise protection settings, upgrade protection relays) and re-calibrate metering to allow supply transformers to achieve their rated thermal capacity.

P50 option costs	
Brief description of the approach used to estimate capex, and, if applicable, opex	Desk-top assessments of high level scopes and building block costs were used to estimate the costs for each of the proposed tasks. The approach and key assumptions used to compile the solution estimates have included (to the extent feasible): • the likely location of new assets based on site layout drawings, and available cable ducts; • a likely scope assessment has been used to estimate materials and work quantities; • typical component costs for material and work quantities have been taken from TEES (US cost) • typical material and plant costs have been determined with reference to period supply contracts currently in place; and • typical installation costs are informed by similar historic projects and applied based on the requirements of the site. The total cost of $0.85m for the specified minor Enhancement and Development project, comprises: • Christchurch RPC: $0.59m; • Real Time Digital Simulator upgrade: $0.1m; and • supply transformer minor enhancement project: $0.16m. All costs are +/- 50 per cent.

Net benefits and outputs	
Option 1	1. The Christchurch RPC project (with the simulator upgrade) will: • allow Bromley capacitors to be controlled by the RPC and therefore enable faster response to events. By adding Bromley transformers' tap-changing capability and capacitors to the RPC, it increases the reactive support capacity which allows more reactive power reserve from the SVC3 and SVC9 at Islington; • increase the power transfer limit to the Upper South Island due to better reactive power management, especially during an event; • upgrade the training simulator to include full redundancy of each RPC (Christchurch area RPC, Islington local RPC, Bromley local RPC), allowing for more reliable testing and implementation of future topology changes or upgrades to the Christchurch network, including the new Bromley transformers above; • make future testing of RPC functional changes easier; and • provide better training facilities for operators and technicians. 2. The RTDS upgrade will: • allow more aspects of the network to be modelled and simulated to provide more detail on our system behaviour under different scenarios. This will mean we can better minimise potential system risks that lead to loss of load and minimise the cost to mitigate before

	the issues arise; and • with the new PB5 card, which has two processors, the upgrade will make it possible to have two network solutions in one rack so that the simulator can represent more than double the number of nodes (144). 3. The supply transformer minor enhancement project will address the N-1 transmission capacity issue in the next 10 to 15 years, ensure there is no loss of load for an unexpected outage of either one of the supply transformers at these GXPs, and defer more significant investment.

Option risk assessment	
Option 1	Christchurch RPC: there is a risk of cost variation and controller 'teething' issues. Usually this occurs in the first 12 months as we gain familiarity with the equipment. Potential problems could be switching in/out of capacitors and transformer tapping unexpectedly which could lead to an unexpected change in system voltage.

Preferred option(s)	
What is the currently preferred option / sequence of options / or short-listed options?	Option 1.
Set out the reasons for choosing the preferred **option(s)**.	1. Christchurch reactive power controller – upgrade the RPC to accommodate new interconnecting transformer at Bromley and the capacitor banks connected to the tertiary windings and enhance the training simulator to allow for more reliable testing and implementation of future changes. 2. Real Time Digital Simulator upgrade – able to model more complex system model. 3. Supply transformer minor enhancement project – able to fully utilise the transformer thermal capacity.
List key **assumptions** used in determining the preferred option(s).	
List any **interdependencies** which the preferred option is reliant upon for a successful outcome.	The ability to obtain outages of sufficient number and duration to undertake the work are the keys for a successful outcome in most cases.

Steps to completion	
What are the next step(s) in choosing the solution	In accordance with our business case process (as described in section 3.6.1 of the AM03 - Planning Lifecycle Strategy) the next steps are 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 options; • complete consultation with affected stakeholders, as required; • submit the preferred solution for approval; and • complete the BC3 for project execution.
Identify the key services and assets that will need to be procured to complete the preferred option	This depends on the preferred solution identified in the detailed assessment (BC2) phase. Once an investment proposal is identified, we will identify the key services and assets that will need to be procured to complete the preferred option. 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 (as needed) 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.

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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.	