Powerco CPP – Portfolio Overview Document

Portfolio Name	Pyes Pa Capacity Reinforcement
Expenditure Class	Capex
Expenditure Category	Growth & Security
As at Date	12 June 2017

Expenditure Forecast[1,2]	Pre CPP	FY19	FY20	FY21	FY22	FY23	Post CPP	CPP Period Total	Project Total
Pre-Internal Cost Capitalisation and Efficiency Adjustments[3] *(2016 Constant NZ$(M))*	$2.4	$2.6	$0.0	$0.0	$0.0	$0.0	$0.0	$2.6	$5.0
Post-Internal Cost Capitalisation and Efficiency Adjustments *(2016 Constant NZ$(M))*	$2.6	$2.8	$0.0	$0.0	$0.0	$0.0	$0.0	$2.8	$5.4

Description

Project need overview	The distribution network supplying the Pyes Pa area to the south of Tauranga is currently unable to meet our security of supply standards. There is insufficient backup capacity to support the load if normal supply fails. This exposes customers to low voltages. Accelerated and sustained load growth in the area has and will continue to worsen these issues. Not doing anything will risk exposing customers to unacceptably long outage periods during a fault event.

Preferred Solution

Project solution Overview	The preferred solution is to build a new 33/11kV zone substation at Pyes Pa which will be supplied from Kaitimako GXP via Tauranga GXP. The new substation will address many existing issues and will have the required capacity to support the growing demand in future.

[1] Forecast expenditure is based on Powerco's financial year (i.e. FY18 is for the period April 2017 through March 2018). Expenditures do not consider general price level changes over time (i.e. are in real or constant terms).
[2] Only includes Growth & Security Expenditure. Some projects discuss and rely on the replacement of assets that are at "end of life". However, the replacement cost for these assets is accounted for in the Replacement Expenditure category.
[3] All other forecast expenditure / cost estimates in this POD are pre-internal cost capitalisation and efficiency adjustments, consistent with this forecast.

Need Identification	
Background	The region to the southwest of Tauranga has, in recent years, witnessed rapid growth driven by a mix of residential, commercial and industrial development projects in the suburbs of Pyes Pa and Tauriko. The area is presently supplied at 11kV direct from the Tauranga 11 kV GXP. Residential growth—led by the Lakes subdivision in Pyes Pa—will ultimately consist of 2,081 sections housing over 7,000 people when completed. Across the road from the Lakes subdivision, there is a 350ha development by IMF Industrial Park, which has seen rapid growth due to the strong economy in the Bay of Plenty region. The areas around Pyes Pa are expected to experience sustained growth as has been identified in the Bay of Plenty's (BoP) Smart-Growth strategy and Tauranga City Council City Plan[4,5]documents. Powerco has been reticulating these developments in a staged manner to match, as closely as possible, the cost of assets deployed to revenue growth as these developments progress. In prior stages of development, sub-transmission 33 kV cables were installed and operated at 11 kV to provide supply, which was to defer the need of the substation for as long as possible.
Underlying Drivers and Investment Triggers	The following constraints/issues exist in this area: • At the distribution level, the 11kV feeders (TGA17 Maleme St, TGA21 Maleme Express) supplying the area are heavily loaded. Estimated growth rates of 14.4% pa (TGA17) and 7.5% pa (TGA21) are forecast for these feeders. Existing infrastructure does not have enough capacity to support the growing demand in future. • The ICP counts per feeder for the general area already exceed our planning guidelines. • It is problematic to maintain quality of supply when backfeeding areas of the network due to the high loads. Voltage and thermal issues are exacerbated with future load growth. • Reliability issues are anticipated to get worse with increasing load, resulting in significant SAIDI risk. • The 110/11kV transformers at Tauranga 11kV GXP exceed firm capacity. • The 110kV transmission network is heavily loaded between Kaitimako and Tauranga. The N-1 rating of these circuits can be exceeded at peak loads.

[4] Tauranga City Council website
[5] Operative District Plan 2012, Western Bay of Plenty District Council, http://www.westernbay.govt.nz/, retrieved 23 October, 2015.

Timing	Due to the rapid growth within the area, the constraints need to be addressed now in order to improve security of supply to the area and capacity is available to support the expected future load increase.

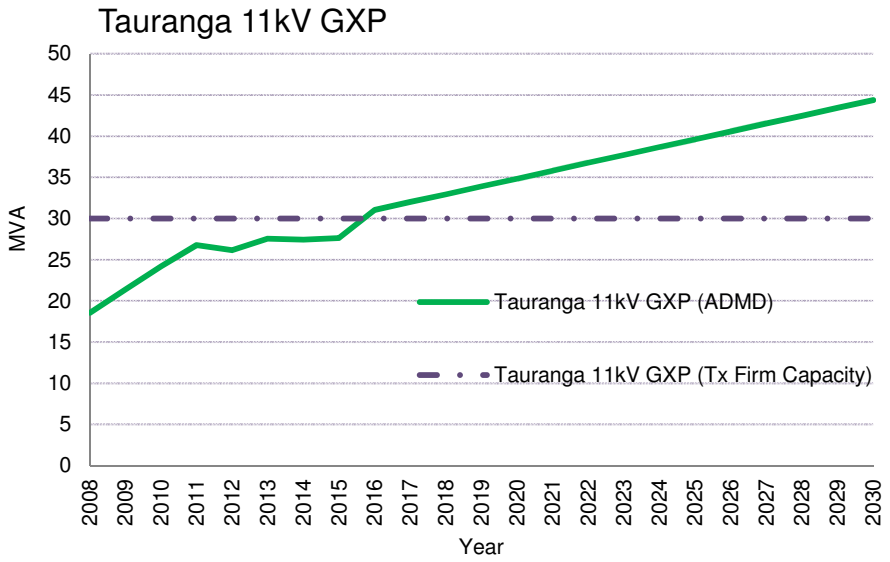
Demand Forecast | Tauranga Area

TAURANGA AREA SUBSTATIONS			FORECAST MAXIMUM DEMAND [MVA]						
SUBSTATION	CLASS CAPACITY	GROWTH	2016	2017	2018	2019	2020	2025	2030
Aongatete	7.2	2.7%	8.4	8.6	8.8	9.0	9.2	10.2	11.2
Bethlehem	8.0	4.4%	9.4	9.8	10.1	10.5	10.9	12.7	14.6
Hamilton St	22.4	1.3%	15.5	15.7	15.9	16.1	16.2	17.2	18.1
Katikati	5.3	1.6%	8.3	8.4	8.6	8.7	8.8	9.5	10.1
Kauri Pt	2.0	0.6%	3.1	3.1	3.1	3.2	3.2	3.3	3.4
Matua	7.2	0.3%	10.2	10.2	10.2	10.3	10.3	10.5	10.6
Omokoroa	13.2	1.5%	11.5	11.6	11.8	11.9	12.1	12.8	13.6
Otumoetai	13.6	2.1%	14.0	14.3	14.6	14.9	15.1	16.6	18.0
*Tauranga 11	30.0	2.9%	31.1	32.0	33.0	33.9	34.9	39.6	44.4
Waihi Rd	24.1	0.4%	21.9	22.0	22.0	22.1	22.2	22.6	22.9
Welcome Bay	21.4	2.0%	22.6	23.0	23.5	23.9	24.3	26.5	28.7

TAURANGA AREA SUBSTATIONS			FORECAST MAXIMUM DEMAND [MVA]						
SUBSTATION	TX CAPACITY	GROWTH	2016	2017	2018	2019	2020	2025	2030
*Tauranga GXP	100.0	1.5%	82.2	83.4	84.6	85.8	87.1	93.0	99.3

Notes:

1. Class capacity is similar to Firm Capacity and represents the capacity that can be delivered following the first outage of any major equipment. Unlike Firm Capacity it considers the deliverable capacity in the context of switching and network reconfiguration (11kV & 33kV) post-fault conditions.
2. All maximum demand values are in MVA.
3. Purple shaded cells indicate that the substation's Class Capacity has been exceeded and network enhancements should be considered.
4. The Tauranga GXP forecast excludes the effects of the Trustpower Kaimai Hydro Scheme (i.e. is a true



representation of the consumer load).
5. A "*" and alternate colour indicates a zone substation affected by this project.

Options Analysis | Long List of Project Options | High Level Assessment	
Assessment Process	A wide range of potential options are available for the resolution of network constraints. However, depending on local conditions many of the options can have significant challenges and/or shortcomings. On this basis a two tier Options Analysis is followed. In the first instance all potential options are considered against a set of high level criteria. Those options that are identified as having significant challenges and not favourable are not considered further. As a result of the process a short list of viable options is identified for further analysis.
Long List of Options	The following table contains a list of the high level project options that are potentially available to resolve the electrical supply issues within the southwest Tauranga area. Option 1 involves maintaining the status quo and allowing the risks associated with consumer non-supply to increase over time. Adoption of this option is possible but as a prudent network operator Powerco is of the view that following this path would not be appropriate, given the supply network would not meet Powerco's Security-of-Supply Standard. Option 1 is thus not short-listed. The three non-network options (Options 2, 3 and 4) are not shortlisted on the following basis: • Renewable generation sources are often not viable due to their intermittent nature and cost. Viable renewable generation options are also limited by the fact that the load on the southwest Tauranga area is winter peaking. Fossil fuelled generation is technically viable but not shortlisted due to cost, environmental and consenting issues. • Fuel switching and demand side response (DSR) are considered to be deferment strategies and their viability is not certain. Powerco uses a mains-borne ripple control system to control significant amounts of hot water cylinder load on its network. During peak loading periods most hot water cylinders are turned off. The demand reduction, however, is not sufficient to alleviate the constraints. No significant/additional winter peaking consumer loads have been identified for control. Both Options 5 and 6 are shortlisted as they either make use of the existing underground network or involve construction of new underground 11kV circuits from Tauranga GXP to reinforce the area. These present considerably lower consenting risk. Consequently they are considered to be the more cost effective options.

Long List of Options | High Level Assessment

Pyes Pa Capacity Reinforcement		*Long list of projects and high level assessment*	*Assessment Criteria*						
PROJECT FOCUS	**No.**	**PROJECT**	Fit	Feasible	Practical	GEIP	Security	Cost	**Short-list**
Do Nothing	1	Allow the electrical demand & risk of consumer non-supply to increase	✗	✓	✓	✗	✗	✓	✗
Non-network:	2	Distributed Generation (DG) including peak lopping generation	✗	✓	✗	✓	✓	✗	✗
	3	Fuel switching to reduce electrical demand	✓	✗	✗	✓	✓	✗	✗
	4	Demand Side Response (DSR)	✓	✗	✗	✓	✓	✗	✗
Network:	5	New zone substation at Pyes Pa	✓	✓	✓	✓	✓	✓	✓
	6	Construct more 11kV feeders to support load growth	✓	✓	✓	✓	✓	✗	✓

Key:

Fit	Fit for Purpose: Does the option address the need appropriately and does it fit with other developments in the vicinity.
Feasible	Technically Feasible: Consider the complexity, future adaptability, and whether it aligns with company standards, strategies and policies.
Practicality	Practical to Implement: Are there potential environmental or property issues which may be insurmountable. Can it be achieved in the required time frame.
GEIP	Good Electricity Industry Practice (GEIP): Good practice (technically and environmentally) and in terms of AM practice (capacity, age, technological, safety)
Security	Security and Reliability: Does the option provide adequate levels of security and appropriate reliability considering the demand, load type and future growth.
Cost	Some options will intuitively be known to be far more expensive than other options, and this may preclude them.

Options Analysis | Short List of Options		
Option	**Cost** Error! Bookmark not defined.	**Description**
Option 5: ***New zone substation at Pyes Pa***	$5.0M	This option involves the construction of a greenfield zone substation located at Pyes Pa, in the heart of the area's residential and industrial development. The zone substation will house two 12.5/17MVA 33/11 kV transformers, which will give the capacity required to support the forecasted demand over the planning period. The twin 11 kV feeders presently supplying the area will be converted to 33 kV operation to supply the new substation—as transformer feeders—from Kaitimako 33 kV GXP via Tauranga 33 kV GXP through an in-out arrangement. Extension of the cables (~1.6 km route length) is required to get the subtransmission supply to the proposed substation site. Re-energisation of the cables at 33kV is expected to be straightforward. The new substation will supply the Pyes Pa area and surrounds, encompassing the Kaimai region to the southwest and parts of Oropi towards the east, which in turn reduces loading at Welcome Bay substation.
Option 6: ***Construct more 11kV feeders to support load growth***	$13.5M	This option involves the reinforcement of the existing network with new 11kV feeder construction. The project will involve the following work: • Staged construction of six new 11kV underground feeders from Tauranga 11kV GXP to service the Pyes Pa industrial and residential areas in order to address the requirements for growth and ICP criteria. • Expansion of the existing Tauranga GXP site is required to enlarge the switchroom for housing the additional 11kV feeders. • Upgrade of the two 30MVA 110/11kV GXP transformers to larger capacity units to address the growing demand and the firm capacity issues. This will either be the addition of a third transformer, or replacement of the two existing units with higher capacity transformers that have higher impedances. The project has to get underway immediately as construction is envisaged to take at least a couple of years

Option Analysis | Advantages vs Disadvantages

The following sections summarise the advantages/disadvantages associated with the short listed options. The intention being to also capture project risks and inter-dependencies.

Option	Advantages	Disadvantages
Option 5: ***New zone substation at Pyes Pa***	• Improves network reliability to required Powerco security levels. • Reduces loading at Tauranga 11kV GXP and the upstream 110kV transmission circuits from Kaitimako. • Practical and achievable in terms of consenting and routes as the substation can be supplied from the existing 33kV-capable cables currently energised at 11kV. • Utilises known technology and proven designs. • Significantly improves the capability to support future industrial and residential load growth in the area.	• None envisaged.
Option 6: ***Construct more 11kV feeders to support load growth***	• Improves network reliability to required Powerco security levels • Practical and achievable in terms of consenting and routes. • Utilises known technology and proven designs.	• Does not reduce loading at Tauranga 11kV GXP and the upstream 110kV transmission circuits from Kaitimako. • With further load growth, low voltages may appear in future particularly on long feeders or in areas with a high load density. • Most expensive approach to secure the load.
Shared Features	• Practical and achievable in terms of consenting and routes. • Utilises known technology and proven designs. • Enhances the infrastructure to support the expected future growing demand.	

Preferred Option	
Preferred Option	**Option 5 : New zone substation at Pyes Pa**
Reasons for choosing Option	Option 5 is determined to the most economic option. It has the following benefits and advantages over the other option considered: • The lowest capital overall cost. • Utilises the existing 33kV-capable circuits to supply the new substation. • The highest economic net benefits in terms of reliability cost savings. • Delivers lower electrical losses. • Offloads Tauranga 11kV GXP load and reduces upstream loading through the 110kV transmission circuits from Kaitimako.

POWERCO

Project Name: PoD-G21 Pyes Pa Capacity Reinforcement

Item	Description	Actual Cost	Projected Cost
A	Property & Consent Costs		
A.1	Land purchase	-	$300,000
A.2	Planning and consents	$77,061	$22,239
B	Investigation and Reporting Costs		
	-	-	-
C	Substation Costs		
C.1	Transformers	-	$1,438,579
C.2	Civil works	-	$634,430
C.3	Switchboard	-	$464,095
C.4	Protection/Auxiliary/Communications	-	$590,383
D	Cabling Costs		
D.1	Cable works	-	$1,444,865
		-	

E	Committed/Historical Costs (A+B+C+D)	$77,061

F	Future Projected Costs (A+B+C+D)	$4,894,591

G	Anticipated Final Cost (E+F)	**$4,971,652**

Implementation Plan

Project or Action	Start Year[1]	End Year[1]	NZ $'000[1]	Details / Comments
Project costs to date	-	FY16	$77	Costs that have already occurred on Preliminary designs/Concept Costings
Land purchase	FY17	FY17	$300	Costs associated with purchase of the land to build the new zone substation.
Planning & consents	FY17	FY17	$22	Costs associated with planning, access and consenting, and preliminary designs.
Transformers	FY18	FY19	$1,439	Costs associated with the procurement and installation of the two new 33/11kV transformers.
Civil works	FY17	FY18	$634	Costs associated with the earthworks, site preparation, civil design, switchroom construction and earthing system.
Switchboard	FY18	FY19	$464	Costs associated with the procurement and installation of the new switchboard.
Protection/Auxiliary/Communications	FY18	FY19	$590	Costs associated with the procurement and installation of protection systems, auxiliary supplies and communications for the zone substation.
Cabling works	FY18	FY19	$1,445	Costs associated with the 11kV cabling works and minor extension of the 33kV cables into the zone substation.
Total Project Costs ➔	**FY16**	**FY19**	**$4,972**	Includes Only Growth & Security Expenditure.

Supporting Documents and Models	
Planning documents ***Standards | Policies*** ***Reviews and Consultant reports*** ***Concept Designs | Estimates***	1. Pyes Pa Capacity Reinforcement – Options Analysis. 2. Pyes Pa Substation Concept Design Report – Edison Consulting, Rev.5, dated 23 Aug 2016. 3. Powerco Network Development Plan. 4. Powerco's Demand Forecast. 5. Powerco's 2016 Asset Management Plan (AMP). 6. "*310S001 Security-of-Supply Classifications – Zone Substations*", Powerco Standard. 7. "*393S041 Zone Substation Transformer Ratings*", Powerco Standard. 8. "*393S035 Electrical network Conductor Rating Standard*", Powerco Standard.

Notes/Assumptions	
Generic Assumptions in relation to Options Costs	• Costs are expressed in 2016 (real) dollars. • The costs quoted are to construct the network and do not include economic factors (i.e. costs of non-supply) • The capital costs fall within the Growth and Security expenditure categories only. • The capital costs only include Powerco's capital expenditure (not Transpower or other parties). • The costs include all costs associated with the proposed projects (or alternate options) regardless of whether those costs fall within the CPP period or not.
Specific Assumptions in Relation to Options Costs	• Cost estimation for the options has initially been achieved via a desktop study using Powerco's standard building block unit costs. The costs have then been refined by further investigations. • Property and consenting costs are usually a high risk area involving considerable uncertainty. Due to the urban/lifestyle-block nature of area underground cable is used and where possible installed in road reserve. • The costs in this POD may differ from those in the detailed Options Analysis document. This is because some of the costs have been further reviewed and refined to confirm the preferred solution. The refined costs have been checked against the estimates used in the Options Analysis to ensure that it does not materially impact the Option Analysis outcomes and that the preferred solution still ranks higher than alternatives. • The option analysis was done before the thermal upgrade of the existing Greerton-Omokoroa circuits was completed so this was included as part of a solution option. The thermal upgrade project has since been completed and the costs have been allocated to the routine projects budget. Again, the Option Analysis has been reviewed to ensure this change does not materially affect the outcome with regard to the solution preference.

Figure 1 Map showing the Pyes Pa development area

Figure 2 Existing Kaitimako-Tauranga Sub-transmission Network: Geographic Diagram

Figure 3 Option 5 –New 33/11kV Substation at Pyes Pa: Geographic Diagram

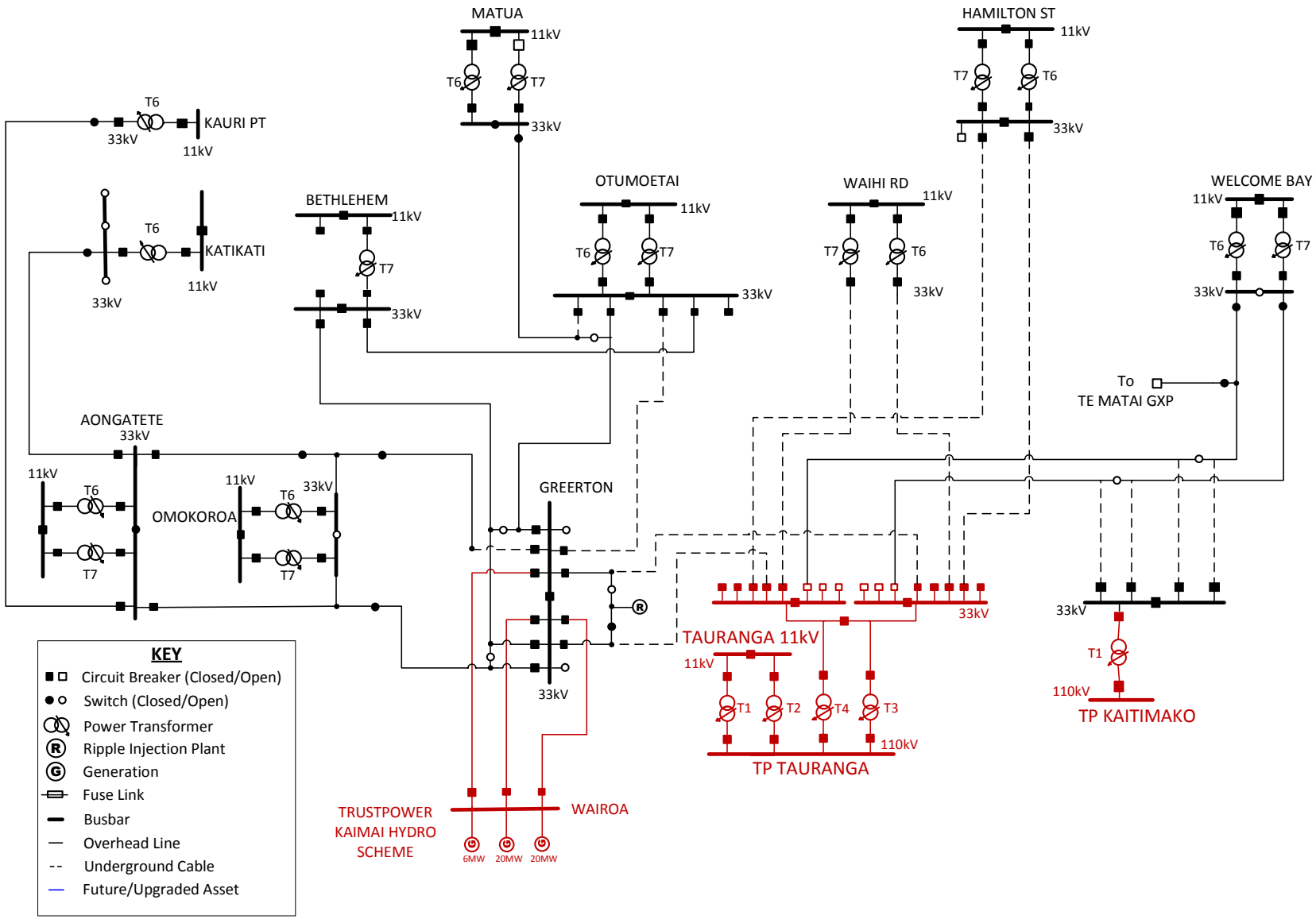


Figure 4 Existing Tauranga & Kaitimako Complete Sub-transmission Network: One-Line Diagram

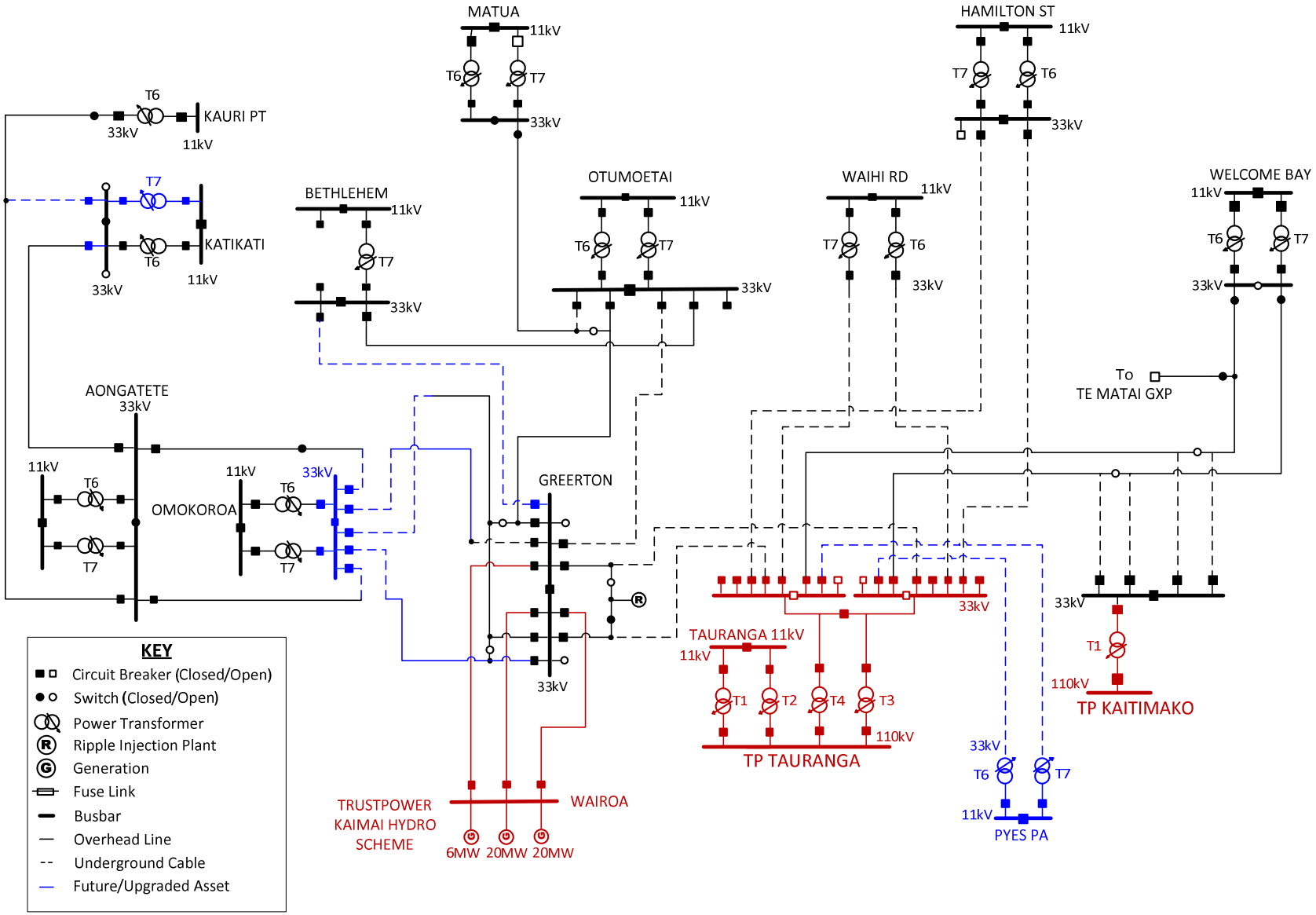


Figure 5: Option 5 – New 33/11kV Zone Substation at Pyes Pa- One-Line Diagram circa 2023