



DISTRIBUTION SPEND JUSTIFICATIONS

Commercial in Confidence

FINAL DRAFT

11 May 2015

1.1. Major Distribution Areas

There are numerous areas where the reallocation of metering CAPEX can be utilised. The draft AECOM World Bank funded “Upgrade of Grids and Preparing the Utility for Operations with Renewable Energy Plants - Stage 2¹” report highlights a number of areas where TPL will need to either fund or seek funding to enable the grid to integrate renewables as part of the TERM objectives. Additionally there are grid update projects pending on ‘Eua, Ha’apai and Vava’u funded by the ADB that will require CAPEX support. Finally property subdivisions and other developments (Government sponsored) are growing and TPL will need to fund these extensions, net of any customer contributions. These three areas are expanded on in sections 20.2.1 to 20.2.3.

1.1.1. AECOM World Bank Study

This report is being funded by the World Bank to highlight the field requirements and costs to enable the TPL network to deliver on the Government’s renewables strategy. This report is in final draft but will be available by early-mid May. The draft report highlights significant amounts of CAPEX will be required to upgrade the network. This includes the fourth feeder and submarine cable and many other significant investment requirements. TPL will need to be a contributor to many of these costs and again this is contained in the AECOM draft report. We are unable to release this report to the Commission until the report is completed but it paints a compelling picture as to TPL’s likely additional investment contribution/co-ordination to facilitate the Government’s strategy.

1.1.2. Fourth Feeder

The following graph shows the loading on the Nuk2 Feeder (Green line). It shows that the Nuk 2 Feeder has peak demands during the day with the evening peak much less prominent as compared to Nuk 1 and Nuk 2 Feeders. There have been a number of internal reports commissioned by various parties that have all indicated that electricity demand is projected to grow over the next 10 to 15 years. Note that the graph below is for the year 2013, since then TPL has experience record electricity demands of 8.4 MW over the summer season 2014/2015. This shows that the peak capacity of the feeder feeding the CBD (Nuk 2) will soon be met and a secondary feed to this heavily loaded (electricity) area is needed.

¹ As previously mentioned this report is in final draft and will be available from mid-May.



Nuk1 Feeder

Nuk2 Feeder

Vaini Feeder

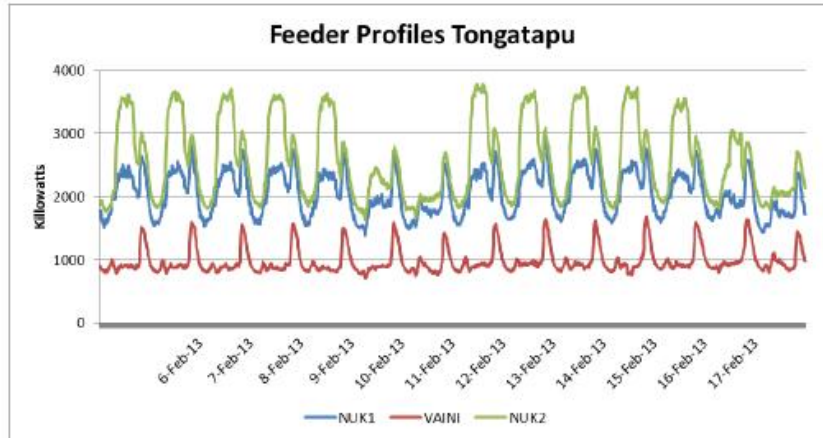


Figure 1 Feeder profiles for Tongatapu and illustrations of the areas that they feed electricity to.

Additionally the AECOM report, as indicated above, identifies the current distribution system architecture as a risk when having high renewables present on the network. This is because the current network topology does not allow alternative routes for electricity to flow if a fault should occur on a particular part of the network. The following figure shows an example of ‘ring’ topology which TPL’s networks need to migrate towards so as to allow more renewables to be connected to the network.

The first step in achieving this ring to the eastern half of the island is to build a fourth feeder from the Popua power station. This will free up the Nuk 1 feeder so that the ring feeder to the eastern half of the island can be implemented. Without the fourth feeder the Nuk 1 feeder does not have enough capacity to be able to withstand the electrical load it has to bare in order to be part of the ring towards the East. The electrical models support this fact. Nuk 2 and the new fourth feeder would then become the ring feeder to the western half of the island so that more renewables can also be installed in that area.

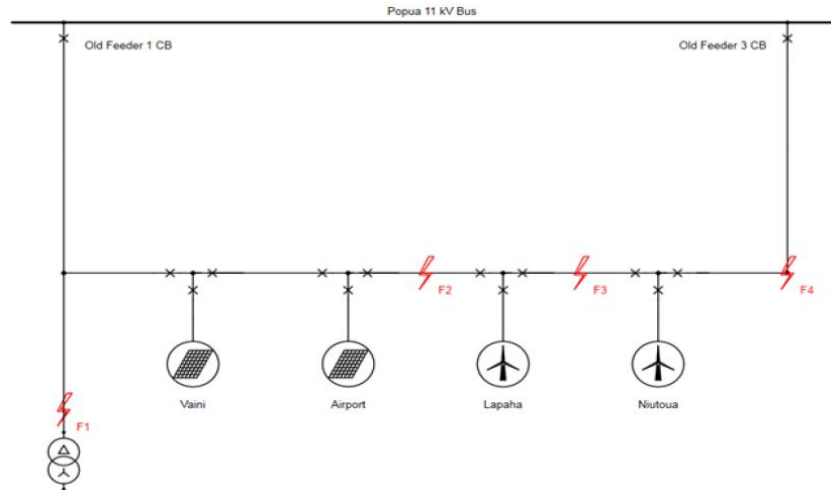


Figure 2 Ring Topology example for the Eastern half of Tongatapu showing two routes for electricity to flow to any generation site connected to the network.



Figure 3 Illustration of the changes to the network necessary so as to introduce a ring to the Eastern half of the island.

1.1.3. Submarine Cable

Further to the AECOM report, the strength of a ring is based on the quality of the feeder overall. The submarine cable is an obvious point of weakness, being very old and exposed to a harsh marine environment but not being technically adequate for a marine environment (it is not a submarine cable by modern day standards) means that the cable is highly susceptible to failure. Add to this the fact that there is no stand-by cable available and that the alternative route that

can supply the area that would be affected with electricity would be at the expense of power quality resulting in even more problems for individual customers than it is obvious. Replacement of the submarine should be an area of focus when it comes to investment decisions.

1.1.4. Outer Islands

OIEEP and HCIRP - Outer Island Energy Efficiency Project and Ha'apai Cyclone Ian Recovery Project.

These projects are based on the same principles as TVNUP on Tongatapu. TPL is currently funding significant portions of HCIRP and will continue to do so over the next two years. To date TPL has committed over \$800,000 to HCIRP. OIEEP as a program is commencing on 'Eua within the next 12 months, followed by Vava'u. For OIEEP a guiding rule of thumb is that for every \$5m US invested by donors Tonga is expected to contribute \$300,000 US, which typically falls on TPL as the agent of the Government. Conservative estimates are for some \$1.5m TOP over the next five years to fund these programs and it should be clearly noted these amounts were not included in the original Proposal.

1.1.5. Subdivisions and Other Developments

The Proposed budgets do not allow for many potential network extensions and TPL is aware of several areas where development CAPEX will likely be required. These include:

Pacific Games:

Regardless of the fourth feeder, the Games footprint is highly likely to require significant TPL investment to facilitate. This would require HV cable, poles, transformers and other assets which are currently not budgeted by TPL. We are endeavouring to get closer to the organising committee to understand their requirements. Much of this infrastructure will remain permanent and will be a cost to TPL and this will not be optional.

Water Board Project:

Rehabilitation and Extension of Mataki'eua and Tongamai Projects.

This ADB funded project is unlikely to see Government fund the electricity reticulation. Discussions with the project team have indicated a firm expectation that there will be no charge

for the electricity reticulation. This could cost upwards of \$500,000 with the customer being the Government who are likely to see TPL as the provider of funding of this project.

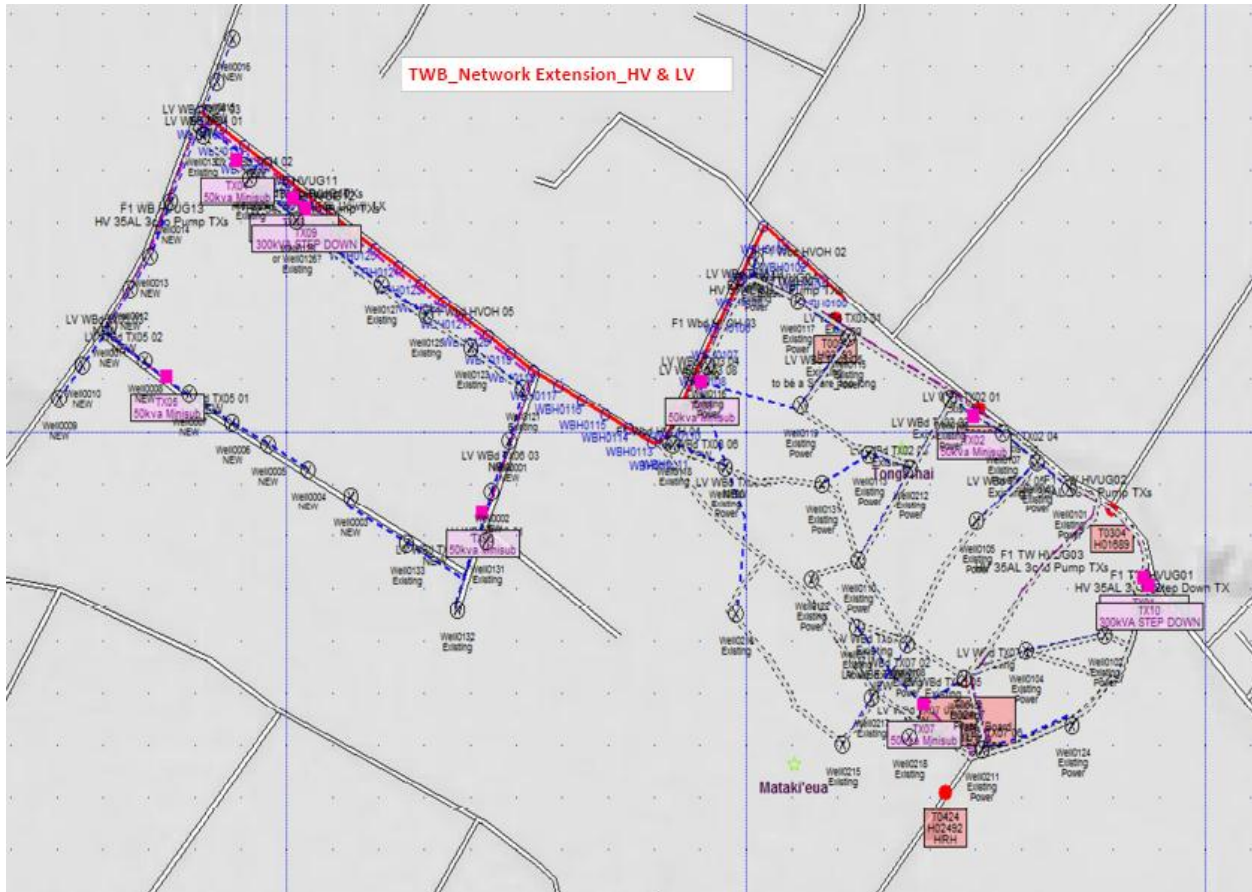


Figure 4 Preliminary design showing the existing the and planned extension to the existing water pumpin farm.

Sub Division Patangata

The existing land allotment is now being converted to a subdivision by the Government. TPL has provided Government with a quote to carry out the works but TPL expectation is that the company will be required to carry these out with minimal if any contribution from Government. The extension will be approximately 600m of High Voltage and is likely to proceed within the next 12 months. This project is conservatively estimated at \$400,000.

PROPOSED HV AND LV DISTRIBUTION LINE ROUTE FOR PATANGATA



Figure 5 Preliminary Design of the Patangata reticulation.

Fua'amotu Resort

This project could be upwards of \$1.5m and documentation is commercially sensitive but TPL has seen preliminary designs and note load expectations could be upwards of 2MW. This innovation is being heavily supported by the Ministry of Tourism and we understand the land issues have now been resolved. A considerable amount of backbone upgrade will be required for this investment, which TPL is anticipating having to fund at a greater level than would be typical as the customer has indicated a strong desire for a Government incentive. The developer's objective is to have this project completed well before the Pacific Games.



FUA'AMOTU BEACH RESORT, TONGATAPU ISLAND, TONGA



Figure 6 Preliminary design recieved from the developers of the Fua'amotu Beach Resort.