

Revised 3-page, now 7-page, summary of the feasibility study

Section 1: Scale and deliverability

The proposed **3MWe plus biomethane biogas plant** is fully supported by mature, off-the-shelf technologies, systems, and know-how. Additionally, the proposed project is large enough and technically interesting enough to attract the best European biogas technology providers and professionals. This is essential in delivering a vital piece of Tongan infrastructure that will have a long and reliable in-service life.

1.1 Question from Tevita:

Please add some proof of why 3MWe is selected and most feasible option for Tonga. May be someone will ask why not 2MWe or 5MWe? OR if you can refer to proof in the appendices.

1.2 Answers

Scale is covered in Section 3 of the main feasibility document and further referred to on Page 17 of Attachment C and again in Sheet 10 of Attachment B.

1.3 The following is taken from Section 3: 'Scale is an important and highly influential feasibility element in the development of a modern, commercial biogas plant. Succinctly stated, the bigger the size of the biogas plant, the lower the cost of energy production. Additionally, the bigger the size of the biogas plant, the more products, and services the biogas plant is able to deliver and support. I.e., The bigger the size of the biogas plant, the more influential the biogas plant will be in enabling broader, circular economy based socioeconomic development'.

1.4 Hitting TPL's feed-in-tariff benchmark whilst delivering an investor ready, profitable project: The size of the biogas plant was also influenced by meeting Tonga Power Limited's (TPL's) US14cents/kWh feed-in-tariff benchmark and co-delivering a

substantial discount to the price of imported LPG that the biomethane will replace. The biogas plant needed to support these outcomes whilst concurrently supporting a profitable, investor ready project with an Internal Rate of Return (IRR) of around 15%.

1.5 Using 5% of fallow land on Tongatapu: Through the MAFF led investigative and community consultation processes, it was determined that 5% of the current fallow agricultural land on Tongatapu can be readily bought into service to support the production of HTG. The proposed project is conditionally supported from 4.8% of Tongatapu's fallow agricultural land.

1.6 Mechanisation of the supply chains: The size of the biogas plant was also influenced by the need and the financial capacity to support the full mechanisation of the HTG supply chains.

Section 2: Substrates

A biogas plant requires access to the supply of high security substrates and **Hybrid Tropical Grass (HTG) is a, proven, high-performance, high-security substrate**. HTG will leverage exceptional efficiencies from Tonga's prolific and inexhaustible tropical photosynthesis resources.

Basing the biogas plant initially on HTG will enable the co-digestion (co-processing) of a wide range of additional 'opportunity substrates' as and when they become available.

Apart from supporting the biogas plant, the HTG will also have an immediate, associated role to play as a livestock feed thus replacing some imported feeds.

2.1 Question from Tevita:

Provide or refer to a proof or evidences for this one.

2.2 Answer:

Please refer to Section 6.3 of the main feasibility document along with Attachments D and E

Section 3: Strategic Reserve

The ensiled HTG will also support the creation of a high security strategic reserve that will enable the biogas plant to operate continually even under the most adverse conditions.

It should be noted that Tonga Power Limited (TPL) has highlighted the lack of a suitable strategic reserve as a threat within its latest Business Plan.

3.1 Question from Tevita

Please add positive ideas from the Ministry of Agriculture or other reliable agency for security of supply and plan to ensure security of supply.

3.2 Answers

This is covered in Section 6 of the main feasibility study document.

3.3 Implementation protocol: Firstly, the HTG must be established in Tonga and this is covered in section 6.3 of the main feasibility document.

3.4 Complete mechanisation of the HTG supply chains: Secondly, the proposed project will support the participating Tongan farmers through the complete mechanisation of the HTG supply chains covering planting, harvesting, transport and digestate handling/supply. CAPEX allocations for this mechanisation are covered in Sheet 11 of Attachment B.

3.5 Digestate: Thirdly, the digestate produced by the biogas plant will be returned to the HTG farmers thus covering much of the nutrient demand for growing the HTG whilst concurrently and continually building soil carbon.

3.6 A fair price: Fourthly, a fair price must be paid to the Tongan farmers to grow the HTG. As established in Attachment B, in addition to the abovementioned support, it's proposed that the project will pay

the Tongan farmers US\$1.6 million/year for the HTG substrates. It must be remembered that the HTG is a relatively low input **perennial crop** (planted once) with a productive lifecycle of around 20-years and not an annual crop requiring annual planting.

3.7: The proven concept of a silage-clamp based strategic

reserve: Below is a photo of the whole-crop maize silage based silage clamp the Government of Tonga and SPC delegation to Germany visited in August 2018.



What the delegation was standing in front of in Germany was a large-scale organic battery. This organic battery can store energy over periods of months and years and the biogas plant can access this stored energy at any time.

In Tonga, the organic battery (the silage clamp) will be based on HTG. In Tonga, the HTG will leverage optimised biomass (energy) outcomes from Tonga's prolific and inexhaustible tropical photosynthesis resources.

Section 4: All agricultural elements unequivocally endorsed by MAFF

The agricultural strategies and specific agricultural support elements that underpin this proposed project have been unequivocally endorsed (Attachment H) by the Ministry for Agriculture, Food, and Forestry (MAFF). This endorsement comes as a direct result of the more than 40 community consultations that MAFF directly supported across the Tongan agricultural and related sectors.

One of the principal outcomes from these broad-based consultations is that when it comes time to enter into the conceptual planning phase of the project, **there will be strong interest from the Tongan agricultural sector to become fully engaged**. The specifically targeted agricultural support elements that are proposed for this project will intensify and support this interest.

4.1 Comment from Tevita: This is excellent but anybody can ask the conditions or people's specific interest in order to engage in the implementation of the project.

Section 5: Electricity feed-in

The biogas fuelled 3MWe Combined Heat and Power (CHP) package will support the production of baseload renewable electricity whilst concurrently supporting the Tongatapu grid with voltage regulation, frequency control, and peak demand response.

The 25million kWh's/year of renewable electricity that this CHP package is able to generate is **2.7 times more** than the total amount of renewable electricity generated across all 4 of TPL's Island grids in 2019/20. Importantly and distinctively, this electricity will be fed into the Tongatapu grid in a manner simply not supported by intermittent renewables such as Solar PV and Wind.

Section 6: Specific TPL response to Tongatapu grid feed-in

A following was put directly to TPL:

'The project will have the capacity to feed 25million kWh/year of electricity into the Tongatapu grid. We can arrange the biogas fuelled Combined Heat and Power systems (CHP's) to support the Tongatapu grid in the same manner the diesel generation currently supports. In-fact, the grid interactive electronics package of the biogas fuelled CHP's will be far superior to the current diesel generation assets.

With the above in mind, will the Tongatapu grid be able to accept 25million kWh/year of electricity into the grid, delivered via the generation package described above, against an anticipated project commissioning date of mid 2024 or earlier'?

The specific answer provided by Nikolasi Fonua, TPL's Strategic Development and Engineering Manager, is as follows:

'Yes, TPL can accept the quantity of power mentioned in your question particularly if it is from firm generation sources i.e., a like for like replacement of diesel generation'.

Section 7: Supporting the Lifeline Tariff

The proposed US14cents/kWh feed-in-tariff equates to about 32senti/kWh. This feed-in-tariff is supportive of TPL's objectives of holding its 'Lifeline Tariff' at 65senti/kWh.

Section 8: Profitable

No country has or can secure a prosperous, largely self-determined future through donor funding. This is impossible. Tonga must develop large-scale profitable projects that Tongan's can invest in. This proposed project is profitable, secure, and fully deliverable.

Section 9: US\$300million of new investments

Off the back of implementing the proposed 3MWe plus biomethane biogas plant, some US\$300million of new agricultural and agri-industrial aligned circular economy developments can be enabled. These projects will be driven by Tonga's tropical photosynthesis and enabled by Anaerobic Digestion, biogas, and digestate.

Ultimately, the sustainable supply of substrates in support of a 'full-service' Tongan biogas sector will come from these expansive, agricultural, and agri-industrial aligned circular economy systems. Additionally, on the other side of that exact same coin, the full-service Tongan biogas sector will enable these systems to exist and to operate at exceptional efficiencies.

These exceptionally efficient agricultural and agri-industrial aligned circular economy systems can deliver food, feed, organic fertiliser, and energy security for Tonga and in doing so they can support thousands of fully sustainable, future-proof Tongan jobs. Only large, commercial scale biogas has the proven ability to deliver these optimised circular economy outcomes.

The outstanding investigative and community consultation initiatives driven and supported by MAFF are acknowledged here.