CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

Technical Assistance Response Plan – Terms of Reference

Country	**Tonga**
Request ID#	**2019000026**
Title	*Tonga Circular Economy Project- Biogas Feasibility Study*
NDE	Mr. Paula Pouvalu Ma'u Chief Executive Officer, Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications, Nuku'alofa, Tongaf paulm@mic.gov.to
Proponent	Energy Division Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications, Nuku'alofa, Tonga Contact Person: Dr. Tevita Tukunga, Director of Energy- ttukunga@gmail.com

Summary of the CTCN technical assistance

Tonga is among the most vulnerable countries to the impacts of climate change yet continue to be increasingly dependent on imported fossil fuels that dominates its Greenhouse Gas emissions. To reduce its energy reliance on the imported fuel, Tonga has adopted an energy target under Tonga Energy Road map (TERM) of 70% renewable energy by 2030. The Nationally Determined Contribution of Tonga also reflect these targets, joining the global community to reduce GHG emission. Tonga's renewable energy development is so far based on solar and wind resources.

Hence, Tonga has made this CTCN request to explore the feasibility of generating base load energy at an industrial scale of 0.5 MW from the biogas to diversify the energy source and accelerating the renewable energy transition. Tonga's tropical climate also makes it favourable for biomass planting and biogas has been demonstrated to be used at household and institutional levels Tonga as well as in other Pacific Island Countries. While biogas is a promising resource to be used for generating base load energy at industrial scale, it also could have sustainable impacts both in positive and negative ways along the value chain of Bioeconomy. Land use change, creating competition for food, incremental usage of water and energy, generation of waste are some of these impacts. The request is designed to address such impacts through Circular Economy approach. Circular Economy is where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimized. Hence, it ensures best utilization of resources and least generation of wastes.

The outcome of this request will support the Govt. of Tonga to take decision on considering the biogas as a source of energy generation at industrial scale (0.5 MW and above) to include it in the national strategy/ roadmap as a base load to achieve circular economy.
The main activities to achieve this outcome will be:

- Biogas/biomass resource assessment and baseline analysis of biogas technologies
- Feasibility study of biogas-based energy generation at industrial scale (0.5 MW) in Tonga
- Capacity development on biogas technologies
- Support in funding proposal development to request fund for implementation of biogas to energy plant and support to procure technical resources

Besides NDE and the project proponent the relevant department in the ministry, local resources in the

related field, farmer's federation and critical players along the value chain of the bio-economy value chain in Tonga will have important role in this project. The project is envisaged to be completed with in a time frame of one year with an estimated budget in the range of USD 141,100 to USD 179,100.

Agreement:

(If possible, please use electronic signatures in Microsoft Word file format)

National Designated Entity to the UNFCCC Technology Mechanism
Name: Mr. Paula Pouvalu Ma'u
Title: Chief Executive Officer, Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications, Nuku'alofa, Tonga

Date: 6/11/19
Signature:

Proponent (signature of the Proponent is optional)
Name:
Title: Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications, Nuku'alofa, Tonga

Date: 6/11/2019
Signature:

UNFCCC Climate Technology Centre and Network (CTCN)

Name: Ms. Rose Mwebaza
Title: CTCN Director
Date: 2/12/2019
Signature:

Background and context

Energy scenario in Tonga

Tonga is actively trying to balance the requirements of meeting the nation's energy needs while reducing Tonga's GHG emissions (including via reductions in energy intensity) to tackle climate change impacts. Accordingly, the Government of Tonga is working to identify the best social, environmental and economic technology options, while ensuring sustainable development is achieved. Tonga depends almost entirely on imported fossil fuel for its energy requirements. Any increases in the cost of oil or fuel supply disruptions will greatly impact Tonga's economy and development. Hence, the Government of Tonga is looking at reducing the country's dependency on externally sourced fossil fuels with exposure to the associated price volatility, increasing the accessibility to electricity for all inhabitants and improving the affordability of electricity for all users via a lower electricity tariff. To achieve these objectives, the Government of Tonga has set, amongst others, an ambitious target to generate 50% of the country's electricity from renewable energy resources by 2020 alongside its Nationally Determined Contribution of 70% renewable energy generation by 2030.

Ongoing efforts to foster energy security in Tonga

Tonga adopted Tonga Energy Road Map (TERM 2010-2020) in 2010 and has since made efforts to meet its energy targets. Presently, it has 17.7 MW of installed diesel capacity with 6.2 MW of installed renewable energy on-grid capacity. The renewable energy penetration based on generation in Tonga is about 7% to 16% based on the variations in weather affecting the wind and solar energy. Tonga's renewable energy development has been focusing on solar and wind, so far. The Government of Tonga wants to explore other source of energy to diversify the baseload energy mix to achieve clean and affordable access to energy. The Nationally Determined Contribution of Tonga has emphasized on energy generation from renewable sources to reduce the GHG emission from fossil fuel-based electricity sector which has high share of GHG emission about 23%.

Consideration of Biogas to generate energy is strongly related to the notion of a Circular Economy

Tonga and Pacific Island Countries have been using biogas as a source of energy for quite some time but mostly at the household and community levels. At this scale, the biogas has demonstrated promising potential. Biogas is produced by the decomposition of bio matter, including energy crops, residual after harvesting and animal waste.

Being an agriculture-based economy and having high poultry consumption, Tonga is exploring the potential of bio-resources to generate energy at an industrial scale. Furthermore, in Tonga, energy crop such as Saafa grass, grows everywhere and can be harvested annually[1]. Agriculture contributes about 16% of GDP in Tonga[2]. FAO estimates that 33,000 ha, out of 75,000 ha of country area, is used for agricultural activities[3]. According to the 2015 Agriculture Census, there were 13,944 households in Tonga engaging agricultural activities. Over 95% of them were subsistence and semi-subsistence agricultural activities whereas less than 5% were engaged in commercial activities. Root crops cover about 50% of total exports from Tonga[4]. Approximately 60% of the root crops are exported to New Zealand. Most households have relatively small agricultural area (about 8 acres), used for crop cultivation, livestock activities. However, about half of the agricultural land is fallow, which can be considered to be used for different purposes such as growing energy crop for biogas production.

[1] https://www.spc.int/updates/news/2018/09/tonga-exploring-cheaper-and-sustainable-electricity-through-biogas-generation
[2] https://pafpnet.spc.int/resources/650-the-tonga-agriculture-policy-bank
[3] http://www.fao.org/countryprofiles/index/en/?iso3=TON
[4] https://pafpnet.spc.int/resources/650-the-tonga-agriculture-policy-bank

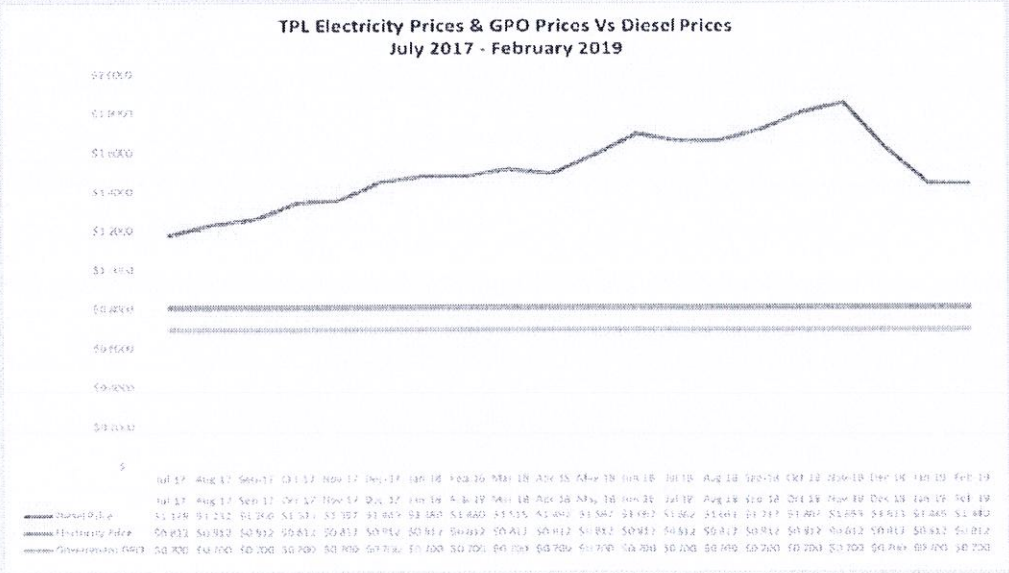
Elaborating a circular economy approach in the agriculture sector will further foster energy security in Tonga by reducing the import of fossil fuels and diversify the energy mix connected to the grid to generate electricity. Tonga has conducted some background work with support from the Pacific Community (SPC) and IfaS, Germany to study the viability of biogas to generate energy in Tonga. Based on the preliminary assessment Tonga is seeking to approach the waste to energy project using the concept of circular economy where the bio-resources (organic wastes and residues) generated along the value chain of food, feed, bio energy and bio products will be assessed in an integrated way to feed into the biogas plant to generate energy promoting zero waste. On the other hand, the biogas-based energy will be coupled with other sources of energy like solar PV and solar thermal to power the circular loop of the bio-economy.

It should be noted that as a Small Island Developing State with 172 islands, Tonga faces unique challenges in implementing a circular economy approach, especially with regards to the transport of raw fuels and the distribution of energy. As such, Government of Tonga has requested CTCN technical assistance for conducting a feasibility study to introduce biogas as a source of energy at industrial scale (about 0.5 MW) using a circular economy approach.This study will not only demonstrate the viability of technologies and evaluate the production potential in the agriculture sectors but also unleash the availability of sustainable bio resources.

1. Problem statement

Uncertain cost of electricity and reliance on imported fuel

Tonga is among the most vulnerable countries to the impacts of the climate change yet continues to be dependent on imported fossil fuels. One of the major usages of imported fossil fuel is to generate electricity in Tonga. The electricity tariff is presently 0.81 Tonga dollar (0.40 USD cents) per unit of electricity. With the fluctuating price of imported fossil fuels, the electricity tariff also tends to be uncertain and mostly to be increased following the international trend on the price of the fossil fuels. Though, Tonga Power Limited (TPL) and Government of Tonga (GPO) tried to keep the electricity price constant since 2017 as shown in the graph below, however that is majorly through subsidies and non-fuel components of electricity tariff.



Considering the electricity tariff majorly comprise of the fuel charges of about 70% largely affected by the price fluctuation of the imported fossil fuel and the increasing burden on the national funds due to the subsidies, the cost of electricity is a major concern in Tonga. With such increasing dependency, Tonga faces the double challenge of volatile fuel prices and exposing its fragile environment to air pollution, fuel spills and water contamination.

To deal with this, Tonga is continuously working in increasing the renewable energy share in the total energy mix under the TERM (Tonga Energy Roadmap 2010-2020). Tonga has renewable energy developments mainly focused on solar and wind power so far. To further diversify the renewable energy portfolio, the government wants to explore other base load opportunities like biogas to make electricity with the least impact on climate and affordable for Tonga.

Biogas is promising but has its own challenges

Biogas has demonstrated promising potential as a source of energy at household and institutional level in Tonga. Through this Technical Assistance, Tonga would like to explore the feasibility of biomass-fueled biogas plant at an industrial scale to provide baseload power in its power supply. The outputs of the project will be applied in determining the use of biogas as a resource of renewable energy at industrial scale in consideration with a circular economy and agricultural strategy of Tonga. The response plan is designed to integrate activities to deal with the potential challenges and risks of considering biogas and recommend for serious consideration during implementation like:

- Use of biogas at large scale may trigger broad range of activities, situated along a multitude of different bio-based value chains, each including suppliers, producers, distributors, and purchasers. The social, economic and environmental impacts using biogas is not always limited to the place of its production but can reach back to the location of biomass provision/production and may affect people, regions and countries in different ways. Bio-based products and processes may entail (intended or unintended) impacts on human society and the environment. These impacts may occur along the entire value chain of bio-based products and might be linked to the production of biomass, to biorefinery (and related) processes, and to the actual characteristics and effects of the new, bio-based products. One single product or process can have several impacts, which are also influenced by factors, which are not related to the product or process.
- Biogas technology itself is a complicated technology as it involves chemical and biological processes, depending upon multiple factors. The nature of feeding biomass/ substrate decides the suitable technology to be adopted. The technologies suitable for substrate with high and low solid content are completely different. Further, the grid integration of the plant with other sources connected also needs careful study as it ultimately depends on the production of biogas from biochemical process which might be intermittent sometimes. The analysis shall consider the operational efficiency of biogas power plant as a distributed plant vis a vis connected to the regional/ central grid.

The Circular Economy approach is designed to address the challenges. Circular Economy following the definition by European Commission is where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimized. In the project context, the circular economy approach includes:

- Improved resources and eco-efficiency including the focus on bio-based products, share, reuse, recycle and remanufacturing of resources
- Low GHG footprint across the value chain with cascading use of resources and waste

- Reducing demand for fossil carbon by reducing or replacing them in the entire value chain
- Valorization of waste and side streams including the organic recycling and nutrient recycling

The activities carried out in designing the biogas plant shall be checked against the above conditions to confirm that the circular economy approach is applied and followed.

2. Logical Framework for the CTCN Technical Assistance:

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Objective: *To undertake feasibility study and technical designing for biogas-based energy plant at an industrial scale in Tonga.*												
Outcome: *Empower Govt. of Tonga to take decision on considering the biogas as a source of energy generation at industrial scale (0.5 MW and above) to include it in the national strategy/ roadmap as a base load to achieve circular economy.*												
Output 1: Development of implementation planning and communication documents												
Activity 1: *All implementers must undertake the following activities at the beginning and at the end of the CTCN technical assistance* i) *Kick off discussion* The kick off discussion will be held among CTCN, the Implementer, Energy Division and Climate Change division at MEIDECC broadly on the proposed implementation plan, timelines, support required, and mitigation measures planned for any risks envisaged in the implementation. The implementer will prepare and submit the minutes of the discussion. This meeting is envisaged to be held on before Deliverable 1. ii) A detailed work plan of all activities, deliveries, outputs, deadlines and responsible persons/organisations and detailed budget to implement the Response Plan. The detailed work plan and budget must be based directly on this Response Plan; iii) Based on the work plan, a monitoring and evaluation plan with specific, measurable, achievable, relevant, and time-bound indicators used to monitor and evaluate the timeliness and appropriateness of the implementation. The monitoring and evaluation plan should apply selected indicators from the Closure and Data Collection report template and enable the lead implementer to complete the CTCN Closure and Data collection report at the end of the assignment (please refer to item iv below and section 14 in the Response Plan); iv) A two-page CTCN Impact Description formulated in the beginning of the technical assistance and update/revised once the technical assistance is fully delivered (a template will be provided); v) A Closure and Data Collection report completed at the end of the technical assistance (a template will be provided).												
Deliverable 1: **D 1.1:** Minutes of Kick off meeting discussion **D 1.2:** Detailed work plan **D 1.3:** Monitoring and evaluation plan **D 1.4:** CTCN Impact Description **D 1.5:** Closure and Data Collection report												

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
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Outcome: *Empower Govt. of Tonga to take decision on considering the biogas as a source of energy generation at industrial scale (0.5 MW and above) to include it in the national strategy/ roadmap as a base load to achieve circular economy.*												
Output 2: ***Baseline and resource assessment to support industry scale biogas plant in Tonga***												
Activity 2.1: *Undertake studies and surveys to demonstrate the availability of sustainable resources along the bio-economy value chain[5] to use as input to the biogas plant* This assessment will provide detailed outlook on the availability of raw fuel resources from various potential sources, based on latest information available to generate biogas in Tonga. It will also assess the options for sustainable supply of the resources to operate these plants throughout their technical lifetime using circular economy approach applied[6] along the bio economy value chain in Tonga. While studying the availability of raw fuel resources, their sustainability will also be assessed through their potential impacts on land, energy and water usage over baseline, competing use and food conflicts etc, if suggested to use for biogas production. *Activity 2.1.1:* Study the literatures, database, maps on the bio resources from the wastes generated along the value chain, that can be used for biogas generation in Tonga either available in public domain or made readily accessible with the aid of the Government of Tonga, including assessing potential challenges unique to Tonga with its 172 islands and high transport costs. *Activity 2.1.2:* Identify relevant stakeholders along the value chain and undertake primary survey with the stakeholders to assess the potential sustainable impacts and select resources *Activity 2.1.3:* Recommend on the sustainability and availability of resources selected from 2.2.1 and 2.2.2 by • Use an approach (like Life Cycle Assessment) to demonstrate that the suggested resources do not have any negative impacts • Use scientific methodology to demonstrate that the selected resources are available in surplus.												
Activity 2.2: *Analysis of existing biogas technologies relevant for Tonga*												

[5] Value chain here refers along food, feed, bio-based products and bioenergy
[6] The "Circular Bioeconomy" – Concepts, Opportunities and Limitations - European Commission

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
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Activity 2.2.1: Identify demonstrated local and global technologies and appraise biogas initiatives and success stories which are at intended scale in the region, with broad technical specifications that can use the selected resources in Tonga (resources identified in Activity 2.1) to produce biogas to feed in the energy plants at industrial scale[7]												
Deliverable 1: **D 2.1:** Report on resource availability and sustainability **D 2.2:** Report on biogas technologies												
Output 3: Biogas technologies at industrial scale will be identified												
Activity 3.1: *Conduct feasibility studies on the biogas technologies* Activity 3.1.1: Develop a scoring tool based on criterion developed in collaboration with stakeholders for conducting pre-feasibility assessments of biogas technologies identified in Activity 2.2. This tool will be used to prioritize the biogas technologies and should consider, amongst other factors, the potential contribution of the technology to the achievement of Tonga's NDC targets. The factors for technology prioritization will include, but not limited to the nature of the available raw fuel and substrate for digestion to produce biogas and suitable reactor technologies like Anaerobic reactor, Up-flow Anaerobic Sludge Blanket Reactor, Fluidized Bed Reactor, Continuous Stirred Tank Reactor, Solid Concentrating reactor, Sequential batch reactor. This activity is applicable as envisaged to manage scenario where a long list of technologies identified under output 2. Activity 3.1.2: Conduct the detailed feasibility analysis of the technology shortlisted in activity 3.1.1. The feasibility analysis will be including but not limited to the following: Detailed technical description, operational parameters and challenges for biogas production and economic analysis using indicators like payback period, IRR, NPV and socio-environmental impacts. The analysis shall consider determining the achievable capacity of the biogas plant with the available resources and feasible technology based on the operational												

[7] With a capacity of 0.5 MW and above- Request Document from Tonga

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
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efficiency of biogas power plant as a distributed plant vis a vis connected to the regional/ central grid. The project is envisaged to request funding from GCF to support the implementation of the outcome of the feasibility study. Hence the requirements of GCF shall also be considered in the feasibility study like sustainable financing arrangements to upscale and replicate the project.												
Activity 3.2: *Conduct stakeholder consultations* Activity 3.2.1: Undertake a consultation workshop to receive the feedback on the outcome of the feasibility study. Relevant stakeholders like from Tonga's Joint National Action Plan (JNAP) and the requirements from the GCF perspective will be included in the consultation to review and provide feedback on the draft feasibility study and GCF proposal. Please see GCF related activity under Output 5.												
Deliverables 3: **D 3.1.1:** Report on biogas technology prioritization **D 3.1.2:** Draft feasibility study report **D 3.2:** Report on stakeholder consultation (Detailed minutes and synthesized version) **D 3.1.3:** Final feasibility report												
Output 4: Capacity Development on biogas technologies												
Activity 4.1: Design program to conduct an industrial study trip and experience sharing to visit the industrial scale biogas plants that are relevant for Tonga as the outcome of the feasibility study. The TA may cover the support for the study trips designed within the region like countries in Pacific Island, Australia or New Zealand or else for the trip to any other country the program designed under this activity can be used as a proposal to be considered under other financial mechanisms.												
Activity 4.2: Design and conduct appropriate training pre/post-industrial study trip in discussion with MEIDECC to enhance capacity of Tonga Government on the outcome of the feasibility study This will be including but not limited to the study materials, training manuals and a training program to enhance capacity of Tonga Government. While these training and study resources will be inspired by the existing successful cases from other countries and regions, the requirements in local context will also be considered in												

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
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designing.												
Deliverables 4: **D 4.1.1:** Report on the study trip program **D 4.1.2:** Report on the findings of the study trips after completion, if applicable **D 4.2:** Report on the training (the chapters/ presentations, manuals and toolkits developed will be annexed to this report)												
Output 5: Support provided for GCF proposal development												
Activity 5.1: Prepare a draft proposal to apply for the implementation of the biogas project under other international funding mechanisms. The draft feasibility report will provide relevant input to the GCF proposal which should be elaborated in close collaboration with the NDE and NDA. The GCF proposal will undergo stakeholder consultation conducted under Output 3.												
Activity 5.2: Design technical specifications as the part of the Request for Proposal to support the procurement of the biogas plant.												
Deliverables 5: D 5.1.1: Draft GCF proposals for JNAP and NDA review D 5.1.2: Revised GCF proposals for NDA consideration D 5.2.1: Draft specifications for Request for Proposal D 5.2.2: Final specifications for Request for Proposal												

3. Resources required and itemized budget:

Activities and Outputs	Input: Human Resources	Input: Travel	Inputs: Meetings/events	Input: Equipment/Material	Estimated cost	
					Minimum	Maximum
Output 1: Development of implementation planning and communication documents	***2,600-3,200***				***2,600.00***	***3,200.00***
Activity 1.1: Formulation of i) Kick off discussion, ii) Detailed work plan, iii) Monitoring and evaluation plan, iv) CTCN Impact Description, v) Closure and Data Collection report.	*2,600-3,200 (SBE-2, PM-2)*				*2,600.00*	*3,200.00*
Output 2: Baseline and resource assessment to support industry scale biogas plant in Tonga	***40,300-51,650***				***40,300.00***	***51,650.00***
Activity 2.1: Undertake studies and surveys to demonstrate the availability of sustainable resources along the bio-economy value chain to use as input to the biogas plant	*18,400-23,200 (SBE-10, PM-12, LE- 20, GE-1)*	*12,000-16,000 (travel cost to Tonga and DSA to conduct surveys)*			*30,400.00*	*39,200.00*
Activity 2.2: Analysis of existing biogas technologies relevant for Tonga	*9,900-12,450 (SBE-5, PM-7, LE- 10, GE-1)*				*9,900.00*	*12,450.00*
Output 3: Biogas technologies at industrial scale will be identified	***43,000-54,750***				***43,000.00***	***54,750.00***

Activities and Outputs	Input: Human Resources	Input: Travel	Inputs: Meetings/events	Input: Equipment/Material	Estimated cost	
					Minimum	Maximum
Activity 3.1: Conduct feasibility studies on the biogas technologies	*16,600- 20,700 (SBE-12, PM-12, LE- 10, GE-1)*				*16,600.00*	*20,700.00*
Activity 3.2: Conduct stakeholder consultations	*10,400-13,050 (SBE-5, PM-8, LE- 10, GE-1)*	*12,000-16,000 (travel cost to Tonga and DSA for meetings and consultation workshop)*	*4,000-5,000 (stakeholder consultation workshop)*		*26,400.00*	*34,050.00*
Output 4: Capacity Development on biogas technologies	***37,500- 47,400***				***37,500.00***	***47,400.00***
Activity 4.1: Design program to conduct an industrial study trip and experience sharing to visit the industrial scale biogas plants that are relevant for Tonga as the outcome of the feasibility study.	*9,000-11,250 (SBE-5, PM-7, LE-7, GE-1)*	*20,000-25,000 (travel cost for Tonga representatives and DSA for study strips)*			*29,000.00*	*36,250.00*
Activity 4.2: Design and conduct appropriate training pre/post-industrial study trip in discussion with MEIDECC to enhance capacity of Tonga Government on the outcome of the feasibility study	*6,500-8,150 (SBE-3, PM-5, LE-6, GE-1)*		*2,000-3,000 (training workshop)*		*8,500.00*	*11,150.00*

Activities and Outputs	Input: Human Resources	Input: Travel	Inputs: Meetings/events	Input: Equipment/Material	Estimated cost	
					Minimum	Maximum
Output 5: Support provided for proposal development	***17,700-22,100***				***17,700.00***	***22,100.00***
Activity 5.1: Design proposal to apply for the implementation of the biogas project under other international funding mechanisms.	*9,300-11,650 (SBE-5, PM-7, LE-8, GE-1)*				*9,300.00*	*11,650.00*
Activity 5.2: Design technical specifications as the part of the Request for Proposal to support the procurement of the biogas plant.	*8,400- 10,450 (SBE-5, PM-7, LE-5, GE-1)*				*8,400.00*	*10,450.00*
Estimated range of costing for the entire Response Plan					***141,100.00***	***179,100.00***

(SBE- Senior Biomass Expert, PM- Project Manager, LE- Local Expert in biomass and agriculture, GE- Gender Expert)

4. Profile and experience of experts

The project comprises activities ranging from undertaking technical surveys to preparing procurement documents and financial proposals with application of new and emerging approaches. Hence, it is suggested that the project to be led by a project manager who has experience of delivering multidisciplinary complex project. He will be having senior subject matter experts at international and local level supporting him.

Experts required	Brief description of required profile
Senior Biogas Expert (International)	The Senior Biogas Expert shall have the following expertise and experience: • The senior expert shall have an engineering qualification with at least 7 years work experience in conducting feasibility studies and designing, implementing and operating grid connected biogas to energy plants of industrial scale. • The senior expert shall demonstrate the experience of assessing impact along bio value chain • Prior experience of working on energy sector in Pacific Island countries and understanding of circular economy

Experts required	Brief description of required profile
	will be an added advantage • The senior expert shall have demonstrated experience of writing technical proposals for international grants and funds like GCF and GEF • The senior expert shall have proficiency in reading, writing and speaking English and must be able to communicate with stakeholders effectively.
Project Manager	The project manager shall have the following expertise and experience: • The project manager shall have demonstrated experience of leading, managing and delivering biomass/ biogas to energy projects including the procurement of biomass/biogas technologies • The project manager shall have experience of managing and delivering surveys, stakeholder engagements, capacity development programs and financial proposals. • Prior experience of working on energy sector in Pacific Island countries and understanding of circular economy will be an added advantage • The project manager shall have experience of working with government and international organizations • The project manager shall have proficiency in reading, writing and speaking English and must be able to communicate with stakeholders effectively.
Biomass/ Agriculture Expert (Local)	Biomass Expert shall have the following expertise and experience: • The expert shall have prior work experience of conducting biomass survey in Pacific Island Countries, preferably in Tonga. • The expert shall have demonstrated experience of conducting Life cycle Assessment for food, feed, bioenergy and bio-products and its value chain including farming, processing and consumption of bio resources. • The expert shall have experience of undertaking surveys, capacity development programs and stakeholder consultations. • The senior expert shall have proficiency in reading, writing and speaking English and must be able to communicate with stakeholders effectively.
Gender Expert	The Gender Experts shall have the following expertise and experience: • Understanding and demonstrated ability of gender considerations in farming, processing and consumption of bio resources. • The Gender Expert shall have proficiency in reading, writing and speaking English and must be able to communicate with stakeholders effectively.

5. Intended contribution to impact over time

A megawatt sized biogas-based power plant can generate about eight and half million units of electricity which at a good efficiency can directly replace a megawatt sized diesel engine. In a relative term a MW sized biogas plant has potential to save three million units of diesel oil in a year which is equivalent to about a reduction eight thousand tons of CO_2 per year. This will be a significant contribution under NDC and Tonga Energy Road Map. Further, the project has large potential to linked with GCF supported Tonga Renewable Energy Project which envisaged to reduce 475,750 tons of CO_2 over the lifetime of the project.

6. Relevance to NDCs and other national priorities

- The Nationally Determined Contribution of Tonga has emphasized on energy generation from renewable sources to reduce the GHG emission from fossil fuel-based electricity sector which has high share of GHG emission about 23%.
- The energy efficiency is also emphasized under other various other national plans in Tonga like Tonga Strategic Development Framework, National Climate Change Policy and Tonga Energy Roadmap. Please refer the request documents for more details.

7. Linkages to relevant parallel on-going activities:

CTCN has helped Tonga in preparing the Tonga Energy Efficiency Master Plan and now supporting them to take it for implementation with Cabinet approval. Please see the details in the link below:
https://www.ctc-n.org/technical-assistance/projects/development-tonga-energy-efficiency-master-plan
https://www.ctc-n.org/technical-assistance/projects/development-tonga-energy-efficiency-master-plan

8. Anticipated follow up activities after this technical assistance is completed:

- Decision of Govt. of Tonga to implement the biogas to energy plant at industrial scale
- Procure services and technology to implement biogas-based plant
- Apply to international funding organizations to support the pilot projects and scale up

9. Gender and co-benefits:

Imbedded in design of the activities:	The TA is designed with an imbedded intention to deal with the gender issues in the following ways as also reflecting in the request document: • The feasibility study will look at the ways in which men, women, children and the disadvantaged can contribute to and benefited from the project. (Activity 3.1 and 3.2 for Output 3) • The consulting meetings and training workshops planned under the TA will address the gender aspects of the project • The training in the workshops will cover ways in which communities and households can productively use products from biogas plant (Activity 4.1 for Output 4) For information on the guidance, please visit CTCN website here: https://www.ctc-n.org/technologies/ctcn-gender-mainstreaming-tool-response-plan-development
Gender and co-benefits intended as result of the	• Likely generation of livelihoods as the positive developments from this TA will generate opportunities in farming and processing

activities:	• Energy security for all

10. Main in-country stakeholders in implementation of the technical assistance activities:

In country stakeholder	Role in implementation of the technical assistance
National Designated Entity	Overall Oversight of the TA
Energy Department, Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications (MEIDECC)	Day to day management and coordination of TA
Ministry of Agriculture	Coordination with agriculture, livestock and forestry divisions
Farmer's federation	Coordination with relevant stakeholders on supply of grass and green biomass
Statistics Department	Provision of data
Communities	Experience sharing through survey and stakeholder consultations
Pacific Community's (SPC) Pacific Centre for Renewable Energy and Energy Efficiency	Relevant stakeholder on the work done in this context

11. SDG Contributions:

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-3 SDGs)
1	End poverty in all its forms everywhere	
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	
5	Achieve gender equality and empower all women and girls	TA will generate equal opportunities in farming and processing
6	Ensure availability and sustainable management of water and sanitation for all	Circular Economy approach ensures the optimum use of resources with least wastage
7	Ensure access to affordable, reliable, sustainable, and modern energy for all (consider adding targets for 7)	
	7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services	Biogas based generation will increase the access to affordable, reliable and modern energy services
	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix	
	7.3 - By 2030, double the global rate of improvement in energy efficiency	
	7.a - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	
	7.b - By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
10	Reduce inequality within and among countries	

11	Make cities and human settlements inclusive, safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	Circular economy approach will enable the sustainable consumption and production patterns
13	Take urgent action to combat climate change and its impacts	Reduce GHG emissions by replacing the fossil fuels by renewable energy
	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	
	13.2 - Integrate climate change measures into national policies, strategies and planning	
	13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	
	13.a - Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	
	13.b - Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	Promote capacity development in Tonga which is a SIDS, including focusing on women, youth and local and marginalized communities
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	

12. Classification of technical assistance:

Please indicate primary type of technical assistance. Optional: If desired, indicate secondary type of technical assistance.

Please tick off the relevant boxes below	*Primary*	*Secondary*
☐ 1. Decision-making tools and/or information provision	☐	☐
☐ 2. Sectoral roadmaps and strategies	☐	☐
☐ 3. Recommendations for law, policy and regulations	☐	☐
☐ 4. Financing facilitation	☐	☐
☐ 5. Private sector engagement and market creation	☐	☐
☐ 6. Research and development of technologies	☐	☐
☐ 7. Feasibility of technology options	☐	☐
☐ 8. Piloting and deployment of technologies in local conditions	☐	☐
☐ 9. Technology identification and prioritisation	☐	☐

Please note that all CTCN technical assistance contributes to strengthening the capacity of in country actors.

13. Monitoring and Evaluation process

Upon contracting of the implementing partners to implement this Response Plan, the lead implementer will produce a monitoring and evaluation plan for the technical assistance. The monitoring and evaluation plan must include specific, measurable, achievable, relevant, and time-bound indicators that will be used to monitor and evaluate the timeliness and appropriateness of the

implementation. The CTCN Technology Manager responsible for the technical assistance will monitor the timeliness and appropriateness of the Response Plan implementation. Upon completion of all activities and outputs, evaluation forms will be completed by the (i) NDE about overall satisfaction level with the technical assistance service provided; (ii) the Lead Implementer about the knowledge and learning gained through delivery of technical assistance; and (iii) the CTCN Director about timeliness and appropriateness of the delivery of the activities and outputs.

Annex 1. Guidance Note for the Response Plan template