Concept Note

Project Title:	**Tonga Circular Economy Project**.
Country(ies):	Kingdom of Tonga
National Designated Authority(ies) (NDA):	Ministry of Meteorology, Energy, Information, Disaster management, Environment, Climate change, and Communications (MEIDECC)
Accredited Entity(ies) (AE):	Asian Development Bank
Date of first submission/ version number:	*[YYYY-MM-DD] [V.0]*
Date of current submission/ version number	*2021-07-XX*

GREEN CLIMATE FUND

Please submit the completed form to **fundingproposal@gcfund.org**, using the following name convention in the subject line and file name:
"CN-[Accredited Entity or Country]-YYYYMMDD"

Notes

- The maximum number of pages should **not exceed 12 pages**, excluding annexes. Proposals exceeding the prescribed length will not be assessed within the indicative service standard time of 30 days.
- As per the Information Disclosure Policy, the concept note, and additional documents provided to the Secretariat can be disclosed unless marked by the Accredited Entity(ies) (or NDAs) as confidential.
- The relevant National Designated Authority(ies) will be informed by the Secretariat of the concept note upon receipt.
- NDA can also submit the concept note directly with or without an identified accredited entity at this stage. In this case, they can leave blank the section related to the accredited entity. The Secretariat will inform the accredited entity(ies) nominated by the NDA, if any.
- Accredited Entities and/or NDAs are encouraged to submit a Concept Note before making a request for project preparation support from the Project Preparation Facility (PPF).
- Further information on GCF concept note preparation can be found on GCF website Funding Projects Fine Print.

A. Project/Programme Summary (max. 1 page)			
A.1. Project or programme	☒ Project ☐ Programme	**A.2. Public or private sector**	☐ Public sector ☒ Private sector
A.3. Is the CN submitted in response to an RFP?	Yes ☐ No ☐ If yes, specify the RFP: _____	**A.4. Confidentiality**[1]	☒ Confidential ☐ Not confidential
A.5. Indicate the result areas for the project/programme	Mitigation: Reduced emissions from: ☒ Energy access and power generation ☒ Low emission transport ☒ Buildings, cities and industries and appliances ☐ Forestry and land use Adaptation: Increased resilience of: ☒ Most vulnerable people and communities ☒ Health and well-being, and food and water security ☒ Infrastructure and built environment ☒ Ecosystem and ecosystem services		
A.6. Estimated mitigation impact (tCO2eq over lifespan)		**A.7. Estimated adaptation impact (number of direct beneficiaries and % of population)**	100% of the Tongan population will be beneficially impacted by this circular economy project
A.8. Indicative total project cost (GCF + co-finance)	Amount: **USD$32,840,000**	**A.9. Indicative GCF funding requested**	Amount: USD **$32,840,000 (50% as grant + 50% as a loan made available to a specialist Tongan company, RECET)**
A.10. Mark the type of financial instrument requested for the GCF funding	☒ **50% Grant** ☐ Reimbursable grant ☐ Guarantees ☐ Equity ☒ **50% Subordinated loan** ☐ Senior Loan ☐ Other: specify_____		
A.11. Estimated duration of project/ programme:	a) disbursement period: **3 to 5 years** b) repayment period, if applicable **20 years on the subordinated loan**	**A.12. Estimated project/ Programme lifespan**	**3 to 5 years**
A.13. Is funding from the Project Preparation Facility requested?[2]	Yes ☒ No ☐ Other support received ☐ If so, by who:	**A.14. ESS category**[3]	☒ A or I-1 ☐ B or I-2 ☐ C or I-3
A.15. Is the CN aligned with your accreditation standard?	Yes ☐ No ☐	**A.16. Has the CN been shared with the NDA?**	Yes ☒ No ☐

[1] Concept notes (or sections of) not marked as confidential may be published in accordance with the Information Disclosure Policy (Decision B.12/35) and the Review of the Initial Proposal Approval Process (Decision B.17/18).
[2] See here for access to project preparation support request template and guidelines
[3] Refer to the Fund's environmental and social safeguards (Decision B.07/02)

A.17. AMA signed (if submitted by AE)	Yes ☐ No ☐ If no, specify the status of AMA negotiations and expected date of signing:	**A.18. Is the CN included in the Entity Work Programme?**	Yes ☐ No ☐
A.19. Project rationale, objectives and approach of project (max 100 words)	Tropical photosynthesis is Tonga's most enabling natural advantage. Tonga's inexhaustible ability to grow prolific amounts of biomass in support of food, feed, fibre, energy, organic fertiliser, and bio-products underpins Tonga's ability to transition to a circular economy. However, tropical photosynthesis is only one of the required enabling elements. The other required element is Anaerobic Digestion which is the biological process at the heart of a biogas plant. This project draws together tropical photosynthesis and modern, world best practice, commercial scale Anaerobic Digestion within agricultural and agri-industrial aligned circular economy systems. This strategy and this project will set in motion Tonga's transition to an equitable, prosperous, fully sustainable, and largely self-determined circular economy.		

B. Project/Programme Information (max. 8 pages)

B.1. Context and baseline (max. 2 pages)

Due to its geographical location and topography, Tonga is one of the most vulnerable countries to climate change. However, Tonga's socioeconomic reality means it's one of the least capable countries to deal with the effects of climate change. This project seeks to substantially change Tonga's current reality and set in motion a transition to an equitable, prosperous, fully sustainable, and largely self-determined circular economy.

Tonga's reliance on imported energy, in the form of fossil fuels, along with imported food, feed, and chemical fertilisers in ever increasing amounts dominates the Tongan economy. Compounding this entrenched unsustainability is the continual, debilitating loss of human capital.

Driven by economic necessity, more Tongans live and work abroad than live and work in Tonga and this drains Tonga of its essential human capital.

Agriculture is at the core of the Tongan economy. However, over 50% of Tonga's rich agricultural land lays fallow and the vast majority of land that is in service is used for subsistence agriculture adding little value to the country's economic output or food security. Additionally, Tonga's manufacturing sector is minimal and accounts for less than 3% of GDP.

As a percentage of GDP, Tonga relies more on remittances than any other country. Remittances make up 40% of the Tongan economy and in 2019 some US$191 million in remittances were sent home by Tongans living and working abroad in support of an economy with a GDP of just US$490million. What is particularly disabling about Tonga's unsustainable, import dominant, linear economy is that most of the remittances sent home in support of family and friends flow straight back out again in support of imported energy, food, feed, chemical fertilisers, and other products.

To reduce its dependency on imported fossil fuels and reduce GHG emissions, Tonga set a target to generate 70% of its electricity from renewable sources by 2030. Currently, Tonga's renewable electricity generation is achieved via Solar PV and Wind. However, these intermittent generation sources cannot provide the baseload, dispatchable electricity and grid support services required to support Tonga's small, Islanded electricity grids. Additionally, these fully imported, intermittent electricity generation systems offer minimal local employment opportunities.

A further shortcoming of intermittent PV and Wind is their inability to effectively address the critically important issue of access to commercial quantities of affordable and reliable **process energies**. In a country that cannot feed itself because it has no capacity to process food or feed, access to commercial quantities of sustainable, affordable, and reliable thermally based process energies is as important as renewable electricity.

In 2017/18, at the request of the Tonga Government, the 'Climate Technology Centre and Network' worked closely with the Tongan Energy Department to develop a 'Tonga Energy Efficiency Master Plan' (TEEMP). The TEEMP report showed that in 2017 imported fossil fuels dominated the Tongan energy sector and therefore dominated the Tongan economy. What the TEEMP report also showed is that after achieving a 70% renewable electricity target by 2030 through the continued rollout of PV and Wind, along with the adoption of every energy efficiency measure recommended in the TEEMP report, the post 2030 Tongan economy **will still be dominated by imported fossil fuels**.

Therefore, something far more substantial and socioeconomically engaging, enabling, and empowering is required to shift the Tongan economy and society onto a sustainable development footing that **concurrently and comprehensively addresses multiple socioeconomic development challenges**. This is the essence of an agricultural and agri-industrial aligned circular economy strategy that is driven by tropical photosynthesis and enabled by commercial scale, world-best-practice, Anaerobic Digestion.

B.2. Project description (max. 3 pages)

The 'Tongan Circular Economy Project'

Tropical photosynthesis is Tonga's most enabling natural advantage. Tonga's inexhaustible ability to grow prolific amounts of biomass in support of food, feed, fibre, energy, organic fertiliser, and bio-products underpins Tonga's ability to transition to a fully sustainable circular economy. However, tropical photosynthesis is only one of the required enabling elements. The other required enabling element is Anaerobic Digestion which is the biological process at the heart of a biogas plant.

The Tongan Circular Economy Project draws together Tonga's prolific and inexhaustible tropical photosynthesis potentials with modern, commercial scale, worlds-best-practice Anaerobic Digestion within agricultural and agri-industrial aligned circular economy systems. These synergistic systems will set in motion Tonga's transition to an equitable, prosperous, fully sustainable, and largely self-determined circular economy. The key elements of the **Tongan Circular Economy Project** are as follows:

The biogas plant

- A large, commercial scale biogas plant based on worlds-best-practice, European sourced, technologies, systems, and know-how suitably adapted to this Tropical country. The quality of the biogas plant and related elements along with the experience of the European biogas partners is fundamental and **essential** to the success of the project.
- The scale of the biogas plant will be sufficient to support a Combined Heat and Power (CHP) package of 3MW electrical and approx. 3.2MW thermal. The CHP package will be configured to provide the full range grid support services that are not offered by PV and Wind. These grid support services include voltage regulation, frequency control, and peak demand response.
- The thermal energy from the CHP will play a unique and enabling role in the provision of commercial quantities of affordable and reliable **process energies** – particularly in support of food and feed processing.
- In addition to supporting the CHP package, the biogas plant will also support the production of sufficient quantities of biomethane to displace 2,500 tonnes/year of imported LPG.

The initial principal substrate

- The initial, 'principal substrate' for the biogas plant will be Hybrid Tropical Grass (HTG). HTG is an exceptionally high yielding, sterile hybrid with a proven history as a biogas plant substrate and as a multipurpose agricultural and agri-industrial crop. HTG is ideally suited to Tonga's tropical climate.
- HTG is a **non-invasive** perennial crop that can only be established through the planting of sterile canes. A well-managed HTG plantation has a high yielding, in-service life beyond 20-years and can be harvested up to 6 times/year.
- Importantly, HTG can be ensiled which is a common agricultural practice that has been used globally for thousands of years to preserve the energy and nutrient content of harvested biomass. The ensiling of HTG creates what is essentially a large-scale organic battery and strategic reserve. The HTG 'silage clamp' will be sized to mitigate

against **all possible supply chain interruptions** thus underpinning the ability of the biogas plant to produce biogas and digestate continuously and uninterrupted.

- The ensiled HTG will enable the co-digestion of other, existing but limited substrates such as manures and foodwastes. These substrates are not available in sufficient quantities to support a commercially viable, and socioeconomically impactful biogas plant but they will play an important co-digestion role. Again, the quality of the biogas plant and related elements is **fundamental and essential** to being able to co-digest these existing but limited substrates.
- The ensiled HTG will also have an immediate role to play in displacing some imported livestock feeds. The same ensiled HTG that is fed to the biogas plant can also be fed to cattle and pigs which are the dominant livestock species in Tonga.
- Additionally, into the future, within an expanding Tongan circular economy, HTG will also support multiple bioproduct development pathways. HTG has already been trialled as a feedstock in support of a proven and commercialised German designed biorefinery that can be implemented in Tonga.
- Importantly, the high productivity of the HTG aligned to Tonga's prolific and inexhaustible tropical photosynthesis resources means that **less than 5% of the fallow agricultural land** on the main island of Tongatapu can support the HTG requirements of this biogas plant.
- Specific HTG related allocations have been made within the project budget to cover the following:
    - ✓ The trialling of HTG to establish country specific inputs and yields.
    - ✓ The commercial plantings of the HTG on the agricultural land of the participating Tongan farmers.
    - ✓ The **complete mechanisation** of the HTG planting systems, harvesting systems, and HTG and digestate supply chains. This mechanisation will be available to other elements of the Tongan agricultural sector.
    - ✓ The establishment and equipping of a biogas plant biological support laboratory, R&D testing facility, and general agricultural support facility inclusive of required staffing and training.

Enabling the development of a wide range vertically integrated agricultural and agri-industrial aligned circular economy systems

- Over time, the existence of the commercial scale biogas plant will enable the development and implementation of a wide range vertically integrated agricultural and agri-industrial aligned circular economy systems. These are fundamental to Tonga's socioeconomic development and by extension Tonga's ability to respond to the realities of climate change. These systems will include, but **are not limited to**:
    - ✓ A commercial scale, multi-input feedmill. **NOTE:** Tonga currently has no local feed production capabilities. The limited amounts of imported feeds are expensive and have a high embedded carbon footprint. Additionally, the general lack of quality feeds in Tonga leads to poor livestock health and by extension, poor public health outcomes.
    - ✓ A complete, vertically integrated poultry meat sector. **NOTE:** On a per capita basis, Tongans consume more poultry meat than any peoples on earth. However, apart from limited, subsistence-based home slaughtering, all of this meat is fully imported. Additionally, Tonga is used as a dumping ground for poor

quality poultry meat that has no market in the country of origin thus amplifying Tonga's poor public health outcomes.

- ✓ An expanded and modernised egg sector.
- ✓ A complete vertically integrated dairy sector**. NOTE:** All of Tonga's dairy products are fully imported.
- ✓ A fish processing facility: **NOTE:** Due to its long string of islands, Tonga has a large 'Exclusive Economic Zone'. Despite this, Tonga has minimal commercial fishing and no commercial fish processing facility. A fish processing facility developed as a key element within an Anaerobic Digestion enabled circular economy system will add significantly to Tonga's ability to meet its own nutritional demands for humans and livestock along with its nutrient demands for cropping.

- Importantly, as they are developed, the residues and wastes from all these vertically integrated systems will feed back into an expanding Tongan biogas sector thus providing a clear pathway to energy independence, food security, feed security, and fertiliser security whilst concurrently enabling the most impactful socioeconomic development pathway in Tonga's history.
- It should be clearly noted that without the existence of a high quality, commercial scale biogas plant, the development of these agricultural and agri-industrial aligned circular economy systems is **not commercially or practically viable**. Again, the quality of the biogas plant and related elements along with the experience of the European biogas partners is **fundamental and essential** to the success of the project.
- **US$2.5million** has been allocated in the project budget to support the conceptual planning followed by the detailed planning, engineering, and consent authority approvals required in support of the development of these vertically integrated, agricultural, and agri-industrial aligned circular economy systems.

A drop in, multi-species, red meat processing facility

- Tonga has relatively large numbers of pigs and cattle but no red meat processing facility. The processing of red meat in Tonga is undertaken via a practice referred to as 'bush kills'. As the name suggests, this is quite literally the slaughtering of livestock in the bush under completely unhygienic, unsafe, and poor animal welfare conditions.
- A drop in, multi-species red meat processing facility, colloquially referred to as a 'kill and chill' facility, will be implemented **concurrently with the biogas plant**. This facility will provide a safe and hygienic environment to process both cattle and pigs whilst concurrently supporting higher level animal welfare and efficiency outcomes.
- The facility will have an initial modest processing capacity of 5 head/day of cattle and 10 pigs/day in one limited shift. However, capacity can and will be expanded as supply chains are developed and training increases.
- All wastes from the processing facility will be directed to the biogas plant and the biogas plant will concurrently support the full array of energy inputs required for processing facility. This includes steam, hot water, chilling, and freezing (process energies) supported from the thermal side of the CHP package.
- A budget allocation of **US$3.5million** has been made for this drop in, multi-species red meat processing facility and this covers the development of organised supply chains and training.

Green CO2

- The Green CO2 available from the biogas to biomethane upgrading will be captured in support of a wide range of local systems and processes. Initially there will be a focus on the production of dry ice which will fulfill multiple functions within this tropical country.

Digestate (the co-product of Anaerobic Digestion)

- It should be noted that there is no fertiliser production capacity in Tonga. Given the high costs of imported chemical fertilisers, many crops in Tonga are under-fertilised which is reflected in poor quality crops and reduced crop yields. These realities amplify the poor public health outcomes related to the Tongans that consume those crops and the livestock that are fed by those crops.
- The prolific amounts nutrient dense, residual carbon rich, and microbiologically active digestate produced by the biogas plant will be made available to the broad Tongan agricultural sector.

Unequivocally endorsed by the Tongan Ministry of Agriculture Food and Forestry

- The agricultural and agri-industrial strategies and systems underpinning this project were developed in close cooperation with the Tongan Ministry of Agriculture, Food, and Forestry (MAFF) along with the broader agricultural and business community. MAFF has unequivocally endorsed the strategies and systems underpinning this project and will be an important, strategic, and practical, hands-on partner in the delivery of this project.

Growing a local biogas, bioenergy, and circular economy sector

- This project represents the first significant step in enabling the development of a Tongan biogas, bioenergy, and circular economy sector. Given this, it is essential that a specific Tongan circular economy focused company is established to work directly with the European biogas technology providers and other agricultural and agri-industrial aligned specialist stakeholders to develop and deliver this benchmark project. To this end, a local specialist Tongan circular economy company called **'Renewable Energy and Circular Economy Tonga'** (RECET) has been established to support this role and to capture the experience that will flow from the development and implementation of this project,
- Beyond its initial establishment, RECET will be structured to enable the widest range of Tongan stakeholders and investors to become directly engaged in the company.

B.3. Expected project results aligned with the GCF investment criteria (max. 3 pages)

The Tonga Circular Economy Project will deliver the following outcomes:

- Bring approximately 400 hectares of fallow agricultural land back into commercial production with the planting of highly productive and highly versatile HTG.
- Provide complete training for the Tongan farmers that will grow the HTG.
- Provide a new income source for the participating Tongan farmers in the amount of US$1.7million/year and fully support these farmers with crop trials, crop establishment, and the complete mechanisation of planting, harvesting, and HTG and digestate supply chains.
- Via the HTG silage clamps, enable the creation of an energy bank and strategic energy reserve capable of mitigating against cyclones and other supply chain interruptions.
- The HTG will have an additional immediate role to play in displacing the importation of some livestock feeds.
- Enable the co-digestion of existing waste-based substrates that on their own are insufficient in quantity to support a commercially viable biogas plant
- The biogas fuelled 3MW electrical 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/year of renewable electricity that the CHP package will generate is 2.7 times more than the total amount of renewable electricity generated across all 4 of Tonga Power Limited's (TPL) Island grids in 2019/20. Importantly and distinctively, this electricity will be fed into the Tongatapu grid in a manner simply not supported by the current intermittent renewables.
- The electricity will be fed into the Tongatapu electricity grid against a feed-in-tariff set by Tonga Power Limited. This feed-in-tariff is supportive of Tonga Power Limited's objectives of holding its 'Lifeline Tariff' for low-income customers at 65senti/kWh.
- The approx. 3.2MW thermal generation capacity of the CHP package will support the supply of commercial quantities of reliable and affordable process energies covering steam, hot water, cooling, chilling freezing, and drying. These process energies will be made available to any Tongan entity looking to add value to what they grow or produce with a particular emphasis on food and feed processors.
- The biogas plant will concurrently produce sufficient quantities of biomethane to displace the importation of 2,500 tonnes per year of LPG.
- Green CO2 captured from the biogas to biomethane upgrading and applied initially to the production dry ice that will have multiple roles to play within this tropical country.
- Over time, the existence of this commercial scale biogas plant will enable the development and implementation of a wide range vertically integrated agricultural and agri-industrial aligned circular economy systems. These systems will include, but are not limited to, a commercial scale, multi-input feedmill, a vertically integrated poultry meat sector, an expanded and modernised egg sector, a vertically integrated dairy sector, and a fish processing facility. US$2.5million has been allocated in the project budget to support the conceptual planning followed by the detailed

planning, engineering, and consent authority approvals required in support of the development of these vertically integrated, agricultural, and agri-industrial aligned circular economy systems.

- As these systems are developed, the residues and wastes will feed back into an expanding Tongan biogas sector thus enhancing energy independence, feed security, food security, fertiliser security whilst concurrently enabling the most Impactful socioeconomic development pathway in Tonga's history.
- Provide industrial quantities of nutrient dense, residual carbon rich, and microbiologically active digestate to be applied to Tongan agricultural soils.
- **NOTE:** The scale and breadth of deliverables supported by this biogas plant sends a very clear signal to the European biogas sector that Tonga is serious about not only establishing a large, commercial scale biogas plant but creating a vertically integrated Tongan biogas sector and leveraging all the inherent circular economy deliverables that come with that sector.
- Support a substantial and ever-increasing number of training and up-skilling opportunities along with fully sustainable jobs.
- Provide clear pathways for Tongans living and working abroad to return home to apply their overseas acquired training and skills in support of their beloved country.

B.4. Engagement among the NDA, AE, and/or other relevant stakeholders in the country (max ½ page)

- The initial Tongan engagement began in Tonga in June 2018. The purpose of that initial engagement was to explain the inherent and enabling interconnections between agricultural and agri-industrial aligned circular economy systems and anaerobic digestion, biogas, and digestate within the context of a topical country with unlimited photosynthesis potentials and biomass resources.
- In late August 2018, a 4-man Government of Tonga and Pacific Community delegation went to Germany. The focus of the trip was to:
    - ✓ see first-hand modern, commercial / industrial scale biogas plants within agricultural and agri-industrial settings.
    - ✓ see first-hand multiple elements of a mature biogas sector.
    - ✓ see first-hand the enabling role anaerobic digestion, biogas, and digestate play in support of agricultural and agri-industrial circular economy systems and the broader circular economy
    - ✓ to meet with IfaS.
- The 4-man delegation was led by the Hon. Tongan Minister for the 'Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications' (MEIDECC).
- In November 2018 Professor Dr. Peter Heck, the head of IfaS, reciprocated with a visit to Tonga where we were given the opportunity to present biogas and the circular economy to the Prime Minister and Cabinet. This trip also incorporated a wide range of stakeholder engagements.
- In late March early April 2019, the Ministry for Agriculture Food and Forestry (MAFF) took the lead in the further development of the agricultural and agri-industrial aligned circular economy strategies and initiatives.
- In May 2019 MAFF once again supported further in-country community and stakeholder consultations. All up, MAFF supported more than 40, in-country, broad-based community and stakeholder consultations and engagements. These consultations and engagements spanned the agricultural sector, the commercial sector, the aid/donor sector, the finance sector, the Government sector, and broader Tongan society.
- Since winning the UNIDO tender, broad stakeholder engagements have continued through numerous video conferences and phone calls.
- Importantly, the agricultural and agri-industrial strategies and systems underpinning this project have been unequivocally endorsed by MAFF.

C. Indicative Financing/Cost Information (max. 3 pages)

C.1. Financing by components (max ½ page)

Table 1: CAPEX support from GCF as DONOR funding

Project Element	Allocated budget to be funded by GCF donor funding to RECET in USD
Civils in support of the biogas plant site inclusive of; establishing the construction site, earthworks, permanent access roads, carparking, fencing, stormwater, sewer, landscaping, ancillary buildings/structures, and silage clamps	3,500,000
Crop trails, crop establishment, agricultural training, complete mechanization of cropping systems, substrate and digestate supply chains.	5,000,000
Design, construct, and equip an Anaerobic Digestion and agricultural support laboratory and testing facility	2,000,000
Fully inclusive, drop-in red meat processing facility inclusive of complete integration with the biogas plant.	3,500,000
Conceptual planning, detailed planning, engineering, and consent authority approval studies in support of additional agricultural and agri-industrial aligned circular economy systems to be enabled by the biogas plant. These will include a commercial scale, multi-input feedmill, a vertically integrated poultry meat sector, an expanded and modernised egg sector, a vertically integrated dairy sector, and a fish processing facility	2,500,000
Total donor funded CAPEX support from GCF	**16,500,000**

Table 2: CAPEX support from GCF SUBORDINATED LOAN

Project Element	Allocated budget to be funded by GCF as a subordinated loan to RECET USD
Biogas plant detailed design, engineering, and consent authority approvals.	1,500,000
Biogas plant substrate handling preconditioning and dispensing systems, biological processing systems, CHP package, biogas to biomethane upgrading system inclusive of CO2 capture.	14,840,000
Total CAPEX support from GCF subordinated loan	**16,340,000**
TOTAL PROJECT CAPEX to be funded by donor support and subordinated loan	**32,840,000**

C.2. Justification of GCF funding request (max. 1 page)

Due to its geographical location and topography, Tonga is one of the most vulnerable countries to climate change. However, Tonga's socioeconomic reality means it's one of the least capable countries to deal with the effects of climate change. This project seeks to substantially change Tonga's current reality and set in motion a transition to an equitable, prosperous, fully sustainable, and largely self-determined circular economy.

Tonga's reliance on imported energy, in the form of fossil fuels, along with imported food, feed, and chemical fertilisers in ever increasing amounts dominates the Tongan economy. Compounding this entrenched unsustainability is the continual, debilitating loss of human capital.

Driven by economic necessity, more Tongans live and work abroad than live and work in Tonga.

Agriculture is at the core of the Tongan economy. However, over 50% of Tonga's rich agricultural land lays fallow and the vast majority of land that is in service is used for subsistence agriculture adding little value to the country's economic output or food security. Additionally, Tonga's manufacturing sector is minimal and accounts for less than 3% of GDP.

As a percentage of GDP, Tonga relies more on remittances than any other country. Remittances make up 40% of the Tongan economy and in 2019 some US$191 million in remittances were sent home by Tongans living and working abroad in support of an economy with a GDP of just US$490million. What is particularly disabling about Tonga's unsustainable, import dominant, linear economy is that most of the remittances sent home in support of family and friends flow straight back out again in support of imported energy, food, feed, chemical fertilisers, and other products.

To reduce its dependency on imported fossil fuels and reduce GHG emissions, Tonga set a target to generate 70% of its electricity from renewable sources by 2030. Currently, Tonga's renewable electricity generation is achieved via Solar PV and Wind. However, these intermittent generation sources cannot provide the baseload, dispatchable electricity and grid support services required to support Tonga's small, Islanded electricity grids. Additionally, these fully imported, intermittent electricity generation systems offer minimal local employment opportunities.

A further shortcoming of intermittent PV and Wind is their inability to effectively address the critically important issue of access to commercial quantities of affordable and reliable **process energies**. In a country that cannot feed itself because it has no capacity to process food, access to commercial quantities of sustainable, affordable, and reliable thermally based process energies is as important as renewable electricity.

In 2017/18, at the request of the Tonga Government, the 'Climate Technology Centre and Network' worked closely with the Tongan Energy Department to develop a 'Tonga Energy Efficiency Master Plan' (TEEMP). The TEEMP report showed that in 2017 imported fossil fuels dominated the Tongan energy sector and therefore dominated the Tongan economy. What the TEEMP report also showed is that after achieving a 70% renewable electricity target by 2030 through the continued rollout of PV and Wind, along with the adoption of every energy efficiency measure recommended in the TEEMP report, the post 2030 Tongan economy **will still be dominated by imported fossil fuels**.

Therefore, something far more substantial and socioeconomically engaging, enabling, and empowering is required to shift the Tongan economy and society onto a sustainable development footing that **concurrently and**

comprehensively addresses multiple socioeconomic development challenges. This includes Tonga's ability to respond to the realities of climate change. Through the development and implementation of the proposed 'Tongan Circular Economy Project' the path forward will be made clear.

C.3. Sustainability and replicability of the project (exit strategy) (max. 1 page)

Please explain how the project/programme sustainability will be ensured in the long run and how this will be monitored, after the project/programme is implemented with support from the GCF and other sources.

For non-grant instruments, explain how the capital invested will be repaid and over what duration of time.

D. Supporting documents submitted (OPTIONAL)

- ☐ Map indicating the location of the project/programme
- ☐ Diagram of the theory of change
- ☒ Economic and financial model with key assumptions and potential stressed scenarios
- ☐ Pre-feasibility study
- ☒ Evaluation report of previous project
- ☐ Results of environmental and social risk screening

Self-awareness check boxes

Are you aware that the full Funding Proposal and Annexes will require these documents? Yes ☐ No ☐

- Feasibility Study
- Environmental and social impact assessment or environmental and social management framework
- Stakeholder consultations at national and project level implementation including with indigenous people if relevant
- Gender assessment and action plan
- Operations and maintenance plan if relevant
- Loan or grant operation manual as appropriate
- Co-financing commitment letters

Are you aware that a funding proposal from an accredited entity without a signed AMA will be reviewed but not sent to the Board for consideration? Yes ☐ No ☐