Country	Papua New Guinea
Request ID#	2024000020
Title	Pre-feasibility study on Ocean Energy focusing on Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion
NDE	Mr. Danny Nekitel Manager Mitigation and Low Carbon Growth, Climate Change & Development Authority +675 7700-7838 danny.nekitel@ccda.gov.pg; dan.nekitel@gmail.com Enchi Bldg | Ground Floor | Wards Rd, Hohola, Port Moresby | NCD | Papua New Guinea
Proponent	Organisation: National Energy Authority Contact Person: Larsen Daboyan Position: Manager Research and Statistics Email: Larsen.Daboyan@nea.gov.pg Address: Goada Herea Building, Waigani Dr., P.O. Box 494, WAIGANI, National Capital District, Papua New Guinea

Summary of the CTCN technical assistance

Papua New Guinea (PNG) is on the verge of harnessing its ocean energy potential to enrich its renewable energy portfolio. However, the scarcity of comprehensive data and expertise in emerging ocean energy technologies, such as Salinity Gradient Energy and Electrochemical Ocean Thermal Energy Conversion (e-OTEC), alongside Blue Battery Technology, presents obstacles to their practical application. The CTCN's Technical Assistance (TA) project is designed to tackle these challenges through a detailed pre-feasibility study, assessing the practicality, technical demands, and environmental consequences of deploying these technologies within PNG. This endeavour involves crucial stakeholders, including the PNG Department of Petroleum & Energy, Climate Change and Development Authority (CCDA), National Energy Authority and local energy sector participants, setting a solid foundation for subsequent ocean energy ventures in PNG.

Situated at the frontier of tapping into ocean energy to diversify its energy resources, PNG's strategy aligns with its National Energy Policy 2018-2028 and its commitments under the Paris Agreement, underscoring the urgency of seeking out sustainable energy alternatives to conventional sources. The exploration into ocean energy technologies comes as a strategic response to the energy sector's current reliance on hydro and fossil fuels, addressing critical issues of access, reliability, and sustainability—challenges acutely felt within PNG's remote and island communities. The PNG government's commitment to exploring sustainable ocean energy solutions underscores a strategic move to address the nation's growing energy demands sustainably.

The CTCN's TA project is strategically positioned to provide the essential technical groundwork and knowledge base enabling PNG to utilise its ocean energy potential effectively. By focusing on cutting-edge technologies compatible with PNG's unique geographical and environmental landscape, the project aims to contribute to the nation's renewable energy journey and reinforce its commitments to both national and global climate action.

PNG's proactive efforts to combat climate change and promote sustainable development are evident through ongoing policy reforms, capacity-building initiatives, and community-based adaptation projects. The establishment of the Climate Change and Development Authority (CCDA) to lead climate action and the comprehensive strategies laid out in PNG's strategic plans and Nationally Determined Contributions (NDC) highlight the nation's dedication to sustainable economic growth and climate resilience. These plans emphasise crucial actions across multiple sectors, including efforts to maintain high forest cover and reduce emissions, especially in key areas like agriculture and energy.

The CTCN's TA project aims to empower PNG to achieve its ocean energy aspirations and foster a sustainable, resilient energy future. The project's primary goal is to conduct a pre-feasibility study on ocean energy, specifically focusing on Salinity Gradient Energy Technology and e-OTEC, including Blue Battery Technology. The anticipated outcome is to elevate PNG's technical knowledge and capabilities in these areas, offering vital data to streamline policy and strategic development, thereby facilitating the adoption and expansion of ocean energy projects. This initiative promises to catalyse pilot project development, enhance collaborative efforts among government, community, private sector, and international partners, and contribute to economic growth through the renewable energy sector. Ultimately, this project marks a pivotal advancement in leveraging PNG's ocean energy potential, promoting sustainable growth, and contributing to climate change mitigation.

Agreement:

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

National Designated Entity to the UNFCCC Technology Mechanism
Name: Danny Nekitel
Title: Manager Mitigation and Low Carbon Growth

Date: 14/06/2024

Signature:

Proponent (signature of the Proponent is optional)
Name: Larsen Daboyan
Title: Manager Research and Statistics

Date: 14/06/24

Signature:

UNFCCC Climate Technology Centre and Network (CTCN)
Name: Rajiv Garg
Title: CTCN Director (*ad interim)*

Date: 18 June 2024

Signature:

1. Background and context

Papua New Guinea (PNG), endowed with vast coastal and marine resources, stands at the threshold of tapping into the promising domain of ocean energy to diversify its energy portfolio. This initiative is aligned with the country's National Energy Policy 2018-2028 and its commitment under the Paris Agreement, highlighting the urgency to explore sustainable energy solutions beyond traditional sources. Ocean energy technologies, particularly Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion (e-OTEC), including Blue Battery Technology, while promising, are at a nascent stage and necessitate thorough feasibility assessments to ascertain their viability, integration potential, and environmental implications within the PNG setting.

The energy sector in PNG, predominantly powered by hydro and fossil fuels, grapples with issues of accessibility, reliability, and sustainability, challenges that are particularly pronounced in the nation's remote and island communities. The exploration of ocean energy emerges as a viable solution to these challenges, potentially enhancing energy security, aiding climate change mitigation efforts, and driving economic growth. The PNG government, recognising the criticality of leveraging the nation's marine resources, is keen on investigating innovative ocean energy solutions to sustainably meet the country's burgeoning energy needs.

The CTCN's technical assistance is poised to play a pivotal role at this juncture, aiming to lay down the essential technical foundation and knowledge base for PNG to effectively exploit its ocean energy potential. This initiative will concentrate on state-of-the-art technologies that are congruent with PNG's unique geographical and environmental contours, thereby significantly contributing to the nation's renewable energy trajectory and bolstering its national and global climate action commitments.

With various initiatives already underway to combat climate change and promote sustainable development, including policy reforms, capacity-building programs, and community-based adaptation projects, PNG's commitment to the climate cause is evident. The establishment of the Climate Change and Development Authority (CCDA) to spearhead climate action and regulatory frameworks exemplifies this commitment. Furthermore, PNG's endeavours to fulfil its obligations under the United Nations Framework Convention on Climate Change (UNFCCC), as manifested in its strategic plans like PNG Vision 2050, the National Development Strategic Plan 2010-2030, and its Nationally Determined Contributions (NDC), underscore the nation's dedicated efforts towards sustainable economic development and climate resilience.

The NDC outlines key actions across various sectors, emphasising the importance of maintaining high forest cover and reducing emissions, particularly in the Agriculture, Forestry, and Other Land Use (AFOLU) and Energy Sectors. Adaptation remains a priority, with a focus on critical sectors like agriculture, health, transport, and infrastructure, paving the way for comprehensive climate resilience strategies aligned with the United Nations Sustainable Development Goals (SDGs).

In this context, the CTCN's technical assistance project represents a strategic intervention to empower PNG in realising its ocean energy ambitions, thereby fostering a sustainable and resilient energy future.

2. Problem statement

In Papua New Guinea (PNG), the pursuit of climate change mitigation and adaptation through renewable energy technologies is confronted by significant challenges. The country's ambition to transition to a sustainable energy mix is hampered by a lack of technical expertise, insufficient data on the potential of innovative energy solutions, and incomplete environmental impact assessments. Specifically, the integration of renewable ocean energy technologies, such as Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion (e-OTEC), including advanced applications like Blue Battery technology, hold promise for PNG, a nation with vast coastal resources and a critical need for sustainable energy solutions to combat climate change impacts like rising sea levels and increased extreme weather events.

However, barriers such as the limited understanding of these technologies' feasibility, potential environmental impacts, and the specific operational requirements for their implementation in PNG's unique geographical and ecological context restrict their adoption. The lack of reliable and clean energy sources, especially in remote coastal areas, exacerbates the vulnerability of these communities to climate change, while reliance on fossil fuels continues to contribute to greenhouse gas emissions.

The CTCN's technical assistance project is designed to overcome these barriers by conducting a comprehensive pre-feasibility study on the mentioned ocean energy technologies. This initiative aims to pave the way for sustainable, low-carbon development within PNG's energy sector, aligning with the country's commitments under the UNFCCC and the Paris Agreement, and its ambitious renewable energy targets for 2030. Through this project, PNG seeks to enhance its capacity for climate change mitigation and adaptation, leveraging its status as a Small Island Developing State (SIDS) to transition towards a resilient and renewable energy-driven future.

3. Logical Framework for the CTCN Technical Assistance:

(Guidance: Please note that multiple activities lead to one Output, and multiple Outputs lead to one Outcome. There can be several Outputs, but only one Outcome description capturing the CTCN technical assistance. Deliverables are the products or services to be delivered to the NDE/Proponent/CTCN based on the Activities and the Outputs.)

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Objective: The main objective of this technical assistance is to conduct a pre-feasibility study on Ocean Energy focusing on Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion, including Blue Battery Technology in PNG.												
Outcome: This project aims to enhance technical knowledge and capabilities for Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion systems in Papua New Guinea. The project will provide critical data to inform policy development and strategic planning, simplifying the process for PNG to adopt and scale ocean energy projects. The project will enable PNG to begin developing pilot projects with clear site identification, an understanding of environmental and social implications, and a capacity-building roadmap. The project will foster collaboration among government entities, local communities, the private sector, and international partners, ensuring that resources are mobilised, knowledge is shared, and ocean energy projects are sustainable. By implementing and scaling ocean energy technologies in PNG, greenhouse gas emissions will be reduced, and renewable energy targets will be met, reducing PNG's dependence on fossil fuels and enhancing energy security and climate resilience. Additionally, this project will contribute to supporting economic development through the creation of new industries and job opportunities in the renewable energy sector. Overall, this project represents a strategic step forward in harnessing PNG's ocean energy potential, promoting sustainable development, and mitigating the impacts of climate change.											
Mandatory Output: Project management *All implementers must undertake the following project management activities at the beginning of, during and at the end of the CTCN technical assistance.*												
Activity A: Pre-implementation 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; Based on the work plan, a monitoring and evaluation (M&E) 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). This M&E plan also includes a CTCN Impact Description formulated in the beginning of the technical assistance											

which will be revised in the Closure and Data Collection report once the technical assistance is fully delivered (templates will be provided). Furthermore, a gender evaluation and gender action plan (GAP) will be prepared and followed throughout the technical assistance (a template will be provided).[1]												
Activity B: Implementation A project steering committee will be formed, consisting of the implementing team (international and local consultants), the NDE, the project proponent(s), and CTCN. This project steering committee will meet at least on a bi-annual basis in order to report project progress and discuss any questions and challenges.												
Activity C: Post-implementation A Closure and Data Collection report completed at the end of the technical assistance (a template will be provided). Project-end communication and dissemination activities will be conducted in collaboration with the CTCN Secretariat, which will include: • Development of a press release • Delivery of a knowledge sharing webinar • Organization of a dialogue with financial institutions for potential follow-on support												
Mandatory deliverables: Deliverable A: Detailed work plan; M&E plan; gender assessment and gender action plan Deliverable B: Project Steering Committee meeting reports Deliverable C: Closure and Data Collection report; press release, webinar, dialogue with financial institutions	X X					X						X X
Output 1: Establishment of Steering Committee and Preliminary Technical Preparation The output aims to identify relevant stakeholders among governmental institutions at the national and sub-national levels, sector professionals, the private sector, civil society, academic institutions, and beneficiaries.												

[1] Additional information is available under Section 10 of the response plan.

The output involves deploying scientific equipment in pre-identified areas based on existing data, including bathymetry data. Pressure sensors, current meters, and CTD (Conductivity, Temperature, Depth) instruments will be used to capture water column temperature data. This information will help identify the most appropriate technology to develop (wave, tidal, or thermal energy) as well as the most suitable sites. The Implementing Partner will provide the country with insights into the potential of ocean energy in the area.												
Activity 1.1: Mapping stakeholders, Background data analysis and site selection 1. Based on this list of stakeholders, a limited Steering Committee will be created to supervise the implementation of this Technical Assistance. The committee will maintain a gender balance and ensure adequate representation of vulnerable groups. It will provide technical oversight and high-level guidance at every stage of implementation. 2. The site identified based on the bathymetry data will be validated in consultation with the country. The suitability of the site from the operational aspects of the technologies will also be discussed. 3. The objective of this activity is also to consider the social and environmental aspects of the proposed sites. Hence, if suggested by the country, the communities or their representatives would also be consulted for site selection. 4. Based on 1 and 2, a list of identified sites and ocean-based energy will be the outcome of this activity with suitable supporting reasoning. Besides technical feasibility, the selected site should also consider the sustainable operation of the proposed technology with climate-proofing to stand extreme weather events.												
Activity 1.2: Inception workshop and Deployment of data collection equipment A multi-stakeholder inception workshop will be organised to inform stakeholders of the start of the project and ensure their active participation throughout the implementation process. This meeting will be held in person. Consultative meetings will be held with each member of the Steering Committee to understand previous initiatives and discussions will focus on where the data collection equipment should be hosted, how to operate it and who the future users and administrators of the equipment will be. The objective of the data collection is to further analyse and document the suitability of the selected sites (1 or 2 sites) and the ocean energy generation technologies to undertake the pre-feasibility study. 1. The data set, templates for capturing raw data, data monitoring tenure and worksheet will be designed in consultation with the country or any relevant stakeholders identified by the government. 2. The data will be collected using various equipment such as pressure sensors, current meters, and CTD (Conductivity, Temperature, Depth) devices. The country will provide logistic support for deploying and operating the equipment at the project site for a specified duration. The implementing partner will provide training to the country on how to operate the equipment.												
Deliverable 1:					X							

1.1: A reporting including: 1. List of stakeholders and steering committee 2. List of sites identified with potential ocean-based energy generation technologies 3. Approaches for site selection 4. Equipment used for data collection 5. Data collection process and data sets (raw and processed data) 1.2: A reporting including: 1. Minutes of the consultative meetings. 2. Minutes of the inception workshop with the list of participants, disaggregated by gender, materials used for the workshops and photos of the event. 3. Working sheets including the raw data and data analysis												
Output 2: Pre-feasibility of the technologies - Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion (e-OTEC) including Blue Battery Technology The output will undertake a pre-feasibility study of the selected technology and site based on technical, social, environmental and economic aspects. The approach used for undertaking the study and the outcomes will be consulted with the stakeholders comprising the communities and the government agencies.												
Activity 2.1: Technical pre-feasibility (commissioning and operational aspects) 1. The data collected by monitoring equipment will be processed to analyse the most suitable sites for Salinity Gradient Energy Technology and e-OTEC. These technologies can provide renewable energy-based electricity and water security to the island. Additionally, Blue Battery Technology, a seawater-based energy storage system, will be explored to enhance the synergy of introducing ocean-based energy. 2. The pre-feasibility study will address but not limited to the following: - Overview of technology - Potential size - Performance and cost - Challenges and barriers with references from other projects 3. Besides technical implementation to produce renewable energy, the pre-feasibility study shall also consider the following: - Sustainable operation of the plant throughout the technical lifetime of the technology with climate proof ability to stand extreme weather conditions - Fresh water production through desalination - Undertake the feasibility of the potential of Aquaculture along with those technologies. The feasibility will be conducted in consultation with stakeholders.												

Activity 2.2: Socio-economic and financial analysis This activity will cover a socio-economic analysis, weighing the socio-economic costs against the socio-economic benefits of each ocean energy technology. It will also include a financial analysis, assessing the viability and profitability of each technology as well as the different financing options. This analysis will also take into consideration the environmental impacts of the development of ocean energy technologies. 1. Required data will be collected regarding the demography focusing on the communities of the identified sites, biodiversity in the coastal areas and financial data on the identified ocean energy technologies from primary and secondary sources. 2. Socio-economic impact assessment be conducted using globally recognised approach but applicable to the local conditions. It should be designed to accommodate the aspects of the targeted communities on gender inclusiveness, employment, food and water security and capacity building. 3. Financial analysis will be conducted to assess the profitability of the selected ocean energy technologies, and various financing options will be identified.												
Activity 2.3: Pre-feasibility report and stakeholder consultations (Communities and government) 1. The analysis conducted on technical aspects under 3.1 will be complemented by the socio-economic and financial analysis undertaken in activity 3.2 to package and present under the draft pre-feasibility study. 2. Tools like Multi Criteria Decision Analysis (MCDA) will be used to undertake the prefeasibility of the selected technologies. 3. The underlying tool and the draft outcomes of the report will be consulted with stakeholders comprising the communities and government agencies. 4. The comments and feedback of the stakeholders will be addressed and reflected in the revised feasibility study.												
Deliverable 2: 2.1: Draft pre-feasibility study report with worksheets on the socio-economic and financial analysis conducted 2.2: Stakeholder consultation/Webinar with follow-up online consultation survey 2.3: Final pre-feasibility study report with worksheets on the socio-economic and financial analysis conducted									X			
Output 3: GCF concept note and In-person workshop The guidelines to prepare GCF concept note are to be considered throughout all the activities listed above for better alignment of the deliverables with the requirements of the concept note and would help in the filling of the GCF note template under this output with best available data and information generated from this project. Other Pacific island countries have the potential to harness ocean energy. The note should also serve as a successful case for the other countries in the region to replicate the approach.												

The Implementing Partner will travel to the country to deliver an in-person workshop and dissemination of the findings of the project on the pre-feasibility study on both Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion including Blue Battery Technology in PNG.												
Activity 3.1: Development of 1 GCF Concept Note As per standard requirements, the GCF concept note will include a project summary, detailed project information, indicative financing/cost information and supporting documents that may include a theory of change, economic and financial models, pre-feasibility studies, evaluation reports from previous projects, and/or results of environmental and social risk screening.												
Activity 3.2: In-person workshop and project wrap-up The Implementing Partner will prepare presentation materials and compile previous deliverable reports into a final, publicly available report for the country. The Implementing Partner will travel to deliver the final project presentation and disseminate materials. During this final workshop, relevant MDBs will be identified and invited. Additionally, the GCF NDA and GEF focal point need to be invited to explore opportunities for scaling up after the conclusion of this project.												
Deliverable 3: 3.1: One GCF Concept Note with the package of supporting documents, as applicable. 3.2: Final report and in-person presentations Final compiled deliverable, combining deliverables 1, 2, 3 and 4 into a final report. Project presentation delivering key project findings in-person in a visit to the country.												X

4. Resources required and itemized budget:

Please provide an indicative overview of the resources required and itemized budget required to implement the CTCN technical assistance, including for M&E-related activities, using the table below. Important to note that minimum 5% of the budget should explicitly target gender specific activities related to the technical assistance (please see section 10 for further information on gender). Once the Response Plan is completed, a Response Implementation partner(s) will be selected by the Climate Technology Centre (CTC). A detailed activity-based budget for the CTCN assistance will be finalized by the CTCN and selected Implementer.

Activities and Outputs	**Input: Human Resources** *(Title, role, estimated number of days)*	**Input: Travel** *(Purpose, national vs. international, number of days)*	**Inputs: Meetings/events**	**Input: Equipment/Material** *(Item, purpose, buy/rent, quantity)*	**Estimated cost** *Please accumulate the costing at Activity and Output level and provide an estimated costing range for*

			(Meeting title, number of participants, number of days)		*each activity and the total Response Plan*	
					Minimum	**Maximum**
Mandatory Output: Project Management					*USD 13,500*	*USD 15,000*
Mandatory Activities: A: Pre-implementation B: Implementation C: Post-implementation	IE1: 10 days IE2: 10 days IE3: 10 days				*13,500*	*15,000*
Output 1: Establishment of Steering Committee and Preliminary Technical Preparation					*67,050*	*74,500*
Activity 1.1: Mapping stakeholders, Background data analysis and site selection	IE1: 15 days IE2: 15 days IE3: 15 days NE1: 10 days NE2: 10 days				*24,750*	*27,500*
Activity 1.2: Inception workshop and Deployment of data collection equipment	IE1: 15 days IE2: 15 days IE3: 15 days NE1: 10 days NE2: 10 days	International travel: 5 days	In-person kick-off meeting: 3 days		*42,300*	*47,000*
Output 2: Pre-feasibility of the technologies - Salinity Gradient Energy Technology and					*74,250*	*82,500*

Electrochemical Ocean Thermal Energy Conversion (e-OTEC) including Blue Battery Technology						
Activity 2.1: Technical pre-feasibility (commissioning and operational aspects)	IE1: 15 days IE2: 15 days IE3: 15 days NE1: 10 days NE2: 10 days				*24,750*	*27,500*
Activity 2.2: Socio-economic and financial analysis	IE1: 15 days IE2: 15 days IE3: 15 days NE1: 10 days NE2: 10 days				*24,750*	*27,500*
Activity 2.3: Pre-feasibility report and stakeholder consultations (Communities and government)	IE1: 15 days IE2: 15 days IE3: 15 days NE1: 10 days NE2: 10 days				*24,750*	*27,500*
Output 3: GCF concept note and In-person workshop					*67,050*	*74,500*
Activity 3.1: Development of one GCF Concept Note	IE1: 15 days IE2: 15 days IE3: 15 days NE1: 10 days NE2: 10 days				*24,750*	*27,500*

Activity 3.2: In-person workshop and project wrap-up	IE1: 15 days IE2: 15 days IE3: 15 days NE1: 10 days NE2: 10 days	International travel: 5 days	In-person kick-off meeting: 3 days		*42,300*	*47,000*
Estimated range of costing for the entire Response Plan					221,850	*246,500*

5. Profile and experience of experts

Based on the required Human Resources identified in section 4 (Resources required and itemized budget) please provide a description of the required profile of all involved experts for the implementation of the CTCN Response Plan.

Experts required	Brief description of required profile
International Experts	
Project manager (IE1)	• Relevant master's degree in environmental engineering, energy technology, economics of power systems or other disciplines with a focus on the field of similar issues in a developing country context. • At least 11 years of working experience with issues of electricity market design, and policies for renewable integration in a developing country context. • Knowledge and experience in electrical engineering, technology and power systems in climate change adaptation and mitigation. • At least 5 references in the Pacific Island countries or similar geographic landscape. • Fluency in English is mandatory.
Ocean energy specialist (IE2)	• Relevant master's degree in electrical/mechanical engineering, energy technology, economics of power systems or other disciplines with a focus on the field of similar issues in a developing country context. • At least 8 years of working experience with issues of ocean energy, and policies for renewable integration in a developing country context. • Knowledge and experience in ocean data, climate modelling for coastal areas and conducting feasibility studies in the related field. • At least 5 references in the Pacific Island countries or similar geographic landscape.

	• Fluency in English is mandatory
Energy economics specialist (IE3)	• Relevant master's degree in energy economics, energy technology, economics of power systems or other disciplines with a focus on the field of similar issues in a developing country context. • At least 8 years of working experience with issues of energy related to socio-economic assessment for communities in remote and island areas in a developing country context. • Knowledge and experience in conducting commercial feasibilities and recommending financing options for the technologies like ocean energy. • At least 5 references in the Pacific Island countries or similar geographic landscape. • Fluency in English is mandatory
National Experts	
Research engineer (NE1)	• Relevant master's degree in mechanical/chemical engineering, energy technology, economics of power systems or other disciplines with a focus on the field of similar issues in a developing country context. • At least 5 years of working experience with issues of the renewable energy sector in a developing country context. • Knowledge and experience in renewable energy and climate technology in climate change adaptation and mitigation. • At least 3 references in PNG, Pacific Island countries or similar geographic landscape. • Fluency in English is mandatory.
Gender expert (NE2)	• Relevant master's degree in Gender studies or other disciplines with a focus on the field of gender issues in a developing country context. • At least 5 years of working experience with gender mainstreaming issues in a developing country context. • Knowledge and experience of gender mainstreaming in climate change adaptation and mitigation. • At least 3 references in PNG, the Pacific Island countries or similar geographic landscape. • Presence in PNG desired or availability to travel frequently and for long periods. • Fluency in English is mandatory.

6. Intended contribution to impact over time

This CTCN technical assistance project in Papua New Guinea is poised to significantly contribute to the country's resilience to climate change and efforts in carbon abatement. By conducting a pre-feasibility study on Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion, the project intends to unlock the potential of ocean energy, a renewable resource that could drastically reduce reliance on fossil fuels, thereby lowering greenhouse gas emissions in the energy sector, which is currently the largest net emitter in PNG.

The successful implementation of ocean energy technologies could lead to an estimated increase in the share of renewables in PNG's energy mix to 78% by 2030, aligning with national targets. This shift is expected to impact people in coastal and remote communities through improved energy access, enhancing livelihoods and reducing vulnerability to climate impacts. Economically, the focus on renewable energy could stimulate sectors related to ocean technology, contributing significantly to PNG's GDP through job creation, technology innovation, and energy exports.

The carbon abatement pote`ntial of this project is considerable, aiming to reduce emissions in the energy sector from its current levels. By meeting its objective, PNG could set a precedent for renewable energy adoption among Small Island Developing States, showcasing the integration of innovative ocean energy solutions into national and regional climate action strategies.

7. Relevance to NDCs and other national priorities

This CTCN technical assistance project directly supports Papua New Guinea's Nationally Determined Contributions (NDCs) and aligns with various national priorities, including National Adaptation Plans (NAPs). PNG's commitment to increasing the share of renewable energy in its energy mix from 30% in 2015 to 78% by 2030, as outlined in its NDC, is a primary goal that this project actively advances by exploring the pre-feasibility of Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion.

By focusing on the untapped potential of ocean energy, the project addresses key barriers identified in PNG's national plans such as the lack of technical knowledge and environmental impact assessments for emerging renewable technologies. The intended outcomes will enhance PNG's technical and institutional capacities, crucial for the implementation of its NDCs in the energy sector.

Furthermore, the project's emphasis on sustainable, low-carbon development is in line with PNG's NAPs, addressing the urgent need for adaptation strategies that can withstand the adverse effects of climate change. Given the country's vulnerability as a Small Island Developing State, enhancing energy resilience through renewable sources is a strategic priority to safeguard against climate-induced disruptions.

By contributing to the reduction of greenhouse gas emissions through the promotion of renewable ocean energy, this technical assistance also supports PNG's broader climate goals under the Paris Agreement and its own Vision 2050, aiming for sustainable and inclusive economic growth. The project's success in identifying viable ocean energy solutions could serve as a model for other SIDS, emphasizing the importance of international support and cooperation in meeting global climate targets.

In summary, this CTCN project is a pivotal component of PNG's strategy to meet its NDC targets and other climate-related national priorities, facilitating a transition towards a more sustainable and resilient energy future.

8. Linkages to relevant parallel on-going activities:

The CTCN technical assistance project for Papua New Guinea on ocean energy technologies will complement and build upon a series of existing initiatives in the public and private sectors aimed at enhancing the country's renewable energy capacity and climate resilience.

These initiatives include:

- PNG Electrification Partnership (PEP): A collaboration between PNG and international partners (Australia, Japan, New Zealand, and the United States) aiming to achieve 70% electrification across the country by 2030. The CTCN project aligns with PEP's goals by exploring sustainable ocean energy solutions that can contribute to rural electrification, particularly in coastal and remote areas.

- PNG Power Sector Development Project: Funded by the Asian Development Bank (ADB), this project focuses on improving power generation capacity through renewable sources. The CTCN assistance will complement this by providing specific pre-feasibility studies on ocean energy potentials, enhancing the diversification of renewable energy sources in PNG's power sector.

- Climate Resilient Green Growth (CRGG) Strategy: Led by the Global Green Growth Institute (GGGI) in collaboration with the PNG government, this strategy aims to integrate climate resilience and green growth into national development planning. The CTCN's focus on environmentally sound ocean energy technologies supports the CRGG's objectives by promoting green energy solutions and climate change adaptation.

- Private Sector Initiatives on Renewable Energy: Various private companies in PNG are exploring renewable energy projects, including solar, hydro, and geothermal energy. The CTCN project will provide valuable data and insights on another renewable sector—ocean energy—thereby encouraging private investment in this untapped area. The feasibility study results can attract private sector engagement by highlighting potential investment opportunities and partnerships.

- UNDP supported Climate Change Adaptation Projects: These projects, focusing on enhancing climate resilience among communities, offer a foundational framework for integrating ocean energy solutions as part of broader adaptation strategies. The operational link between these initiatives and the CTCN project lies in the shared objective of mitigating climate change impacts through innovative technology deployment.

By building on these initiatives, the CTCN assistance will leverage existing networks, resources, and knowledge, ensuring a coordinated approach to expanding PNG's renewable energy sector and achieving its climate goals. The collaboration between the CTCN project and ongoing initiatives will foster synergies, avoid duplication of efforts, and amplify the impact of sustainable ocean energy development in PNG.

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

Upon the completion of the CTCN technical assistance project on ocean energy technologies in Papua New Guinea, the outputs and deliverables are expected to be utilised by a range of stakeholders, serving as foundational tools for the future development and deployment of renewable ocean energy solutions in the country.

The primary beneficiaries and uses of these outputs include:

- Government Entities: The Department of Petroleum & Energy and the Climate Change and Development Authority (CCDA) will use the pre-feasibility study and environmental impact assessments to inform policy formulation and regulatory frameworks. These documents will guide the integration of ocean energy technologies into the national energy plan, aiming to increase the renewable energy share in PNG's energy mix. The findings will also assist in updating the Nationally Determined Contributions (NDCs) under the Paris Agreement with new commitments based on ocean energy potentials.

- PNG Power Limited (PPL): As the main electricity utility in PNG, PPL will utilise the technical assessments and capacity-building materials to explore the integration of ocean energy into the grid. This will include planning for pilot projects, infrastructure upgrades, and grid stability analyses to accommodate new renewable energy sources.

- Research and Academic Institutions: Universities and research centres in PNG and the region will use the study's data for further research on ocean energy technologies and their applicability in the Pacific context. This will foster innovation and develop local expertise in ocean energy solutions.

- Local Communities and NGOs: Community-based organisations and NGOs focused on sustainable development and climate resilience will leverage the stakeholder engagement reports and capacity-building materials to raise awareness about the benefits of ocean energy. These resources will support community-led initiatives and advocacy for renewable energy adoption.

- Private Sector: Energy companies and investors will use the pre-feasibility study and environmental assessments to evaluate investment opportunities in ocean energy projects in PNG. This could lead to the development of public-private partnerships for the financing and implementation of ocean energy infrastructure.

- International Donors and Development Partners: Entities such as the Asian Development Bank (ADB), Global Green Growth Institute (GGGI), and bilateral partners involved in PNG's energy sector development will reference the project's outputs for aligning international support with PNG's renewable energy goals. This may result in targeted funding and technical support for subsequent phases of ocean energy projects.

For next step, following the project's completion, a series of actions are anticipated, including the convening of a national workshop to disseminate findings, the initiation of discussions with potential investors and development partners, and the development of a roadmap for pilot project implementation. Stakeholders will collaboratively work towards mobilising resources for the next phase of ocean energy development, aiming for pilot project launches within 2-3 years post-study completion. This comprehensive utilisation of the technical assistance outputs will significantly contribute to advancing PNG's renewable energy capabilities, promoting sustainable development, and enhancing climate resilience.

10. Gender and co-benefits:

Each technical assistance must integrate gender mainstreaming activities and lead to gender and other co-benefits. At least 5% of the technical assistance budget needs to be allocated to gender mainstreaming activities.

Imbedded in design of the activities:	A gender mainstreaming analysis is mandatory to include for all technical assistances. A gender expert will be assigned to carry out an assessment and evaluation regarding gender mainstreaming and will develop a gender action plan (GAP) to be followed during the implementation of the TA. This will include the following components: • Analysis of gender disparities (assess the situation of gender disparities in the context of the project, including socio-economic, cultural and institutional factors. Identify areas where inequalities exist, etc.). • Data collection (collect and analyze gender-disaggregated data to understand the specific needs and preferences of different genders). • Adaptive and gender-responsive design (evaluate the project design to ensure that it takes into account the different roles, responsibilities and interests of different genders. Analyze how the project can empower marginalized genders and promote gender equality). • Gender and innovation ecosystem (evaluate how the proposed technologies could promote women as entrepreneurs). • Gender budgeting (budget allocation to guide gender mainstreaming activities. Also ensure that gender-specific needs are adequately funded). Gender Mainstreaming Analysis: A gender expert will be integrated into the project team to ensure a gender-responsive approach is adopted from the outset. This expert will conduct a thorough gender analysis to identify gender-specific barriers and opportunities within the context of ocean energy development in PNG. Capacity Building: The project will include gender-sensitive capacity-building sessions aimed at ensuring women's participation in the renewable energy sector. Training programs will be designed to address the needs of women and men equally, encouraging women's leadership in energy projects. Stakeholder Engagement: Special emphasis will be placed on inclusive stakeholder engagement processes that ensure women's voices are heard and considered in decision-making related to ocean energy development. This will include targeted outreach to women's groups and communities. Employment Opportunities: The project will advocate for and promote the creation of employment opportunities for women in the emerging ocean energy sector, including technical, managerial, and support roles, to ensure equitable access to the benefits of renewable energy development.
Gender and co-benefits intended	Enhanced Women's Participation: By prioritizing gender equality, the project expects to significantly increase women's participation in the renewable energy sector in PNG. Women will have greater opportunities for

as result of the activities:	employment, leadership, and entrepreneurship within the sector, contributing to economic empowerment and gender equality. Improved Access to Clean Energy: The successful implementation of ocean energy technologies is expected to improve access to clean and reliable energy for all, with particular benefits for women and children who are often disproportionately affected by energy poverty. This can have transformative impacts on health, education, and livelihoods. Strengthened Climate Resilience: Gender-responsive climate action, facilitated by the project, will contribute to building more resilient communities. Women's active participation in designing and implementing adaptation and mitigation strategies ensures that these efforts are more inclusive and effective. Socio-economic Benefits: Beyond the direct benefits of renewable energy access, the project's emphasis on gender equality and women's empowerment is expected to yield broader socio-economic benefits, including improved family welfare, reduced inequalities, and stronger community cohesion. Policy Influence: The insights and lessons learned from the gender mainstreaming efforts within this project are anticipated to inform national policies and strategies, promoting a more gender-responsive approach to energy and climate policy in PNG and potentially influencing other nations and sectors.

11. Main in-country stakeholders in implementation of the technical assistance activities:
Using the table below, please list and describe the role of in-country stakeholders, participants and beneficiaries who will be involved in or directly consulted during implementation of the assistance.

In country stakeholder	Role in implementation of the technical assistance
National Designated Entity (NDE)	Support the request and monitor its implementation; Request Applicant
National Energy Authority	Responsible for energy policy for the government of Papua New Guinea. The Secretariat will receive the deliverables of technical assistance project from the Implementing Partner that may assist them in forming future energy policy.
Climate Change and Development Authority (CCDA)	Leading national agency responsible for coordinating climate change actions and policies.
Department of Petroleum & Energy	Responsible for energy planning, regulation, and infrastructure development in Papua New Guinea.
Academic Institutions and Universities	Providing technical expertise, research support, and capacity-building opportunities in renewable energy and climate change adaptation.
Community Organizations and Civil Society	Representing local communities and facilitating participatory approaches in project implementation and decision-making processes.

12. SDG Contributions:

Instructions: Please complete the grey section below for ***a maximum of three SDGs*** *that will be advanced through this TA. A complete list of SDGs and their targets is available here: https://sustainabledevelopment.un.org/partnership/register/.*

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-3 SDGs)
1	End poverty in all its forms everywhere	This technical assistance will facilitate the growth of ocean power generation in PNG, leading to reduced electricity costs for customers. Currently, the country relies heavily on costly diesel-based electricity generation. However, the promotion of ocean power should help cut down expenses.
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	
6	Ensure availability and sustainable management of water and sanitation for all	
7	Ensure access to affordable, reliable, sustainable, and modern energy for all (consider adding targets for 7)	This technical assistance will enhance access to clean energy resources, such as ocean power generation, to improve supply reliability and reduce costs.
	7.1 - By 2030, ensure universal 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	
13	Take urgent action to combat climate change and its impacts	Promoting the use of ocean energy will help reduce the impacts of emissions from diesel generation and help combat climate change. It will contribute to mitigation efforts through renewable energy adoption.
	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	
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	

13. 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.

14. 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; and (ii) the Lead Implementer about the knowledge and learning gained through delivery of technical assistance. Furthermore, the NDE together with the project proponent(s) will complete a periodic post-implementation form to track the impact of the activities beyond the technical assistance end date.

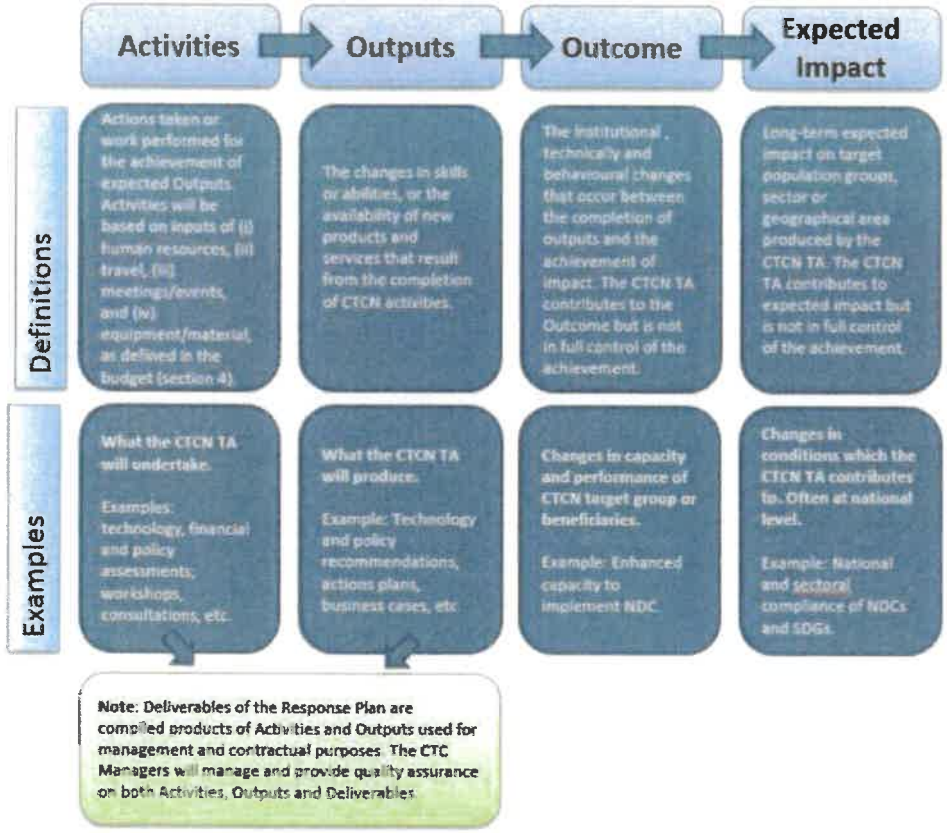
Annex 1: Guidance note for designing a Response Plan (to be deleted when submitting the Response Plan)

1. Objective of the Response Plan

The Response Plan is developed by CTCN specialists in response to a country request for technical assistance. It constitutes the Terms of Reference of the CTCN technical assistance that will be provided to the country and it provides the formulation of and subsequent basis for the monitoring and evaluation of the Response Plan implementation, as well as its expected outcomes and anticipated impacts.

2. Results chain and Logical Framework Approach to be defined in the CTCN Response Plan

The result chain is the causal sequence that stipulates the necessary flow of actions and processes to achieve desired objectives and results – beginning with inputs, moving through activities and outputs, and culminating in individual outcomes. The outcome will contribute to the desired impact in the society. The Logical Framework Approach is an analytical process used to support objectives-oriented project planning and management. It provides a set of pre-defined concepts which are used as part of an iterative process to aid structured and systematic analysis and management of the CTCN technical assistance.



3. Role of the Response Planning Design Team

The Response Planning Design Team is selected by the Climate Technology Centre (CTC). The composition of the team depends on each particular request but may include the National Designated Entity (NDE), the request Proponent, Climate Technology Manager of the CTCN, experts from the CTCN Consortium, UNIDO and UNEP experts from regional offices and other experts as needed.

The role of CTCN Consortium experts is to lead the design of the Response Plan. The NDE will provide overall guidance on national context and priorities whereas the request Proponent will provide more detailed information on the sector, barriers and requested assistance. The Climate Technology Manager of the CTCN will provide quality assurance of timeliness and appropriateness of the Response Plan.

The Response Planning Design Team will draft all sections of the Response Plan template building on the information contained in the CTCN Request, based on expertise on the given topic and potentially further data collection, as required. This will be done by the CTCN Consortium Experts in consultation with the NDE, request Proponent and relevant stakeholders. The Response Plan has to be agreed to and approved by the NDE and the CTCN Director. This Response Plan will serve as the basis to identify, select and engage an expert institution from the Climate Technology Network or Consortium to lead the implementation of the CTCN Response Plan in the requesting country.

To the extent possible, staff from UNEP and UNIDO Regional, Sub-Regional and/or National Offices should be involve in all stages of formulation of the Response Plan to maximize synergies and avoid overlap with ongoing initiatives, as well as ensure relevance to regional and national context.

4. Process for designing the Response Plan

The Response Planning process should be completed over a period of up to 60 working days (12 weeks). Indicative steps and related timelines are laid out below:

5. Design Considerations

UN environment programme | CTCN UN Climate Technology Centre & Network

Annex 1. Guidance Note for the Response Plan template

In order to maximize the impact of the technical assistance provided by the CTCN and provide an effective M&E process, the Response Plan should integrate as much as possible the considerations below:

Climate Technology focus: The Response Plan should have a clear focus on climate technologies, and identify activities that enable the identification, development, deployment or diffusion of one or several specific technologies (including equipment, techniques, knowledge and skills).

Barrier removal / Problem solving: The activities should contribute to address the specific problem statement identified in the Request. The barriers identified should be those hampering the identification, development, deployment or diffusion of one or several climate technologies or climate actions. Therefore, it may be necessary to limit the CTCN Response Plan to a set of activities for technical assistance commonly agreed with the NDE (and Proponent when needed) compared to the original request submitted. The CTCN will liaise with NDEs and Proponent in case the scope of the technical assistance deviates from the original request.

Use of the CTCN assistance by stakeholders: The Response Plan should identify clearly how the products of the CTCN assistance will be used in the short term once support is delivered, by who and when, to ensure it will lead to specific impacts in the country. The activities should engage the stakeholders that will use the concrete results of the assistance to deploy the technologies, including from the private sector, the public sector, research institutions, etc.

Within the scope of CTCN resources: The cost of the technical assistance provided by the CTCN cannot exceed USD 250,000 per Response Plan. Therefore, it may be necessary to prioritize activities and limit the CTCN Response Plan to a set of priority activities commonly agreed with the Proponent and the NDE to remain under this value. Under section 4 of the Response Plan template, an indicative activity based budget should be presented. The proposed budget is indicative and should present an estimated costing range per activity, output as well as a total costing range for the delivery of the Response Plan. Once the Response Plan is finalised and published for tendering, interested parties will provide competitive offer against the indicative budget.

CTCN activities and outputs should be linkable to monitoring and evaluation indicators: All proposed activities and outputs must be linkable to monitoring and evaluation indicators that are specific, measurable, achievable, relevant, and time-bound. The monitoring and evaluation process and corresponding indicators will be developed by the Lead Implementer as part of the work plan and will allow the CTCN technology Manager to monitor the timeliness and appropriateness of the implementation.

Synergies with existing efforts: The Response Plan should focus on activities that are not already being fully supported or that are in the process of being fully supported by another national, regional or international organization. Synergies and complementarity also require that the CTCN assistance is not duplicating past activities. It is possible in the Response Plan to indicate co-financing from the government, the Proponent or another stakeholder, that will maximize the effectiveness of the CTCN assistance.

Gender mainstreaming: The CTCN mission is to build or strengthen developing countries' capacities to identify technology needs, to facilitate the preparation and implementation of technology projects and strategies taking into account gender considerations. The Response Plan must therefore describe how gender considerations will be included and monitored within the proposed activities, and any gender co-benefits that will be gained as a result of implementing the CTCN technical assistance.