Monitoring & Evaluation (M&E) Plan and Impact Statement Form

Objective of the M&E Plan and Impact Statement:

- The M&E Plan and Impact Statement must be designed based on the Technical Assistance Response Plan and must enable the Implementer to complete the Closure Report at the end of the assistance.

Process for filling in the form:

- The Implementer must identify relevant quantitative and qualitative indicators as specified in the Closure Report. A sub-set of indicators to monitor and assess must be chosen among these.
- The Implementer may also identify other specific, measurable, achievable, relevant, and time-bound indicators suitable to monitor Activities, Outputs and anticipated Outcomes from the technical assistance and add to the M&E Plan and Impact Statement.
- During implementation of the TA or FTA, the Implementer must collect all relevant data as described in the Monitoring & Evaluation Plan. Aggregated data on selected indicators as well as an updated version of the Impact Statement will be presented in the Closure Report at the end of the assistance.

Basic Information	
Title of response plan	**Pre-feasibility study on Ocean Energy focusing on Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion**
Technical assistance reference number	**2024000020**
Country/ countries	**Papua New Guinea**
NDE focal point and organisation	▪ *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*
Sector(s) addressed	▪ *Renewable (ocean) energy* ▪ *Water-Energy Nexus*
Technologies supported	▪ *Salinity gradient power* ▪ *Ocean thermal energy conversion* ▪ *Seawater-based energy storage*
Implementation period and total duration	**01/09/2024 – 31/08/2025 (1 year)**

Total budget for implementation	*TA: USD246,500*
Designer of the response plan	*Hanki Kim, Korea Institute of Energy Research, South Korea (KIER), hankikim@kier.re.kr*
Implementer of response plan	▪ *[Project Manager] Dr. Hanki Kim, Korea Institute of Energy Research, South Korea (KIER)* ▪ *[Project Coordinator / Focal Point] Dr. Woonho Baek, Korea Institute of Energy Research, South Korea (KIER)* ▪ *[Technical Advisor] [Project Coordinator] Dr. Joonhyun Kim, Korea Institute of Energy Research, South Korea (KIER)* ▪ *[Ocean Energy Specialist] Dr. Kyosik Hwang, Korea Institute of Energy Research, South Korea (KIER)* ▪ *[Energy Economy Specialist] Woohyun Kim, Korea Institute of Energy Research, South Korea (KIER)* ▪ *[Gender Expert] Boseok Seo, Korea Institute of Energy Research, South Korea (KIER)*

(A) Outputs and Activities as described in the Response Plan	(B) Indicator	(C) Expected results	(D) Method and frequency for data collection	(F) Comments
Output 1: Development of implementation planning and communication documents	▪ *Total number of deliverables produced during the assistance (excluding mission, progress and internal reports)*			▪ *Inception meeting* ▪ *Stakeholder's consultation*
Activity 1.1 Formulation of i) Detailed work plan, ii) Monitoring and evaluation plan, iii) CTCN Impact Description, iv) Closure and Data Collection report.	▪ *Number of communication materials, including news releases, newsletters, articles, presentations, social media postings, etc.*	▪ *Inception workshop* ▪ *Work plan report (presentation)* ▪ *Data collection report about seawater and freshwater salinity, ocean temperature* ▪ *evaluation plan of pilot-scale ocean energy plant in PNG* ▪ *CTCN impact description* ▪ *Closure and Data collection report*	▪ *At least, 3 times during the project period*	
Output 2: Preliminary Technical Preparation	▪ *Number of communication materials, including news releases, newsletters, articles, presentations, social media postings, etc.*		▪ *Virtual meeting (quarterly)*	
Activity 2.1: Background data analysis and site selection Activity 2.2:	▪ *Number of other information materials strengthened, revised or created*	▪ *Conceptual design of ocean energy (salinity gradient power, e-OTEC and/or seawater-*	▪ *Installation of the equipment* ▪ *Acquisition of the data from*	

Deployment of monitoring equipment, data collection and processing	*(For example training and workshop reports, Power Points, exercise docs etc.)* ▪ *Number of trainings organized by proponents and implementing partners*	*based energy storage) plant* ▪ *Presentation file for technical preparation* ▪ *Environmental condition analysis report* ▪ *Installation of monitoring equipment* ▪ *Data acquisition from installed monitoring equipment*	*equipment every month* ▪ *Estimation of yearly electricity generation from salinity gradient energy, OTEC and seawater-based energy storage assumed based on the result of the report of TA:* *(1) Size of power output* *(2) Power factor* *(3) Annual elec. Generation can be calculated with (1) and (2) above.*	
Output 3: Pre-feasibility of the technologies - Salinity Gradient Energy Technology and Electrochemical Ocean Thermal Energy Conversion (e-OTEC) including Blue Battery Technology	▪ *Number of climate technology RD&D related documents and events*		▪ *Virtual meeting (quarterly)* ▪ *Technology meeting in-person at PNG (or KIER, South Korea)*	
Activity 3.1: Technical pre-feasibility (commissioning and operational aspects) Activity 3.2: Socio-economic and financial analysis Activity 3.3: Pre-feasibility report and stakeholder consultations (Communities and government)	▪ *Number of ocean energy technology RD&D related documents and events* ▪ *Total number of institutions trained*	▪ *Mathematical and computational simulation of salinity gradient energy, e-OTEC and/or seawater-based energy storage (Blue-Battery) system by adopting data from PNG.* ▪ *Evaluation and estimation reports of pre-feasibility of the technologies* ▪ *Socio-economic*	▪ *Pre-feasibility test would be conducted based on the ocean thermal data and salinity gradient profile on the estuary in PNG*	

		analysis of ocean energy implementation in PNG ▪ *Pre-feasibility report* ▪ *Technology training workshop*		
Output 4: GCF concept note and In-person workshop	▪ *Total number of events organized by proponents and implementing partners*		▪ Wrap-up meeting (in-person)	
Activity 4.1: Development of one GCF Concept Note Activity 4.2: In-person workshop and project wrap-up	▪ *Total number of policies, strategies, plans, laws, agreements or regulations supported by the assistance* ▪ *number of technologies transferred or deployed as a result of CTCN support*	▪ *GCF concept note* ▪ *Ocean energy workshops (in-person)* ▪ *Technology transfer strategy report* ▪ *Introducing technology training program in KIER*		

Note: The Response Plan may contain information useful for the section below. The information in the table below will be used by the CTCN for public communication of the achieved and expected results of the Technical Assistance through the CTCN website www.ctc-n.org and other communication channels. See for example: https://www.ctc-n.org/sites/www.ctc-n.org/files/benin_a_ag_forestry.final_.pdf

Impact Statement	
Challenge	*The challenge of this TA is to determine the viability of Salinity gradient energy, OTEC and seawater-based energy storage (also called blue battery) as an alternative for the provision of clean energy, reduction of GHG emissions, and reduction of diesel importation in PNG, while at the same time providing adaptation solutions such as access to variable renewable energy sources, desalinated drinkable water, reduction of air pollution, etc.* *The study has to prove that multiple benefits in the economy through this project can balance the high investment costs required for this project.*
CTCN assistance	• *Conduct collection and assessment of technical data to identify best sites for the installation of an ocean energy plant* • *Conduct consultation with stakeholders regarding water and energy benefits* • *Conduct socio-economic and gender analysis regarding the introduction*

	of ocean energy technology, and financial analysis of the viability and accessibility of financing options *Drafting a concept note for the GCF*
Anticipated impact	*[Problem statement]:* *[Desired impact]:* *The TA is expected to facilitate decision making by providing expert knowledge on best ocean energy alternatives (including salinity gradient energy, e-OTEC, and seawater-based energy storage), best geographical locations for the installation of a prospective ocean energy plant in PNG, and detailed information on additional benefits such as for adaptation and economic activities as a result of the installation of the plant.* *[Stakeholders]:* • *PNG government* • *Local universities* *[Deliverables]:* • *Comparison of viability of ocean energy alternatives* • *Scientific study on locations for ocean energy (salinity gradient energy, OTEC and/or seawater-based energy storage) plant (based on surface temperatures, salinity profiles and freshwater accessibility)* • *Technical, socio-economic, and financial analysis of ocean energy (salinity gradient energy, OTEC and/or seawater-based energy storage) plant (GHG emission reduction potential, energy generation, investment costs, socio-economic benefits, co-benefits)* • *GCF concept note*
Anticipated co-benefits from the TA	• *A kW scale salinity gradient energy pilot plant and MW-scale OTEC pilot plant would be suggested to displace the use of diesel energy. This will release a burden of the economy to reduce diesel imports, and more importantly population will benefit with the reduction of air pollution.* • *Various ocean energy technologies including salinity gradient energy, OTEC and seawater-based energy storage not only will provide clean energy to the country. One of the main benefits will be the provision of accessible and predictable energy supply to independent power grid(system), which has direct repercussions in energy security.* • *Aside from water, the technology can provide other benefits such as refrigeration and air conditioning that can be used at industrial level, with direct repercussions in the economy.*
Gender aspects of the TA	• *A gender analysis has been conducted through revision of available information and interviews. Some findings are indicated below:* • *There is limited knowledge on gender issues in the country in general, and still limited knowledge and progress in relation to gender mainstreaming in the government and other institutions, although the government encourages female recruitment.* • *Energy and water issues have a significant impact in Nauruan households. Women are directly affected by variability of water and energy availability as well as electricity prices which normally tends to be*

	high. • *There are potential areas for training for both, male and female population about direct and indirect benefits of OTEC technology.* • *Participation on a gender balanced decision-making process remains to be studied.*
Anticipated contribution to NDC	• *By 2030 GHG emissions are expected to be reduced by replacement of diesel generated electricity plants by renewable energy sources.* • *Adaptation measures include water security, energy security, food security, and a healthy environment.* • *The NDC contemplates studies and introduction of salinity gradient energy sources in addition to the MW-scale energy storage system (ESS) currently being introduced.*
The narrative story	*Approximately 1200 characters with spaces* *Please provide a brief description of the background and context for the technical assistance. Describe the main problems and barriers for climate change mitigation and/or adaptation in terms of climate technologies that the CTCN technical assistance will address.*
Contribution to SDGs	*[SD6]: OTEC technology brings the unique opportunity of providing access to safe and affordable drinking water for the population, with direct benefits on health, agriculture, among others.* *[SD7]: The technology will provide access to affordable, reliable and modern energy services, as well as an increase in the share of renewable energy, while reducing the dependence on fossil fuels importation.* *[SDG13]: The TA will contribute to integrating climate change measures in national planning as well as increase capacities and build the base to strengthen resilience while introducing mitigation measures. In particular, [13b] the project is linked directly with support to SIDS.* *Other SDGs related with the implementation of this project are: SD1, SD2, SD3, SD9, SD11, SD14, SD17.*
Reference to knowledge products	