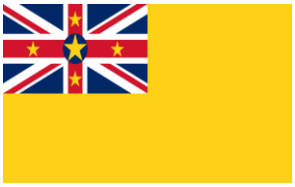

Niue
PROJECT DOCUMENT

United Nations Development Programme

Project Title: Accelerating Renewable Energy and Energy Efficiency Applications in Niue (AREAN)		
Country: Niue	**Implementing Partner: In Niue:** Department of Utilities. Ministry of Infrastructure	**Management Arrangements:** National Implementation Modality (NIM)
UNDAF/Country Programme Outcome: *UN Pacific Strategy 2018-2022*: Outcome 1 – Climate Change, Disaster Resilience and Environmental Protection. *UNDP Sub-Regional Programme Document 2018-2022*: Outcome 1 – By year 2022, people and ecosystems in the Pacific are more resilient to the impacts of climate change, climate variability and disasters; and environmental protection is strengthened.		
UNDP Strategic Plan Output: *Output 1.4*: Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented. *Output 1.5*. Inclusive and sustainable solutions adopted to achieve increased energy efficiency and universal modern energy access (especially off-grid sources of renewable energy)		
UNDP Social and Environmental Screening Category: Moderate	**UNDP Gender Marker: GEN1**	
Atlas Project ID/Award ID number: 00117508	**Atlas Output ID/Project ID number: 00114277**	
UNDP-GEF PIMS ID number: PIMS 6037	**GEF ID number: [1] 9752**	
Planned start date: 1 October 2019	**Planned end date: 30 September 2023**	
LPAC date: 16 September 2019		
Brief project description: The objective of the AREAN project is to enable the achievement of low carbon energy access, sustainable energy and green growth targets of Niue as stated in the Niue Sustainable Energy Road Map (NiSERM), which is the basis of the country's latest NDC. The government has been, and continues to be, very focused on the achievement of its renewable energy and energy efficiency targets, especially the generation of 80% of its electricity needs from renewable sources by 2025; however the available financial and technical resources will not be sufficient to guarantee a timely and full achievement of said targets without additional support from international donors. The design of AREAN follows a holistic approach to the removal of all the barriers, identified in the AREAN Project Information Form (PIF) and confirmed during the project development stage, by synergistically interconnecting all the activities of five (5) different components, namely: 1) Improvements in Energy Integrated Development Policy and Planning; 2) Institutional Capacity Building on Low Carbon Development; 3) Improvements in the Financing of Low Carbon Development Initiatives; 4) Climate Resilient and Low Carbon Technologies Applications; and 5) Enhancement of		

[1]Project ID number will be assigned by GEFSEC and to be entered by Agency in subsequent document submissions.

Awareness on Low Carbon Development. The project will be implemented over a period of 48 months, spanning from 2019 to 2023, and the total amount of GHG emission reductions is estimated to be approximately 110,000 tons of CO_2. The GHG emission reductions will be partly realized during the implementation period of the AREAN project and partly achieved after the completion of the project, throughout the lifespan of the equipment provided for the demonstration projects as well as other investment type activities.	
FINANCING PLAN	
GEF Trust Fund	USD
UNDP TRAC resources	
Cash co-financing to be administered by UNDP	
(1) Total Budget administered by UNDP	**USD**
PARALLEL CO-FINANCING (*all other co-financing that is not cash co-financing administered by UNDP)*	
UNDP	USD
Co-financing: Grants	
Co-financing: In-Kind	
-	
-	
-	
(2) Total co-financing	**USD**
(3) Grand-Total Project Financing (1) +(2)	**USD**

SIGNATURES		
Signature: print name below	**Agreed by Government**	**Date/Month/Year:**
Signature: print name below	**Agreed by Implementing Partner**	**Date/Month/Year:**
Signature: print name below	**Agreed by UNDP**	**Date/Month/Year:**

List of Abbreviations & Acronyms

ADB	Asian Development Bank
ADO	Automotive Diesel Oil
AREAN	Accelerating Renewable Energy and Energy Efficiency Applications in Niue
BAU	Business As Usual
BEMS	Building Energy Management System
CCM	Climate Change Mitigation
DoT	Department of Transport
DoU	Department of Utilities
EC	Energy Conservation
EDF	European Development Fund
EE	Energy Efficiency
EMRS	Energy Monitoring and Reporting System
EV	Electric Vehicle
GDP	Gross Domestic Product
GHG	Green House Gas
GJ	Giga Joule
GoN	Government of Niue
GoNZ	Government of New Zealand
GW	Giga Watt
GWh	Giga Watt hour
INDC	Intended Nationally Determined Contribution
IRR	Implementing Rules and Regulations
IUCN	International Union for Conservation of Nature
km^2	Square kilometer
kW	kilo Watt
kWh	kilo Watt hour
kWp	kilo Watt peak
LC	Low Carbon
LCD	Low Carbon Development
LFA	Log Frame Analyses
LPG	Liquefied Petrol Gas
MCO	Multi-Country Office
MoI	Ministry of Infrastructure
MW	Mega Watt
MWh	Mega Watt hour
MWp	Mega Watt peak
M&E	Monitoring and Evaluation
NBF	Niue Bulk Fuels
NDB	Niue Development Bank
NDC	Nationally Determined Contribution
NiSERM	Niue Strategic Energy Road Map
NNSP	Niue National Strategic Plan
NPC	Niue Power Corporation
NPD	National Project Director
NZD	New Zealand Dollar
NZHC	New Zealand High Commission
OFP	Operational Focal Point
O&M	Operation and Maintenance
PALS	Pacific Appliance and Labelling Standards

PB	Project Board
PIC	Pacific Island Country
PIR	Project Implementation Review
PMCU	Project Management and Coordination Unit
PMU	Project Management Unit
PV	Photo Voltaic
PWD	Public Works Department
RE	Renewable Energy
RET	Renewable Energy technology
RMU	Ring Main Unit
SAIDI	System Average Interruption Duration index
SCADA	Supervisory Control And Data Acquisition
SDG	Sustainable Development Goal
SIDS	Small Islands Developing States
SOE	State Owned Enterprise
SPC	Secretariat of the Pacific Community
TA	Technical Assistance
$tCO_{2\text{-}eq}$	tonne Carbon di-Oxide equivalent
ToC	Theory of Change
toe	tonne oil equivalent
UNDP	United Nation Development Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar

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II. DEVELOPMENT CHALLENGE

2.1 Development Challenge and Relevance to National Development Priorities, Global Environment and Sustainable Development Goals (SDGs)

Niue is a South Pacific elevated coral island located in the middle of a triangle formed by Tonga, Samoa and the Cook Islands. With a land area of 260 km^2 and a population of approximately 1500 people, Niue is one of the smallest and least populated countries in the world. The terrain consists of steep limestone cliffs along the coast with a central plateau rising to about 60 meters above sea level. The island has a tropical climate, with most rainfall occurring between November and April. Because of its small land size and population, and relatively poor soil, Niue has very limited natural and human resources, making the country highly dependent on foreign aid and international support.

Niue gained a status of self-government in free association with New Zealand in 1974, as an outcome of a referendum. New Zealand, however, maintains a statutory obligation to provide financial support to Niue. The country's 2012 GDP was NZD 24.5 million (~USD 19.5 million), equivalent to a GDP per capita of NZD 16,300 (~USD 13,000) (NiSERM). New Zealand's financial support is about 70% of Niue's GDP (INDC[2]). Due to its geographic isolation, freight costs to provide goods and services are particularly high.

Because of all these constraints, Niue is far from being economically self-sufficient and it strongly depends on financial support from international developing partners. In addition, Niue is not currently accredited to apply for loans (a membership request to the Asian Development Bank – ADB– is still under consideration) and therefore financial support has to come in the form of grants.

On October 2016, Niue submitted to the UNFCCC its Intended Nationally Determined Contribution or INDC, and on the same date the Government of Niue (GoN) also ratified the Paris Agreement essentially turning its INDC into an NDC. The NDC is based on the Niue Strategic Energy Road Map for 2015-2025 (NiSERM[3]), which contains all its energy targets set and/or reformulated. The main goal set in the NiSERM is to generate 80% of its electricity needs from Renewable Energy (RE) sources by 2025. The achievement of this target will be Niue's contribution to the global environmental protection and to the world's efforts of reducing the total GHG emissions. However, Niue does not have the financial means or the technical expertise to achieve this goal on its own and without external support it will not be able to achieve its target. To fulfill its pledge the country is therefore requesting financial aid and technical assistance through the preparation of the present project proposal: ***Accelerating Renewable Energy and Energy Efficiency Applications in Niue (AREAN)***. The objective of AREAN is to enable and facilitate the achievement of low carbon energy access, sustainable energy, and green growth targets of Niue. The achievement of this target is prevented by grid instability issues that affected the electric grid during the early stages of solar PV projects implementation, issues that are yet to be solved. In addition, stakeholder consultations have shown that these problems of grid instability have led to a general climate of lack of confidence in this technology among Niueans.

It must be noted that the country has two remarkable features: 1) Niue has achieved 100% electricity penetration and all 14 villages spread throughout the island are grid connected; and 2) the

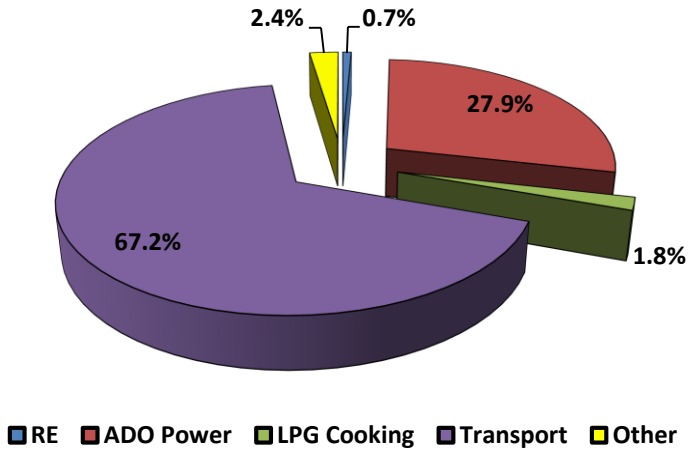
[2] Niue Intended Nationally Determined Contributions, http://www4.unfccc.int/ndcregistry/PublishedDocuments/Niue%20First/Niue%20INDC%20Final.pdf

[3] Niue Strategic Energy Road Map for 2015-2025, http://prdrse4all.spc.int/system/files/niue_strategic_energy_road_map_2015-2025_updated_3.pdf

island is a net sink for GHG emissions, due its large forest area. Every year Niue removes approximately 139,000 $tCO_{2\text{-}eq}$ versus ~5,000 $tCO_{2\text{-}eq}$ emitted (GHG emissions from waste and agriculture sectors are not measured) (NiSERM).

The major issue for Niue's energy sector is that 99% of energy demand is met through imported fossil fuels (primarily used for land/air/marine transportation, electricity generation, and cooking; Figure 1 provides a breakdown of all energy consumed in Niue in 2017), while only 1% is met domestically (solar energy for water heaters and electricity generation, and biomass for cooking).

Figure 1. Niue Energy Consumption in 2017 – Total Energy 111,900 GJ (GoN)



Due to high freight costs, energy imports impact by as much as 15.3% of Niue's GDP (NiSERM), which is practically twice as large as the average value of 7.8% for fossil fuels imports as percentage of GDP recorded for similar Pacific Island Countries (PICs) (PFTAC – IMF[4]). The situation is worsened by two factors: 1) Niue has a very small population, which means a small basis for tax revenues; however GoN still has to provide all basic services (health, education, finance, safety, etc.) whose costs cannot be distributed over a large number of beneficiaries resulting in high costs per capita; and 2) additionally, and perhaps most importantly, the population density of Niue is among the lowest in the whole world standing at less than 6 people/km^2; since villages practically occupy the entire island, this translates into extremely high costs per capita of building, operating and maintaining infrastructures necessary to deliver public services (roads, electricity distribution network, water distribution system, public illumination, waste collection and disposal systems, etc.).

In addition, being so dependent on fuel imports, Niue is constantly exposed to the risk of not receiving fuel supplies on time, especially during cyclone seasons, which lasts from November through April. GoN has also plans to increase its fuel supply security to 60 days (regular shipments are delivered every 28 days), up from the current levels of 42 days (which provides a two-week buffer in addition to the normal four-week shipment schedule). Furthermore, air quality around the powerhouse is negatively affected by the constant burning of diesel oil. Reducing the diesel generator operations to only provide 20% of the electricity needs will improve not only the working conditions of the Niue Power Corporation (NPC) employees but the air quality of the people living in proximity of the powerhouse as well.

[4] www.pftac.org/content/dam/PFTAC/Documents/Useful%20Links/Regional%20Papers/PFTAC_Energy_Prices.pdf

Besides providing global environment benefits and making Niue more energy independent, a significant advantage of achieving the RE and Energy Efficiency (EE) targets established in the NiSERM would be the possibility of freeing a significant portion of the public finances and direct the funds toward activities to promote social and economic advancements.

AREAN is relevant to the achievement of several Sustainable Development Goals (SDGs) as set by the United Nations Development Programme (UNDP). Primarily to Goal 7: "Ensure access to affordable, reliable, sustainable and modern energy for all", but also to Goal 8: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all", Goal 13: "Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy", and to a lesser extent to Goal 6: "Ensure availability and sustainable management of water and sanitation for all" and Goal 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation".

2.2 Barrier Analysis

The approach taken for the design of the AREAN project is barrier removal. The barriers hindering the achievement of the green growth targets set in the NiSERM have been identified in the AREAN Project Information Form (PIF). During the Logical Framework Analysis (LFA) Workshop, held in Alofi, Niue on February 13 and 14 2018, the participant stakeholders have analyzed them and identified the immediate, intermediate and root causes of the core problem of low carbon energy access, sustainable energy, and green growth targets of Niue not being fully achieved. The identified immediate causes of the core problem are:

1. Inadequate and not fully enforced policies, regulations and standards related to sustainable energy and Low Carbon Development.
2. Uncoordinated to non-enforcement of plans, policies, regulations and implementation of programs/projects on the application of climate resilient and low carbon technologies in the end-use sectors.
3. Limited availability of, and access to, financing for sustainable energy, energy access and low carbon development initiatives in the energy supply and demand sectors.
4. Climate resilient and low carbon techniques and practices are not adopted and implemented in the energy supply and energy end use sectors.
5. Low level of confidence in the viability of climate resilient and low carbon technology applications in the energy supply and demand sectors.
6. Low level of awareness and poor attitude towards Climate Resilient and Low Carbon technologies in the energy end use sectors.

The causes of the core barriers are discussed next.

Policy and Regulatory Barriers:

The main barrier under this category is the lack of policies for enabling actions that would motivate interest in developing and sustaining the country's energy sector. Among these are: (a) very general policies on renewable energy and energy efficiency; (b) lack of policies regarding financial/fiscal incentives that would encourage private sector (local and/or foreign) capital in sustainable energy projects in the country; (c) inadequate enforcement of existing energy policies and strategies, inclusive of the supporting rules/guidance and legislations/regulations; and, (d) lack of specific policies and regulations about the energy utilization in major end-use sectors, e.g., buildings sector (i.e., no specific aspects of EE and RE applications in the national building code) and in the transport sector. Apart from the policy/regulatory related barriers, there is the absence of energy integrated

development planning for the different sectors of the national economy that consider the energy and environmental impacts of development policies, decisions and programs implemented.

Institutional Barriers:

Presently, the coordination of the national energy objectives and strategies to the policies, strategies and work programs of other relevant government entities are inadequate. With the current status of the NPC as a State Owned enterprise (SOE), it is not very clear how it coordinates its work with the responsible GoN entity in electricity generation and distribution. This problem of weak institutions that are inadequate to provide sustainable operations of energy systems is exacerbated by the fact that NPC needs capacity building in this area. Also, among the causes of the weak institutional capacity is the lack of government energy planners and energy specialists on RE, non-RE and EE technologies that can ensure donor funded energy projects are in fact appropriate for the country.

Financial and Market Barriers:

The lack of financing is the major financial/market barrier to the implementation of RE and EE projects in the country. This is mainly because of: (a) dependence on donor funding for this kind of projects; (b) inadequate government budgets for renewable energy development; (c) fiscal policies that are biased against RE and EE (e.g., import duties levied on RE/EE systems); (d) limited opportunities for access to funding for EE and RE projects by energy consumers, due to lack of capacity to develop and prepare bankable RE and EE project proposals; and, (e) private sector involvement in the energy sector is limited. In addition, the cost of RE-generated electricity is often perceived to be not competitive, which is due to the fact that petroleum fuels are convenient to use and currently are relatively cheap compared to previous years. Furthermore, the rather small market size of Niue is not attractive to private enterprise interested in providing RE systems or selling EE appliances/equipment. The market for technical skills and products is small for the profitable development of a private sector technical services or sales industry.

Technical Barriers:

The current major technical barrier is the grid instability when more RE-based systems are integrated to the existing power grid. While the limited capacity of NPC technical and operational personnel on the integration of RE-based power generation systems and on the operation and maintenance of such grid connected systems contributes to this problem, such problems have not yet been adequately addressed. This has resulted to some of the presently installed on-grid solar PV systems not able to feed into the grid. The current low level of energy generated from renewable sources achieved so far reflects the limited successful Renewable Energy Technology (RET) applications experience, particularly RE systems for electricity generation. The lack of capacity to operate and maintain RE systems (power and non-power applications) is exacerbated by the difficult environment for installed electrical and mechanical equipment for RE-based power generation. There is also very small number of government and private sector people having technical competence applicable to energy development because of the lack of opportunities, apart from projects, for continuing education on RE and EE technologies applications, and in the operation and maintenance of systems employed in such applications.

Awareness and Capacity Barriers:

There is in general lack of confidence in RE due to previous project failures in Niue and in other PICs, and the current grid stability problem that resulted in the non-use of some of the installed grid connected solar PV systems. This makes it difficult to generate enthusiasm at either the public or private level for new RE efforts. This is also due to the lack of understanding of the application of RE and EE technologies by decision makers, the general public and businesses especially on the

advantages, disadvantages and costs of RE and EE technologies. Because of the lack of opportunities to apply knowledge and skills learned from capacity development on RE and EE technology applications, and in the operation and maintenance of systems in such applications, the expected impact in terms of the level of knowledge and technical skills of technical personnel in NPC and the government was not realized.

With regards to knowledge and information on low carbon (both RE and EE) technologies, there is lack of information about LC technologies, and the performance of the solar PV systems that are connected into the NPC grid. Information about the power generation performance of the utility remains very limited for NPC or government to be able to make a truly informed decision as to the proper course to take to improve the system performance reliability. Moreover, there is also low level of capacity among government institutions in data acquisition, analysis and data management, as well as on the use of existing computer models for sustainable energy and LCD.

The abovementioned barriers, if not properly and adequately addressed/removed will continue to prevent the timely and complete achievement of the NiSERM target.

III. STRATEGY

3.1 Business As Usual Scenario

The choice of the strategy adopted as the best option for the design of AREAN will appear clear once the Business As Usual (BAU) scenario and the baseline projects of GoN energy supply and end-use sectors initiatives are illustrated.

AREAN Project's objective to enable Niue to achieve its low carbon energy access, sustainable energy, and green growth targets is based on the country's NDC, which in turn was based on the NiSERM, an energy road map prepared for the decade 2015-2025. The main target set by Niue is the generation of 80% of its electricity needs from renewable sources by 2025. Additionally, the road map established other RE/EE targets, as shown in Table 1 below. To date very little has been done to convert in action the recommendations provided by the NiSERM. Specifically, in the past three years the projects completed or initiated are: a) the establishment, in early 2017, of a USD 80,000 high energy efficiency household appliances rebate/loan scheme (which includes freezers, refrigerators and washing machines). To date the scheme has disbursed all of its available budget yet; b) the installation of a 90 kWp solar PV system in 2016 funded through EDF-10; c) the recent shipment and installation of 200 kWp of solar PV panels donated by Japan; d) the installation of two water solar pumps that reduce the electricity demand (issues have been reported on the mal-functioning of these pumps, likely related to the inadequate power capacity to supply the required water volumes); and e) three second hand electric vehicles (EV) have been purchased by private owners, while the GoN has ordered 10 more second hand EVs (at the time this report has been prepared, the vehicles have not been shipped yet).

Table 1. Niue RE and EE Targets (NiSERM and updates from GoN)

Target	Target Year	Baseline
Generate 80% of electricity with renewable sources	2025	2% in 2014
Reduce electricity demand by 10%	2020	BAU
Reduce electricity demand by 15%	2025	BAU
Reduce power station losses to 4.5%	2020	5.2% in 2011
Reduce power station losses to 4.0%	2025	5.2% in 2011
Increase diesel GenSets power generation efficiency to 4.0 kWh/ltr	2020	3.77 kWh/ltr in 2014
Introduce 1.0% of fuel efficient vehicles	2020	0% in 2014
90% of households use LPG for cooking	2025	34% in 2014
Keep Average Forced Outage below the regional average of 5.4%*	2020	
Keep SAIDI < 200 min/customer, the regional average goal*	2020	

*: Baseline values for these two targets are not available

It appears clear that under this BAU scenario, Niue will be unable to timely achieve all its targets if financial and technical support from international donors and development partners are not made available.

The biggest technical challenges faced by Niue are the severe grid instability issues suffered since the beginning of the adoption of solar PV technologies. Because of these issues, the majority of the PV

systems have been put off-line and a thorough assessment analysis has been conducted on how instability issues of that current grid can be resolved (KEMA[5]). Because of this situation, solar PV panels only provide about 2% of Niue's ~3.5 GWh of yearly electricity generation. With the installation of the 200 kWp PV panels donated by Japan (the installation costs are borne by New Zealand), Niue has reached a solar PV generation capacity of 543 kWp, but since the instability issues have not been solved yet the current amount of on-grid/off-grid solar panels is not clearly defined.

3.2 Alternative Scenario

3.2.1 Baseline Projects

Currently, there are several baseline projects[6] and activities devised to allow Niue to get closer to achieve the targets stated in Table 1. These include:

1) ***Niue/NZ Renewable Energy Partnership – 1st Tranche:*** This is a NZD 5.0M (~USD 3.5M) grant project funded by New Zealand, to be carried out in two consecutive phases. The activities that will be implemented during the first phase (~USD 0.5M) are: a) the installation of the 200 kWp solar PV system donated by Japan (already completed); b) the purchase of 9 transformers and switchgears (Ring Main Unit – RMU); and c) capacity building for NPC personnel. Phase 1 is scheduled to be completed XXX. During the second phase (~USD 3.0M), the following interventions will be carried out: a) installation of 600 kWp solar PV panels (currently ongoing); b) installation of 750 kWp of inverters and power conversion equipment; c) purchase of 3.15 MWh Li-ion Powerwall II Tesla batteries for electricity storage; and d) interventions towards the stabilization of the electric grid. Phase 2 is scheduled to be completed by YYY. The completion of this project should bring power generation capacity (kW) from solar PV systems up to a level that will generate electricity that is approximately 35% of the total national electricity production. It is important to highlight that the activities under this project will not remove all the grid instability issues.

2) ***Niue/NZ Renewable Energy Partnership – 2nd Tranche:*** A subsequent NZD 5.0M (~USD 3.5M) grant from New Zealand, will be used for the following initiatives: a) purchase additional Li-ion Powerwall II Tesla battery banks; and b) additional solar PV panels. The exact total capacity that will be installed during this phase has not been determined yet and it will also depend on the battery capacity that will be procured (the objective is to add 5.0 MWh of storage capacity). It is estimated that this should bring Niue to achieving approximately 55% RE electricity production by 2025 (provided that all other goals are achieved; a detailed discussion is given in Annex L). During consultations with stakeholders, the New Zealand High Commission (NZHC) in Niue has indicated New Zealand willingness to provide more financial support to achieve the target 80% electricity production from RE. Completion of this project is slated for ZZZ.

3) ***Construction of the new Cabinet and Parliamentary House (Fale Fono):*** GoN has recently announced its intention to construct a new building to host the country's Premier and Cabinet. The site of the new Parliament House will be inland, far from the western coast where the current building is located and highly exposed to severe natural events and to cyclones, as during Cyclone Heta in 2004. The budget allocated for the Fale Fono is NZD 5.0M (~USD 3.5M) and while state of the art resilient and adaptation measures are incorporated in the building design, RE technologies and EE measures have not been adequately included and adopted.

4) ***Implementation of the Niue National Strategic Plans:*** Niue is currently implementing the Niue National Strategic Plan (NNSP[7]) for the period 2016-2026. The NNSP is an annual strategic

[5] "Niue Dynamic Stability Study – Integrating Renewable Energy", Niue Power Corporation, DNV KEMA, 2012
[6] Some of the baseline projects identified at the time of the Project Information Form (PIF) preparation are already completed by 2018.

development planning based on inputs provided by the various GoN ministries and departments, including the implementation of specific policy research studies and capacity development in economic planning. The funds are provided by the GoN and it has a cumulative budget, over the expected period of implementation of the AREAN project, of ~USD 340,000.

5) ***Implementation of the Niue Strategic Energy Road Map:*** The GoN is also undertaking activities for the implementation of its energy road map for the decade 2015-2025. This project entails the implementation of specific projects identified in the NiSERM (energy, water and waste), including annual evaluation of ongoing projects, formulation of recommendations for further interventions that will be covered in the NiSERM. This also entails conducting researches in the sectors covered, including capacity development of selected personnel of the relevant GON agencies. This project is also funded by the GoN and it has a cumulative budget, over the expected period of implementation of the AREAN project, of ~USD 600,000.

6) ***Implementation of the Asset Management Plan:*** This project is relative to the implementation of the infrastructure improvement and maintenance program of the GoN. This includes specific activities in the efficient and cost-effective operation of government-owned facilities, including evaluation of efforts done in regards impacts and contributions to the achievement of the NiSERM targets. The asset management plan is co-funded by NZAid and the GoN and it has a cumulative budget, for the four-year period 2018-2021, of ~USD 3.5M.

7) ***Construction of the Waste Recycling Centre:*** This AusAid and NZAid funded project has the objective of establishing and operating a waste recycling system. The activities implemented under this project will also include the assessment of potential and feasibility of waste-to-energy systems using solid and liquid wastes. The budget that Australia and New Zealand have made available for this project, scheduled to be completed by the end of 2019, is approximately USD 0.5M.

8) ***Implementation of the Water Strategic Plan:*** The activities for this project include the implementation of specific water system improvement projects as part of the initiatives to achieve the water sector targets specified in the NiSERM. Additional activities for the improvement of the water sector entail a capacity building program in water supply and use, including the potential application of EE and EC measures. The total budget, for this GoN sponsored project, amounts to ~USD 600,000.

9) ***Procurement of 11kV Transformer and Switchgears:*** A grant from EDF-11 for completion of the underground electric cables network (which will make Niue's electric grid completely underground); and b) 7 transformers and 8 switchgears. The remaining available budget for this project is approximately USD 140,000.

10) ***Adoption of Fuel Efficient Vehicles:*** The NiSERM has a set target of 1% of efficient vehicles (including electric vehicles, hybrid cars, and engine cylinder capacity of less than 1300 cc) by 2020. To support this initiative and incentivize people to buy fuel efficient vehicles, the GoN is currently completely waiving import duties on such type of vehicles, which has already led people to purchase three second hand EVs. In addition, the GoN has ordered 10 second hand EVs for a total budget of nearly USD 100,000.

11) ***High EE Household Appliances Financing Scheme:*** This is part of a GEF funded regional project (Nauru, Niue and Tuvalu) and entails a fixed 25% rebate for purchasing high energy efficient refrigerators, freezers and washing machine. Alternatively, the participant to this financing scheme

[7] "Niue National Strategic Plan – 2016-2026", Government of Niue, 2016

can opt to obtain a 0%-interest loan on the entire capital. Launched at the beginning of 2017, with a budget of USD 80,000 (less than half has been spent at the time this proposal was prepared), the financing scheme has been mildly successful, because of the lack of advertisement of the initiatives and, perhaps more importantly, because energy and money savings opportunities over the lifespan of the appliance were not properly explained to people.

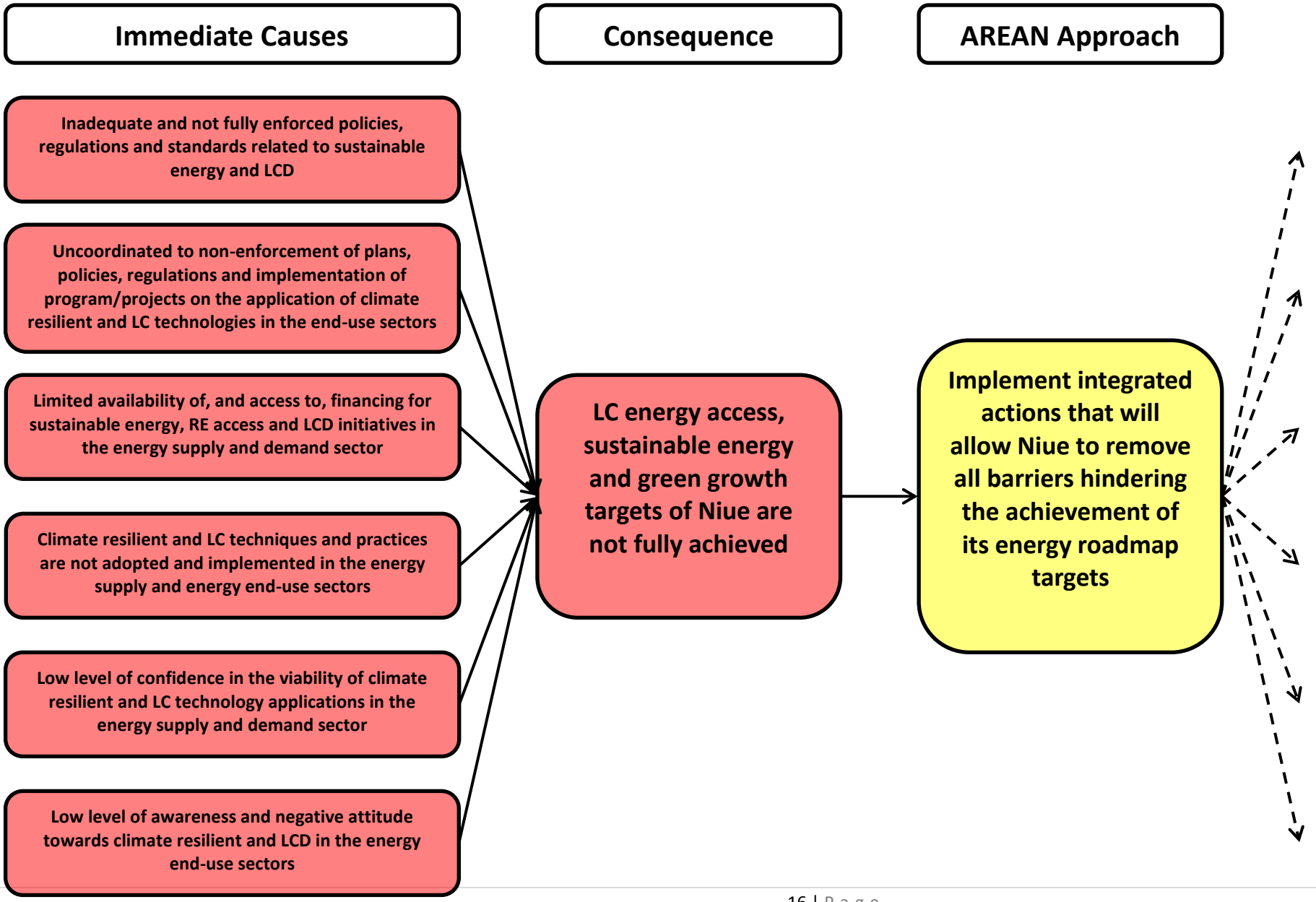
The successful completion of all these projects will not be sufficient for Niue to realize the timely achievement of all of its RE/EE targets. The AREAN Project is intended to enable and facilitate the achievement of such targets by proposing and implementing a set of incremental activities that will enhance the results achieved with these baseline projects. These incremental activities are designed *ad-hoc* to allow GoN to remove all the barriers hindering the achievement of its energy targets. A brief description of these incremental and complementing activities, which complete the proposed Alternative Scenario, is provided in the section below, while Chapter 4 offers a more detailed description.

3.2.2 Applied Project Strategy and Incremental Activities

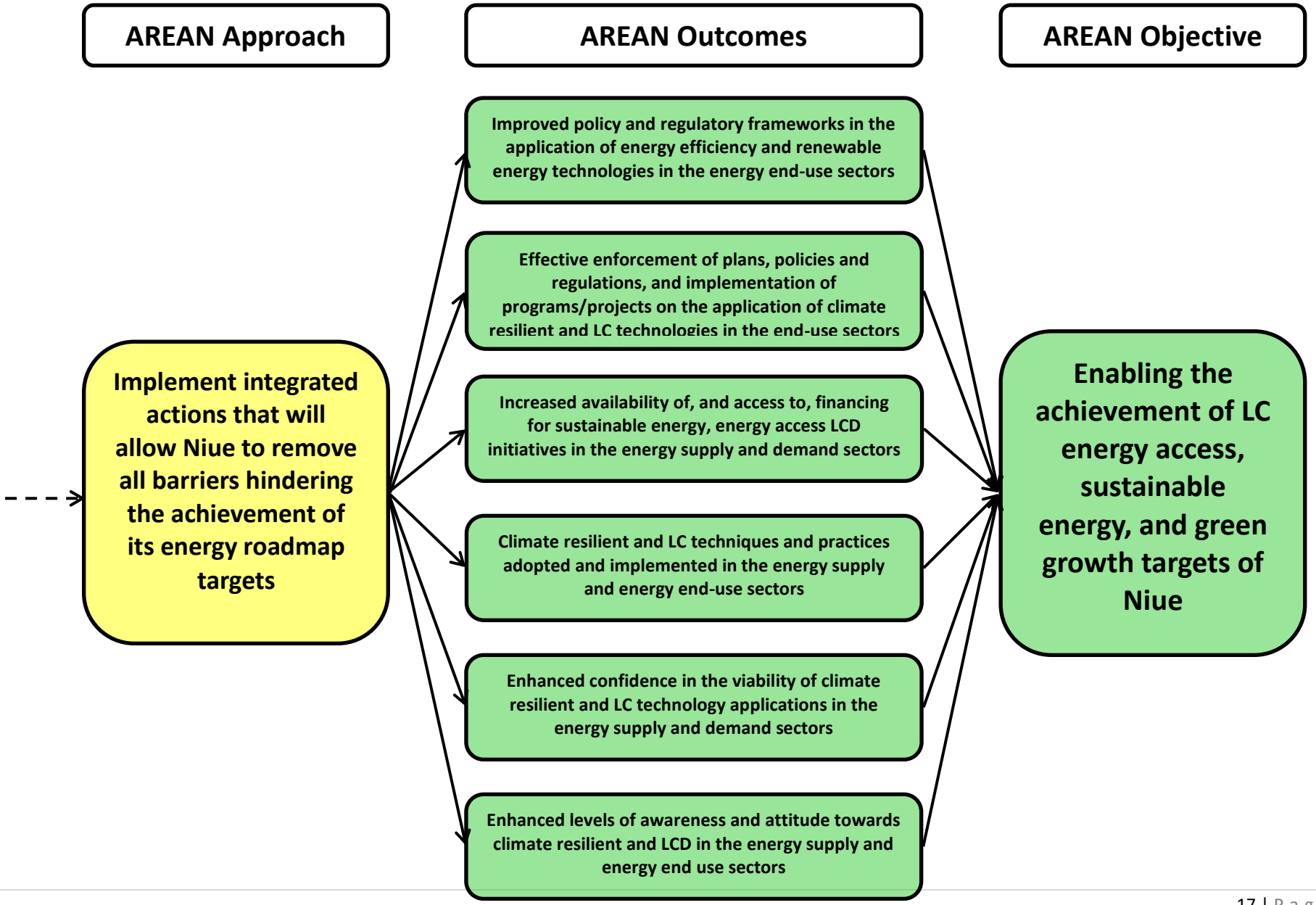
During the PIF preparation phase and the LFA Workshop barriers (problems/issues) that are impeding the achievement of the RE/EE targets have been assessed and the inter-relationship (cause and effect) of these barriers established. The best option for the AREAN Project is to implement a barrier removal strategy, which has been successfully applied by UNDP in numerous projects. The strategy, as the name suggests, consists in designing *ad-hoc* activities that building on, and complementing, the baseline projects will help Niue to tackle the problems at the source and remove the causes that led to the core barrier (discussed in Section 2.2). A barrier removal approach is the best available strategy because of its sustainability; removing the root, intermediate and immediate causes of the core problem of Niue's energy access, sustainable energy, and green growth targets not being fully achieved will enable the country to become independent in pursuing its energy targets in the future. The strategy is illustrated in the Theory of Change (ToC) diagram below. The ToC shows the immediate causes that hinder GoN's efforts to achieve its energy roadmap targets and the consequence of not removing them. The implementation of the activities of the AREAN Project will remove and overcome the barriers and realize desirable outcomes that contribute to the achievement of the Project Objective: ***"Enabling the achievement of low carbon energy access, sustainable energy, and green growth targets of Niue"***.

The barrier removal strategy will entail the implementation of technical advice/assistance and capacity development (e.g., training) activities as well as investments in RE/EE demonstration activities. The proposed activities build on the baseline projects and are properly designed to fill all the gaps and needs ascertained during the stakeholder consultation phase.

Theory of Change (ToC) – 1 of 2



Theory of Change (ToC) – 2 of 2



Improved policy and regulatory frameworks in the application of energy efficiency and renewable energy technologies in the energy end-use sectors: the approach to deliver this first outcome is a threefold plan. It will start with the verification and confirmation of the earlier and new identified gaps and needs to fill in current policies and regulations as well as definition of areas of competence in relevant GoN departments and ministries. Next, existing laws and acts are revised, and new ones are formulated, approved and enforced in order to support the development and implementation of LC technologies. Recommended revised and new policies and regulations will be primarily delivered during the first half of the project implementation so that they can be evaluated and subsequently follow-up action plans to continue to improve the policy and regulatory frameworks can be prepared and implemented. These activities will be completed by an assessment of capacity needs of GoN personnel and, during the second half of the project implementation, training programs will be designed *ad-hoc* to make them capable of carrying out, after the project completion, energy planning and management of technology applications.

Effective enforcement of plans, policies and regulations, and implementation of programs/projects on the application of climate resilient and LC technologies in the end-use sectors: this second outcome is connected to the previous outcome. Niue does not have a clear institutional framework in place to enforce the RE/EE policies and regulations that will be formulated/revised to deliver the first outcome. AREAN is designed to take all the actions required to define and/or clarify the role of all relevant stakeholders that are part of the institutional framework and coordinate their efforts, interactions and synergies for enforcing RE/EE policies and regulations. Training programs for relevant GoN personnel and stakeholders will be designed on how to fulfill their institutional mandates. A new government entity will be established to harmonize donor requirements with national systems in place, which will help standardize the design, implementation and management of LCD projects. Also, with the recent change of status of NPC becoming a SOE, the introduction of an independent regulator would facilitate the supervision of NPC operations. Similar to the previous outcome, evaluation reports will be prepared to draft and implement the necessary follow-up action plans that will allow supporting the institutional framework.

Increased availability of, and access to, financing for sustainable energy, energy access LCD initiatives in the energy supply and demand sectors: The achievement of this outcome is pivotal for the success of AREAN in facilitating and enabling Niue to achieve all its green energy targets. Despite the high costs for importing efficient appliances and RE/EE technologies, Niue does not have in place any sort of incentives except for efficient cars (for which import duties are waived). AREAN strategy is to introduce financial and fiscal incentives that will increase the adoption of LC technologies. Training of key GoN stakeholders will make Niue capable of preparing and managing its own bankable project design. Training and support will be also provided to financial institutions (i.e., Niue Development Bank and Kiwibank) to run financing schemes to favor the adoption of EE technologies and special loans for the implementation of RE installations. These activities have the intent of establishing a private market to attract local and foreign investments; this economic and social development will be further supported by implementing training programs for RE/EE service providers and by producing and disseminating information material. These designed and implemented financing instruments will be assessed and evaluation reports will be prepared and used for drafting and implementing follow up action plans to provide financing resources for LCD initiatives for the long term.

Climate resilient and LC techniques and practices adopted and implemented in the energy supply and energy end-use sectors: For the achievement of this outcome AREAN will tackle the biggest hurdle to the achievement of Niue's green energy targets, the stabilization of the electric grid. The approach is to further enhance the NZ-funded solar PV system projects described in Section 3.2.1. The stakeholder consultation stage has been useful to identify the activities needed to complement the

baseline projects and guarantee the stable functioning of the electric grid. These activities will concern primarily the establishment, adoption and enforcement of codes and regulations that all RE power installers will have to follow and abide by. These activities will lead to the standardization of RE system implementations which in turn will allow NPC to perform a more efficient control of the electric grid (comprised of both the diesel generator sets and the solar PV systems) and to implement more reliable load dispatch procedures. Training programs designed for NPC personnel will familiarize them with the new technologies and control systems. AREAN will also assess safe handling and disposal of RE/EE waste (i.e., batteries, solar PV panels, incandescent light bulbs, etc.) as well as assessment of potential uses of municipal waste for power generation and safe disposal of ultimate residual waste; these needs were identified during the stakeholder consultations as well. In order to guarantee the long term sustainability of these activities, follow-up actions plans will be designed based on a comprehensive evaluation of these activities and those that collectively contributed to the realization of the other project outcomes.

Enhanced confidence in the viability of climate resilient and LC technology applications in the energy supply and demand sectors: Because of the severe grid instability issues due to the integration of solar PV units into the existing power grid, Niueans became understandably skeptical towards solar PV power generation technology. Furthermore, since electricity and money savings associated with the purchase of high energy efficiency household appliances have not been clearly explained and illustrated with examples, such appliances are simply perceived as too expensive. It is therefore crucial to propose a portfolio of LC technology applications and LC development projects that can be implemented, demonstrated, and then possibly replicated. This portfolio of LC interventions, which besides demos will also include a full-scale project, will enhance people confidence in RE/EE technologies. Strengthening people confidence is propaedeutic to the creation of a local market for LC technologies and for private investments. Furthermore, these interventions will help validate proven, cost-effective LC technologies never implemented in Niue and also facilitate the achievement of the NiSERM energy targets. Once installed, the performance of these projects will be monitored and evaluation reports will be prepared. Producing evaluation reports will allow paving the way to scale-up and replicate these LC interventions, not only in Niue but also in similar PICs. The selected RE and EE technology applications (detailed descriptions are given in Annex M) are:

1) *Improvement of Power Grid Stability and Reliability* (This is a full-scale project that builds on the Niue/NZ Renewable Energy Partnership and EDF-11 projects, which by themselves will not be sufficient to stabilize the electric grid)

2) *Integrated*[8] *Solar Powered LED Street Lights*

3) *Retrofit of Buildings with Energy Efficiency and Renewable Energy Technologies*

4) *Energy Efficiency Technologies Financing Scheme*

5) *Solar Energy Use in Water Pumping Systems*

Enhanced levels of awareness and attitude towards climate resilient and LCD in the energy supply and energy end use sectors: The activities to deliver the outputs that will collectively bring about this last outcome includes the design, establishment and operationalization of various low carbon development enabling systems (energy audit, energy monitoring and reporting, energy database and

[8] Here "Integrated" refers to the fact that all equipment (solar PV panels; LED light; rechargeable battery; pole; and cables and control system) is assembled into one integrated system.

information sharing); conduct of energy audits, and piloting of the energy monitoring and reporting system. Associated capacity building for the relevant GoN personnel and stakeholders will be carried out on the operation and use of these established systems. Lastly, activities and initiatives to raise awareness about RE and EE technologies and programs in Niue are also included.

The successful implementation of AREAN will benefit the entire population of Niue in several aspects. Niue will have a more efficient, reliable and cost-effective power generation and distribution network. Also, with the adoption of public LED streetlights and solar water pumps, the country will have safer and more robust infrastructures. The creation of a RE/EE market capable of attracting local and foreign private investments and creating new jobs will also provide significant socio-economic benefits for everybody.

In terms of innovativeness, as already mentioned, some demonstrations such as introducing hybrid cars and electric vehicles in a PIC is new, while solar water pumps have not been widely adopted yet. AREAN can therefore provide the basis for lessons learned and then replicated also in similar island countries is the pacific as well as other regions. Furthermore, in example the adoption of hybrid cars and EVs could pave the roads in the future for the introduction of solar PV powered fast charging stations, which would prevent surges in electricity demand, a technology that has not been deployed yet in the PICs. Lastly, and perhaps the most significant innovativeness in the design of AREAN is its holistic approach to the solution of all the problems by interconnecting activities of different components synergistically. The success of AREAN design and implementation can create a model that can be replicated in other island countries that share with Niue similar problems and barriers to LCD.

IV. RESULTS AND PARTNERSHIPS

4.1 Expected Results

Goal: Improved energy consumption index and reduced annual growth rate of GHG emissions in the country's energy supply and energy end-use sectors.

Project Objective: Enabling the achievement of low carbon energy access, sustainable energy, and green growth targets of Niue.

Project Components, Outcomes, Outputs and Activities:

Component 1: Improvements in Energy Integrated Development Policy and Planning

Outcome 1: Improved policy and regulatory frameworks in the application of energy efficiency and renewable energy technologies in the energy end-use sectors

Output 1.1: Comprehensive policy research, impact analyses and assessment reports on sustainable energy and low carbon (LC) development policies and regulations

Activity	Description
Activity 1.1.1: Conduct assessments to identify gaps and needs in sustainable energy and LC development policies and regulations.	A review of the existing policy and regulatory framework in force in Niue's energy supply and end-use sectors will be conducted. Simultaneously, a review of policy and regulatory frameworks established in PICs and SIDS that share with Niue similar development challenges will also be conducted in order to take advantage of the lessons learned in previous analogous projects. A report will be produced to guide GoN on the actions to take to revise, or write new, policies and regulations to incorporate sustainable energy and LCD measures.
Activity 1.1.2: Define RE/EE areas of competence and gaps to fill of relevant GoN ministries and departments and assess potential synergies.	An analysis will be undertaken of all key GoN stakeholders to contour their areas of competence for the advancement of RE and EE technologies implementation. Roles and responsibilities will also be clearly defined in order to prevent duplication of work and to potentially foster synergistic interaction between all relevant stakeholders.

GEF support is required for the incremental technical assistance in the conduct of the review of the background documents and for report preparation.

Output 1.2: Formulated/revised, approved and enforced policies, implementing rules and regulations (IRRs) and LC standards

Activity	Description
Activity 1.2.1: Revise the Electricity Act and incorporate RE and EE matters.	This involves the incorporation of relevant provisions on RE and EE matters in the Electricity Act that is currently undergoing revision. This will also involve capacity building for local professionals and GoN technical staff who are working on the review. Technical assistance will be provided

	to assist the GoN and other relevant stakeholders in analyzing the implications of the new Electricity Act, if needed make the required amendments to the Act, and finally favor its approval.
Activity 1.2.2: Formulate/recommend, approve and enforce policies for independent power producers to connect to the grid, and for the private sector to participate to the energy sector.	This involves the drafting of a document to set the rules to follow for those independent power producers (primarily solar PV systems) that want to connect to the grid. The rules will cover the size of the system, the required equipment and the definition of the technical specs for power installations to qualify for grid connection. The formulation of such policy and its subsequent approval and enforcement will prepare the ground for the creation of a market capable of attracting private investors.
Activity 1.2.3: Provide technical assistance in establishing and implementing sectoral codes of conduct, guidelines and standards of operations for the energy industry.	This activity involves establishing energy industry codes to define the roles and responsibility of participants, the standard procedures for their operations and the interactions with each other, as well as their minimum performance expectations. This activity will include conducting a comprehensive review of the current situation of energy industry practices in Niue and the regional and international experience in establishing and enforcing energy industry codes, especially in similar PICs. The energy industry codes will be developed through a participatory process, involving all stakeholders, under the umbrella of the new Energy Act that is being developed at the moment. The codes will focus mainly on the electricity sector, covering electricity supply, connection of independent power production systems, metering, quality of services, safety, asset managements, etc. Technical assistance will be provided in endorsing and implementing the developed energy industry codes.
Activity 1.2.4: Draft and implement a waste management plan for RE projects (i.e., batteries, PV panels, incandescent light bulbs, etc.).	Introduction of LC technologies will also generate special waste that needs to be adequately managed. A plan will be developed for the collection, storage, and safe final disposal of waste produced from RE projects. The plan will also cover potential recycling and reuse of this waste once a local RE/EE market has been stablished.
Activity 1.2.5: Conduct integrated development planning and prepare energy integrated development plans for sectors of the national economy involving energy and environmental impacts.	This involves the development of an inter-ministerial, integrated development plan covering all aspects of energy generation and consumption, environmental protection, as well as the required infrastructures. The proposed integrated development plans will be prepared and presented to the GON for approval and implementation.
Activity 1.2.6: Establish and implement appropriate energy prices and service quality regulations.	This entails reviewing regional and international experiences in regulating energy prices, in particular electricity prices, and service quality in similar PICs. This will include developing appropriate: a) price setting methodologies; b) service quality standards; and c) prices and services monitoring and review mechanisms. Prices established need to reflect the full cost of delivering energy and ensure satisfactory service quality. Properly priced energy, and electricity, will also provide incentives for

	consumers to improve energy efficiency use.

GEF support is required for the incremental technical assistance in the review of the Electricity Act, for policy formulation, development of safety codes, and for the drafting of plans.

Output 1.3: Completed and fully evaluated policies, IRRs and LC standards, and approved and implemented follow-up plans for their enhancement

Activity	Description
Activity 1.3.1: Evaluation of policies, IRRs and LC standards and drafting of evaluation reports.	The efficacy of the policies and regulatory frameworks revised and formulated under AREAN will be evaluated during and at the end of project implementation and related interim and final evaluation reports will be prepared. For the evaluation of policies and regulatory frameworks and preparation of the reports an international consultant will be hired and supported by a local professional, which will also contribute to capacity building.
Activity 1.3.2: Develop and implement follow-up action plans based on the evaluation reports.	The evaluation reports prepared in Activity 1.3.1 will be the basis for the formulation and implementation of follow-up action plans. The drafting of these plans will also involve capacity building for the local professionals in the development of follow-up action plans.
Activity 1.3.3: Assess capacity needs of GoN personnel, design training programs, and train GoN personnel to carry out energy planning and management of technology applications.	The activity involves a capacity assessment of relevant GoN personnel to determine the needs and gaps to fill in the area of energy planning and management of technology applications. Based on the assessment a training program will be organized and conducted for stakeholders from GoN departments, SOEs and other organizations related to energy planning and management of technology applications (i.e., participant will be selected from the Department of Utilities, Department of Transport, Treasury Department, Crown Law, NPC, NBF, PMCU, NDB, etc.). A year after its completion the efficacy of the training program will be assessed, and based on the outcome of this evaluation, if required, a follow up training program will be organized, conducted and then evaluated.

GEF support is required for the incremental technical assistance in the evaluation of policy, IRRs and LC standards, training programs, preparation of reports, and drafting and implementation of action plans.

Component 2: Institutional Capacity Building on Low Carbon Development

Outcome 2: Effective enforcement of plans, policies and regulations, and implementation of programs/projects on the application of climate resilient and low carbon technologies in the end-use sectors

Output 2.1: Formulated and recommended institutional framework that supports the implementation of LC development policies and regulations

Activity	Description
Activity 2.1.1: Assess the current institutional arrangements for implementation of	To conduct the assessment all the institutional steps and procedures that the key stakeholders must follow for the implementation of energy and infrastructure plans will be simulated. This will allow highlighting of the gaps to fill with the establishment of new professional figures or through

energy and infrastructure plans and assess stakeholders' role and gaps to fill.	the participation of additional GoN departments, and to clearly define roles and responsibility for all stakeholders involved. At the end of the assessment a report will be prepared.
Activity 2.1.2: Establish an operational Government entity that is capable of effectively implementing LCD policies and regulations.	Technical assistance will be provided to establish and operationalize a GoN unit devoted to the implementation of LC development policies and regulations. Depending on the expertise required, members of the unit can be a combination of available personnel of GoN departments and ministries with the addition of new staff to bring to the unit missing and desirable skills. Staff members will be trained on how to be part of Niue's institutional framework in supporting the implementation of LCD policies and regulations.
Activity 2.1.3: Formulate and mandate laws to regulate the implementation of LC policies and initiatives.	The assessment of role and gaps to fill completed in Activity 2.1.1 will be used as basis for the formulation, approval and enforcement of new laws for LCD. The laws should be formulated also with the intent to favor the coordination between national and donors' requirements.

GEF support is required for the incremental technical assistance in the evaluation of institutional arrangements, training programs, and preparation of reports.

Output 2.2: Adopted and enforced suitable institutional mechanisms that integrate LC development with the socio-economic, climate change, infrastructure and disaster management objectives of the country

Activity	Description
Activity 2.2.1: Design and implement training programs for relevant GoN personnel and stakeholders to fulfill their institutional mandates.	Training programs will be designed, organized and conducted to teach how to integrate institutional mechanisms (developed in Activity 2.2.2 and 2.2.3) with other related objectives of Niue. Participants to the training will comprise personnel from relevant GoN departments and ministries and other key stakeholders (including the operational unit stablished in Activity 2.1.2).
Activity 2.2.2: Develop and apply procedures or guidelines on how to integrate LC developments with energy, climate change and other relevant objectives of Niue.	Documents defining energy and climate change mitigation/adaptation, as well as socio-economic and infrastructure management objectives of Niue (i.e., NiSERM, NDC, NNSP, etc.) will be reviewed and used as references to develop procedures tailor-made for Niue on how to align and integrate the development of LC projects with those objectives. The procedures will then be applied to the LCD activities proposed under AREAN as well as in future LDC projects in Niue.
Activity 2.2.3: Establish an appropriate corporate governance structures for the two SOEs (NPC and NBF) in the energy sector.	With the status of NPC and NBF as SOEs, the aim of this activity if to formulate, approve, and implement SOE legislation, with the objectives to delineate the roles and responsibility of government and SOEs and to establish appropriate governance mechanisms and performance requirements for SOEs. An independent utility regulator position will be established.

GEF support is required for the incremental technical assistance in capacity building, developing procedure for LCD, formulation and implementation of new legislations, and the establishment of an independent utility regulator position (the salary will be responsibility of GoN).

Output 2.3: Performance evaluation report on the adopted institutional framework and mechanisms, promotion and implementation of the recommendations offered, and maintenance strategy incorporated in the design of projects

Activity	Description
Activity 2.3.1: Evaluate the adopted institutional framework and produce evaluation reports.	Efficacy of the adopted institutional frameworks established under AREAN will be evaluated and interim and final evaluation reports will be prepared. For the evaluation of the institutional framework and preparation of the reports an international consultant will be hired and supported by a local professional, which will also contribute to capacity building.
Activity 2.3.2: Prepare and implement follow-up action plans based on the evaluation reports.	The evaluation reports prepared in Activity 2.3.1 will be the basis for the formulation and implementation of follow-up action plans. Similarly to Activity 2.3.1, for the drafting of these action plans will be hired an international consultant that will be supported by a local professional, which will also contribute to capacity building.
Activity 2.3.3: Prepare and enforce maintenance strategy in RE/EE project designs.	Each new RE/EE technology introduced in Niue, whether as a baseline project or as an incremental activity funded through GEF, will be accompanied by the preparation of a maintenance strategy that will maximize the efficiency and possibly extend the lifespan of the equipment, particularly in a challenging environment like Niue. The drafted strategies will then be applied to the installation of solar PV systems, li-ion battery banks, power inverters, transformers, solar water pumps, solar powered LED streetlights, etc.

GEF support is required for the incremental technical assistance in evaluation of institutional frameworks, report preparation, drafting and implementation of action plans, and formulation of a maintenance strategy

Component 3: Improvements in the Financing of Low Carbon Development Initiatives

Outcome 3: Increased availability of, and access to, financing for sustainable energy, energy access and low carbon development initiatives in the energy supply and demand sectors

Output 3.1: Designed and implemented financing instruments for the Niue Development Bank for financing EE and RE technology application initiatives

Activity	Description
Activity 3.1.1: Design and implement financing instruments to stimulate the adoption of EE applications and RE technologies.	A preliminary assessment phase will be performed to determine which financing instruments and with what timeframe can be implemented in Niue. The potential mechanisms include net metering and feed-in tariffs for independent power producers. The design will also establish the "per unit" incentives and the total available budget to avoid the creation of a financial bubble.

GEF support is required for the incremental technical assistance in the assessment and design of potential financing schemes

Output 3.2: Evaluation report on the performance of the established financing instruments

Activity	Description
Activity 3.2.1: Evaluate the designed and implemented financing instruments and produce evaluation reports.	Efficacy of financing instruments established under AREAN will be evaluated and interim and final evaluation reports will be prepared. Based on the outcome of this evaluation, if required, modifications of the financing instruments will be made. For the preparation of such reports international consultant will be hired and supported by a local professional, which will contribute to capacity building.

GEF support is required for the incremental technical assistance in the evaluation of the financing schemes and preparation of reports

Output 3.3: Enhanced financing policies for supporting initiatives on LC development

Activity	Description
Activity 3.3.1: Design and implement training programs for relevant GoN personnel and stakeholders in RE/EE financing to develop and prepare bankable project proposals.	The activity involves a capacity assessment of relevant GoN personnel to determine the needs and gaps to fill. Based on the assessment a training program will be designed, organized and conducted for stakeholders from GoN departments, SOEs and other organizations related to project proposal preparation. Participant will be selected from NPC, NBF, PMCU, NDB, DoU, DoT, Treasury Department, Crown Law, etc.
Activity 3.3.2: Formulate, approve and enforce financing policies to support LC development.	This activity will include: a) mapping available or potentially available domestic and international financial sources and financing mechanisms for RE/EE development in Niue; b) exploring new financing sources and innovative financing models for the development of RE/EE in Niue, including private sector investment, various forms of public-private partnerships, development assistance, South-South and Triangular Cooperation, investment from multilateral development banks, diaspora investment, etc.; c) improving the capacity of local financial institutions for financing RE/EE development through capacity training and developing new financing products; d) exploring mechanism that will enable lending from international capital market; and e) formulating corresponding financing policies for increased financing for LC development. The policy prepared will then undergo approval by GoN and will be already enforced during AREAN implementation.

GEF support is required for the incremental technical assistance in the design and organization of training programs, and formulation and approval of policies

Output 3.4: Competitive market for private sector on RE/EE products and technical skills

Activity	Description
Activity 3.4.1: Design training programs to improve technical skills	While the activities implemented under Components 1-4 aim to set up the institutional, regulatory, and technical frameworks for a functioning RE/EE market and provide both fiscal and financial incentives encouraging the

of RE/EE service providers.	entry of private players, to favor the establishment of a functioning RE/EE market, local service providers need to acquire the ability to install, service and repair the RE/EE equipment. The training program will be designed, organized and implemented together with the Chamber of Commerce and will include, but not limited to, solar PV panels, batteries, hybrid cars and electric vehicles, LED streetlights, etc. During the design phase, the most cost effective and efficient way of delivering the training programs will also be assessed. For example, in person vs online courses, or locally organized vs abroad courses.
Activity 3.4.2: Prepare informative material on RE technologies and EE appliances to increase public awareness and interest.	Informative material on RE/EE technologies will be developed and published for dissemination. These include pamphlets that illustrate to the general public the energy and economic advantages. The pamphlets will show with examples the investment recovery time for independent solar PV installations; vis-à-vis comparisons between cost savings by choosing high energy efficient appliances vs. low efficiency ones; advantages of buying an energy efficient vehicles vs a conventional diesel or petrol one; etc. In addition, promotion of RE/EE initiatives will also be done through local media and in public offices and schools.
Activity 3.4.3: Establish financial and fiscal incentives to encourage RE/EE products.	This activity will be performed in coordination with the Treasury Department, the Chamber of Commerce and NDB/Kiwibank. Potential fiscal and financial incentives will be evaluated and selected. Among the possible fiscal incentives that can be considered is the waiver or reduction of import duties on RE/EE technologies for private installers. In this case, a detailed list of products that qualify for the incentives will be produced and publicized. In addition, financial incentives in combination with existing rebate/loan programs will be considered through the development of schemes that will be specifically prepared and described in Outcome 4.2 below.

GEF support is required for the incremental technical assistance in the design and organization of training programs, preparation of informative material, and evaluation and establishment of fiscal/financial incentives

Component 4: Climate Resilient and Low Carbon Technologies Applications

Outcome 4.1: Climate resilient and low carbon techniques and practices adopted and implemented in the energy supply and energy end-use sectors

Output 4.1.1: Completed comprehensive assessments of other applicable LC technologies that can be feasibly implemented in the energy generation and energy end-use sectors to support the timely achievement of the NiSERM targets

Activity	Description
Activity 4.1.1.1: Assess applicable LC technologies to support the achievement of the NiSERM targets and prepare an assessment report.	At the early stages of AREAN implementation, an assessment will be conducted of potential applicable LC technologies for the country to determine their individual feasibility. A feasibility assessment report will be prepared. Furthermore, the report will define the capacity to install and the timeline of these RE/EE developments necessary to allow Niue to achieve its NiSERM targets.
Activity 4.1.1.2: Evaluate	This activity entails the evaluation of the various options for the

the optimal solar PV power generation inputs into the existing power grid system.	installation of solar PV systems in terms of determining the timing of the installations and the capacity of each solar PV power generation systems. This step is crucial to allow proper pacing of the completion of the PV installations and guaranteeing enough time to put in place all the supporting equipment (shunt reactors, RMUs, batteries, etc.) as well as the required control systems and load dispatch procedures, and then verify the stability of the grid.

GEF support is required for the incremental technical assistance in the assessment of LC technologies, report preparation, and evaluation of optimal PV inputs

Output 4.1.2: Completed design, engineering, financial and implementation plans for the most feasible grid stability scheme that will be implemented

Activity	Description
Activity 4.1.2.1: Develop comprehensive design and implementation plans for the most feasible scheme for grid stability improvement.	The initial step of this activity will be a thorough review of the grid stability assessment report prepared by DNV KEMA in 2012, when solar PV installations contributed only a small fraction of the total power generation capacity. An updated grid stability improvement scheme will be designed to reflect the 2025 target of 80% electricity generation from RE sources set by Niue. The scheme will involve the establishment of grid codes requirements to support the grid system during normal operation and during grid failure. Furthermore, for stability and reliability purposes, NPC must maintain basic electrical data/information on the existing grid system with assets management procedures. The activity also entails the establishment of implementation plans for the designed grid stability schemes, to be completed during AREAN implementation. A detailed description of the recommended actions is provided in Annex K.
Activity 4.1.2.2: Increase power grid stability and electricity supply reliability.	This activity is strictly connected to Activity 4.1.2.1. Grid codes and requirements will perform a preventive action to favor stabilization of the electric grid and reliability of electricity supply operations. Corrective measures will be undertaken, to further stabilize the electric grid and increase the reliability of electricity supply operations, by designing an improved grid. The design will include sizing and implementation of shunt reactors, replacement of transformers and addition of RMUs, installation of battery storage systems, providing generators with adequate low voltage ride through capabilities, provide frequency control capabilities, include automated monitoring and control systems, and any other equipment and measure deemed necessary, as explained in Annex K. The installation of the battery energy storage systems will support the diesel generators in stabilizing the grid in the event of a drop in solar PV electricity generation. This activity is strongly correlated to Activity 4.2.2.2 below.
Activity 4.1.2.3: Automate the operations of remote solar PV power system installations and data	This activity entails the automation of system operations as well as control and data acquisition of both existing and new solar PV installations (solar PV panels, power inverters, and batteries). The new transformer will be equipped with data loggers and the SCADA (Supervisory Control And Data Acquisition) system[9] at NPC powerhouse will be updated as part of the

[9] The new SCADA system will be able to communicate with the solar PV installations, the battery energy storage system, the grid components and the RMUs to determine power quality issues, grid stability issues, manual control/remote monitoring and measure the electricity generated by each solar PV system and load supplied into the grid.

collection.	New Zealand project. The adequacy of the new SCADA system will have to be reassessed because of the addition of new equipment (e.g., new transformers and switchgears, as well as new PV panels and battery storage systems) and new grid code requirements. Training programs will be also designed and organized to familiarize NPC personnel with the new codes and procedures (described in Activity 4.1.2.1) and new equipment.
Activity 4.1.2.4: Implement an integrated RE generation forecasting tool to the SCADA system.	This activity entails the installation of a state-of-the art forecasting tool to allow the SCADA system to perform day-ahead planning of the load dispatch planning and support the reliability and operational procedures. The purpose of the RE generation forecasting system is to assist NPC to distinguish between variability and uncertainty when planning and operating the grid system with 80% solar PV. The forecasting tool will reduce the uncertainty of the solar PV generation, so that its variability can be more precisely accommodated in the grid system. The accuracy of forecasts and timely operational responses for up-ramps and down-ramps are critical for maintaining reliability and lowering the grid operation cost because of the high solar PV penetration level in the grid system. Training of the NPC personnel will be conducted with the support of expert staff members of the Niue Met Services.
Activity 4.1.2.5: Demonstrate the monitoring, operation and performance of the RE-generation forecasting tool to support with day-ahead planning.	NPC personnel dedicated to the operation and control of the solar PV systems, supported by staff of the Niue Met Services, will participate in trials designed to demonstrate and evaluate the performance of the RE-generation forecasting tool. Uniform standards for the preparation and delivery of RE-generation forecasts will be developed and approved. Following these standards and based on expected amount and timing of sunshine, NPC will perform dry-runs on how to convert the forecasts in practical operation of the diesel gensets and the battery packs to prevent grid instability and power outages. The efficacy of the forecasting tool will be tested and evaluated each time a significant amount of intermittent power generation capacity has to be connected to the electric grid and appropriate modifications to the forecasting tool will be carried out.
Activity 4.1.2.6: Optimize the performance of power generation units at NPC powerhouse with solar PV systems integrated into the electric grid.	This activity involves the implementation of combined load dispatch control capabilities with energy storage functionalities. A fuel save controller is already installed in the NPC diesel powerhouse to optimize the fuel consumptions of existing diesel gensets. Compensation of the varying loads will be performed with the support of the battery energy storage systems, and reactive power and voltage/frequency control. This intervention is intended to optimize the performance of the power generation units and in turn reduce diesel fuel consumptions, with reduction of GHG emission and improvement of air quality for the NPC personnel.
Activity 4.1.2.7: Monitor and evaluate the power generation performance at NPC.	Power plant performance testing procedures will be designed for NPC, to verify the energy efficiency of generation of their power units (both diesel gensets and solar PV systems), as well as their distribution systems. The performance testing will cover waste heat recovery potential as well. NiSERM also sets targets for utility performance in terms of reliability of the electricity distribution system (forced outage rate) and duration of power outages (System Average Interruption Duration Index – SAIDI), for which Niue currently has no data. Concurrently, needed measuring and monitoring equipment will be procured and relevant NPC personnel will be trained in using such equipment.

Activity 4.1.2.8: Establish codes and regulation for safe power generation control and load dispatch.	This activity is linked to Activity 4.1.2.1. The grid codes, guidelines and regulations that will be established for safe control and operation of the electric grid and optimal load dispatch strategies include: RE system installation and grid-connection procedures; RE protection equipment requirements (i.e., solar PV panels, battery storage systems, PV panels and battery inverters, etc.); voltage regulations; active and reactive power control; grid compliance testing; grid control systems; voltage and frequency control systems; power quality and power factor; grid stabilization procedures; SCADA communication and optimal load dispatch/regulation strategies; safety and protection procedures; and all other aspects deemed necessary to guarantee stability and reliability of the electric grid. The established codes and regulations will be afterwards approved by DoU-MoI and enforced. The established codes, guidelines and regulations will be evaluated a year after they have been approved and, if required, appropriate modifications will be made.
Activity 4.1.2.9: Design and implement a capacity building program on electricity generation, transmission and distribution O&M.	Design a capacity development program on grid code requirements for RE; utility practices and procedures for data collection/analysis and real time control; battery storage settings and functionality; asset management reporting; operation and Maintenance (O&M) of the electricity distribution grid; SCADA system operations for 80% electricity generated with RE sources; and optimal load dispatch. Due to the large amount of topics to cover, the capacity building activities will be organized in stages. Participants will be organized in teams. During the first training stage, each team will be trained on a specific set of skills (in this way there will be personnel skilled on every subject). The following training stage the teams will be rotated in such a way that at the end of all training stages every participant will be trained on every topic. Participants in this training program will be NPC staff and relevant GoN personnel.

GEF support is required for the incremental technical assistance to develop implementation plans for grid stabilization, establish measures to increase grid stability, automate remote PV systems operation and data collection, optimize the SCADA system and the diesel gensets operation, establish codes and regulation for optimal load dispatch, develop and test a forecasting tool, and for training programs

Output 4.1.3: Completed design and implementation plans for the replication and/or scale up of demonstrated EE sustainable energy and LC energy projects

Activity	Description
Activity 4.1.3.1: Train a pool of local experts in energy development and utilization as well as in applying new RE/EE technologies.	Design, organize and conduct a training program to educate local expert on renewable energy technologies, focusing on those that have been and will be demonstrated and installed in Niue, as well as on the utilization of those RE technologies. Participants will include personnel from relevant GoN offices, NPC, NBF, the Chamber of Commerce, and service providers. In order to guarantee the sustainability and replicability of the RE/EE technology systems installed, a mid- to long-term plan will be developed in cooperation with the GoN to periodically organize (i.e., every three years) similar and follow-up training programs to educate new local experts as well as to update and strengthen the capabilities of previously trained experts.
Activity 4.1.3.2: Design	Based on the action plan prepared under Activity 4.1.4.4, feasible

the implementation plan for the scale up of RE/EE projects.	replication and/or scale-up RE/EE projects will be designed, and the implementation plans will be prepared. The plans could include, but not be limited to, the installations of additional LED streetlights, the extension of high EE household appliances financing schemes, introduction of more high efficiency vehicles, etc. For the design and implementation of the scale-up projects an international consultant will be hired and supported by a local professional, which will also contribute to capacity building.

GEF support is required for the incremental technical assistance in the design and organization of training programs, and design and implementation of scale-up plans

Output 4.1.4: Fully evaluated portfolio of follow-up sustainable energy and LC technology (EE and RE) application projects in other villages

Activity	Description
Activity 4.1.4.1: Evaluate RE/EE application projects and produce evaluation reports.	Efficiency and reliability of the RE/EE projects implemented under AREAN will be assessed and interim and final evaluation reports will be prepared. For the evaluation of the RE/EE projects and preparation of the reports an international consultant will be hired.
Activity 4.1.4.2: Assess safe RE/EE waste disposal (i.e., batteries, solar PV panels, incandescent light bulbs, etc.) and prepare an assessment report.	This activity involves the conduct of an assessment of various means/approaches for the safe disposal of RE/EE waste that could be potentially harmful for the environment. Based on the assessment, the procedure for a safe disposal of such waste, in the context of Niue, will be established. The assessment will ascertain what types of waste can be possibly reused or recycled. Additionally, for the portion of waste that must be disposed of, it will be determined if it can be disposed of in Niue or if it has to be shipped overseas. Facilities where reuse, recycle or dispose RE/EE waste can also be part on the newly established RE/EE market in Niue. The report drafted will build on the strategies developed under Activity 1.2.4. This activity will build on and expand the objective of the baseline project sponsored by AusAid and NZAid for the construction of a waste recycling center and described in Section 3.2.1.
Activity 4.1.4.3: Assess potential use of municipal waste for energy generation, including safe disposal of final residual waste, and prepare evaluation report.	This activity entails the assessment of potentially use municipal waste (kitchen waste, gardening, sewage, etc.) as a source of sustainable energy. During the assessment the volumes of waste as well as type of energy produced (biogas, electricity, etc.) and capacity of generation will be determined. In addition, it will also be established a plan for the logistics of the process, such as waste collection, transport to the processing facility and distribution of the energy generated. Finally, safe disposal of residual waste (i.e., in an eco-friendly landfill) will also be evaluated. An evaluation report will be then prepared. This activity will also build on the AusAid/NZAid project mentioned above.
Activity 4.1.4.4: Prepare a follow-up action plan based on the evaluation report.	The evaluation report prepared in Activity 4.1.4.1 will be the basis for the formulation and implementation of a follow-up action plan. For the drafting of the action plan an international consultant will be hired and supported by a local professional, which will also contribute to capacity building.

GEF support is required for the incremental technical assistance in the evaluation of RE/EE projects, RE/EE waste disposal systems and waste to energy potential, and preparation of action plans and evaluation reports.

Outcome 4.2: Enhanced confidence in the viability of climate resilient and low carbon technology applications in the energy supply and demand sectors

Output 4.2.1: Completed designs and implementation plans of LC technology application demonstrations

Activity	Description
Activity 4.2.1.1: Evaluate feasibility of RE and EE demonstration projects and prepare assessment reports.	Based on the recommendations for LC demonstration projects, as summarized in Annex M and building on the baseline projects described in Section 3.2.1, detailed assessments will be carried out on the feasibility of these demos. The assessment will determine the actual number and capacity of units that will be installed under each demo; such as solar powered LED streetlights and solar water pumps. For EE financing schemes related to household appliances, independent PV installations and efficient vehicles, the assessment will determine the viability of the incentives recommended at this design stage and refine them accordingly. Finally, for the EE buildings, the assessment will establish the feasibility of the interventions proposed in Annex M and refine them as needed. The findings, results and recommendations of the feasibility assessments will be presented and discussed in detail in the assessment report.
Activity 4.2.1.2: Prepare engineering design and implementation plans for the implementation of the selected RE and EE demonstration projects.	Based on the recommendations provided in Annex M and on the assessment reports produced under Activity 4.2.1.1, the demo projects will be designed in detail. Subsequently, implementation plans will be prepared to assure the completion of all demos within the timeframe established by AREAN.

GEF support is required for the incremental technical assistance in assessing the feasibility of the RE/EE demo projects, and preparation of engineering designs and implementation plans.

Output 4.2.2: Successfully installed and operational systems of the implemented demonstrations of sustainable energy and LC technology (EE and RE) applications

Activity	Description
Activity 4.2.2.1: Install and operate the selected RE and EE demonstration projects.	This activity involves the installation of all selected RE/EE demos under the direction of the project manager and the supervision of GoN and UNDP. This entails the actual installation, operation and maintenance of the systems that make up the RE/EE demonstrations. The implementation of the demo projects will be carried out by the demo host with the support of the AREAN project team to ensure that all requirements for the successful implementation of the demo are in place. Each demo project will be regularly monitored by the host and the AREAN project personnel using a common M&E system that will be designed and employed for this purpose. Procurement of the equipment will be done internationally following a best-bidder criterion. Where appropriate, installation of the equipment, replacement/repair warranties, and proper training of staff for the operation of the demos must be included.
Activity 4.2.2.2: Improve the power grid stability	The transformers and switchgears provided by the NZHC and EDF-11 projects to the NPC will not be sufficient to stabilize the entire electric

and reliability.	grid, especially with the implementation of additional solar PV systems. This activity is designed to guarantee grid stability and optimal electric load dispatch. The number and capacity of the transformers and switchgears needed will be assessed first and then procured and installed. This new equipment will: a) increase the electric grid efficiency by reducing the transmission losses; b) improve the reliability of NPC operations and electricity dispatch; and c) have environmental benefits since old transformers leak oil into the ground. Proper safe recycling and disposal of the replaced equipment will also be comprised, while NPC will provide for the maintenance of the new equipment after the completion of the AREAN project.
Activity 4.2.2.3: Prepare the demo project profiles (as case studies).	This involves the documentation of the results of the implemented RE/EE technology application demonstrations. An inventory of the demo project results (e.g., energy use, operational performance, economic performance) will be prepared. The results will be compared to the results of similar RE/EE technology application projects that were implemented in other countries. Each project report will be summarized into project profiles (or case studies) following an agreed presentation format.
Activity 4.2.2.4: Conduct an overall performance evaluation of the demo projects.	This involves a comprehensive analysis of the results from each demonstration. The analysis will be on the energy performance, as well as the economic feasibility performance of each demo. The results of the analysis and pertinent conclusions and recommendations will be publicized, including the demo project results and recommendations. Technical guidance materials (web-based and printed media) on specific RE/EE technology applications will also be prepared and disseminated.

GEF support is required for the incremental technical assistance for the installation and operation of the RE/EE demos as well as transformers and switchgears, and the preparation of case studies and evaluation reports.

Output 4.2.3: Established and operational energy monitoring and reporting system (all energy forms), and completed and evaluated pilots on its implementation

Activity	Description
Activity 4.2.3.1: Assess gaps in energy data collection (all energy forms and both supply and consumption) and design an energy monitoring and reporting system.	An assessment of the gaps existing in the data collection procedures and systems in the energy supply and energy end-use sectors will be carried out. The assessment will consider all energy forms and will also include unbilled electricity (used for public illumination and for the water distribution system). Findings/results and recommendations will be documented in an assessment report. The report will be then the basis for the development and establishment of an all-encompassing energy monitoring and reporting system (EMRS).
Activity 4.2.3.2: Design, organize and conduct a training program on energy monitoring and reporting system.	This activity entails the design and organization of a capacity development program on the energy monitoring and reporting system established under Activity 4.2.3.1. The training program will cover all the features and functioning of the EMRS and how it links to both existing technologies and new technologies introduced under AREAN. Participants in the training program will include all relevant energy stakeholders, such as personnel from NPC, NBF, DoU, DoT and the Chamber of Commerce.
Activity 4.2.3.3: Design and evaluation of	This activity involves the design of EMRS pilot projects to test the validity of the system before its full-scale deployment and operationalization. The

energy monitoring and reporting system pilots.	required measuring devices will be procured and installed. These pilots will also allow assessing the efficacy of the training program. The results of the assessment will then be used to adopt potential corrective measures for the finalization of the EMRS. The EMRS will be re-evaluated a year after it has been finalized and, if required, appropriate modifications will be made.

GEF support is required for the incremental technical assistance in the development of the EMRS, training programs, design of EMRS pilots, procurement of measuring devices, and preparation of reports.

Component 5: Enhancement of Awareness on Low Carbon Development

Outcome 5: Enhanced levels of awareness and attitude towards climate resilient and low carbon development in the energy supply and energy end use sectors

Output 5.1: Established and operational energy audit system covering government and commercial buildings and facilities, as well as industrial companies

Activity	Description
Activity 5.1.1: Design an energy audit system and facilitate its approval and implementation.	Energy auditing processes will be designed to check the energy utilization efficiency of government and commercial buildings, and large public energy consumers (i.e., NBF, the wharf, etc.) to determine potential areas of energy consumption (EC) reduction and EE improvement. Energy audits will be based on procedures enforced in the Pacific region, preferably New Zealand or another PIC. Intervals to conduct the auditing will also be determined at this stage. The designed energy auditing procedures will be presented and promoted to the relevant GoN entity for approval and application. The energy audit system will be evaluated a year after it has been finalized and, if required, appropriate modifications will be made.
Activity 5.1.2: Design and train relevant GoN personnel and stakeholders in conducting energy audits.	To allow continuation of energy auditing processes past the lifetime of AREAN implementation, training programs for relevant GoN personnel and other key stakeholders will be organized on how to conduct energy audits for government and commercial buildings, and large public energy consumers. An energy audit unit within the MoI will be formed and mandated to carry out energy audits of energy consuming entities in the country.
Activity 5.1.3: Perform energy auditing of GoN and commercial buildings.	The trained energy audit unit will conduct the energy auditing process in identified energy end-users at established intervals of time. To guarantee impartiality of the process, the energy auditing unit will be headed by the independent energy regulator.

GEF support is required for the incremental technical assistance in the design of an energy audit system, for conducting energy audits, and for training programs.

Output 5.2: Established and operational energy (all energy forms) and energy technology database system

Activity	Description
Activity 5.2.1: Establish an energy database to	This activity involves the design and establishment of a database, which will be the official repository of data and information on planned and

store all energy related information and establish a communication plan.	implemented LC (RE and EE) technology applications in the country as well as data collected with the EMRS developed under Activity 4.2.3.1. The information relative to the RE/EE technology applications and that relative to all energy forms will be stored into two separate modules of the main database. The database will be accessible to all energy stakeholders in Niue and will be used for energy planning and for drafting policies and regulations. The database will be also shared with international donors, implementing partners and consultants when designing and implementing energy related projects. In order to avoid conflict and duplication of data, proper communication channels and procedure will be established. Procedures for servicing data/information request will also be established. It would be advisable to house the energy database with the MoI-DoU. The operation of the database will be evaluated a year after it has been finalized and, if required, appropriate modifications will be made.
Activity 5.2.2: Operate and maintain the energy database.	This activity is mainly for the designated responsible party for the operation and maintenance of the energy database. This involves the gathering of the relevant energy data from the various data sources through the established communication channels and procedures. Data gathered will be processed (analyzed and verified) and encoded into the energy database. Processing of relevant data into useful information, such as charts, graphs and tables, and requests for data/information will be carried out by the designated database management entity.
Activity 5.2.3: Design and implement a capacity building program for Government institutions on the operation and maintenance of the energy database.	This involves the design, organize and conduct training courses for all relevant GoN and SOEs personnel on the operation and maintenance of the energy database. The training will include how to gather and analyze the energy data, both energy supply and end-user sectors. Participants will become able to interpret and manage energy data and organize the information in tables, graphs and other useful forms to be used for planning, budgeting, project proposals and similar actions. Staff from the department of statistics will be engaged in the training program design and implementation.

GEF support is required for the incremental technical assistance in the establishment, operation and maintenance of an energy database and a communication plan, and for capacity building.

Output 5.3: Established and operational information exchange network for the promotion and dissemination of knowledge on sustainable energy and LC development

Activity	Description
Activity 5.3.1: Establish an information exchange/sharing platform on sustainable energy and LC development for the general public.	This activity involves the creation of an energy information sharing platform (website, information desks, etc.) where RE/EE related data will be stored, processed and made available to the general public. Differently from the energy database described in Activity 5.2.1, this platform and its communication channels are devoted to the general public to inform them about LC technologies and for helping them making energy-related decisions, such as: the purchase of a new appliances or a car, the installations of an independent solar PV system, the calculation of energy savings associated to RE/EE technologies, their potential participation in the newly established RE/EE market, etc. The website and the information desk could be housed at and maintained by the Chamber of Commerce or by NDB/Kiwibank. The operation of the information exchange network

	will be evaluated a year after it has been finalized and, if required, appropriate modifications will be made.
Activity 5.3.2: Design, implement and evaluate awareness raising programs on RE/EE projects.	Due to the grid instability issues and to the extremely expensive high energy efficiency household appliances the general public in Niue has little confidence in the viability of RE/EE technologies. Programs will be designed to increase people's confidence in LC technologies. These programs will include activities in school where students prepare projects on sustainable energy, with a final exhibition with family and friends. Information material prepared under Activity 3.4.2 will be made available in all public offices (Chamber of Commerce, NDB/Kiwibank office, PWD, etc.). Other initiatives will be organized at the Fale Fono, the EE demo building described in Annex M, where people can see in person EE technologies and ask information on RE/EE programs supported by GoN. Furthermore, once training programs on different aspects of LCD for relevant GoN personnel and key stakeholders have been completed (part of Activity 5.3.3), two windows will be open, one at the DoU for technical matters and one at NDB/Kiwibank for financial inquiries, where trained staff will answer questions from the general public. A survey will also be prepared and performed at the beginning, mid-term, and end of AREAN implementation to monitor and evaluate the success of the awareness raising programs.
Activity 5.3.3: Design and implement training programs for relevant GoN personnel and stakeholders (Chamber of Commerce, DoU, NDB and Kiwibank) to inform the general public on advantages of LC technologies.	This activity will complement Activity 5.3.2 above. Relevant GoN personnel, especially from the Chamber of Commerce, NDB/Kiwibank and the DoU will undergo a training program designed *ad-hoc* to educate them about all LC technologies implemented in Niue. The participants will also be trained on policies, financial/fiscal incentives available to the private sector and all active plans and program in order to be able to provide information to the general public on all aspects of sustainable energy and low carbon technology developments.

GEF support is required for the incremental technical assistance in the establishment of an information exchange platform, design and implementation of an awareness raising program, design and conduction of surveys, and for training programs.

4.2 Partnerships

The AREAN Project will be implemented in partnership with several international donors that also contribute to addressing the development challenges and support the achievement of GoN energy targets.

Partners	Relevance to AREAN and Description of Initiatives
Government of Niue (GoN)	The Government of Niue will be a pivotal partner for this project because of the many ministries, departments and SOEs involved in AREAN design and implementation. GoN is the implementer and/or sponsor on most of the baseline projects that are currently ongoing or planned in Niue and that will constitute the backbone of the project co-financing activities. The personnel will be involved in all the project components especially for the establishment, approval and implementation of policies and regulations, and

	as participants in several of the training programs that will be organized under AREAN. In addition, one of the demonstration projects (EE building design and construction) will involve the newly planned Government Cabinet building (the Fale Fono).
Government of New Zealand (GoNZ)	New Zealand has a statutory obligation to financially support Niue's development initiatives, including LCD and climate change mitigation interventions. As such, New Zealand, through its diplomatic mission, is supporting GoN efforts in meeting its target of 80% electricity generation from RE sources by 2025. GoNZ is financing two consecutive USD 3.5 M (NZD 5.0 M) projects for the implementation of solar PV panels, solar battery storage banks, power conversion systems, a portion of the required transformers and switchgears, NPC personnel training, and several remediation intervention of the existing generation and network assets. During stakeholder consultations, NZHC has pledged additional GoNZ financial support, if needed, to reach the 80% RE target. Several AREAN activities, especially those relevant to the grid stabilization, are incremental activities tailored around New Zealand's sponsored baseline projects. For the amount of the grants and typology of initiatives, NZHC is a primary partner for the implementation of the AREAN project.
European Developing Fund (EDF)	EDF has sponsored several energy-related projects in Niue. Specifically, EDF-11 is supporting the completion of the underground electric grid and they are also sponsoring the acquisition of additional power transformers and switchgears (still not sufficient to achieve NPC total needs). The project relevance to AREAN is for contributing to the stabilization of the electric grid.
Niue Development Bank (NDB) and the Alofi branch of Kiwibank	Niue currently has a high energy efficiency household appliances rebate/loan program with Low Carbon Islands Project funded by GEF through IUCN and implemented by NDB and the Alofi Kiwibank branch. The USD 80,000 has had limited success to date, but it has laid the ground for AREAN's incremental activities to further support high efficiency appliances penetration, by adding other appliances, upgrading the budget, refining the scheme and preparing informational and promotional materials.
Niue's Chamber of Commerce	The Chamber of Commerce has expressed its intention and willingness to partner with AREAN to support the creation of a local market for RE and EE technologies and services. Specifically, the Chamber is interested in sponsoring and help organizing programs to train repair and service providers in technologies new to Niue and that will be adopted under AREAN, such as electric vehicles and hybrid cars.
Village/Community Leaders	The country of Niue is sectioned into 14 villages, each with its own council who actively participate into all decisions involving the village and its inhabitants. For the selection of the location of some of the LC technology demos (such as for the LED streetlights and for the solar water pumps), for the subsequent project implementation, and for the planning of their replication, the project management team will partner with the village councils and leaders in Niue.

4.3 Risks and Assumptions

As per standard UNDP requirements, the Project Manager will monitor risks quarterly and report on the status of risks to the UNDP Country Office. The UNDP Country Office will record progress in the UNDP ATLAS risk log. Risks will be reported as critical when the impact and probability are high (i.e. when impact is rated as 5, and when impact is rated as 4 and probability is rated at 3 or higher). Management responses to critical risks will also be reported to the GEF in the annual PIR.

The risks that might prevent the project objectives from being achieved, during the project implementation, are listed as follows:

Project Risks					
Description	**Type**	**Impact & Probability**	**Mitigation Measures**	**Owner**	**Status**
The project activities may not be fully implemented due to inadequate local capacity	Technical, Operational	P = 2 I = 4	**Prevention**: GoN will set up a capable project team comprising competent local and international experts to expand the capacity of the local community people in the implementation of the relevant project activities. The proposed project will be coordinated closely with other relevant projects in the country mainly to make use of potential synergies in the management of the project implementation. This is in addition to the support from UNDP-Samoa MCO that GoN can request. **Alleviation**: UNDP-Samoa MCO, with the agreement of the implementing partner will manage and expedite the procurement process for external personnel that will work on the project activities. Potential modification of activities to allow for expeditious implementation will be done.	PMU, DoU, PMCU	No Change
The pre-identified and other anticipated co-financing for specific activities of the project may not be available on a timely manner	Financial	P = 1 I = 4	**Prevention**: GoN assurance of co-funding shall be confirmed and secured prior to project launching. The project team will closely monitor and ensure the timely availability of co-financing from project partners and co-financers during project implementation. **Alleviation**: Reallocation of budget to support the implementation of activities that will be affected by the delays in the availability of co-financing. In case co-financing will not happen, potential modifications of activities can be done to allow delivery of alternative outputs that are still contributing to the achievement of the relevant outcomes. Together with the NPD conduct follow-up meetings with co-financer, or alternatively find and negotiate with other potential co-financers.	PMU, PMCU	Reducing
The follow-up/through work needed to sustain the achieved outcomes and benefits may not happen	Operational, Financial	P = 3 I = 2	**Prevention**: As part of the project activities, the development of a sustainable follow-up plan will ensure that follow-through from the key stakeholders (e.g., GoN) will happen by involving them in the planning process itself and getting their commitments when signing off on the plan implementation. The sustenance of the outcomes that are realized during the course of project implementation will form part of	PMCU, DoU-MoI	No Change

			the follow-up plan. **Alleviation**: Agreement and regular follow up with the project partners involved in the implementation of completed activities in the sustained application of the systems/frameworks that will be established and operationalized by the project.		
RE-based energy generation (power and non-power purposes) installations can be seriously affected by adverse climate-related events	Environmental	P = 2 I = 4	**Prevention**: It is already common in international design and engineering practices, as well as in the construction/installation of RE-based energy generation units to follow proper engineering design and construction that ensure not only structural integrity but also climate resilience. This applies also in the procurement, design/engineering, installation and operation of the pertinent installations. **Alleviation**: Depending on the extent of the impacts of the adverse climate–related events, appropriate modifications in the installations (and budget) will be done. Potential reduction in the number of installations, or replacement with alternative demos will be done while taking into account the need to ensure the resulting interventions are still contributing to the realization of the project outcomes.	DoU, NPC, PMU, PMCU	No Change
Villages may not support the project implementation	Operational, Organizational	P = 1 I = 3	**Prevention**: The coordination of the project implementation with the project partners will be the main responsibility of DoU-MoI and is expected to be supported by other departments of MoI. MoI good standing and rapport will be put to good use to actively promote the implementation of this project and ensure the support of the villages. **Alleviation**: In the first place, select villages that are willing to support the project. In case selected villages will withdraw support during the course of the project implementation, the demos will be redesigned for implementation within and in the fringes of the national capital.	DoU-MoI PMCU	Reducing
The recommended policies and regulations of the project by the pertinent GoN agencies may be delayed in approval and enforcement	Political, Regulatory	P = 1 I = 3	**Prevention**: Advocacy campaigns will be included in the project to gain adequate support from the regulatory bodies on the adoption of the recommended policies and regulations. UNDP will assist if necessary. **Alleviation**: PB meetings and special meetings with the pertinent GoN agencies will be conducted to discuss and determine what it will take for the agencies to expedite the approval and enforcement of the recommended policies and IRRs and come up with the appropriate actions to resolve the issues/problems. Thereafter implement the action points accordingly.	PMU, PMCU	No Change
Change in national government administration may potentially reduce government	Political	P = 1 I = 3	**Prevention**: DoU-MoI and other GoN departments involved in the project will monitor political dynamics and will try to resolve any misunderstanding within the project. If warranted, UNDP executive management intervention may be required. **Alleviation**: PB meetings and special meetings with the implementing partner and GEF OFP will be	DoU-MoI PMCU	No Change

support to the project			conducted to discuss courses of actions to take to sustain GoN's support to the project and carry out such plans accordingly.		
Further reduction in petroleum fuel prices will reduce interest in RE-based power generation	Strategic	P = 1 I = 3	**Prevention:** While the project has no control on the petroleum fuel prices, the project's awareness raising interventions are expected to sustain the overall interest of the country in transforming their power generation system to RE-based systems even when the petroleum fuel prices are relatively low. **Alleviation**: Although the petroleum fuel prices are currently in on an uptrend, which is good for RE promotion and application, in case prices go down, the project will emphasize the need to take advantage of the energy, environment and economic benefits of RE, and the country's obligation towards the realization of its CCM targets in its NDC to ensure that the interest of GoN in low carbon development is sustained.	DoU, NPC, NBF, PMCU	No Change

A preliminary Social and Environmental Safeguard screening was conducted during the PIF preparation and it has been reviewed and updated during this project design process and included here as Annex F. The overall social and environmental risk rating of the project is ***moderate***, with four out of the eight risk categories rated moderate and four rated low risk. Because of this rating, all AREAN activities will be preceded by the preparation of an Environmental and Social Management Plan (ESMP). Since the completion of the ESMP is propaedeutic to any activities, it is important to complete the plan during the first year of AREAN implementation. The activities that will have the strongest impact will be especially the demo projects.

For example:

1. Environmental:
   a. All special waste generated by implementing RE and EE technologies will have to be properly disposed (i.e., battery banks for RE electricity storage, solar PV panels, incandescent lightbulbs, low energy efficiency household appliances, etc.).
   b. Locations for LED streetlight installations must not have a negative impact on the local fauna (in other PICs, bird nesting has been affected by an improper choice of sites for streetlight installations).
2. Social:
   a. Waste disposal facilities must be chosen without affecting the health and safety of local population.
   b. Any activity involving replacement of equipment (i.e., transformers, solar water pumps, etc.) has to be done, whenever possible, in the same site of the old equipment; if this is not possible, the new site must be chosen without affecting health and safety of the local population and taking into consideration the risks of natural climate events affecting Niue.

Environmental and social grievances will be reported to the GEF in the annual PIR.

4.4 Stakeholder Engagement Plan

Stakeholder	Roles and Responsibilities in Project Implementation
Department of Utilities – Ministry of	The Department of Utilities is the government entity that has control of the energy-related state owned enterprises, such as NPC and NBF. DoU has been

Infrastructure (DoU-MoI)	designated as the implementing partner for AREAN and therefore it will assume a leadership role during project implementation providing guidance and supervision. DoU staff will cooperate closely with the project implementation management team throughout the entire duration of the project and for all activities. DoU will be responsible for communication and coordination with the office of the national GEF OFP and UNDP and will liaise with villages during implementation of the demo projects. Lastly, they will provide data inputs on plans and programs of the country concerning the energy provision in the public infrastructure, transport and communications projects of the government.
Project Management and Coordination Unit (PMCU)	The project will be implemented under UNDP's National Implementation Modality (NIM) mechanism. PMCU, a department under the Premier's office, will provide centralized project management services, coordinate project management activities, and facilitate stakeholder relationships.
Niue Power Corporation (NPC)	NPC, newly established as state owned enterprise, manages all assets and is responsible for the generation and distribution of power generation in Niue. NPC role will be critical in the implementation of all AREAN's activities related to grid stabilization, installation of RE power generation systems and ancillary equipment. Its management and staff will work closely with the implementation management team to provide information, support and it will be the recipient of several training programs
Department of Transportation – Ministry of Infrastructure (DoT-MoI)	DoT will be involved in the activities that will facilitate the adoption of high energy efficiency cars, especially electric vehicles and hybrid cars. Furthermore, as responsible for Niue's roads, it can provide valuable guidance to select the best locations for the solar powered LED streetlights. Similarly, to most stakeholders involved, staff members will be trained through some of the programs that will be planned and delivered under AREAN.
Treasury Department	The role of the Treasury Department will be pivotal for the approval and enforcement of fiscal and financial incentives to support the development of RE and EE technologies. Electricity price revision and extension of energy subsidies will be also undertaken by this department.
Crown Law	Responsible for the provision of legal comments on project agreements and documents for projects.
Niue Bulk Fuel (NBF)	Similar to NPC, this SOE manages the imports and distribution of fossil fuels into Niue. With a shift towards RE/EE technologies, the day-to-day operation of this unit will be highly affected by the implementation of AREAN activities (especially in terms of diesel imports). NBF will provide valuable information and support to AREAN and its staff will be recipient of some of the training programs.
Department of Agriculture, Fisheries and Forestry – Department of Natural Resources – Department of Social Services –	All these GoN departments and stakeholders will be involved during AREAN implementation activities. Their services, expertise and database of information will be especially useful for the success of the demonstration projects, for capacity building and awareness rising around RE and EE technologies. Staff members will be involved in several training initiatives.

Department of Statistics – Department of Water Resources – Niue Chamber of Commerce –Niue Met Services	
Niue Population	The entire population of Niue will be involved in the awareness activities that will be organized and implemented under AREAN. They will all be beneficiaries of a more efficient and reliable electricity grid as well as a greener and more sustainable environment.

4.5 Gender Equality and Empowering Women

Stakeholder consultations held during the first field mission have been also used to bring to light potential gender issues. For this preliminary exploration it has been very instrumental the meeting with Ms. Gaylene Tasmania, the Director of the Department of Social Services. Ms. Tasmania remarked that there are no particular gender issues in Niue. Statement supported by some numerical evidence. For example, in GoN there are 11 managerial positions, five (5) of which are currently held by women. Additionally, school enrolment (level of instruction can be used as an indicator to infer the future shaping of government managerial and other skilled positions) counts 55% of girls vs. 45% of boys.

Furthermore, there were no discriminations observed in any workplace or any specific socio-economic sector that would favor one gender over the other. In any case, all activities under AREAN will be designed and implemented in a gender inclusive manner, which will continue to guarantee the equal opportunity environment established in Niue. A complete gender analysis is included as Annex Q.

4.6 South-South and Triangular Cooperation (SSTrC)

Pacific islands share similar obstacles with one another when it comes to remoteness, challenging environmental conditions, limited professional skills and scarce natural resources. It is therefore useful to create an osmotic flux of lessons learned from previous projects among PICs. Whenever possible, experience with similar projects in other PICs should be used especially in terms of experience acquired and lesson learned. Many PICs have already implemented projects involving, among others: a) installation of large capacities, in percentage terms, of solar PV systems for electricity generation; b) successful financial schemes for the adoption of high energy efficiency household appliances; and c) training programs to strengthen local capacity in RE/EE technologies. AREAN project design, and especially implementation, will tap into the pool of lessons learned from these projects. For example, there are projects already implemented in the Cook Islands and Tokelau (countries that enjoy statutory obligations from New Zealand similar to the one established by Niue); whenever technically possible and financially viable suppliers and service providers that have already had experience in PICs are to be favored. Alternatively, procuring equipment and expertise from developing countries in the South-East Asia and Pacific areas will also be explored.

On the other hand, there are activities designed for which Niue will be a pioneer implementer, including: a) country-wide scale installation of water solar pumps; b) adoption of electric vehicles and hybrid cars; and c) holistic approach to the introduction of policies, regulatory framework,

institutional framework, and codes and procedures for grid control and optimal electric load dispatch. In these cases, the flux of information and lessons learned will flow in the opposite direction and other countries will benefit from Niue's experience.

This two-way cooperative approach, which involves expertise and technology transfer, will accelerate development of LC technologies and initiatives in the Pacific region with subsequent socio-economic advancements and furthermore it will facilitate PICs in achieving Sustainable Development Goals.

4.7 Sustainability and Scaling Up

Sustainability: The project will involve the creation of the required enabling conditions that through the adoption of supportive policies/regulations, institutional mechanisms, and financial/fiscal incentives will facilitate the widespread application of sustainable energy and low carbon technologies in the energy generation and energy end-use sectors in Niue. This is to ensure sustainability of the systems and frameworks that will be established under the project. The development of a suitable follow-up action plan for approval and enforcement after project completion will ensure the sustainability of these established systems/frameworks. Since the project is linked and is complementing and supplementing the development and infrastructure plans of the country, e.g., Niue National Strategic Plan; National Integrated Strategic Energy Road Map (NiSERM), the sustainability of project outputs will be continued.

Potential for Scaling-up: The project is also meant to support the current plans and programs of the country towards achieving its NiSERM targets. The RE-based energy system demonstrations that will be implemented in selected villages can be replicated as is, or at a scaled-up configuration in other villages. Such demonstrations are meant to be replicated and/or scaled-up to achieve enhanced energy security and climate resilient energy supplies. The portfolio of feasible low carbon technology application projects that will be developed under the project would most likely include those that are scale-up and replication of the demo projects. Best practices and lessons learned that will come out from the project implementation will also be shared with other PICs and SIDS with similar circumstances of the country, thereby ensuring the scaling up of the project interventions beyond Niue.

V. PROJECT MANAGEMENT

5.1 Cost Efficiency & Effectiveness

The remoteness and small population of Niue, which impedes any substantial economy of scale, strongly affect the price of goods and services imported. Generating 80% of electricity with indigenous renewable sources will significantly and positively impact GoN's balance of payments (besides providing environmental benefits and facilitating energy independence), since costly diesel shipments will be drastically reduced. As described in Section 3.2.2, the proposed approach for enabling the achievement of the %RE targets in the NISERM is barrier removal. More specifically the removal of barriers associated with the lack of supportive policies, regulations and institutional mechanisms; as well as the limited capacity and knowledge about the application, design, financing and operation of feasible RE-based energy systems (both for power and non-power applications) by the public and private sectors of the country would form the bulk of the proposed UNDP-GEF project. Most of the barrier removal activities make up the incremental activities that the project will carry out, particularly those that the GoN will not be, or presently does not have the capacity of, addressing. It is very necessary to provide the incremental support activities to facilitate the demonstration of the processes and procedures involved in integrated energy planning, application of the energy-saving techniques and technologies in the energy end use sectors (public and residential) of the country. Without the incremental barrier removal and enabling activities the achievement of the anticipated alternative scenario in the energy end use sectors in Niue will not be realized. Incremental activities to establish and enforce policy and regulatory frameworks that are supportive (through effective institutional arrangements, financial/fiscal incentives, information sharing, etc.) will be necessary to sustain the replication of low carbon technologies/techniques that will be showcased and promoted under the project. It should be emphasized that the realization of the substantial sustainable development benefits that result from the application of such initiatives is contingent to the removal of the barriers that the GEF can help eliminate.

The applied barrier removal approach is a strategy proven to be very successful in numerous RE/EE projects implemented over the years by UNDP in several PICs. In addition, AREAN holistic approach of simultaneously removing all identified barriers makes the project more cost efficient and more effective by avoiding any unnecessary duplication while taking advantage of all synergies created. As mentioned above, many AREAN activities have been designed to complement and improve the baseline of RE/EE projects currently ongoing or planned with the purpose of maximizing the effectiveness of the interventions proposed. For example, introducing standardized technical specs for RE/EE equipment and systems, as well as establishing and approving codes and procedures for RE technology implementations, grid control and optimal load dispatch will leverage the financial efforts of co-financed projects. Cost efficiency, when implementing AREAN activities, will be further pursued by procuring the most financially viable equipment and service providers available, which have been possibly already proven in similar projects.

Since the main essence of the proposed project is the reduction of diesel-based power generation in the country, the global environmental benefits of the proposed GEF project would mainly come from GHG emission reductions (tons CO_2) from fossil fuel substitutions in electricity generation, and other energy end-uses particularly in using available feasible RE resources. Sustainable energy initiatives that would lead to the improvement of the specific energy consumption of energy end use sectors through improved energy utilization efficiency will also contribute to this. In summary, the GHG emissions reductions would come from: (1) Direct emission reductions from completed sustainable energy and low carbon technology application demonstrations and replications; and, (2) Indirect emission reductions from follow-up sustainable energy and low carbon (RE and EE) technology

application projects in the country as influenced by this proposed GEF project. The cumulative amount of GHG emission that will be avoided because of AREAN will be approximately 110,000 tCO_{2eq}; this figure takes into account that the LC technologies that will be implemented (such as solar PV panels, solar water pumps, EVs and hybrid cars, LED streetlights, high energy efficient household appliances, etc.) have a lifespan longer than the duration of the AREAN project implementation phase. It should be also pointed out that many of the activities proposed under AREAN are for Technical Assistance (TA), which will contribute to capacity building by offering training programs designed *ad-hoc* to relevant GoN personnel and key stakeholders. Skilled personnel can guarantee the long-term sustainability of the measures adopted and demos implemented under AREAN, contributing to improving cost efficiency and effectiveness of the project. Considering the small scale of Niue and that many of the designed interventions will be TA activities, which facilitate GHG emission reduction but do not have a direct impact, removing ~110,000 tCO_{2eq} is a positive result.

5.2 Project Management

The responsibility for the execution of the project under the national implementation modality is with the Implementing Partner (DoU-MoI) and will work closely with other relevant stakeholders, especially the PMCU. The DoU-MoI in cooperation with the PMCU will establish a Project Management Unit (PMU) for the overall coordination, as well as resource management, of this project. The PMU will be organized to include the services of the Project Manager, the national Project Director, the Project Administration and Finance Officer, and the Chief Technical Advisor (CTA). As part of the arrangement, the UNDP CO will provide support staff to DoU-MoI and PMCU.

The PMU will be very helpful in providing management services by following the procedures of UNDP and funding agencies and the Financial Regulations and Rules of UNDP and providing for the required guidance to ensure best value for money, fairness, integrity, transparency, and effective international competition that UNDP adheres to.

With PMU providing the supportive role, the Project Manager is responsible for:

- Managing the overall conduct of the project
- Implementing activities by mobilizing goods and services
- Checking on progress and watch for plan deviations
- Ensuring that changes are controlled and problems addressed
- Monitoring progress and risks
- Reporting on progress including measures to address challenges and opportunities.

The Project Manager should coordinate with the pertinent programme and operational units of the DoU-MoI and PMCU on the follow up of disbursements against obligations and other matters in relation to project implementation and management.

5.3 Agreement on Intellectual Property Rights and Use of Logo on the Project's Deliverables and Disclosure of Information

To accord proper acknowledgement to the GEF for providing grant funding, the GEF logo will appear together with the UNDP logo on all promotional materials, other written materials like publications developed by the project, and project hardware. Any citation on publications regarding projects funded by the GEF will also accord proper acknowledgement to the GEF. Information will be

disclosed in accordance with relevant policies notably the UNDP Disclosure Policy[10] and the GEF policy on public involvement[11].

[10] See http://www.undp.org/content/undp/en/home/operations/transparency/information_disclosurepolicy/

[11] See https://www.thegef.org/gef/policies_guidelines

VI. PROJECT RESULTS FRAMEWORK

This project will contribute to the following Sustainable Development Goal (s):

SDG 7: "Ensure access to affordable, reliable, sustainable and modern energy for all"; SDG 13: "Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy"; SDG 8: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all"; and, SDG 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation"

This project will contribute to the following country outcome included in the UNDAF/Country Programme Document: *UN Pacific Strategy 2018-2022*: Outcome 1 – Climate Change, Disaster Resilience and Environmental Protection; *UNDP Sub-Regional Programme Document 2018-2022*: Outcome 1 – By year 2022, people and ecosystems in the Pacific are more resilient to the impacts of climate change, climate variability and disasters; and environmental protection is strengthened.

This project will be linked to the following output of the UNDP Strategic Plan: Output 1.4: Scaled up action on climate change adaptation and mitigation cross sectors which is funded and implemented.
Output 1.5: Inclusive and sustainable solutions adopted to achieve increased energy efficiency and universal modern energy access (especially off-grid sources of renewable energy)

	Objective and Outcome Indicators	Baseline	Mid-term Target	End of Project Target	Means of Verification	Assumptions
Project Goal: Improved energy consumption index and reduced annual growth rate of GHG emissions in the country's energy supply and energy end-use sectors	Reduction in the overall national energy utilization intensity (toe[12]/1,000 USD GDP[13])	0.109	0.095	0.089	Annual energy supply and consumption reports submitted by relevant GoN entities, NPC, NBF, DoU-MoI, and the Treasury Department Project M&E reports	Continuous commitment of GoN in efforts to achieve the NiSERM targets irrespective of which party is in power
	Cumulative GHG emission reduction[14] from fossil fuel utilization, tons CO_2	0	3,828	8,611[15]		
Project Objective: Enabling the achievement of low carbon energy access,	Cumulative fossil fuel savings[16] due to sustainable energy and low carbon interventions	0	1,264	3,048	Annual energy supply and consumption reports submitted by relevant entities, NPC, NBF,	Realization of committed co-financing from the national government in the

[12] Calculation of tons of Oil Equivalent (toe): 1) Amount of solar PV electricity (kWh) is considered as electricity produced from diesel power generation. The amount of diesel fuel (liters) used to generate this amount of electricity is calculated and then converted into toe; and 2) the toe value is added to the rest of the country's energy consumption (toe), i.e., energy consumption in all other sectors, except from solar PV).

[13] GDP data were available for year 2003 and year 2012. These two values have been used to determine the average GDP growth rate over this period, which was 6.2% (CIA gave the same 6.2% GDP growth rate also for the period prior to 2003). The assumption made is that GDP will continue to grow at the same rate for the next few years.

[14] Since the RE and EE targets will be fully achieved by 2025, and the solar PV installations have a duration of ~25 years, the cumulative GHG emission reductions over the lifetime of the equipment acquired will continue well past the end of AREAN implementation. Annex M shows these estimates in detail. By the end of all equipment lifetime the estimated cumulative GHG emission reductions will be 99,633 tCO_2.

[15] To achieve all the NiSERM targets the GoN, with the cooperation of NZHC, will implement projects (not part of the baseline) that during the AREAN will remove an additional 631 tCO_2

[16] Similarly, to the GHG emission reductions, also the fuel savings will continue well past the project implementation, due to the long lifetime of the equipment acquired.

sustainable energy, and green growth targets of Niue	implemented, toe				DoU-MoI and the Treasury Department Project M&E and activity reports Trade and commerce reports	implementation of project activities and monitoring systems
	% RE electricity production[17]	1.8%	64%	73%		
	No. of new jobs created in the application of sustainable energy and LC technologies and techniques in the energy supply and energy end-use sectors in Niue[18]	0	3	8		
Component 1: Improvements in Energy Integrated Development Policy and Planning						
Outcome 1: Improved policy and regulatory frameworks in the application of energy efficiency and renewable energy technologies in the energy end-use sectors	No. of approved and enforced RE and EC&EE policies, and associated guidance and implementing rules and regulations	0	2	2	Documents on RE and EC&EE policies, regulations and energy standards Annual reports from DoU-MoI, NPC, and Bulk Fuels Project M&E and activity reports	Full and continuous commitment and support of the national government in the implementation of energy policies and regulations in the energy and end-use sectors
	No. of formulated and approved policies and regulations incorporated in the country's Energy Act	0	2	2[19]		
Component 2: Institutional Capacity Building on Low Carbon Development						
Outcome 2: Effective enforcement of plans, policies and regulations, and implementation of programs/projects on the application of climate resilient and low carbon technologies in the end-use sectors	No. of sectoral integrated development plans that are implemented and managed through the established and adopted integrated institutional mechanisms	0	1	2	Documents on the institutional mechanisms Documents on low carbon development processes Annual Reports on the sectoral integrated development plan implementation Project M&E and activity reports	Continuous commitment and support by the national government, private sector and public, in general on the successfully implemented institutional arrangements even after the AREAN project completion
	No. of low carbon development initiatives facilitated by adopted and enforced institutional arrangements mentioned in	0	2	4		

[17] NZHC has indicated a very aggressive implementation strategy with the installation of most of the solar PV power capacity to achieve 80% generation completed by mid-term; additional PV systems have been considered after the completion of the 2 NZ projects to achieve the NiSERM target, as pledged by the NZHC..

[18] Job creation will continue past the completion of AREAN implementation, since the benefits of the activities that will lead to the creation of a RE/EE market will continue past project completion.

[19] Review of the Energy Act will be completed by mid-term, therefore there will be no change for the end of project target

	Indicator 1					
Component 3: Improvements in the Financing of Low Carbon Initiatives						
Outcome 3: Increased availability of, and access to, financing for sustainable energy, energy access and low carbon development initiatives in the energy supply and demand sectors	No. of developed and recommended financing schemes/mechanisms with Niue Development Bank for supporting climate resilient and low carbon development initiatives in the country	0	1	2	Documents on the financial schemes/ mechanisms development process Annual Reports on the planned and implemented low carbon development projects that are financed through the adopted financing scheme(s) Project M&E and activity reports	Continuous commitment and support by the national government and financial sector on the implementation of the adopted financing schemes
	No. of small-scale EE projects and RE technology projects financed either through the adopted financing scheme; or by private sector investment	0	2	6		
	No. of recommended finance/fiscal policies for supporting initiatives on LC development	0	2	2[20]		
Component 4: Climate Resilient and Low Carbon Technologies Application						
Outcome 4.1: Climate resilient and low carbon techniques and practices adopted and implemented in the energy supply and energy end-use sectors	No. of completed feasibility assessments conducted for planned energy-integrated socio-economic development activities that feature RE and EE technology applications	0	2	4	RE/EE technology projects feasibility assessment reports Project M&E and activity reports	Consumers and the private sector fully support and commit to the feasible replication of successful results of the demo projects
Outcome 4.2: Enhanced confidence in the viability of climate resilient and low carbon technology applications in the energy supply and demand sectors	Cumulative amount of energy savings from the successfully installed and operational demonstrations (including replications) of sustainable energy and low carbon technology applications, toe[21]	0	0	368	Demo RE-based electricity generation and low carbon technology application project profiles Performance and evaluation reports of the demo projects Project M&E and activity reports	As per schedule implementation and completion of demo projects Consumers and the private sector fully support and commit to the feasible

[20] In order to maximize the benefits of the fiscal/financial policies and incentives, they will be designed and implemented by mid-term.

[21] Demos will be completed during the second half of AREAN and their benefits will largely be achieved after project completion; similarly replications (see Table M.6) will be implemented after the end of AREAN.

	No. of RE and EE technologies application projects designed and financed for implementation as influenced by the results and outcomes of the demonstrations	0	1[22]	5		replication of successful results of the demo projects
Component 5: Enhancement of Awareness on Low Carbon Development						
Outcome 5: Enhanced levels of awareness and attitude towards climate resilient and low carbon development in the energy supply and energy end use sectors	***Incremental*** no. of energy consumers (e.g., households) that will utilize EE appliances and RE-based energy generating and consuming equipment acquired through AREAN initiatives	0	40	160[23]	Survey of energy consumption of consumers (e.g., household energy survey) Business registrations of local technical and engineering service providers that are working on low carbon technology projects Project M&E and activity reports	Continuous commitment and support on sustainable energy and low carbon development by the national government
	No. of local firms that can capably provide technical, engineering and maintenance services for sustainable energy and low carbon technology application projects	0	1	3		

[22] Completion of demo activities will come after the completion of feasibility studies and it will take long time to be completed. Based on the demo projects described in Annex XX only one demo (the completion of the high energy efficiency demonstration building) will be completed by mid-term, all other demos will be completed by end of project.

[23] This represents one third of Niue's ~480 households (it is estimated that just over 50% of the total households have very low efficiency appliances; therefore, AREAN aims to involve about two thirds of the target households).

VII. MONITORING AND EVALUATION (M&E) PLAN

The project results as outlined in the project results framework will be monitored annually and evaluated periodically during project implementation to ensure the project effectively achieves these results. The project monitoring and evaluation plan will also facilitate learning and ensure knowledge is shared and widely disseminated to support the scaling up and replication of project results.

Project-level monitoring and evaluation will be undertaken in compliance with UNDP requirements as outlined in the UNDP POPP and UNDP Evaluation Policy. While these UNDP requirements are not outlined in this project document, the UNDP Country Office will work with the relevant project stakeholders to ensure UNDP M&E requirements are met in a timely fashion and to high quality standards. Additional mandatory GEF-specific M&E requirements (as outlined below) will be undertaken in accordance with the GEF M&E policy and other relevant GEF policies[24].

In addition to these mandatory UNDP and GEF M&E requirements, other M&E activities deemed necessary to support project-level adaptive management will be agreed during the Project Inception Workshop and will be detailed in the Inception Report. This will include the exact role of project target groups and other stakeholders in project M&E activities including the GEF Operational Focal Point and national/regional institutes assigned to undertake project monitoring. The GEF Operational Focal Point will strive to ensure consistency in the approach taken to the GEF-specific M&E requirements (notably the GEF Core Indicators) across all GEF-financed projects in the country. This could be achieved for example by using one national institute to complete the GEF Core Indicators for all GEF-financed projects in the country, including projects supported by other GEF Agencies.[25]

M&E Oversight and monitoring responsibilities:

Project Manager: The Project Manager is responsible for day-to-day project management and regular monitoring of project results and risks, including social and environmental risks. The Project Manager will ensure that all project staff maintains a high level of transparency, responsibility and accountability in M&E and reporting of project results. The Project Manager will inform the Project Board, the UNDP Country Office and the UNDP-GEF RTA of any delays or difficulties as they arise during implementation so that appropriate support and corrective measures can be adopted.

The Project Manager will develop annual work plans based on the multi-year work plan included in Annex A, including annual output targets to support the efficient implementation of the project. The Project Manager will ensure that the standard UNDP and GEF M&E requirements are fulfilled to the highest quality. This includes, but is not limited to, ensuring the results framework indicators are monitored annually in time for evidence-based reporting in the GEF PIR, and that the monitoring of risks and the various plans/strategies developed to support project implementation (e.g. gender strategy, KM strategy etc..) occur on a regular basis.

Project Board (PB): The PB will take corrective action as needed to ensure the project achieves the desired results. The PB will hold project reviews to assess the performance of the project and appraise the Annual Work Plan for the following year. In the project's final year, the PB will hold an end-of-project review to capture lessons learned and discuss opportunities for scaling up and to

[24] See https://www.thegef.org/gef/policies_guidelines
[25] See https://www.thegef.org/gef/gef_agencies

highlight project results and lessons learned with relevant audiences. This meeting will also discuss the findings outlined in the project terminal evaluation report and the management response.

Project Implementing Partner: The Implementing Partner is responsible for providing all required information and data necessary for timely, comprehensive and evidence-based project reporting, including results and financial data, as necessary and appropriate. The Implementing Partner will strive to ensure project-level M&E is undertaken by national institutes and is aligned with national systems so that the data used by and generated by the project supports national systems.

UNDP Country Office: The UNDP Country Office will support the Project Manager as needed, including through annual supervision missions. The annual supervision missions will take place per the schedule outlined in the annual work plan. Supervision mission reports will be circulated to the project team and PB within one month of the mission. The UNDP Country Office will initiate and organize key GEF M&E activities including the annual GEF PIR, the independent mid-term review and the independent terminal evaluation. The UNDP Country Office will also ensure that the standard UNDP and GEF M&E requirements are fulfilled to the highest quality.

The UNDP Country Office is responsible for complying with all UNDP project-level M&E requirements as outlined in the UNDP POPP. This includes ensuring the UNDP Quality Assurance Assessment is undertaken (during the design stage, annually during the implementation stage, and at the end of the project); that annual targets at the output level are developed and monitored and reported using UNDP corporate systems; the regular updating of the ATLAS risk log; and, the updating of the UNDP gender marker on an annual basis based on gender mainstreaming progress reported in the GEF PIR and the UNDP ROAR. Any quality concerns flagged during these M&E activities (e.g. annual GEF PIR quality assessment ratings) must be addressed by the UNDP Country Office and the Project Manager.

The UNDP Country Office will retain all M&E records for this project for up to seven years after project financial closure to support ex-post evaluations undertaken by the UNDP Independent Evaluation Office (IEO) and/or the GEF Independent Evaluation Office (IEO).

UNDP-GEF Unit: Additional M&E and implementation quality assurance and troubleshooting support will be provided by the UNDP-GEF Regional Technical Advisor and the UNDP-GEF Directorate as needed.

Audit: The project will be audited per UNDP Financial Regulations and Rules and applicable audit policies on NIM implemented projects.[26]

Additional GEF monitoring and reporting requirements:

Inception Workshop and Report: A project inception workshop will be held within two months after the project document has been signed by all relevant parties to, amongst others:

a) Re-orient project stakeholders to the project strategy and discuss any changes in the overall context that influence project strategy and implementation;
b) Discuss the roles and responsibilities of the project team, including reporting and communication lines and conflict resolution mechanisms;
c) Review the results framework and finalize the indicators, means of verification and monitoring plan;

[26] See guidance here: https://info.undp.org/global/popp/frm/pages/financial-management-and-execution-modalities.aspx

d) Discuss reporting, monitoring and evaluation roles and responsibilities and finalize the M&E budget; identify national/regional institutes to be involved in project-level M&E; discuss the role of the GEF OFP in M&E;
e) Update and review responsibilities for monitoring the various project plans and strategies, including the risk log; Environmental and Social Management Plan and other safeguard requirements; the gender strategy; the knowledge management strategy, and other relevant strategies;
f) Review financial reporting procedures and mandatory requirements, and agree on the arrangements for the annual audit; and
g) Plan and schedule PB meetings and finalize the first-year annual work plan.

The Project Manager will prepare the inception report no later than one month after the inception workshop. The inception report will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser and will be approved by the PB.

GEF Project Implementation Report (PIR): The Project Manager, the UNDP Country Office, and the UNDP-GEF Regional Technical Advisor will provide objective input to the annual GEF PIR covering the reporting period July (previous year) to June (current year) for each year of project implementation. The Project Manager will ensure that the indicators included in the project results framework are monitored annually in advance of the PIR submission deadline so that progress can be reported in the PIR. Any environmental and social risks and related management plans will be monitored regularly, and progress will be reported in the PIR.

The PIR submitted to the GEF will be shared with the PB. The UNDP Country Office will coordinate the input of the GEF Operational Focal Point and other stakeholders to the PIR as appropriate. The quality rating of the previous year's PIR will be used to inform the preparation of the subsequent PIR.

Lessons learned and knowledge generation: Results from the project will be disseminated within and beyond the project intervention area through existing information sharing networks and forums. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to the project. The project will identify, analyze and share lessons learned that might be beneficial to the design and implementation of similar projects and disseminate these lessons widely. There will be continuous information exchange between this project and other projects of similar focus in the same country, region and globally.

GEF Focal Area Core Indicators: The prescribed GEF Core Indicators will be used to monitor global environmental benefit results. The baseline/CEO Endorsement GEF Focal Area Core Indicators (s) – submitted in Annex D to this AREAN project document – will be updated by the Project Manager/Team and shared with the mid-term review consultants and terminal evaluation consultants before the required review/evaluation missions take place. The updated GEF Core Indicators (s) will be submitted to the GEF along with the completed Mid-term Review report and Terminal Evaluation report.

Independent Mid-term Review (MTR): An independent mid-term review process will begin after the second PIR has been submitted to the GEF, and the MTR report will be submitted to the GEF in the same year as the 3rd PIR. The MTR findings and responses outlined in the management response will be incorporated as recommendations for enhanced implementation during the final half of the project's duration. The terms of reference, the review process and the MTR report will follow the standard templates and guidance prepared by the UNDP IEO for GEF-financed projects available on the UNDP Evaluation Resource Center (ERC). As noted in this guidance, the evaluation will be

'independent, impartial and rigorous'. The consultants that will be hired to undertake the assignment will be independent from organizations that were involved in designing, executing or advising on the project to be evaluated. The GEF Operational Focal Point and other stakeholders will be involved and consulted during the terminal evaluation process. Additional quality assurance support is available from the UNDP-GEF Directorate. The final MTR report will be available in English and will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser and approved by the PB.

Terminal Evaluation (TE): An independent terminal evaluation (TE) will take place upon completion of all major project outputs and activities. The terminal evaluation process will begin three months before operational closure of the project allowing the evaluation mission to proceed while the project team is still in place, yet ensuring the project is close enough to completion for the evaluation team to reach conclusions on key aspects such as project sustainability. The Project Manager will remain on contract until the TE report and management response have been finalized. The terms of reference, the evaluation process and the final TE report will follow the standard templates and guidance prepared by the UNDP IEO for GEF-financed projects available on the UNDP Evaluation Resource Center. As noted in this guidance, the evaluation will be 'independent, impartial and rigorous'. The consultants that will be hired to undertake the assignment will be independent from organizations that were involved in designing, executing or advising on the project to be evaluated. The GEF Operational Focal Point and other stakeholders will be involved and consulted during the terminal evaluation process. Additional quality assurance support is available from the UNDP-GEF Directorate. The final TE report will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser and will be approved by the PB. The TE report will be publicly available in English on the UNDP ERC.

The UNDP Country Office will include the planned project terminal evaluation in the UNDP Country Office evaluation plan and will upload the final terminal evaluation report in English and the corresponding management response to the UNDP Evaluation Resource Centre (ERC). Once uploaded to the ERC, the UNDP IEO will undertake a quality assessment and validate the findings and ratings in the TE report and rate the quality of the TE report. The UNDP IEO assessment report will be sent to the GEF IEO along with the project terminal evaluation report.

Final Report: The project's terminal PIR along with the terminal evaluation (TE) report and corresponding management response will serve as the final project report package. The final project report package shall be discussed with the PB during an end-of-project review meeting to discuss lesson learned and opportunities for scaling up.

Mandatory GEF M&E Requirements and M&E Budget:

GEF M&E requirements	Primary responsibility	Indicative charged to the Project Budget[27] (US$)		Time frame
		GEF grant	Co-financing	
Inception Workshop	UNDP Country Office	10,000	5,000	Within two months of project document signature
Inception Report	Project Manager	None	10,000	Within two weeks of inception workshop
Standard UNDP monitoring	UNDP Country Office	None	None	Quarterly, annually

[27] Excluding project team staff time and UNDP staff time and travel expenses.

GEF M&E requirements	Primary responsibility	Indicative charged to the Project Budget[27] (US$)		Time frame
		GEF grant	Co-financing	
and reporting as outlined in the UNDP POPP				
Monitoring of indicators in project results framework	Project Manager	4,000 per year	None	Annually
GEF Project Implementation Report (PIR)	Project Manager, UNDP Country Office and UNDP-GEF team	None	2,000 per year	Annually
NIM Audit as per UNDP audit policies	UNDP Country Office	4,000 per year	None	Annually or other frequency as per UNDP Audit policies
Lessons learned and knowledge generation	Project Manager	None	4,000 per year	Annually
Monitoring of environmental and social risks, and corresponding management plans	Project Manager, UNDP Country Office	None	2,000 per year	On-going
ESMP monitoring & evaluation	UNDP Country Office	5,000	5,000	Annually
Addressing environmental and social grievances	Project Manager, UNDP Country Office, and BPPS as needed	None for time of project manager, and UNDP Country Office	3,000 per year	
Project Board (PB) meetings	PB, UNDP Country Office, and Project Manager	None	2,000 per year	At minimum annually
Supervision missions	UNDP Country Office	None		Annually
Oversight missions	UNDP-GEF team	None		Troubleshooting as needed
Knowledge management	Project Manager	None		On-going
GEF Secretariat learning missions/site visits	UNDP Country Office, Project Manager, and UNDP-GEF team	None		To be determined
Mid-term GEF Core Indicator Tracking	Project Manager	None	10,000	Before mid-term review mission takes place
Independent Mid-term Review (MTR) and management response	UNDP Country Office, Project Team, and UNDP-GEF team	30,000		Between 2nd and 3rd PIR
Terminal GEF Core Indicators	Project Manager	None	10,000	Before terminal evaluation mission takes place
Independent Terminal Evaluation (TE) included in UNDP evaluation plan, and management response	UNDP Country Office, Project Team, and UNDP-GEF team	30,000		At least three months before operational closure
Translation of MTR and TE reports into English	UNDP Country Office	None	None	
TOTAL indicative COST Excluding project team staff time, and UNDP staff and travel expenses		**107,000**	**92,000**	

VIII. GOVERNANCE AND MANAGEMENT ARRANGEMENTS

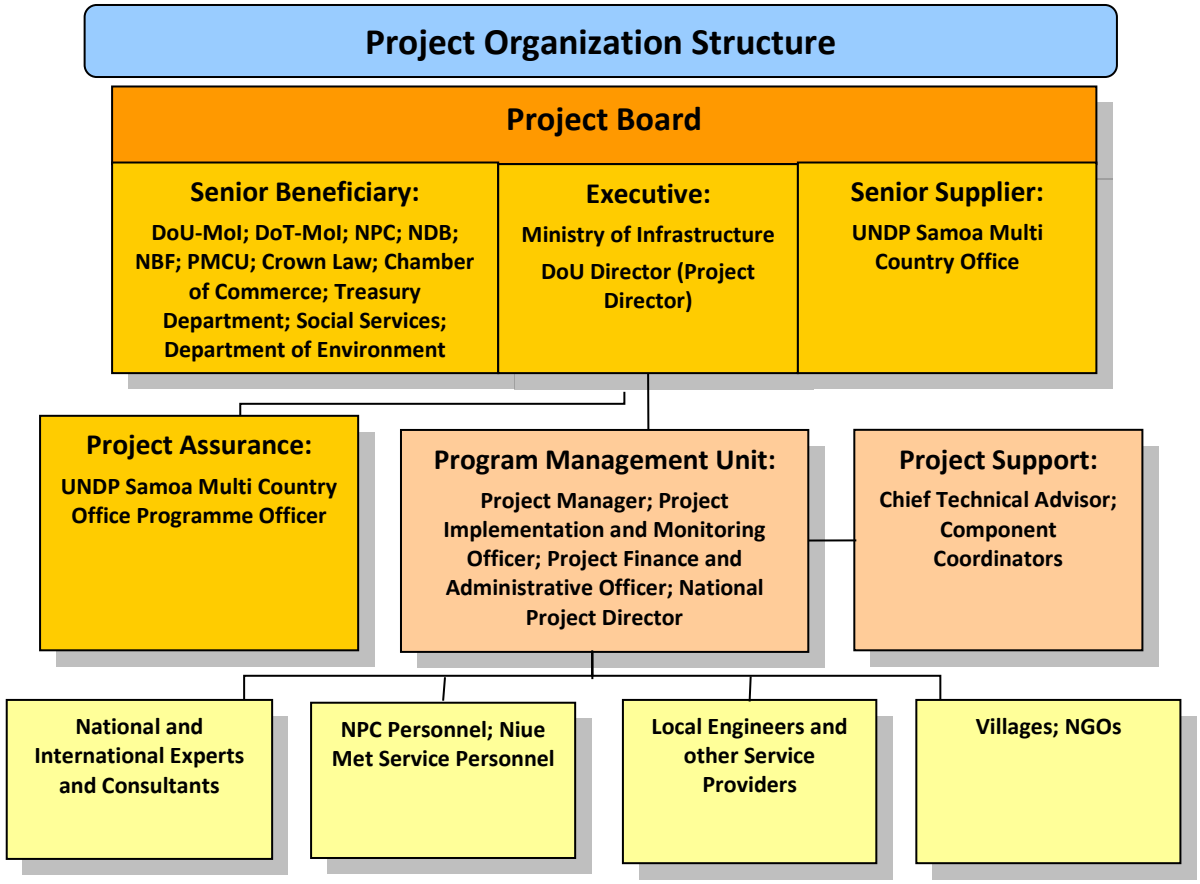
Roles and Responsibilities of the Project's Governance Mechanism

As practiced in all UNDP/GEF-supported projects, UNDP always endeavors to seek adaptive management approach in the implementation of projects. Based on the partnerships defined and firmed up during the project development, the management arrangements have always been anchored on co-operation and mutual sharing of benefits where accountability and responsibility for implementing the project and achieving the project outputs.

The project will be implemented following UNDP's national implementation modality, per the Standard Basis Assistance Agreement between UNDP and the Government of Niue, and the Country Programme.

The **Implementing Partner** for this project is the Niue Ministry of Infrastructure (Department of Utilities). The Implementing Partner is responsible and accountable for managing this project, including the monitoring and evaluation of project interventions, achieving project outcomes, and for the effective use of UNDP resources.

Figure 2. Project Organizational Chart



Project Board: The Project Board (also called Project Steering Committee) is responsible for making by consensus, management decisions when guidance is required by the Project Manager, including recommendations for UNDP/Implementing Partner approval of project plans and revisions, and addressing any project level grievances. In order to ensure UNDP's ultimate accountability, Project Board decisions should be made in accordance with standards that shall ensure management for development results, best value money, fairness, integrity, transparency and effective international competition. In case a consensus cannot be reached within the Board, final decision shall rest with the UNDP Programme Manager.

Specific responsibilities of the Project Board include:

- Provide overall guidance and direction to the project, ensuring it remains within any specified constraints;
- Address project issues as raised by the project manager;
- Provide guidance on new project risks, and agree on possible countermeasures and management actions to address specific risks;
- Agree on project manager's tolerances as required;
- Review the project progress, and provide direction and recommendations to ensure that the agreed deliverables are produced satisfactorily according to plans;
- Appraise the annual project implementation report, including the quality assessment rating report; make recommendations for the workplan;
- Provide ad hoc direction and advice for exceptional situations when the project manager's tolerances are exceeded; and
- Assess and decide to proceed on project changes through appropriate revisions.

The composition of the Project Board must include the following roles:

Executive: The Executive is an individual who represents ownership of the project who will chair the Project Board. This role can be held by a representative from the Government Cooperating Agency or UNDP. The Executive is: *Add who will represent the Executive for the project.*

The Executive is ultimately responsible for the project, supported by the Senior Beneficiary and Senior Supplier. The Executive's role is to ensure that the project is focused throughout its life cycle on achieving its objectives and delivering outputs that will contribute to higher level outcomes. The executive has to ensure that the project gives value for money, ensuring cost-conscious approach to the project, balancing the demands of beneficiary and suppler.

Specific Responsibilities: (as part of the above responsibilities for the Project Board)

- Ensure that there is a coherent project organization structure and logical set of plans;
- Set tolerances in the AWP and other plans as required for the Project Manager;
- Monitor and control the progress of the project at a strategic level;
- Ensure that risks are being tracked and mitigated as effectively as possible;
- Brief relevant stakeholders about project progress;
- Organize and chair Project Board meetings.

Senior Supplier: The Senior Supplier is an individual or group representing the interests of the parties concerned which provide funding and/or technical expertise to the project (designing, developing, facilitating, procuring, implementing). The Senior Supplier's primary function within the Board is to provide guidance regarding the technical feasibility of the project. The Senior Supplier role must

have the authority to commit or acquire supplier resources required. If necessary, more than one person may be required for this role. Typically, the implementing partner, UNDP and/or donor(s) would be represented under this role. The Senior Suppler is: *Add who will represent the Senior Supplier for the project.*

Specific Responsibilities (as part of the above responsibilities for the Project Board)

- Make sure that progress towards the outputs remains consistent from the supplier perspective;
- Promote and maintain focus on the expected project output(s) from the point of view of supplier management;
- Ensure that the supplier resources required for the project are made available;
- Contribute supplier opinions on Project Board decisions on whether to implement recommendations on proposed changes;
- Arbitrate on, and ensure resolution of, any supplier priority or resource conflicts.

Senior Beneficiary: The Senior Beneficiary is an individual or group of individuals representing the interests of those who will ultimately benefit from the project. The Senior Beneficiary's primary function within the Board is to ensure the realization of project results from the perspective of project beneficiaries. The Senior Beneficiary role is held by a representative of the government or civil society. The Senior Beneficiary is: *Add who will represent the Senior Beneficiary for the project.*

The Senior Beneficiary is responsible for validating the needs and for monitoring that the solution will meet those needs within the constraints of the project. The Senior Beneficiary role monitors progress against targets and quality criteria. This role may require more than one person to cover all the beneficiary interests. For the sake of effectiveness, the role should not be split between too many people.

Specific Responsibilities (as part of the above responsibilities for the Project Board)

- Prioritize and contribute beneficiaries' opinions on Project Board decisions on whether to implement recommendations on proposed changes;
- Specification of the Beneficiary's needs is accurate, complete and unambiguous;
- Implementation of activities at all stages is monitored to ensure that they will meet the beneficiary's needs and are progressing towards that target;
- Impact of potential changes is evaluated from the beneficiary point of view;
- Risks to the beneficiaries are frequently monitored.

Project Manager: The Project Manager has the authority to run the project on a day-to-day basis on behalf of the Project Board within the constraints laid down by the Board. The Project Manager is responsible for day-to-day management and decision-making for the project. The Project Manager's prime responsibility is to ensure that the project produces the results specified in the project document, to the required standard of quality and within the specified constraints of time and cost.

The Implementing Partner appoints the Project Manager, who should be different from the Implementing Partner's representative in the Project Board.

Specific responsibilities include:

- Provide direction and guidance to project team(s)/ responsible party (ies);
- Liaise with the Project Board to assure the overall direction and integrity of the project;
- Identify and obtain any support and advice required for the management, planning and control of the project;

- Responsible for project administration;
- Plan the activities of the project and monitor progress against the project results framework and the approved annual workplan;
- Mobilize personnel, goods and services, training and micro-capital grants to initiative activities, including drafting terms of reference and work specifications, and overseeing all contractors' work;
- Monitor events as determined in the project monitoring schedule plan/timetable, and update the plan as required;
- Manage requests for the provision of financial resources by UNDP, through advance of funds, direct payments or reimbursement using the fund authorization and certificate of expenditures;
- Monitor financial resources and accounting to ensure the accuracy and reliability of financial reports;
- Be responsible for preparing and submitting financial reports to UNDP on a quarterly basis;
- Manage and monitor the project risks initially identified and submit new risks to the project board for consideration and decision on possible actions if required; update the status of these risks by maintaining the project risks log;
- Capture lessons learned during project implementation;
- Prepare the annual workplan for the following year; and update the Atlas Project Management module if external access is made available.
- Prepare the GEF PIR and submit the final report to the Project Board;
- Based on the GEF PIR and the Project Board review, prepare the AWP for the following year.
- Ensure the mid-term review process is undertaken as per the UNDP guidance, and submit the final MTR report to the Project Board.
- Identify follow-on actions and submit them for consideration to the Project Board;
- Ensure the terminal evaluation process is undertaken as per the UNDP guidance, and submit the final TE report to the Project Board;

Project Assurance: UNDP provides a three – tier supervision, oversight and quality assurance role – funded by the GEF agency fee – involving UNDP staff in Country Offices and at regional and headquarters levels. Project Assurance must be totally independent of the Project Management function. The quality assurance role supports the Project Board and Project Management Unit by carrying out objective and independent project oversight and monitoring functions. This role ensures appropriate project management milestones are managed and completed. The Project Board cannot delegate any of its quality assurance responsibilities to the Project Manager. This project oversight and quality assurance role is covered by the GEF Agency.

Governance Role for Project Target Groups:

Because of the small population of Niue, combined with the wide range of areas that will be covered by the projects and demos implemented under AREAN, the entire population of Niue is the target group of this project. The population will be engaged directly and through their village councils and leaders in several of the activities that will be conducted during the project implementation phase. First and foremost, the involvement of the village inhabitants and their local representatives will be instrumental in selecting the optimal, desirable locations for the installation of some of the LC technology demos, especially for the PV powered LED streetlights and the solar water pumps. Additionally, he Niue population, being the recipient of the awareness raising programs and initiatives on RE/EE measures, will provide valuable feedback in the form of surveys that will be conducted at the beginning (to design *ad-hoc*, needed actions), mid-term (to made proper additions and corrections to the awareness initiatives), and end (to determine the rate of success of all initiatives).

IX. FINANCIAL PLANNING AND MANAGEMENT

The total cost of the project is USD 19,721,563. This is financed through a GEF grant of USD 3,321,563, and USD 16,400,000 in co-financing from project partners. UNDP, as the GEF Implementing Agency, is responsible for the execution of the GEF resources and the cash co-financing transferred to UNDP bank account only.

Parallel co-financing: The actual realization of project co-financing will be monitored during the mid-term review and terminal evaluation process and will be reported to the GEF. The planned parallel co-financing will be used as follows:

Co-financing source	Co-financing type	Co-financing amount (USD)	Planned Activities/Outputs	Risks	Risk Mitigation Measures
GoN	Cash	3,500,000	***Fale Fono:*** Planned design, engineering and construction of the new Parliament Building	Project may not proceed or get delayed because of lack of budget, land acquisition problems or change in priorities	Facilitate through government procurement system and government acquisition procedures as national priority
	Cash	40,000	***Low Carbon Fund:*** Existing financial scheme to financially support the purchase of energy efficient appliances (washing machines and fridges) by households	The scheme will not be completed because energy and cost savings are not clearly quantified to the general public	Informative campaign to show the energy and cost advantages of RE/EE technologies is readily organized as part of AREAN
	Cash	245,000	***Water Strategic and Implementation Plan:*** Implementation of specific water system improvement projects as part of the initiatives to achieve the water sector targets in the NiSERM	This is part of a USD 700,000 project. Project may not proceed or get delayed because of lack of budget or change in priorities	Facilitate through government procurement system as national priority
	Cash	140,000	***GoN purchase of EVs***	Project may not proceed or get delayed because of lack of budget or change in priorities	Facilitate through government procurement system as national priority
	Cash	105,000	***Assets Maintenance:*** annual budget destined to NPC for the maintenance of the	Government diverts funds to other uses	Facilitate through government procurement

			power generation equipment and the electric grid		system as national priority
	Cash	490,000	***Niue National Strategic Plan (NNSP) Implementation:*** Annual strategic development planning for the implementation of specific policy research studies and capacity development	Project may not proceed or get delayed because of lack of budget or change in priorities	Facilitate through government procurement system as national priority
	In-Kind	560,000	***Energy Compliance:*** Ministry of Infrastructure, Regulatory Unit and Water Supply annual recurrent budget-Staff and Office space for use during the AREAN Project implementation period	Change of priorities in direction and assignment of personnel	Include in regular official programming and budgeting and provide for transitions in case of personnel movements
	In-Kind	1,050,000	***Energy Finances:*** Treasury and Project management unit annual support towards project administrations, financing and M&E duration of the project and project evaluations process	Change of priorities in direction and assignment of personnel	Include in regular official programming and budgeting and provide for transitions in case of personnel movements
	In-Kind	1,400,000	***Energy Facility Asset Maintenance:*** NPC annual support towards technical support, staff and data management of the production information's and RE	Change of priorities in direction and assignment of personnel	Include in regular official programming and budgeting and provide for transitions in case of personnel movements
New Zealand Government	Cash	3,500,000	***NZ Project Phase 1:*** These are the final activities of a USD 3.5M project, there are still to be installed a few step-up transformers and connect the solar PV array and battery storage to the grid	The project implementation is in its final stage and there are no risks to prevent its completion	N/A
	Cash	3,500,000	***NZ Project Phase 2:*** Installation of additional solar PV systems inclusive of solar PV arrays, battery storage units, and grid integration	Project may get delayed if the installation of the solar PV panels form the project above causes	Activities designed under AREAN for grid stability will be prioritized to allow for additional PV

			components.	additional instability issues	installations
AusAid/NZAid	Cash	740,000	***Waste Recycling Centre:*** establishment and operation of a waste recycling system	Change of priorities or delays in disbursing the funds of either or both donors	Support the GoN in liaising with AusAid and NZAid to secure the budget
EU	Cash	190,000	***EDF-11:*** Replacement/upgrading work on the national grid transmission network including capacity development activities	The project implementation is in an advanced implementation stage and there are no risks to prevent its completion	N/A
	Cash	196,000	***GIZ-Alofi:*** Implementation of improvements in the water sector of Niue. Includes capacity building and research to improved water supply and quality.	The project implementation is in an advanced implementation stage and there are no risks to prevent its completion	N/A
Niue Chamber of Commerce	Cash	1,400,000	Planned financial scheme to support waste-to-energy projects	Change of priorities or change of management in the Niue Chamber of Commerce	Support the GoN in liaising with the Chamber of Commerce to secure the budget and initiate the scheme
UNDP	Cash	100,000	Project management and M&E	None	N/A
TOTAL		US$ 17,166,000			

UNDP Direct Project Services as Requested by Government: The UNDP, as GEF Agency for this project, will provide project management cycle services for the project as defined by the GEF Council. In addition, the Government of Indonesia may request UNDP direct services for specific projects, according to its policies and convenience. The UNDP and Government of Indonesia acknowledge and agree that those services are not mandatory, and will be provided only upon Government request. If requested, the services would follow the UNDP policies on the recovery of direct costs. These services (and their costs) are specified in the Letter of Agreement (Annex J). As is determined by the GEF Council requirements, these service costs will be assigned as Project Management Cost, duly identified in the project budget as Direct Project Costs. Eligible Direct Project Costs should not be charged as a flat percentage. They should be calculated on the basis of estimated actual or transaction-based costs and should be charged to the direct project costs account codes: “64397- Services to projects – CO staff” and “74596 – Services to projects – GOE for CO”.

Budget Revision and Tolerance: As per UNDP requirements outlined in the UNDP POPP, the PB will agree on a budget tolerance level for each plan under the overall annual work plan allowing the project manager to expend up to the tolerance level beyond the approved project budget amount for the year without requiring a revision from the PB. Should the following deviations occur, the Project Manager and UNDP Country Office will seek the approval of the UNDP-GEF team as these are considered major amendments by the GEF: a) Budget re-allocations among components in the project with amounts involving 10% of the total project grant or more; b) Introduction of new budget items/or components that exceed 5% of original GEF allocation.

Any over expenditure incurred beyond the available GEF grant amount will be absorbed by non-GEF resources (e.g. UNDP TRAC or cash co-financing).

Refund to Donor: Should a refund of unspent funds to the GEF be necessary, this will be managed directly by the UNDP-GEF Unit in New York.

Project Closure: Project closure will be conducted as per UNDP requirements outlined in the UNDP POPP.[28] On an exceptional basis only, a no-cost extension beyond the initial duration of the project will be sought from in-country UNDP colleagues and then the UNDP-GEF Executive Coordinator.

Operational completion: The project will be operationally completed when the last UNDP-financed inputs have been provided and the related activities have been completed. This includes the final clearance of the Terminal Evaluation Report (that will be available in English) and the corresponding management response, and the end-of-project review Project Board meeting. The Implementing Partner through a Project Board decision will notify the UNDP Country Office when operational closure has been completed. By this time, the relevant parties will have already agreed and confirmed in writing on the arrangements for the disposal of any equipment that is still the property of UNDP.

Transfer or disposal of assets: In consultation with the NIM Implementing Partner and other parties of the project, UNDP programme manager (UNDP Resident Representative) is responsible for deciding on the transfer or other disposal of assets. Transfer or disposal of assets is recommended to be reviewed and endorsed by the project board following UNDP rules and regulations. Assets may be transferred to the government for project activities managed by a national institution at any time during the life of a project. In all cases of transfer, a transfer document must be prepared and kept on file[29].

Financial completion: The project will be financially closed when the following conditions have been met: a) The project is operationally completed or has been cancelled; b) The Implementing Partner has reported all financial transactions to UNDP; c) UNDP has closed the accounts for the project; d) UNDP and the Implementing Partner have certified a final Combined Delivery Report (which serves as final budget revision).

The project will be financially completed within 12 months of operational closure or after the date of cancellation. Between operational and financial closure, the implementing partner will identify and settle all financial obligations and prepare a final expenditure report. The UNDP Country Office will send the final signed closure documents including confirmation of final cumulative expenditure and

[28] see https://info.undp.org/global/popp/ppm/Pages/Closing-a-Project.aspx

[29] See https://popp.undp.org/_layouts/15/WopiFrame.aspx?sourcedoc=/UNDP_POPP_DOCUMENT_LIBRARY/Public/PPM_Project%20Management_Closing.docx&action=default.

unspent balance to the UNDP-GEF Unit for confirmation before the project will be financially closed in Atlas by the UNDP Country Office.

X. TOTAL BUDGET AND WORK PLAN

Total Budget and Work Plan			
Atlas Proposal or Award ID:	00117508	Atlas Primary Output Project ID:	00114277
Atlas Proposal or Award Title:	Accelerating Renewable Energy and Energy Efficiency Applications in Niue (AREAN)		
Atlas Business Unit	WSM10		
Atlas Primary Output Project Title	Accelerating Renewable Energy and Energy Efficiency Applications in Niue (AREAN)		
UNDP-GEF PIMS No.	PIMS 6037		
Implementing Partner	In Niue: Department of Utilities, Ministry of Infrastructure (DoU-MoI)		

GEF Component / Atlas Activity	Responsible Agency	Source of Fund	Budget Code	Description	Annual Expenses				Total	Budget Notes
					Year 1	Year 2	Year 3	Year 4		
Component 1: Improvements in Energy Integrated Development Policy and Planning										
Outcome 1: Improved policy and regulatory frameworks in the application of energy efficiency and renewable energy technologies in the energy end-use sectors	**(DoU-MoI)**	**GEF**	71200	International Consultants	63,000	26,600	8,400	8,400	106,400	1
			71300	Local Consultants	20,400	17,400	2,400	2,400	42,600	2
			71600	Travel	8,000	4,000	4,000	0	16,000	3
			75700	Training, Workshops and Conference	0	0	6,000	12,000	18,000	4
			74500	Miscellaneous Expenses	500	500	500	500	2000	5
Component 1 Total					**91,900**	**48,500**	**21,300**	**23,300**	**185,000**	
Component 2: Institutional Capacity Building on Low Carbon Development										
Outcome 2: Effective enforcement of plans, policies and regulations, and implementation of programs/projects on the application of climate resilient and low	**(DoU-MoI)**	**GEF**	71200	International Consultants	25,200	29,400	7,000	5,600	67,200	6
			71300	Local Consultants	9,000	11,400	2,400	2,400	25,200	7
			71600	Travel	5,600	4,000	4,000	0	13,600	8
			75700	Training Workshops and Conference	5000	10,000	5,000	0	24,000	9
			74200	Audio Visual and Printing Production Costs	500	1,000	500	0	2,000	10

carbon technologies in the end-use sectors			74500	Miscellaneous Expenses	500	500	500	500	2,000	11
Component 2 Total					**45,800**	**56,300**	**19,400**	**8,500**	**130,000**	
Component 3: Improvements in the Financing of Low Carbon Initiatives										
Outcome 3: Increased availability of, and access to, financing for sustainable energy, energy access and low carbon development initiatives in the energy supply and demand sectors	**(DoU-MoI)**	**GEF**	71200	International Consultant	11,200	23,800	12,600	7,000	54,600	12
			71300	Local Consultants	4,200	8,400	2,400	0	15,000	13
			71600	Travel	3,000	2,500	2,500	0	8,000	14
			75700	Training Workshops and Conference	0	10,000	10,000	10,000	30,000	15
			74200	Audio Visual and Printing Production cost	1000	1,200	1,200	1,000	4,400	16
			72500	Supplies	600	600	600	593	2,393	17
Component 3 Total					**18,400**	**43,400**	**30,600**	**21,993**	**114,393**	
Component 4: Climate Resilient and Low Carbon Technologies Application										
Outcome 4.1: Climate resilient and low carbon techniques and practices adopted and implemented in the energy supply and energy end-use sectors	**(DoU-MoI)**	**GEF**	72100	Contractual Services-Companies	38,700	126,000	144,000	69,300	378,000	18
			71300	Local Consultants	0	0	6,000	13,500	19,500	19
			71600	Travel	4,000	8,000	8,000	4,000	24,000	20
			75700	Training Workshops and Conference	4,000	20,000	18,000	12,000	54,000	21
			72800	Information Technology Equipment	10,000	30,000	10,000	10,000	60,000	22
			74500	Miscellaneous	500	1,000	500	500	2,500	23
Outcome 4.1 Total					***57,200***	***185,000***	***186,500***	***109,300***	***538,000***	
			72100	Contractual Services-Companies	10,800	21,600	12,600	0	45,000	24
			71200	International Consultant	25,200	69,300	109,900	79,100	283,500	25
			71600	Travel	4,000	8,000	12,000	8,000	32,000	26
			75700	Training Workshops and Conference	0	12,000	12,000	0	24,000	27

			72300	Materials and Goods	100,000	550,000	405,000	435,500	1,490,500	28
			74200	Audio Visual and Printing Production cost	2,500	3,000	3,000	2,500	11,000	29
			72500	Supplies	2,000	3,000	3,000	3,000	10,000	30
Outcome 4.2 Total					***144,500***	***666,900***	***557,500***	***527,100***	***1,896,000***	
Component 4 Total					**201,700**	**851,900**	**744,000**	**636,400**	**2,434,000**	
Component 5: Enhancement of Awareness on Low Carbon Development										
Outcome 5: Enhanced levels of awareness and attitude towards climate resilient and low carbon development in the energy supply and energy end use sectors	**(DoU-MoI)**	**GEF**	71200	International Consultant	7,000	42,000	49,000	21,000	119,000	31
			71300	Local Consultants	0	0	3,000	3,000	6,000	32
			71600	Travel	0	2,000	3,000	3,000	8,000	33
			75700	Training Workshops and Conferences	0	12,000	28,000	12,000	52,000	34
			72100	Surveys	15,000	0	15,000	15,000	45,000	35
			73300	Rental and Maintenance of Information Technology Equipment	0	0	20,000	10,000	30,000	36
			74200	Audio Visual and Printing Production Costs	0	5,000	20,000	15,000	40,000	37
Component 5 Total					**22,000**	**61,000**	**138,000**	**79,000**	**300,000**	
ALL Components Total					**379,800**	**1,061,100**	**953,300**	**769,193**	**3,163,393**	
Project Management										
			71400	Contractual Services-Individuals	8,000	8,000	8,000	10,000	34,000	38
			74100	Professional Services	0	30,000	10,000	30,000	70,000	39
			71600	Travel	4,000	4,000	4,000	4,000	16,000	40
			72200	Equipment and Furniture	5,000	5,000	5,000	5,000	20,000	41
			72500	Supplies	2,000	2,000	2,000	2,000	8,000	42
			72400	Communications and Audio Visual Equipment	3,000	2,000	3,000	2,170	10,170	43

Project Management Total	**22,000**	**51,000**	**32,000**	**53,170**	**158,170**	
Overall GEF Budget	**405,200**	**1,120,600**	**989,300**	**806,463**	**3,321,563**	

Summary of Funds[30]

Fund Source	**Amount US$**				**Total**
	Year 1	**Year 2**	**Year 3**	**Year 4**	
Global Environment Facility	379,800	1,061,100	953,300	769,193	3,163,393
United Nations Development Programme	22,000	51,000	32,000	53,170	158,170
TOTAL	**401,800**	**1,112,100**	**985,300**	**822,363**	**3,321,563**

Budget Notes:

No.	**Explanation**
1	International consultants: at US$ 106,400 for 152 working days at US$ 700 per working day (multiple activities could be conducted by one consultant), including: • 20 working days for Activity 1.1.1: review of existing policy and regulatory framework in energy supply and end-use sectors, and preparation of a report; • 10 working days for Activity 1.1.2: analysis of all key GoN stakeholders to define their roles for the advancement of RE/EE technologies; • 12 working days for Activity 1.2.1: TA to the GoN to analyze the implication of the new Electricity Act and, if needed, to amend the Act; • 12 working days for Activity 1.2.2: formulate and approve rules for independent power producers that want to connect to the grid; • 30 working days for Activity 1.2.3: establish and implement energy industry codes to define roles of participants and standard of operations; • 12 working days for Activity 1.2.4: draft and implement a waste management plan for RE projects; • 10 working days for Activity 1.2.5: develop an integrated plan for energy generation/consumption, environmental protection and required infrastructures; • 12 working days for Activity 1.2.6: establish and implement appropriate energy prices and service quality regulations; • 12 working days for Activity 1.3.1: evaluation of policies, IRRs and LC standards and drafting of evaluation reports; • 10 working days for Activity 1.3.2: develop and implement follow-up action plans based on the evaluation reports drafted in Activity 1.3.1; • 12 working days for Activity 1.3.3: design a program to train GoN personnel to carry out energy planning and management of technology applications.

[30] Summary table should include all financing of all kinds: GEF financing, co-financing, cash, in-kind, etc.

2	National Consultants: US$ 42,600 for 142 working days at US$ 300 per working day (multiple activities could be conducted by one consultant), including: • 22 working days for Activity 1.1.1: review of existing policy and regulatory framework in energy supply and end-use sectors, and preparation of a report; • 10 working days for Activity 1.1.2: analysis of all key GoN stakeholders to define their roles for the advancement of RE/EE technologies; • 12 working days for Activity 1.2.2: formulate and approve rules for independent power producers that want to connect to the grid; • 30 working days for Activity 1.2.3: establish and implement energy industry codes to define roles of participants and standard of operations; • 12 working days for Activity 1.2.4: draft and implement a waste management plan for RE projects; • 10 working days for Activity 1.2.5: develop an integrated plan for energy generation/consumption, environmental protection and required infrastructures; • 12 working days for Activity 1.2.6: establish and implement appropriate energy prices and service quality regulations; • 12 working days for Activity 1.3.1: evaluation of policies, IRRs and LC standards and drafting of evaluation reports; • 10 working days for Activity 1.3.2: develop and implement follow-up action plans based on the evaluation reports drafted in Activity 1.3.1; • 12 working days for Activity 1.3.3: design and conduct a training program to teach how to carry out energy planning and technology application management.
3	US$ 16,000 for car rental and petrol fee, as well as additional and unbudgeted travel expenses, for consultants and project partners.
4	US$ 18,000 for the organization of the training program for Activity 1.3.3.
5	US$ 2,000 for miscellaneous expenses to support the other aspects of the component outputs and as contingency to related inputs to the activities and target outputs.
6	International Consultants: US$ 67,200 for 96 working days at US$ 700 per working day (multiple activities could be conducted by one consultant), including: • 14 working days for Activity 2.1.1: assess current institutional arrangements for the implementation of energy plans and prepare an evaluation report; • 12 working days for Activity 2.1.2: establish an operational Government entity that is capable of effectively implementing LCD policies and regulations; • 10 working days for Activity 2.1.3: formulate and mandate laws to regulate the implementation of LC policies; • 12 working days for Activity 2.2.1: design a training program to teach how to integrate institutional mechanisms with other objectives of Niue; • 10 working days for Activity 2.2.2: draft and implement guidelines on how to integrate LC developments with energy and other relevant objectives of Niue; • 10 working days for Activity 2.2.3: establish appropriate governance mechanisms and performance requirements for SOEs; • 12 working days for Activity 2.3.1: evaluate the adopted institutional framework and produce evaluation reports; • 6 working days for Activity 2.3.2: develop and implement follow-up action plans based on the evaluation reports drafted in Activity 2.3.1; • 10 working days for Activity 2.3.1: prepare and enforce maintenance strategy in RE/EE project designs.
7	National Consultants: US$ 25,200 for 84 working days at US$ 300 per working day (multiple activities could be conducted by one consultant), including: • 14 working days for Activity 2.1.1: assess current institutional arrangements for the implementation of energy plans and prepare an evaluation report; • 12 working days for Activity 2.1.2: establish an operational Government entity that is capable of effectively implementing LCD policies and regulations; • 10 working days for Activity 2.1.3: formulate and mandate laws to regulate the implementation of LC policies; • 12 working days for Activity 2.2.1: design a training program to teach how to integrate institutional mechanisms with other objectives of Niue; • 10 working days for Activity 2.2.2: draft and implement guidelines on how to integrate LC developments with energy and other relevant objectives of Niue; • 10 working days for Activity 2.2.3: establish appropriate governance mechanisms and performance requirements for SOEs; • 6 working days for Activity 2.3.2: develop and implement follow-up action plans based on the evaluation reports drafted in Activity 2.3.1; • 10 working days for Activity 2.3.1: prepare and enforce maintenance strategy in RE/EE project designs.
8	US$ 13,600 for car rental and petrol fee, as well as additional and unbudgeted travel expenses, for consultants and project partners.

9	US$ 24,000 for the organization of the training program for Activity 2.2.1.
10	US$ 2,000 for acquisition of camera, audio visual equipment and printing, production costs for documenting and promoting the activities and outputs of the project.
11	US$ 2,000 for miscellaneous expenses to support the other aspects of the component outputs and as contingency to related inputs to the activities and target outputs.
12	International Consultants: US$ 54,600 for 78 working days at US$ 700 per working day (multiple activities could be conducted by one consultant), including: • 14 working days for Activity 3.1.1: design and implement financing instruments for the adoption of RE/EE technologies; • 12 working days for Activity 3.2.1: assess the financing instruments designed in Activity 3.1.1 and produce evaluation reports; • 12 working days for Activity 3.3.1: design training programs in RE/EE financing to develop bankable project proposals; • 12 working days for Activity 3.3.2: formulate and approve financing policies to support the development of LC technologies; • 12 working days for Activity 3.4.1: design training programs to improve technical skills of RE/EE service providers; • 6 working days for Activity 3.4.2: prepare informative materials on RE/EE technologies to increase public awareness; • 10 working days for Activity 3.4.3: establish financial and fiscal incentives to encourage RE/EE technologies.
13	National Consultants: USD$ 15,000 for 50 working days at US$ 300 per working day (multiple activities could be conducted by one consultant), including: • 14 working days for Activity 3.1.1: design and implement financing instruments for the adoption of RE/EE technologies; • 12 working days for Activity 3.2.1: assess the financing instruments designed in Activity 3.1.1 and produce evaluation reports; • 12 working days for Activity 3.3.2: formulate and approve financing policies to support the development of LC technologies; • 12 working days for Activity 3.4.3: establish financial and fiscal incentives to encourage RE/EE technologies.
14	US$ 8,000 for car rental and petrol fee, as well as additional and unbudgeted travel expenses, for consultants and project partners.
15	US$ 30,000 for the organization of two (2) training programs, one (1) for Activity 3.3.1 (US$ 15,000) and one (1) for Activity 3.4.1 (US$ 15,000).
16	US$ 4,400 for acquisition of camera, audio visual equipment and printing, production costs for documenting and promoting the activities and outputs of the project.
17	US$ 2,393 for ancillary supplies and miscellaneous provisions.
18	Consulting firm: US$ 378,000 for 420 working days at US$ 900 per working day (multiple activities could be conducted by one consulting firm), including: • 24 working days for Activity 4.1.1.1: assess applicable LC technologies to support the achievement of the NiSERM targets and prepare an evaluation report; • 20 working days for Activity 4.1.1.2: evaluate the optimal solar PV power generation inputs into the existing power grid system; • 28 working days for Activity 4.1.2.1: review background reports and develop an updated grid stability improvement scheme; • 24 working days for Activity 4.1.2.2: design corrective measures to increase power grid stability and electricity supply reliability; • 24 working days for Activity 4.1.2.3: automate the control system and data acquisition of both existing and new solar PV installations; • 24 working days for Activity 4.1.2.5: design and conduct trials to evaluate the RE-generation forecasting tool and, if needed, implement corrective measures; • 28 working days for Activity 4.1.2.6: implement combined load dispatch control capabilities with energy storage functionalities to optimize fuel consumption; • 20 working days for Activity 4.1.2.7: design performance resting procedures to monitor the efficacy of the power generation units and distribution systems; • 50 working days for Activity 4.1.2.8: establish codes and regulation for safe power generation control and load dispatch; • 40 working days for Activity 4.1.2.9: design a capacity building program electricity generation, transmission and distribution O&M; • 18 working days for Activity 4.1.3.1: design a training program for local expert on RET, focusing on those that will be demonstrated and implemented in Niue;

	• 20 working days for Activity 4.1.3.2: design replication and/or scale-up RE/EE projects and prepare implementation plans; • 40 working days for Activity 4.1.4.1: assess efficiency of RE/EE projects implemented under AREAN and prepare interim (18 working days) and final evaluation reports (22 working days); • 20 working days for Activity 4.1.4.2: assess safe disposal of RE/EE waste and ascertain what types of waste can be reused or recycled and prepare a report; • 20 working days for Activity 4.1.4.3: conduct a thorough assessment of municipal waste use for energy generation, including safe disposal of residual waste; • 20 working days for Activity 4.1.4.4: prepare a follow-up action plan based on the evaluation report prepared in Activity 4.1.4.1.
19	National Consultants: USD$ 19,500 for 65 working days at US$ 300 per working day, including: • 25 working days for Activity 4.1.3.2: design replication and/or scale-up RE/EE projects and prepare implementation plans; • 40 working days for Activity 4.1.4.1: assess efficiency of RE/EE projects implemented under AREAN and prepare interim (18 working days) and final evaluation reports (22 working days).
20	US$ 24,000 for car rental and petrol fee, as well as additional and unbudgeted travel expenses, for consultants and project partners.
21	US$ 54,000 for the organization of three (3) training programs, one (1) for Activity 4.1.2.7 (US$ 18,000), one (1) for Activity 4.1.2.9 (US$ 18,000), and one (1) for Activity 4.1.3.1 (US$ 18,000).
22	US$ 60,000 for Equipment, Integration and Technical Support, including: For Activity 4.1.2.4: US$ 20,000 for the RE generation forecasting tool; US$ 10,000 for the integration into the SCADA system; and US$ 10,000/year for three (3) years forecasting data and support (yearly subscription for forecasting data services by external database suppliers).
23	US$ 2,500 for miscellaneous expenses to support the other aspects of the component outputs and as contingency to related inputs to the activities and target outputs.
24	Consulting firm: US$ 45,000 for 50 working days at US$ 900 per working day , including: • 25 working days for Activity 4.2.2.2: conduct an assessment of the transformers/switchgears investment project; • 25 working days for Activity 4.2.2.2: prepare engineering design and implementation plans for the transformers/switchgears investment project.
25	International consultants: at US$ 283,500 for 405 working days at US$ 700 per working day (multiple activities could be conducted by one consultant), including: • 25 working days for Activity 4.2.1.1: conduct an assessment of the LED streetlights and solar water pumps demo projects; • 25 working days for Activity 4.2.1.1: conduct an assessment of the financing scheme demo project; • 25 working days for Activity 4.2.1.1: conduct an assessment of the EE building demo project; • 25 working days for Activity 4.2.1.2: prepare engineering design and implementation plans for the LED streetlights and solar water pumps demo projects; • 25 working days for Activity 4.2.1.2: prepare engineering design and implementation plans for the financing scheme demo project; • 25 working days for Activity 4.2.1.2: prepare engineering design and implementation plans for the EE building demo project; • 20 working days for Activity 4.2.2.3: prepare a project profile, or case study, of the transformers/switchgears investment project; • 20 working days for Activity 4.2.2.3: prepare a project profile, or case study, of the LED streetlights and solar water pumps demo projects; • 20 working days for Activity 4.2.2.3: prepare a project profile, or case study, of the financing scheme demo project; • 20 working days for Activity 4.2.2.3: prepare a project profile, or case study, of the EE building demo project; • 20 working days for Activity 4.2.2.4: analyze the energy and economic feasibility performances of the transformers/switchgears investment project; • 20 working days for Activity 4.2.2.4: analyze the energy and economic feasibility performances of the LED streetlights and solar water pumps demo projects; • 20 working days for Activity 4.2.2.4: analyze the energy and economic feasibility performances of the financing scheme demo project;

	• 20 working days for Activity 4.2.2.4: analyze the energy and economic feasibility performances of the EE building demo project; • 75 working days for Activity 4.2.3.1: (3 consulting jobs: one for 20 days for the assessment, one for 40 days for the design of the EMRS; and one for 15 days for the evaluation of the EMRS); • 20 working days for Activity 4.2.3.3: design and evaluation of EMRS pilots.
26	US$ 32,000 for car rental and petrol fee, as well as additional and unbudgeted travel expenses, for consultants and project partners.
27	US$ 24,000 for the organization of the training program for Activity 4.2.3.2
28	US$ 1,490,500 for Equipment, Installations, and Support Systems including: For Activity 4.2.2.1: US$ 150,000 for the LED Streetlights; US$ 150,000 for the Solar Water Pumps; US$ 350,000 for the EE Financing Scheme; US$ 200,000 for the EE Building; and US$ 20,000 for the M&E System. For Activity 4.2.2.2: US$ 600,000 for Transformers and Switchgears. For Activity 4.2.2.4: US$ 5,500 for the Technical Guidance Material For Activity 4.2.3.3: US$ 15,000 equipment for the Measuring Devices for the piloting of the EMRS
29	US$ 11,000 for acquisition of camera, audio visual equipment and printing, production costs for documenting and promoting the activities and outputs of the project.
30	US$ 10,000 for ancillary supplies and miscellaneous provisions.
31	International consultants: at US$ 119,000 for 170 working days at US$ 700 per working day (multiple activities could be conducted by one consultant), including: • 15 working days for Activity 5.1.1: design an energy auditing system for energy utilization in government and commercial buildings, and large public users; • 15 working days for Activity 5.1.1: evaluate the energy auditing system a year after and make appropriate modifications; • 20 working days for Activity 5.1.2: design and train relevant GoN personnel and stakeholders in conducting energy audits; • 15 working days for Activity 5.2.1: establish an energy database to store all energy related information and establish a communication plan; • 15 working days for Activity 5.2.1: evaluate the operation of the database a year after and make appropriate modifications; • 20 working days for Activity 5.2.3: design a training program on the operation and maintenance of the energy database; • 15 working days for Activity 5.3.1: establish an energy information sharing platform where RE/EE data will be stored, processed and made public; • 15 working days for Activity 5.3.1: evaluate the operation of the energy information sharing platform a year after and make appropriate modifications; • 20 working days for Activity 5.3.2: design, implement and evaluate awareness raising programs on RE/EE projects; • 20 working days for Activity 5.3.3: design a training program on how to educate the general public about the advantages of LC technologies.
32	National Consultants: USD$ 6,000 for 20 working days at US$ 300 per working day, including: • 22 working days for Activity 5.3.2: design, implement and evaluate awareness raising programs on RE/EE projects.
33	US$ 8,000 for car rental and petrol fee, as well as additional and unbudgeted travel expenses, for consultants and project partners.
34	US$ 52,000 for the organization of four (4) training programs, two (2) for Activity 5.1.2, one (1) for Activity 5.2.3 and one (1) for Activity 5.3.3 (last Training is US$ 16,000, all others are 12,000)
35	US$ 45,000 for the organization of three (3) surveys for Activity 5.3.2 (US$ 15,000 each).
36	US$ 30,000 for two (2) software systems and for management and maintenance of the Database and the Information Platform, for Activity 5.2.1 and Activity 5.3.1 (US$ 15,000 each);
37	US$ 40,000 for two (2) information desks (US$ 15,000 each) and two (2) Awareness Rising initiatives (potentially one at the EE Building and one at school) for

	Activity 5.3.2 (US$ 5,000 each).
38	
39	
40	US$ 16,000 for car rental and petrol fee, as well as additional and unbudgeted travel expenses, for consultants and project partners.
41	US$ 20,000 for equipment and furniture.
42	US$ 8,000 for ancillary supplies and miscellaneous provisions.
43	US$ 10,170 for acquisition of camera, audio visual equipment and printing, production costs for documenting and promoting the activities and outputs of the project.

XI. LEGAL CONTEXT

This project document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement between the Government of (country) and UNDP, signed on (date). All references in the SBAA to "Executing Agency" shall be deemed to refer to "Implementing Partner."

This project will be implemented by [name of entity] ("Implementing Partner") in accordance with its financial regulations, rules, practices and procedures only to the extent that they do not contravene the principles of the Financial Regulations and Rules of UNDP. Where the financial governance of an Implementing Partner does not provide the required guidance to ensure best value for money, fairness, integrity, transparency, and effective international competition, the financial governance of UNDP shall apply.

Any designations on maps or other references employed in this project document do not imply the expression of any opinion whatsoever on the part of UNDP concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

XII. RISK MANAGEMENT

Consistent with the Article III of the SBAA *[or the Supplemental Provisions to the Project Document]*, the responsibility for the safety and security of the Implementing Partner and its personnel and property, and of UNDP's property in the Implementing Partner's custody, rests with the Implementing Partner. To this end, the Implementing Partner shall:

a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
b) assume all risks and liabilities related to the Implementing Partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of the Implementing Partner's obligations under this Project Document.

The Implementing Partner agrees to undertake all reasonable efforts to ensure that no UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/sc/committees/1267/aq_sanctions_list.shtml.

Social and environmental sustainability will be enhanced through application of the UNDP Social and Environmental Standards (http://www.undp.org/ses) and related Accountability Mechanism (http://www.undp.org/secu-srm).

The Implementing Partner shall: (a) conduct project and programme-related activities in a manner consistent with the UNDP Social and Environmental Standards, (b) implement any management or mitigation plan prepared for the project or programme to comply with such standards, and (c) engage in a constructive and timely manner to address any concerns and complaints raised through the Accountability Mechanism. UNDP will seek to ensure that communities and other project stakeholders are informed of and have access to the Accountability Mechanism.

All signatories to the Project Document shall cooperate in good faith with any exercise to evaluate any programme or project-related commitments or compliance with the UNDP Social and Environmental Standards. This includes providing access to project sites, relevant personnel, information, and documentation.

The Implementing Partner will take appropriate steps to prevent misuse of funds, fraud or corruption, by its officials, consultants, responsible parties, subcontractors and sub-recipients in implementing the project or using UNDP funds. The Implementing Partner will ensure that its financial management, anti-corruption and anti-fraud policies are in place and enforced for all funding received from or through UNDP.

The requirements of the following documents, then in force at the time of signature of the Project Document, apply to the Implementing Partner: (a) UNDP Policy on Fraud and other Corrupt Practices

and (b) UNDP Office of Audit and Investigations Investigation Guidelines. The Implementing Partner agrees to the requirements of the above documents, which are an integral part of this Project Document and are available online at www.undp.org.

In the event that an investigation is required, UNDP has the obligation to conduct investigations relating to any aspect of UNDP projects and programmes. The Implementing Partner shall provide its full cooperation, including making available personnel, relevant documentation, and granting access to the Implementing Partner's (and its consultants', responsible parties', subcontractors' and sub-recipients') premises, for such purposes at reasonable times and on reasonable conditions as may be required for the purpose of an investigation. Should there be a limitation in meeting this obligation, UNDP shall consult with the Implementing Partner to find a solution.

The signatories to this Project Document will promptly inform one another in case of any incidence of inappropriate use of funds, or credible allegation of fraud or corruption with due confidentiality.

Where the Implementing Partner becomes aware that a UNDP project or activity, in whole or in part, is the focus of investigation for alleged fraud/corruption, the Implementing Partner will inform the UNDP Resident Representative/Head of Office, who will promptly inform UNDP's Office of Audit and Investigations (OAI). The Implementing Partner shall provide regular updates to the head of UNDP in the country and OAI of the status of, and actions relating to, such investigation.

UNDP shall be entitled to a refund from the Implementing Partner of any funds provided that have been used inappropriately, including through fraud or corruption, or otherwise paid other than in accordance with the terms and conditions of the Project Document. Such amount may be deducted by UNDP from any payment due to the Implementing Partner under this or any other agreement.

Where such funds have not been refunded to UNDP, the Implementing Partner agrees that donors to UNDP (including the Government) whose funding is the source, in whole or in part, of the funds for the activities under this Project Document, may seek recourse to the Implementing Partner for the recovery of any funds determined by UNDP to have been used inappropriately, including through fraud or corruption, or otherwise paid other than in accordance with the terms and conditions of the Project Document.

Note: The term "Project Document" as used in this clause shall be deemed to include any relevant subsidiary agreement further to the Project Document, including those with responsible parties, subcontractors and sub-recipients.

Each contract issued by the Implementing Partner in connection with this Project Document shall include a provision representing that no fees, gratuities, rebates, gifts, commissions or other payments, other than those shown in the proposal, have been given, received, or promised in connection with the selection process or in contract execution, and that the recipient of funds from the Implementing Partner shall cooperate with any and all investigations and post-payment audits.

Should UNDP refer to the relevant national authorities for appropriate legal action any alleged wrongdoing relating to the project, the Government will ensure that the relevant national authorities shall actively investigate the same and take appropriate legal action against all individuals found to have participated in the wrongdoing, recover and return any recovered funds to UNDP.

The Implementing Partner shall ensure that all of its obligations set forth under this section entitled "Risk Management" are passed on to each responsible party, subcontractor and sub-recipient and that all the clauses under this section entitled "Risk Management Standard Clauses" are included, *mutatis mutandis*, in all sub-contracts or sub-agreements entered into further to this Project Document.

XIII. MANDATORY ANNEXES

Annex A. Multi-Year Work Plan
Annex B. Monitoring Plan
Annex C. Evaluation Plan
Annex D: GEF CCM Core Indicators
Annex E. Terms of Reference
Annex F. UNDP Social and Environmental and Social Screening Template (SESP)
Annex G. UNDP Project Quality Assurance Report
Annex H. UNDP Risk Log
Annex I. Results of the Capacity Assessment
Annex J. Additional Agreements
Annex K. Stabilization of the Electric Grid
Annex L. GHG Emission Reduction Estimates
Annex M. Description of EC&EE and LC Demonstrations
Annex N. Description of UNDP Country Office Support Services
Annex O. List of People Consulted
Annex P. Annual Targets
Annex Q. Gender Analysis
Annex R. Knowledge Management Plan

Annex A. Multi-Year Work Plan

Work Plan – AREAN Project																
Project Goal: Improved energy consumption index and reduced annual growth rate of GHG emissions in the country's energy supply and energy end-use sectors																
Project Objective: Enabling the achievement of low carbon energy access, sustainable energy, and green growth targets of Niue																
Timeline	**Year 1**				**Year 2**				**Year 3**				**Year 4**			
	Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Component 1: Improvements in Energy Integrated Development Policy and Planning																
Outcome 1: Improved policy and regulatory frameworks in the application of energy efficiency and renewable energy technologies in the energy end-use sectors																
Output 1.1: Comprehensive policy research, impact analyses and assessment reports on sustainable energy and low carbon (LC) development policies and regulations																
Activity 1.1.1: Conduct assessments to identify gaps and needs in sustainable energy and LC development policies and regulations																
Activity 1.1.2: Define RE/EE areas of competence and gaps to fill of relevant GoN ministries and departments and assess potential synergies																
Output 1.2: Formulated/revised, approved and enforced policies, implementing rules and regulations (IRRs) and LC standards																
Activity 1.2.1: Revise the Electricity Act and incorporate RE and EE matters																
Activity 1.2.2: Formulate/recommend, approve and enforce policies for independent power producers to connect to the grid, and for the private sector to participate to the energy sector																
Activity 1.2.3: Provide technical assistance in establishing and implementing sectoral codes of conduct, guidelines and standards of operations for the energy industry																
Activity 1.2.4: Draft and implement a waste management plan for RE projects (i.e., batteries, PV panels, incandescent light bulbs, etc.)																
Activity 1.2.5: Conduct integrated development planning and prepare energy integrated development plans for sectors of the national economy involving energy and environmental impacts																

Activity 1.2.6: Establish and implement appropriate energy prices and service quality regulations																	
Output 1.3: Completed and fully evaluated policies, IRRs and LC standards, and approved and implemented follow-up plans for their enhancement																	
Activity 1.3.1: Evaluation of policies, IRRs and LC standards and drafting of evaluation reports																	
Activity 1.3.2: Develop and implement follow-up action plans based on the evaluation reports																	
Activity 1.3.3: Assess capacity needs of GoN personnel, design training programs, and train GoN personnel to carry out energy planning and management of technology applications																	
Component 2: Institutional Capacity Building on Low Carbon Development																	
Outcome 2: Effective enforcement of plans, policies and regulations, and implementation of programs/projects on the application of climate resilient and low carbon technologies in the end-use sectors																	
Output 2.1: Formulated and recommended institutional framework that supports the implementation of LC development policies and regulations																	
Activity 2.1.1: Assess the current institutional arrangements for implementation of energy and infrastructure plans and assess stakeholders' role and gaps to fill																	
Activity 2.1.2: Establish an operational Government entity that is capable of effectively implementing LCD policies and regulations																	
Activity 2.1.3: Formulate and mandate laws to regulate the implementation of LC policies and initiatives																	
Output 2.2: Adopted and enforced suitable institutional mechanisms that integrate LC development with the socio-economic, climate change, infrastructure and disaster management objectives of the country																	
Activity 2.2.1: Design and implement training programs for relevant GoN personnel and stakeholders to fulfill their institutional mandates																	
Activity 2.2.2: Develop and apply procedures or guidelines on how to integrate LC developments with energy, climate change and other relevant objectives of Niue																	
Activity 2.2.3: Define and implement coordination mechanisms between state-owned enterprise (NPC) and GoN in electricity generation and distribution																	
Output 2.3: Performance evaluation report on the adopted institutional framework and mechanisms, promotion and implementation of the recommendations offered, and maintenance strategy incorporated in the design of projects																	
Activity 2.3.1: Evaluate the adopted institutional framework and produce evaluation reports																	

Activity 2.3.2: Prepare and implement follow-up action plans based on the evaluation reports																	
Activity 2.3.3: Prepare and enforce maintenance strategy in RE/EE project designs																	
Component 3: Improvements in the Financing of Low Carbon Development Initiatives																	
Outcome 3: Increased availability of, and access to, financing for sustainable energy, energy access and low carbon development initiatives in the energy supply and demand sectors																	
Output 3.1: Designed and implemented financing instruments for the Niue Development Bank for financing EE and RE technology application initiatives																	
Activity 3.1.1: Design and implement financing instruments to stimulate the adoption of EE applications and RE technologies																	
Output 3.2: Evaluation report on the performance of the established financing instruments																	
Activity 3.2.1: Evaluate the designed and implemented financing instruments and produce evaluation reports																	
Output 3.3: Enhanced financing policies for supporting initiatives on LC development																	
Activity 3.3.1: Design and implement training programs for relevant GoN personnel and stakeholders in RE/EE financing to develop and prepare bankable project proposals																	
Activity 3.3.2: Formulate, approve and enforce financing policies to support LC development																	
Output 3.4: Competitive market for private sector on RE/EE products and technical skills																	
Activity 3.4.1: Design training programs to improve technical skills of RE/EE service providers																	
Activity 3.4.2: Prepare informative material on RE technologies and EE appliances to increase public awareness and interest																	
Activity 3.4.3: Establish financial and fiscal incentives to encourage RE/EE products																	
Component 4: Climate Resilient and Low Carbon Technologies Applications																	
Outcome 4.1: Climate resilient and low carbon techniques and practices adopted and implemented in the energy supply and energy end-use sectors																	
Output 4.1.1: Completed comprehensive assessments of other applicable LC technologies that can be feasibly implemented in the energy generation and energy end-use sectors to support the timely achievement of the NiSERM targets																	
Activity 4.1.1.1: Assess applicable LC technologies to support the achievement of the NiSERM targets and prepare an assessment report.																	

Activity 4.1.1.2: Evaluate the optimal solar PV power generation inputs into the existing power grid system																	
Output 4.1.2: Completed design, engineering, financial and implementation plans for the most feasible grid stability scheme that will be implemented																	
Activity 4.1.2.1: Develop comprehensive design and implementation plans for the most feasible scheme for grid stability improvement																	
Activity 4.1.2.2: Increase power grid stability and electricity supply reliability																	
Activity 4.1.2.3: Automate the operations of remote solar PV power system installations and data collection																	
Activity 4.1.2.4: Implement an integrated RE generation forecasting tool to the SCADA system																	
Activity 4.1.2.5: Demonstrate the monitoring, operation and performance of the RE-generation forecasting tool to support with day-ahead planning																	
Activity 4.1.2.6: Optimize the performance of power generation units at NPC powerhouse with solar PV systems integrated into the electric grid																	
Activity 4.1.2.7: Monitor and evaluate the power generation performance at NPC																	
Activity 4.1.2.8: Establish codes and regulation for safe power generation control and load dispatch																	
Activity 4.1.2.9: Design and implement a capacity building program on electricity generation, transmission and distribution O&M																	
Output 4.1.3: Completed design and implementation plans for the replication and/or scale up of demonstrated EE sustainable energy and LC energy projects																	
Activity 4.1.3.1: Train a pool of local experts in energy development and utilization as well as in applying new RE/EE technologies																	
Activity 4.1.3.2: Design the implementation plan for the scale up of RE/EE projects																	
Output 4.1.4: Fully evaluated portfolio of follow-up sustainable energy and LC technology (EE and RE) application projects in other villages																	
Activity 4.1.4.1: Evaluate RE/EE application projects and produce evaluation reports																	
Activity 4.1.4.2: Assess safe RE/EE waste disposal (i.e., batteries, solar PV panels, incandescent light bulbs, etc.) and prepare an assessment report																	
Activity 4.1.4.3: Assess potential use of municipal waste for energy generation, including safe disposal of final residual waste, and prepare evaluation report																	
Activity 4.1.4.4: Prepare a follow-up action plan based on the evaluation report																	
Outcome 4.2: Enhanced confidence in the viability of climate resilient and low carbon technology applications in the energy supply and demand sectors																	

Output 4.2.1: Completed designs and implementation plans of LC technology application demonstrations																	
Activity 4.2.1.1: Evaluate feasibility of RE and EE demonstration projects and prepare assessment reports																	
Activity 4.2.1.2: Prepare engineering design and implementation plans for the implementation of the selected RE and EE demonstration projects																	
Output 4.2.2: Successfully installed and operational systems of the implemented demonstrations of sustainable energy and LC technology (EE and RE) applications																	
Activity 4.2.2.1: Install and operate the selected RE and EE demonstration projects																	
Activity 4.2.2.2: Improve the power grid stability and reliability.																	
Activity 4.2.2.3: Prepare the demo project profiles (as case studies)																	
Activity 4.2.2.4: Conduct an overall performance evaluation of the demo projects																	
Output 4.2.3: Established and operational energy monitoring and reporting system (all energy forms), and completed and evaluated pilots on its implementation																	
Activity 4.2.3.1: Assess gaps in energy data collection (all energy forms and both supply and consumption) and design an energy monitoring and reporting system																	
Activity 4.2.3.2: Design, organize and conduct a training program on energy monitoring and reporting system																	
Activity 4.2.3.3: Design and evaluation of energy monitoring and reporting system pilots																	
Component 5: Enhancement of Awareness on Low Carbon Development																	
Outcome 5: Enhanced levels of awareness and attitude towards climate resilient and low carbon development in the energy supply and energy end use sectors																	
Output 5.1: Established and operational energy audit system covering government and commercial buildings and facilities, as well as industrial companies																	
Activity 5.1.1: Design an energy audit system and facilitate its approval and implementation																	
Activity 5.1.2: Design and train relevant GoN personnel and stakeholders in conducting energy audits																	
Activity 5.1.3: Perform energy auditing of GoN and commercial buildings																	
Output 5.2: Established and operational energy (all energy forms) and energy technology database system																	
Activity 5.2.1: Establish an energy database to store all energy related information and establish a communication plan																	
Activity 5.2.2: Operate and maintain the energy database																	

Activity 5.2.3: Design and implement a capacity building program for Government institutions on the operation and maintenance of the energy database																	
Output 5.3: Established and operational information exchange network for the promotion and dissemination of knowledge on sustainable energy and LC development																	
Activity 5.3.1: Establish an information exchange/sharing platform on sustainable energy and LC development for the general public.																	
Activity 5.3.2: Design, implement and evaluate awareness raising programs on RE/EE projects																	
Activity 5.3.3: Design and implement training programs for relevant GoN personnel and stakeholders (Chamber of Commerce, DoU, NDB and Kiwibank) to inform the general public on advantages of LC technologies																	

Annex B. Monitoring Plan:

The Project Manager will guide the collection of results data per the following monitoring plan:

Monitoring	Indicators	Description	Data Source or Data Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
Project Goal: Improved energy consumption index and reduced annual growth rate of GHG emissions in the country's energy supply and energy end-use sectors	Reduction in the overall national energy utilization intensity (toe[31]/1,000 USD GDP	This is a measure of how efficiently energy consumption is converted into GDP generation, including RE sources	DoU-MoI, NPC, NBF, Treasury Department	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants	Annual energy supply and consumption reports submitted by relevant GoN entities, NPC, NBF, DoU-MoI, and the Treasury Department Project M&E reports	Continuous commitment of GoN in efforts to achieve the NiSERM targets irrespective of which party is in power
	Cumulative GHG emission reduction[32] from fossil fuel utilization, tons CO_2	Cumulative reduction of GHG emissions, over the implementation period of the AREAN Project, attributable to the execution of the RE/EE activities proposed under the Alternative Scenario	DoU-MoI, NPC, NBF, Treasury Department, NDB, Chamber of Commerce	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants		
Project Objective: Enabling the achievement of low carbon energy access, sustainable energy, and green growth targets of Niue	Cumulative fossil fuel savings[33] due to sustainable energy and low carbon interventions implemented, toe	Cumulative reduction of fossil fuel consumption, over the implementation period of the AREAN Project, due to the application of all EE measures and RE technology (whether or not implemented by the AREAN project)	DoU-MoI, NPC, NBC, DoT, Treasury department	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants	Annual energy supply and consumption reports submitted by relevant entities, NPC, NBF, DoU-MoI and the Treasury Department Project M&E and activity reports	Realization of committed co-financing from the national government in the implementation of project activities and monitoring
	% RE electricity production	Annual amount of electricity	Dou-MoI, NPC	Annually;	Project		

[31] Tons of Oil Equivalent (toe) has been calculated by: 1) the kWh of solar PV electricity has been first considered as kWh of electricity from diesel and then converted into GJ of diesel that would have been required to generate those kWh; and 2) the result from the calculation above has been summed up to the balance of total GJ consumed (except from solar PV) and multiplied by the conversion factor between GJ and toe.

[32] Since the RE and EE targets will be fully achieved by 2025, and the solar PV installations have a duration of ~25 years, the cumulative GHG emission reductions over the lifetime of the equipment acquired will continue well past the end of AREAN implementation. Annex M shows these estimates in detail. By the end of all equipment lifetime the estimated cumulative GHG emission reductions will be 99,633 tCO_2.

[33] Similarly to the GHG emission reductions, also the fuel savings will continue well past the project implementation, due to the long lifetime of the equipment acquired.

Monitoring	Indicators	Description	Data Source or Data Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
		generated with RE power generation systems (solar PV installations)		Reported in DO tab of the GEF PIR	Manager and Consultants	Trade and commerce reports	systems
	No. of new jobs created in the application of sustainable energy and LC technologies and techniques in the energy supply and energy end-use sectors in Niue	The establishment of a RE/EE market will favor the creation of new service jobs (e.g., repair, installation, waste collection, etc.)	Treasury Department, Chamber of Commerce	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants		
Component 1: Improvements in Energy Integrated Development Policy and Planning							
Outcome 1: Improved policy and regulatory frameworks in the application of energy efficiency and renewable energy technologies in the energy end-use sectors	No. of approved and enforced RE and EC&EE policies, and associated guidance and implementing rules and regulations	Policy documents drafted and approved in Niue concerning the application of RE/EE technologies in the energy end-use sectors	DoU-MoI, GoN	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants	Documents on RE and EC&EE policies, regulations and energy standards Annual reports from DoU-MoI, NPC, and Bulk Fuels Project M&E and activity reports	Full and continuous commitment and support of the national government in the implementation of energy policies and regulations in the energy and end-use sectors
	No. of formulated and approved policies and regulations incorporated in the country's Energy Act	Policy documents on RE/EE drafted and successively incorporated in the country's reviewed 1960 Electric Power Supply Act	DoU-MoI, GoN	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants		
Component 2: Institutional Capacity Building on Low Carbon Development							
Outcome 2: Effective enforcement of plans, policies and regulations, and implementation of programs/projects on the application of climate resilient and low carbon technologies in the	No. of sectoral integrated development plans that are implemented and managed through the established and adopted integrated institutional mechanisms	Development plans and programs for the application of RE/EE technologies in the end-use sectors drafted and implemented through the institutional framework introduced under the AREAN project	DoU-MoI, GoN	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants	Documents on the institutional mechanisms Documents on low carbon development processes Annual Reports on the sectoral integrated development plan	Continuous commitment and support by the national government, private sector and public, in general on the successfully implemented institutional
	No. of low carbon development initiatives facilitated by adopted and	The implementation of the development plans and programs and the	DoU-MoI, GoN	Annually; Reported in DO tab of the	Project Manager and Consultants		

Monitoring	Indicators	Description	Data Source or Data Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
end-use sectors	enforced institutional arrangements mentioned in Indicator 1	introduction of an institutional framework, as described in Indicator 1 of this Outcome, will facilitate and support the application of low carbon technologies and initiatives in Niue		GEF PIR		implementation Project M&E and activity reports	arrangements even after the AREAN project completion
Component 3: Improvements in the Financing of Low Carbon Initiatives							
Outcome 3: Increased availability of, and access to, financing for sustainable energy, energy access and low carbon development initiatives in the energy supply and demand sectors	No. of developed and recommended financing schemes/mechanisms with Niue Development Bank for supporting climate resilient and low carbon development initiatives in the country	Financing schemes and mechanisms designed and implemented in coordination with NDB to support the development of RE/EE technologies and initiatives (i.e., high EE household appliances, independent solar PV installations, etc.)	NDB, Treasury Department	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants	Documents on the financial schemes/ mechanisms development process Annual Reports on the planned and implemented low carbon development projects that are financed through the adopted financing scheme(s) Project M&E and activity reports	Continuous commitment and support by the national government and financial sector on the implementation of the adopted financing schemes
	No. of small-scale EE projects and RE technology projects financed either through the adopted financing scheme; or by private sector investment	With the establishment of financing schemes and mechanisms, the general public can access loans at low interest rates to finance small scale RE/EE projects; additional initiatives will be financed by funds coming from the private sector	NDB, Treasury Department, Chamber of Commerce	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants		
	No. of recommended finance/fiscal policies for supporting initiatives on LC development	Financing and fiscal policy drafted and recommended to provide financial support for the development of RE/EE initiatives	NDB, Treasury Department, Chamber of Commerce	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants		
Component 4: Climate Resilient and Low Carbon Technologies Application							
Outcome 4.1:	No. of completed feasibility	The feasibility and viability	DoU-MoI, Treasury	Annually;	Project	RE/EE technology	Consumers and

Monitoring	Indicators	Description	Data Source or Data Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
Climate resilient and low carbon techniques and practices adopted and implemented in the energy supply and energy end-use sectors	assessments conducted for planned energy-integrated socio-economic development activities that feature RE and EE technology applications	of RE/EE technology applications, which will support socio-economic developments in Niue, is assessed before any funds are disbursed and committed, and results are presented in evaluation reports	Department, NDB, Chamber of Commerce	Reported in DO tab of the GEF PIR	Manager and Consultants	projects feasibility assessment reports Project M&E and activity reports	the private sector fully support and commit to the feasible replication of successful results of the demo projects
Outcome 4.2: Enhanced confidence in the viability of climate resilient and low carbon technology applications in the energy supply and demand sectors	Cumulative amount of energy savings from the successfully installed and operational demonstrations (including replications) of sustainable energy and low carbon technology applications, toe	Cumulative reduction of energy consumption, over the implementation period of the AREAN Project, due to the application of all RE/EE demo activities implemented under the AREAN project and their replication	DoU-MoI, NPC, NBF, Treasury Department	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants	Demo RE-based electricity generation and low carbon technology application project profiles Performance and evaluation reports of the demo projects Project M&E and activity reports	As per schedule implementation and completion of demo projects Consumers and the private sector fully support and commit to the feasible replication of successful results of the demo projects
	No. of RE and EE technologies application projects designed and financed for implementation as influenced by the results and outcomes of the demonstrations	Follow-up RE/EE technology implementation projects spurred by the success of the demo projects implemented under the AREAN project	DoU-MoI, Treasury Department, Chamber of Commerce, NDB	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants		
Component 5: Enhancement of Awareness on Low Carbon Development							
Outcome 5: Enhanced levels of awareness and attitude towards climate resilient and low carbon development in the energy supply and energy end use sectors	***Incremental*** no. of energy consumers (e.g., households) that will utilize EE appliances and RE-based energy generating and consuming equipment acquired through AREAN initiatives	Surveys are designed and conducted to establish the number of households that have adopted and purchased RE/EE technologies and measures acquired through the initiative developed under the AREAN project	Department of Statistics, NDB, UNDP-MCO	Annually; Reported in DO tab of the GEF PIR	Project Manager and Consultants	Survey of energy consumption of consumers (e.g., household energy survey) Business registrations of local technical and engineering service	Continuous commitment and support on sustainable energy and low carbon development by the national government
	No. of local firms that can	Establishment of local	GoN, Treasury	Annually;	Project		

Monitoring	Indicators	Description	Data Source or Data Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
	capably provide technical, engineering and maintenance services for sustainable energy and low carbon technology application projects	service firms providing technical, engineering and maintenance services for RE/EE technology applications will be supported by the creation of a RE/EE market facilitated by the implementation of the AREAN project activities	Department, Chamber of Commerce, NDB	Reported in DO tab of the GEF PIR	Manager and Consultants	providers that are working on low carbon technology projects Project M&E and activity reports	

Annex C. Evaluation Plan

Evaluation Title	Planned start date Month/year	Planned end date Month/year	Included in the Country Office Evaluation Plan	Budget for consultants	Other budget (i.e., travel, site visits, etc.)	Budget for translation
Mid-Term Review	June 2021	July 2021	Yes	USD 22,500 (assuming 20 days for one national and one international consultant)	USD 7,500 (assuming twelve-day mission)	None
Terminal Evaluation	September 2023	November 2023	Yes	USD 22,500 (assuming 20 days for one national and one international consultant)	USD 7,500 (assuming twelve-day mission)	None
Total Evaluation Budget				USD 60,000		

Annex D. GEF CCM Core Indicators

GEF Core Indicators at CEO ER
[PIMS Number: 6037] [Country: Niue]

I. **CORE INDICATOR 6: GREENHOUSE GAS EMISSIONS MITIGATED (METRIC TONS OF CARBON DIOXIDE EQUIVALENT)**

GHG emission type	Metric tons CO_2-eq (expected at PIF)	Metric tons CO_2-eq (expected at CEO ER)	Metric tons CO_2-eq (expected at MTR)	Metric tons CO_2-eq (expected at TE)
Lifetime direct project GHG emissions mitigated		8,611		
Lifetime direct post-project emissions mitigated	110,200	99,633		
Lifetime indirect GHG emissions mitigated		27,100		

Figure at a given stage must be the sum of all figures reported under the first two sub-indicators (6.1 and 6.2) for that stage.

6.1 Carbon sequestered or emissions avoided in the sector of Agriculture, Forestry and Other Land Use

GHG emission type	Ha (expected at PIF)	Metric tons CO_2-eq (expected at PIF)	Ha (expected at CEO ER)	Metric tons CO_2-eq (expected at CEO ER)	Ha (expected at MTR)	Metric tons CO_2-eq (expected at MTR)	Ha (expected at TE)	Metric tons CO_2-eq (expected at TE)
Lifetime direct project GHG emissions mitigated								
Lifetime direct post-project emissions mitigated								
Lifetime indirect GHG emissions mitigated								
Anticipated year	---		---		---		---	

6.2 Emissions avoided

GHG emission type	Metric tons CO_2-eq (expected at PIF)	Metric tons CO_2-eq (expected at CEO ER)	Metric tons CO_2-eq (expected at MTR)	Metric tons CO_2-eq (expected at TE)
Lifetime direct project GHG emissions mitigated		8,611		
Lifetime direct post-project emissions mitigated	110,200	99,633		
Lifetime indirect GHG emissions mitigated		27,100		
Anticipated year				

6.3 Energy saved (megajoules)

Type of Intervention	MJ (expected at PIF)	MJ (expected at CEO ER)	MJ (achieved at MTR)	MJ (achieved at TE)
		$1{,}454 \cdot 10^6$		

Add rows as needed.

6.4 Increase in installed renewable energy capacity per technology (megawatts).

Type of Renewable Energy	MW (expected at PIF)	MW (expected at CEO ER)	MW (achieved at MTR)	MW (achieved at TE)
[biomass, geothermal, ocean, small hydro, solar photovoltaic, solar thermal, wind power, and storage]		2,543		

Add rows as needed.

II. CORE INDICATOR 11: NUMBER OF DIRECT BENEFICIARIES DISAGGREGATED BY GENDER AS CO-BENEFIT OF GEF INVESTMENT

	Total number (expected at PIF)	Total number (expected at CEO ER)	Total number (achieved at MTR)	Total number (achieved at TE)
Women		**Entire Female Population**		
Men		**Entire Male Population**		
Total		Entire Population of Niue		

This indicator is mandatory for all UNDP-GEF projects.

Annex E. Terms of Reference

This section presents the terms of reference (ToRs) for the key personnel positions for the management of the project implementation. These are the TORs for the Project Management Office (PMO) personnel: a) the Project Manager (PM); b) the Chief Technical Adviser (CTA); and c) the Project Board (PB). In addition, the ToRs for the National Project Director (NPD) and the Project Administration and Finance Officer are also provided.

During the inception phase of the project, the PMO will prepare the TORs for the key personnel requirements for the implementation of the various activities in each of the components of the AREAN Project. These are ToRs for consultants/experts/specialists, whose services will be engaged for the implementation of the activities in each project component.

PROJECT MANAGEMENT OFFICE (PMO):

1. PROJECT MANAGER (PM)

The Project Manager will be responsible for organizing, conducting and supervising the day-to-day operation and implementation activities of the AREAN project. The PM will lead the Project Management Unit (PMU) and work closely with the MoI-DoU, the UNDP MCO in Samoa and the regional STA. The services of the PM will be requested for the full duration of the AREAN project implementation phase – four (4) years. The selected candidate will be skilled in LCD technologies and should also have multidisciplinary expertise in RE/EE policy, regulatory and institutional frameworks, and be familiar with RE/EE financing mechanisms and financial/fiscal incentives.

Duties and Responsibilities

- Prepare Quarterly Work Plans and Annual Work Plans and timely submit them for clearance and acceptance.
- Draft, revise and submit Annual Project Reports, GEF Project Implementation Review (PIR) Report, Quarterly Progress Reports, and the Final Project Reports in a timely fashion and assuring high quality.
- Prepare, with assistance of UNDP MCO in Samoa, detailed ToRs for key personnel who will be appointed during the project implementation phase (i.e., members of the Project Management Unit, national and international consultants, contractors, trainers, etc.).
- Organize, supervise and review the work and outputs of the Project Management Unit (PMU) and other appointed key personnel.
- Organize and monitor the progress of all the activities to be implemented under the AREAN project, including:
    a. Implementation and monitoring of the LCD demos and grid stabilization activities, and procurement of the required equipment.
    b. Support and supervise the drafting and approval of the RE/EE policy and regulatory framework.
    c. Support and supervise the establishment and approval of an institutional framework.
    d. Support and supervise the establishment and approval of financing schemes and financial/fiscal incentives.
    e. Support and supervise RE/EE capacity building, training programs and awareness rising.
- Take corrective measures for all problems and bottlenecks experienced during the project implementation.
- Liaise with off relevant stakeholders and project partners.

- Organize and conduct workshops and meetings in coordination with MoI-DoU and UNDP.

Required Qualifications and Experience

- Post Graduate degree (master's level, equivalent or higher) in a relevant environmental science or an engineering field (preferably chemical, mechanical, electrical or energy engineering). A bachelor degree with practical working experience will also be considered.
- A minimum of 10 years of proven relevant, practical working experience managing similar projects. Experience in PICs and SIDS is highly desirable.
- Experience working with government counterparts at high levels.
- Experience technical assistance projects and GEF/UNDP projects, and a strong understanding of UNDP and its mandates, policies and procedures would be an advantage.
- Strong leadership, management and negotiation skills.
- Strong ability to work as part of a team and actively pursuing networking.
- Ability to function effectively in an international, multi-cultural environment.
- Excellent written and verbal communication skills in English.
- Excellent computer skills as well as analytical and problem solving skills.

2. CHIEF TECHNICAL ADVISOR

The principal responsibility of the Chief Technical Advisor is to provide technical assistance in the implementation of the Project under the National Implementation Mode that would augment the capability of the Implementing Partner and the PMU in coordination with UNDP in order to ensure the achievement of project objectives following the UNDP-GEF performance standards and practices. The Chief Technical Advisor will be contracted on an annual basis, with a possibility of extension, up to the full duration of the project (four years), based on performance.

Duties and Responsibilities

- Assist the National Project Director (NPD), PM and PMU in the specific issues and requirements in project implementation that will be requested to achieve project objectives.
- Assist in the development of relevant Terms of References for all consultants and contractors in coordination with the PM.
- Advise on scheduling, procurement and monitoring issues.
- Provide written advice and comment on policy, regulatory, institutional, financial, technical, and awareness issues.
- Advise on establishing and managing monitoring and evaluation programs for all aspects of the project following the LogFrame of the project and on the preparation and finalization of the Annual Project Report/Project Implementation Review as required by the UNDP/GEF M&E system.
- Advise the UNDP, NPD, PM and PMU and independent evaluators in the conduct of the Mid-term Review (MTR) and Terminal Evaluation (TE), exit strategy and the project closure process and other UNDP-GEF requirements.
- Provide support and inputs to the PM for the preparation of the project final report (including the best practices, lessons learnt etc.).
- Any other relevant tasks as assigned by the NPD and PM.

Required Qualifications and Experience

- Advanced degree (master's level, equivalent or higher) in the field of energy, climate change mitigation, or engineering. A bachelor degree with practical working experience will also be considered.

- Minimum of 10 year experience in managing major RE/EE technology application projects, preferably in PICs and SIDS.
- Proven experience in working on, or contributing to design and development of climate change mitigation and energy (energy efficiency and renewable energy) projects. Previous experience with the United Nations System, including UNDP-GEF projects is an asset.
- Ability to function effectively in an international, multi-cultural environment.
- Excellent written and verbal communication skills in English.
- Excellent computer skills as well as analytical and problem solving skills.

3. PROJECT BOARD (PB)

The project board will have responsibility for monitoring of the project at a high level and for providing high-level support and decision-making as needed.

Tasks

- Meeting twice annually, for a total of eight times over the project's four-year lifetime.
- High-level monitoring of project progress particularly in reviewing of outcome-level and objective-level progress of the project.
- Decision-making about major issues facing project that cannot be resolved at the working level.
- Provision of high-level support to push progress in certain areas in which such support can make a difference, such as in policy-making and enforcement and inter-departmental coordination.
- Holding of end of project review to capture lessons learned, discuss opportunities for scaling up and highlighting of project results, and discuss findings of terminal evaluation.

General Qualifications of PB Members

- Roles as senior level officials and managers within government and other organizations.
- Expertise in areas relevant to project, such as power sector, energy, water resources, planning, policy, and finance.

4. NATIONAL PROJECT DIRECTOR (NPD)

The National Project Director will be responsible for week-to-week oversight of the Project Management Unit (PMU) and for providing guidance in strategy to the project. This will be a part-time role. The NPD will follow up with project issues as needed and meet with the project team at least once per week to discuss progress and next steps. The NPD will be a government employee; therefore, the NPD's inputs will be supported through GoN co-financing.

Duties and Responsibilities

- Guidance to the PMU team in implementation, including meetings with project team at least once per week.
- Handling of financial requests and review of financial reports.
- Technical coordination in project implementation with other government stakeholders.
- Liaison for assignment of project responsibilities to MoI-DoU permanent staff.
- Reporting to Project Board on project progress.
- Promoting the project to high level officials to gain their buy-in.
- Representation of the project at important meetings.

Required Qualifications and Experience

- Senior official of MoI-DoU.
- Experience in management of development projects.
- Strong knowledge of the energy sector.
- Experience in policy making, regulatory design, and planning in Niue.
- Knowledge of financial management.
- High level of knowledge of RE and EE technologies.

5. PROJECT ADMINISTRATION AND FINANCE OFFICER

The Project Administration and Finance Officer will be a member of the PMU and work under the guidance of the PM. He/she will look after the day-to-day administrative and financial management matters related to the AREAN project. He/she will support the PM in annual work planning, progress reporting, project monitoring and budget management of project inputs and delivery of its outputs. The Project Administration and finance Officer will be contracted on an annual basis, with a possibility of extension, up to the full duration of the project (four years) based on performance.

Duties and Responsibilities

- General financial and administrative support to the project.
- Assist the PMU in performing budget cycle: planning, preparation, revisions, and budget execution.
- Provide assistance to partner agencies involved in project activities, performing and monitoring financial aspects to ensure compliance with budgeted costs in line with UNDP policies and procedures;
- Monitor project expenditures, ensuring that no expenditure is incurred before it has been authorized.
- Assist project team in drafting quarterly and yearly project progress reports concerning financial issues.
- Ensure that UNDP procurement rules are followed during procurement activities that are carried out by the project and maintain responsibility for the inventory of the project assets.
- Perform preparatory work for mandatory and general budget revisions, annual physical inventory and auditing, and assist external evaluators in fulfilling their mission.
- Ensure the project utilizes the available financial resources in an efficient and transparent manner.
- Ensure that all project financial activities are carried out on schedule and within budget to achieve the project outputs.
- Perform all other financial related duties upon request.

Required Qualifications and Experience

- Bachelor degree in finance, accounting, business, public administration or a closely related field.
- Minimum of 5 year practical experience in administrative functions and financial management of projects. Experience in similar positions with UN agencies and proficiency in Atlas are desirable.
- Experience in providing a streamlined administrative service role to the PMU.
- Demonstrated initiative in carrying out his/her duties and ability to work independently to tight deadlines.
- Knowledge of the energy and power sectors will be a plus.
- Ability to function effectively in an international, multi-cultural environment.

- Excellent written and verbal communication skills in English.
- Excellent computer skills as well as analytical and problem solving skills.

Annex F. UNDP Social and Environmental and Social Screening Template (SESP)

Project Information

Project Information	
1. Project Title	Accelerating Renewable Energy and Energy Efficiency Applications in Niue (AREAN)
2. Project Number	PIMS 6037
3. Location (Global/Region/Country)	Niue

Part A. Integrating Overarching Principles to Strengthen Social and Environmental Sustainability

QUESTION 1: How Does the Project Integrate the Overarching Principles to Strengthen Social and Environmental Sustainability?
Briefly describe in the space below how the Project mainstreams the human-rights based approach
This climate change mitigation project focuses on the application of low carbon (renewable energy and energy efficiency) technologies for the sustainable development of the island nation of Niue. In general terms, the design and implementation of the project activities will be in line with the principles of human rights based approach. The implementing partner as well as the project partners acknowledge human rights practices under international law and the application of human rights-related standards in the design and implementation of the project. The project is designed to enhance the availability, accessibility and quality of benefits and services from the application of renewable energy and energy efficiency technologies in supporting the country's sustainable and climate resilient economic growth. And these are for all relevant target groups including those that are potentially marginalized individuals and groups.
Briefly describe in the space below how the Project is likely to improve gender equality and women's empowerment
The proposed GEF project will involve women working in both management and technical departments of the government agencies/institutions in Niue who can play important roles in the design, development and implementation. Among the issues that will be covered will be those that relate to gender equity and women's role, and will cover potential barriers (if any) posed by gender equity issues, and barriers to: (1) Ensuring gender equity and women empowerment in the promotion and implementation of low carbon development; (2) Enhancing opportunities to improve the role and influence of women in the deployment of low carbon technologies and climate change mitigation options, and, (3) The development of gender-sensitive policies in the energy sector and the energy end-use sectors of the country. Lastly, the design and preparation of this project has taken into account the contributions, impacts and benefits of community based sustainable energy and low carbon (EE and RE) technology applications, including children and indigenous people.
Briefly describe in the space below how the Project mainstreams environmental sustainability
The project will involve the creation of the required enabling conditions that through the adoption of supportive policies/regulations and institutional mechanisms to facilitate the widespread application of sustainable energy and low carbon technologies in the energy generation and energy end-use sectors in Niue. This is to ensure sustainability of the systems and frameworks that will be established under the project. The development of a suitable follow-up action plan for approval and enforcement after project completion will ensure the sustainability of these established systems/frameworks. Since the project is linked and is complementing and supplementing the development and infrastructure plans of the country, e.g., Niue National Strategic Plan; National Integrated Strategic Energy Road Map (NISERM), the sustainability of project outputs will be continued. The proposed project is within the context of sustainable development in Niue, and to ensure the realization of environmental sustainability the design has taken into account best applicable policies and strategies on conserving the natural environment. In addition to environmental sustainability, the project is in line with sustainable development aspirations that will bring about local benefits mainly through

contributions to improvement of the living conditions of the country's citizens and allows them to contribute more productively to the economy; and, protection of the natural environment; diversification of the resource base of the economy. It is geared towards promoting and supporting RE-based energy systems (for power and non-power applications) as among the key elements for the satisfactory achievement of the energy, environment and development agenda of the country.

Part B. Identifying and Managing Social and Environmental Risks

QUESTION 2: What are the Potential Social and Environmental Risks? *Note: Describe briefly potential social and environmental risks identified in Attachment 1 – Risk Screening Checklist (based on any "Yes" responses). If no risks have been identified in Attachment 1 then note "No Risks Identified" and skip to Question 4 and Select "Low Risk". Questions 5 and 6 not required for Low Risk Projects.*	**QUESTION 3: What is the level of significance of the potential social and environmental risks?** *Note: Respond to Questions 4 and 5 below before proceeding to Question 6*			**QUESTION 6: What social and environmental assessment and management measures have been conducted and/or are required to address potential risks (for Risks with Moderate and High Significance)?**
Risk Description	***Impact and Probability (1-5)***	***Significance (Low, Moderate, High)***	***Comments***	***Description of assessment and management measures as reflected in the Project design. If ESIA or SESA is required note that the assessment should consider all potential impacts and risks.***
The construction and operation of the demo low carbon technology application projects may pose potential safety risks to local communities.	P= 1 I= 2	Low	This could happen in project installations in areas where compliance to occupational health and safety standards and rules is at low levels or is not strictly enforced and followed.	The selection of demo sites will include safety aspects (occupational and general) as one of the criteria to be considered. Relevant GoN requirements for constructions shall be emphasized in the selection of demo sites. Furthermore, the financing scheme that will be developed shall also consider safety as one of the requirements for eligibility in securing financial assistance.
The operation of the RE technology demos may potentially result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and/or trans-boundary impacts.	P= 1 I= 2	Low	Potential cases could be: (1) solar PV power generation does not address battery waste disposal; (2) biomass-based energy generation does not properly address waste management	The RE projects that will be developed and implemented will be required to adhere to the standard design practices, which involve taking into account environmental impacts. RE resource preparation, utilization, and the handling of resulting waste or effluents have their general design requirements and guides that have to be complied with. Unless there are specific characteristics of the RE resource, project site, etc., that will require explicit designs, the properly applied standard designs would not make the construction and operation of such facilities release pollutants.

			issues	It will be ensured that the design will not bring about release of materials that would be detrimental to the natural environment accidentally or during disposal.
Social and climate-related risks impact the sustainability of the implementation of the low carbon energy demos that will be implemented direct, and influenced, by the project.	P=3 I=4	*Medium*	• Low level of social acceptance by local communities of renewable energy projects due to benefit-sharing issues. • Climate change hinders full performance of RE-based energy system installations due to disturbance to supply of renewable energy resources and impacts of climate events like flood/drought/landslide.	• As part of the social and environmental safeguard measures, where applicable, the Free, Prior Informed Consent (FPIC) principle will be implemented for the low carbon technology demos that will be implemented. • The design and implementation of the RE-based power generation and other low carbon technology applications shall follow proper engineering and construction design and construction that ensure not only structural integrity but also climate resilience. This applies also in the procurement, design/engineering, installation and operation of the pertinent installations. Climate factors and climate scenario will be taken into account in the feasibility studies that will be conducted in the potential RE-based energy system demo projects, as well as in the design and engineering of the selected low carbon technology application demos.

	QUESTION 4: What is the overall Project risk categorization?		
	Select one (see SESP for guidance)		**Comments**
	Low Risk	☐	
	Moderate Risk	**√**	Of eight risks, four are rated as “medium” and four as “low”.
	High Risk	☐	
	QUESTION 5: Based on the identified risks and risk categorization, what requirements of the SES are relevant?		
	Check all that apply		**Comments**
	Principle 1: Human Rights	☐	
	Principle 2: Gender Equality and Women’s Empowerment	**√**	Gender equality and women's empowerment has been advocated by Niue. The project has been designed and it will be implemented with the idea of enhancing women's active involvement in the design and implementation of CCM actions in the country’s energy and energy end use sectors.
	1. Biodiversity Conservation and Natural Resource Management	☐	

	2. Climate Change Mitigation and Adaptation	☐	
	3. Community Health, Safety and Working Conditions	**√**	Internationally-recognized practices in occupational health and safety shall be fully used in the construction and operation of the low carbon technology installations that the project will support.
	4. Cultural Heritage	☐	
	5. Displacement and Resettlement	☐	
	6. Indigenous Peoples	☐	
	7. Pollution Prevention and Resource Efficiency	**√**	GoN requirements and proper engineering design principles and codes/standards shall be emphasized in the design and operation of the low carbon technology installations that will be supported by the project to mitigate potential pollution.

Final Sign Off

Signature	***Date***	***Description***
QA Assessor		UNDP staff member responsible for the Project, typically a UNDP Programme Officer. Final signature confirms they have "checked" to ensure that the SESP is adequately conducted.
QA Approver		UNDP senior manager, typically the UNDP Deputy Country Director (DCD), Country Director (CD)**,** Deputy Resident Representative (DRR), or Resident Representative (RR). The QA Approver cannot also be the QA Assessor. Final signature confirms they have "cleared" the SESP prior to submittal to the PAC.
PAC Chair		UNDP chair of the PAC. In some cases, PAC Chair, may also be the QA Approver. Final signature confirms that the SESP was considered as part of the project appraisal and considered in recommendations of the PAC.

SESP Attachment 1. Social and Environmental Risk Screening Checklist

Checklist Potential Social and Environmental Risks	
Principles 1: Human Rights	**Answer (Yes/No)**
1. Could the Project lead to adverse impacts on enjoyment of the human rights (civil, political, economic, social or cultural) of the affected population and particularly of marginalized groups?	No
2. Is there a likelihood that the Project would have inequitable or discriminatory adverse impacts on affected populations, particularly people living in poverty or marginalized or excluded individuals or groups? [34]	No
3. Could the Project potentially restrict availability, quality of and access to resources or basic services, in particular to marginalized individuals or groups?	No
4. Is there a likelihood that the Project would exclude any potentially affected stakeholders, in particular marginalized groups, from fully participating in decisions that may affect them?	No
5. Is there a risk that duty-bearers do not have the capacity to meet their obligations in the Project?	No
6. Is there a risk that rights-holders do not have the capacity to claim their rights?	No
7. Have local communities or individuals, given the opportunity, raised human rights concerns regarding the Project during the stakeholder engagement process?	No
8. Is there a risk that the Project would exacerbate conflicts among and/or the risk of violence to project-affected communities and individuals?	No
Principle 2: Gender Equality and Women's Empowerment	
1. Is there a likelihood that the proposed Project would have adverse impacts on gender equality and/or the situation of women and girls?	No
2. Would the Project potentially reproduce discriminations against women based on gender, especially regarding participation in design and implementation or access to opportunities and benefits?	No
3. Have women's groups/leaders raised gender equality concerns regarding the Project during the stakeholder engagement process and has this been included in the overall Project proposal and in the risk assessment?	No
4. Would the Project potentially limit women's ability to use, develop and protect natural resources, taking into account different roles and positions of women and men in accessing environmental goods and services? *For example, activities that could lead to natural resources degradation or depletion in communities who depend on these resources for their livelihoods and well being*	No
Principle 3: Environmental Sustainability: Screening questions regarding environmental risks are encompassed by the specific Standard-related questions below	
Standard 1: Biodiversity Conservation and Sustainable Natural Resource Management	
1.1 Would the Project potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services? *For example, through habitat loss, conversion or degradation, fragmentation, hydrological changes*	No
1.2 Are any Project activities proposed within or adjacent to critical habitats and/or environmentally sensitive areas, including legally protected areas (e.g. nature reserve, national park), areas proposed for protection, or recognized as such by authoritative sources and/or indigenous peoples or local communities?	No
1.3 Does the Project involve changes to the use of lands and resources that may have adverse impacts on habitats, ecosystems, and/or livelihoods? (Note: if restrictions and/or limitations of access to lands would apply, refer to Standard 5)	No
1.4 Would Project activities pose risks to endangered species?	No
1.5 Would the Project pose a risk of introducing invasive alien species?	No
1.6 Does the Project involve harvesting of natural forests, plantation development, or reforestation?	No

[34] Prohibited grounds of discrimination include race, ethnicity, gender, age, language, disability, sexual orientation, religion, political or other opinion, national or social or geographical origin, property, birth or other status including as an indigenous person or as a member of a minority. References to "women and men" or similar is understood to include women and men, boys and girls, and other groups discriminated against based on their gender identities, such as transgender people and transsexuals.

1.7	Does the Project involve the production and/or harvesting of fish populations or other aquatic species?	No
1.8	Does the Project involve significant extraction, diversion or containment of surface or ground water? *For example, construction of dams, reservoirs, river basin developments, groundwater extraction*	No
1.9	Does the Project involve utilization of genetic resources? (e.g. collection and/or harvesting, commercial development)	No
1.10	Would the Project generate potential adverse trans-boundary or global environmental concerns?	No
1.11	Would the Project result in secondary or consequential development activities which could lead to adverse social and environmental effects, or would it generate cumulative impacts with other known existing or planned activities in the area? *For example, a new road through forested lands will generate direct environmental and social impacts (e.g. felling of trees, earthworks, potential relocation of inhabitants). The new road may also facilitate encroachment on lands by illegal settlers or generate unplanned commercial development along the route, potentially in sensitive areas. These are indirect, secondary, or induced impacts that need to be considered. Also, if similar developments in the same forested area are planned, then cumulative impacts of multiple activities (even if not part of the same Project) need to be considered.*	No
Standard 2: Climate Change Mitigation and Adaptation		
2.1	Will the proposed Project result in significant[35] greenhouse gas emissions or may exacerbate climate change?	No
2.2	Would the potential outcomes of the Project be sensitive or vulnerable to potential impacts of climate change?	No
2.3	Is the proposed Project likely to directly or indirectly increase social and environmental vulnerability to climate change now or in the future (also known as maladaptive practices)? *For example, changes to land use planning may encourage further development of floodplains, potentially increasing the population's vulnerability to climate change, specifically flooding*	No
Standard 3: Community Health, Safety and Working Conditions		
3.1	Would elements of Project construction, operation, or decommissioning pose potential safety risks to local communities?	No
3.2	Would the Project pose potential risks to community health and safety due to the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. explosives, fuel and other chemicals during construction and operation)?	No
3.3	Does the Project involve large-scale infrastructure development (e.g. dams, roads, buildings)?	No
3.4	Would failure of structural elements of the Project pose risks to communities? (e.g. collapse of buildings or infrastructure)	No
3.5	Would the proposed Project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, and erosion, flooding or extreme climatic conditions?	No
3.6	Would the Project result in potential increased health risks (e.g. from water-borne or other vector-borne diseases or communicable infections such as HIV/AIDS)?	No
3.7	Does the Project pose potential risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during Project construction, operation, or decommissioning?	Yes *(possible, if not mitigated)*
3.8	Does the Project involve support for employment or livelihoods that may fail to comply with national and international labor standards (i.e. principles and standards of ILO fundamental conventions)?	No
3.9	Does the Project engage security personnel that may pose a potential risk to health and safety of communities and/or individuals (e.g. due to a lack of adequate training or accountability)?	No
Standard 4: Cultural Heritage		
4.1	Will the proposed Project result in interventions that would potentially adversely impact sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible forms of culture (e.g. knowledge, innovations, practices)? (Note: Projects intended to protect, and conserve Cultural Heritage may also have inadvertent adverse impacts)	No
4.2	Does the Project propose utilizing tangible and/or intangible forms of cultural heritage for commercial or other purposes?	No

[35] In regards to CO_2, 'significant emissions' corresponds generally to more than 25,000 tons per year (from both direct and indirect sources). [The Guidance Note on Climate Change Mitigation and Adaptation provides additional information on GHG emissions.]

Standard 5: Displacement and Resettlement		
5.1	Would the Project potentially involve temporary or permanent and full or partial physical displacement?	No
5.2	Would the Project possibly result in economic displacement (e.g. loss of assets or access to resources due to land acquisition or access restrictions – even in the absence of physical relocation)?	No
5.3	Is there a risk that the Project would lead to forced evictions?[36]	No
5.4	Would the proposed Project possibly affect land tenure arrangements and/or community based property rights/customary rights to land, territories and/or resources?	No
Standard 6: Indigenous Peoples		
6.1	Are indigenous peoples present in the Project area (including Project area of influence)?	No
6.2	Is it likely that the Project or portions of the Project will be located on lands and territories claimed by indigenous peoples?	No
6.3	Would the proposed Project potentially affect the human rights, lands, natural resources, territories, and traditional livelihoods of indigenous peoples (regardless of whether indigenous peoples possess the legal titles to such areas, whether the Project is located within or outside of the lands and territories inhabited by the affected peoples, or whether the indigenous peoples are recognized as indigenous peoples by the country in question)? *If the answer to the screening question 6.3 is "yes" the potential risk impacts are considered potentially severe and/or critical and the Project would be categorized as either Moderate or High Risk.*	No
6.4	Has there been an absence of culturally appropriate consultations carried out with the objective of achieving FPIC on matters that may affect the rights and interests, lands, resources, territories and traditional livelihoods of the indigenous peoples concerned?	No
6.5	Does the proposed Project involve the utilization and/or commercial development of natural resources on lands and territories claimed by indigenous peoples?	No
6.6	Is there a potential for forced eviction or the whole or partial physical or economic displacement of indigenous peoples, including through access restrictions to lands, territories, and resources?	No
6.7	Would the Project adversely affect the development priorities of indigenous peoples as defined by them?	No
6.8	Would the Project potentially affect the physical and cultural survival of indigenous peoples?	No
6.9	Would the Project potentially affect the Cultural Heritage of indigenous peoples, including through the commercialization or use of their traditional knowledge and practices?	No
Standard 7: Pollution Prevention and Resource Efficiency		
7.1	Would the Project potentially result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and/or trans-boundary impacts?	No
7.2	Would the proposed Project potentially result in the generation of waste (both hazardous and non-hazardous)?	Yes[37]
7.3	Will the proposed Project potentially involve the manufacture, trade, release, and/or use of hazardous chemicals and/or materials? Does the Project propose use of chemicals or materials subject to international bans or phase-outs? *For example, DDT, PCBs and other chemicals listed in international conventions such as the Stockholm Conventions on Persistent Organic Pollutants or the Montreal Protocol*	No
7.4	Will the proposed Project involve the application of pesticides that may have a negative effect on the environment or human health?	No
7.5	Does the Project include activities that require significant consumption of raw materials, energy, and/or water?	No

[36] Forced evictions include acts and/or omissions involving the coerced or involuntary displacement of individuals, groups, or communities from homes and/or lands and common property resources that were occupied or depended upon, thus eliminating the ability of an individual, group, or community to reside or work in a particular dwelling, residence, or location without the provision of, and access to, appropriate forms of legal or other protections.

[37] Potential pollution from waste such as solar batteries, old appliances, transformers and switchgears.

Annex G: UNDP Project Quality Assurance Report

PROJECT QA ASSESSMENT: DESIGN AND APPRAISAL

OVERALL PROJECT

EXEMPLARY (5) ◎◎◎◎◎	HIGHLY SATISFACTORY (4) ◎◎◎◎○	SATISFACTORY (3) ◎◎◎○○	NEEDS IMPROVEMENT (2) ◎◎○○○	INADEQUATE (1) ◎○○○○
At least four criteria are rated Exemplary, and all criteria are rated High or Exemplary.	All criteria are rated Satisfactory or higher, and at least four criteria are rated High or Exemplary.	At least six criteria are rated Satisfactory or higher, and only one may be rated Needs Improvement. The SES criterion must be rated Satisfactory or above.	At least three criteria are rated Satisfactory or higher, and only four criteria may be rated Needs Improvement.	One or more criteria are rated Inadequate, or five or more criteria are rated Needs Improvement.

DECISION

- **APPROVE** – the project is of sufficient quality to continue as planned. Any management actions must be addressed in a timely manner.
- **APPROVE WITH QUALIFICATIONS** – the project has issues that must be addressed before the project document can be approved. Any management actions must be addressed in a timely manner.
- **DISAPPROVE** – the project has significant issues that should prevent the project from being approved as drafted.

RATING CRITERIA

STRATEGIC

1. Does the project's Theory of Change specify how it will contribute to higher level change? (Select the option from 1-3 that best reflects the project): • **3:** The project has a theory of change with explicit assumptions and clear change pathway describing how the project will contribute to outcome level change as specified in the programme/CPD, backed by credible evidence of what works effectively in this context. The project document clearly describes why the project's strategy is the best approach at this point in time. • **2:** The project has a theory of change. It has an explicit change pathway that explains how the project intends to contribute to outcome-level change and why the project strategy is the best approach at this point in time, but is backed by limited evidence. • **1:** The project does not have a theory of change, but the project document may describe in generic terms how the project will contribute to development results, without specifying the key assumptions. It does not make an explicit link to the programme/CPD's theory of change. **Evidence:**	3 | 2 1 **Evidence** See notes
2. Is the project aligned with the thematic focus of the UNDP Strategic Plan? (select the option from 1-3 that best reflects the project): • **3:** The project responds to one of the three areas of development work[38] as specified in the Strategic Plan; it addresses at least one of the proposed new and emerging areas[39]; an issues-based analysis has been incorporated into the project design; and the project's RRF includes all the relevant SP output indicators. *(all must be true to select this option)* • **2:** The project responds to one of the three areas of development work[1] as specified in the Strategic Plan. The project's RRF includes at least one SP output indicator, if relevant. *(both must be true to select this option)* • **1:** While the project may respond to one of the three areas of development work[1] as specified	3 | 2 1 **Evidence** See Notes

[38] 1. Sustainable development pathways; 2. Inclusive and effective democratic governance; 3. Resilience building

[39] sustainable production technologies, access to modern energy services and energy efficiency, natural resources management, extractive industries, urbanization, citizen security, social protection, and risk management for resilience

in the Strategic Plan, it is based on a sectoral approach without addressing the complexity of the development issue. None of the relevant SP indicators are included in the RRF. This answer is also selected if the project does not respond to any of the three areas of development work in the Strategic Plan. Evidence:	

RELEVANT

3. Does the project have strategies to effectively identify, engage and ensure the meaningful participation of targeted groups/geographic areas with a priority focus on the excluded and marginalized? (select the option from 1-3 that best reflects this project): • **3:** The target groups/geographic areas are appropriately specified, prioritizing the excluded and/or marginalized. Beneficiaries will be identified through a rigorous process based on evidence (if applicable.) The project has an explicit strategy to identify, engage and ensure the meaningful participation of specified target groups/geographic areas throughout the project, including through monitoring and decision-making (such as representation on the project board) *(all must be true to select this option)* • **2:** The target groups/geographic areas are appropriately specified, prioritizing the excluded and/or marginalized. The project document states how beneficiaries will be identified, engaged and how meaningful participation will be ensured throughout the project. *(both must be true to select this option)* • **1:** The target groups/geographic areas are not specified, or do not prioritize excluded and/or marginalized populations. The project does not have a written strategy to identify or engage or ensure the meaningful participation of the target groups/geographic areas throughout the project. Evidence:	3	2
	1	
	Evidence	
4. Have knowledge, good practices, and past lessons learned of UNDP and others informed the project design? (select the option from 1-3 that best reflects this project): • **3:** Knowledge and lessons learned (gained e.g. through peer assist sessions) backed by credible evidence from evaluation, corporate policies/strategies, and monitoring have been explicitly used, with appropriate referencing, to develop the project's theory of change and justify the approach used by the project over alternatives. • **2:** The project design mentions knowledge and lessons learned backed by evidence/sources, which inform the project's theory of change but have not been used/are not sufficient to justify the approach selected over alternatives. • **1:** There is only scant or no mention of knowledge and lessons learned informing the project design. Any references that are made are not backed by evidence.	3	2
	1	
	Evidence	
5. Does the project use gender analysis in the project design and does the project respond to this gender analysis with concrete measures to address gender inequities and empower women? (select the option from 1-3 that best reflects this project): • **3:** A participatory gender analysis on the project has been conducted. This analysis reflects on the different needs, roles and access to/control over resources of women and men, and it is fully integrated into the project document. The project establishes concrete priorities to address gender inequalities in its strategy. The results framework includes outputs and activities that specifically respond to this gender analysis, with indicators that measure and monitor results contributing to gender equality. *(all must be true to select this option)* • **2:** A gender analysis on the project has been conducted. This analysis reflects on the different needs, roles and access to/control over resources of women and men. Gender concerns are integrated in the development challenge and strategy sections of the project document. The results framework includes outputs and activities that specifically respond to this gender analysis, with indicators that measure and monitor results contributing to gender equality. *(all*	3	2
	1	
	Evidence	

must be true to select this option) • **1:** The project design may or may not mention information and/or data on the differential impact of the project's development situation on gender relations, women and men, but the constraints have not been clearly identified and interventions have not been considered.	
6. Does UNDP have a clear advantage to engage in the role envisioned by the project vis-à-vis national partners, other development partners, and other actors? (select from options 1-3 that best reflects this project): • **3:** An analysis has been conducted on the role of other partners in the area where the project intends to work, and credible evidence supports the proposed engagement of UNDP and partners through the project. It is clear how results achieved by relevant partners will contribute to outcome level change complementing the project's intended results. If relevant, options for south-south and triangular cooperation have been considered, as appropriate. *(all must be true to select this option)* • **2:** Some analysis has been conducted on the role of other partners where the project intends to work, and relatively limited evidence supports the proposed engagement of and division of labor between UNDP and partners through the project. Options for south-south and triangular cooperation may not have not been fully developed during project design, even if relevant opportunities have been identified. • **1:** No clear analysis has been conducted on the role of other partners in the area that the project intends to work, and relatively limited evidence supports the proposed engagement of UNDP and partners through the project. There is risk that the project overlaps and/or does not coordinate with partners' interventions in this area. Options for south-south and triangular cooperation have not been considered, despite its potential relevance.	3 / 2 / 1 **Evidence**
SOCIAL & ENVIRONMENTAL STANDARDS	
7. Does the project seek to further the realization of human rights using a human rights based approach? (select from options 1-3 that best reflects this project): • **3:** Credible evidence that the project aims to further the realization of human rights, upholding the relevant international and national laws and standards in the area of the project. Any potential adverse impacts on enjoyment of human rights were rigorously identified and assessed as relevant, with appropriate mitigation and management measures incorporated into project design and budget. *(all must be true to select this option)* • **2:** Some evidence that the project aims to further the realization of human rights. Potential adverse impacts on enjoyment of human rights were identified and assessed as relevant, and appropriate mitigation and management measures incorporated into the project design and budget. • **1:** No evidence that the project aims to further the realization of human rights. Limited or no evidence that potential adverse impacts on enjoyment of human rights were considered.	3 / 2 / 1 **Evidence**
8. Did the project consider potential environmental opportunities and adverse impacts, applying a precautionary approach? (select from options 1-3 that best reflects this project): • **3:** Credible evidence that opportunities to enhance environmental sustainability and integrate poverty-environment linkages were fully considered as relevant, and integrated in project strategy and design. Credible evidence that potential adverse environmental impacts have been identified and rigorously assessed with appropriate management and mitigation measures incorporated into project design and budget. *(All must be true to select this option)*. • **2:** No evidence that opportunities to strengthen environmental sustainability and poverty-	3 / 2 / 1 **Evidence**

environment linkages were considered. Credible evidence that potential adverse environmental impacts have been identified and assessed, if relevant, and appropriate management and mitigation measures incorporated into project design and budget. • **1:** No evidence that opportunities to strengthen environmental sustainability and poverty-environment linkages were considered. Limited or no evidence that potential adverse environmental impacts were adequately considered.		
9. Has the Social and Environmental Screening Procedure (SESP) been conducted to identify potential social and environmental impacts and risks? The SESP is not required for projects in which UNDP is Administrative Agent only and/or projects comprised solely of reports, coordination of events, trainings, workshops, meetings, conferences and/or communication materials and information dissemination. [If yes, upload the completed checklist. If SESP is not required, provide the reason for the exemption in the evidence section.]	Yes	No
MANAGEMENT & MONITORING		
10. Does the project have a strong results framework? (select from options 1-3 that best reflects this project): • **3:** The project's selection of outputs and activities are at an appropriate level and relate in a clear way to the project's theory of change. Outputs are accompanied by SMART, results-oriented indicators that measure all of the key expected changes identified in the theory of change, each with credible data sources, and populated baselines and targets, including gender sensitive, sex-disaggregated indicators where appropriate. *(all must be true to select this option)* • **2:** The project's selection of outputs and activities are at an appropriate level, but may not cover all aspects of the project's theory of change. Outputs are accompanied by SMART, results-oriented indicators, but baselines, targets and data sources may not yet be fully specified. Some use of gender sensitive, sex-disaggregated indicators, as appropriate. *(all must be true to select this option)* • **1:** The results framework does not meet all of the conditions specified in selection "2" above. This includes: the project's selection of outputs and activities are not at an appropriate level and do not relate in a clear way to the project's theory of change; outputs are not accompanied by SMART, results-oriented indicators that measure the expected change, and have not been populated with baselines and targets; data sources are not specified, and/or no gender sensitive, sex-disaggregation of indicators.	3	2
	1	
	Evidence	
11. Is there a comprehensive and costed M&E plan in place with specified data collection sources and methods to support evidence-based management, monitoring and evaluation of the project?	Yes	No
12. Is the project's governance mechanism clearly defined in the project document, including planned composition of the project board? (select from options 1-3 that best reflects this project): • **3:** The project's governance mechanism is fully defined in the project composition. Individuals have been specified for each position in the governance mechanism (especially all members of the project board.) Project Board members have agreed on their roles and responsibilities as specified in the terms of reference. The ToR of the project board has been attached to the project document. *(All must be true to select this option)*. • **2:** The project's governance mechanism is defined in the project document; specific institutions are noted as holding key governance roles, but individuals may not have been specified yet. The ProDoc lists the most important responsibilities of the project board, project director/manager and quality assurance roles. *(all must be true to select this option)*	3	2
	1	
	Evidence	

• **1:** The project's governance mechanism is loosely defined in the project document, only mentioning key roles that will need to be filled at a later date. No information on the responsibilities of key positions in the governance mechanism is provided.		
13. Have the project risks been identified with clear plans stated to manage and mitigate each risks? (select from options 1-3 that best reflects this project): • **3:** Project risks related to the achievement of results are fully described in the project risk log, based on comprehensive analysis drawing on the theory of change, Social and Environmental Standards and screening, situation analysis, capacity assessments and other analysis. Clear and complete plan in place to manage and mitigate each risk. *(both must be true to select this option)* • **2:** Project risks related to the achievement of results identified in the initial project risk log with mitigation measures identified for each risk. • **1:** Some risks may be identified in the initial project risk log, but no evidence of analysis and no clear risk mitigation measures identified. This option is also selected if risks are not clearly identified and no initial risk log is included with the project document.	3	2
	1	
	Evidence	
EFFICIENT		
14. Have specific measures for ensuring cost-efficient use of resources been explicitly mentioned as part of the project design? This can include: i) using the theory of change analysis to explore different options of achieving the maximum results with the resources available; ii) using a portfolio management approach to improve cost effectiveness through synergies with other interventions; iii) through joint operations (e.g., monitoring or procurement) with other partners.	Yes	No
15. Are explicit plans in place to ensure the project links up with other relevant on-going projects and initiatives, whether led by UNDP, national or other partners, to achieve more efficient results (including, for example, through sharing resources or coordinating delivery?)	Yes	No
16. Is the budget justified and supported with valid estimates? • **3:** The project's budget is at the activity level with funding sources, and is specified for the duration of the project period in a multi-year budget. Costs are supported with valid estimates using benchmarks from similar projects or activities. Cost implications from inflation and foreign exchange exposure have been estimated and incorporated in the budget. • **2:** The project's budget is at the activity level with funding sources, when possible, and is specified for the duration of the project in a multi-year budget. Costs are supported with valid estimates based on prevailing rates. • **1:** The project's budget is not specified at the activity level, and/or may not be captured in a multi-year budget.	3	2
	1	
	Evidence	
17. Is the Country Office fully recovering the costs involved with project implementation?	3	2
	1	

• **3:** The budget fully covers all project costs that are attributable to the project, including programme management and development effectiveness services related to strategic country programme planning, quality assurance, pipeline development, policy advocacy services, finance, procurement, human resources, administration, issuance of contracts, security, travel, assets, general services, information and communications based on full costing in accordance with prevailing UNDP policies (i.e., UPL, LPL.) • **2:** The budget covers significant project costs that are attributable to the project based on prevailing UNDP policies (i.e., UPL, LPL) as relevant. • **1:** The budget does not adequately cover project costs that are attributable to the project, and UNDP is cross-subsidizing the project.	**Evidence**	
EFFECTIVE		
18. Is the chosen implementation modality most appropriate? (select from options 1-3 that best reflects this project): • **3:** The required implementing partner assessments (capacity assessment, HACT micro assessment) have been conducted, and there is evidence that options for implementation modalities have been thoroughly considered. There is a strong justification for choosing the selected modality, based on the development context. *(both must be true to select this option)* • **2:** The required implementing partner assessments (capacity assessment, HACT micro assessment) have been conducted and the implementation modality chosen is consistent with the results of the assessments. • **1:** The required assessments have not been conducted, but there may be evidence that options for implementation modalities have been considered.	3 / 2 / 1 **Evidence**	
19. Have targeted groups, prioritizing marginalized and excluded populations that will be affected by the project, been engaged in the design of the project in a way that addresses any underlying causes of exclusion and discrimination? • 3: Credible evidence that all targeted groups, prioritizing marginalized and excluded populations that will be involved in or affected by the project, have been actively engaged in the design of the project. Their views, rights and any constraints have been analyzed and incorporated into the root cause analysis of the theory of change which seeks to address any underlying causes of exclusion and discrimination and the selection of project interventions. • 2: Some evidence that key targeted groups, prioritizing marginalized and excluded populations that will be involved in the project, have been engaged in the design of the project. Some evidence that their views, rights and any constraints have been analyzed and incorporated into the root cause analysis of the theory of change and the selection of project interventions. • 1: No evidence of engagement with marginalized and excluded populations that will be involved in the project during project design. No evidence that the views, rights and constraints of populations have been incorporated into the project.	3 / 2 / 1 **Evidence** See notes	
20. Does the project conduct regular monitoring activities, have explicit plans for evaluation, and include other lesson learning (e.g. through After Action Reviews or Lessons Learned Workshops), timed to inform course corrections if needed during project implementation?	Yes	No
21. The gender marker for all project outputs are scored at GEN2 or GEN3, indicating that gender has	Yes	No

been fully mainstreamed into all project outputs at a minimum.	**Evidence**
22. Is there a realistic multi-year work plan and budget to ensure outputs are delivered on time and within allotted resources? (select from options 1-3 that best reflects this project): • **3:** The project has a realistic work plan & budget covering the duration of the project *at the activity* level to ensure outputs are delivered on time and within the allotted resources. • **2:** The project has a work plan & budget covering the duration of the project at the output level. • **1:** The project does not yet have a work plan & budget covering the duration of the project.	3 / 2 1 **Evidence**
SUSTAINABILITY & NATIONAL OWNERSHIP	
23. Have national partners led, or proactively engaged in, the design of the project? (select from options 1-3 that best reflects this project): • 3: National partners have full ownership of the project and led the process of the development of the project jointly with UNDP. • **2:** The project has been developed by UNDP in close consultation with national partners. • **1:** The project has been developed by UNDP with limited or no engagement with national partners.	3 / 2 1 **Evidence**
24. Are key institutions and systems identified, and is there a strategy for strengthening specific/ comprehensive capacities based on capacity assessments conducted? (select from options 0-4 that best reflects this project): • **3:** The project has a comprehensive strategy for strengthening specific capacities of national institutions based on a systematic and detailed capacity assessment that has been completed. This strategy includes an approach to regularly monitor national capacities using clear indicators and rigorous methods of data collection, and adjust the strategy to strengthen national capacities accordingly. • **2.5:** A capacity assessment has been completed. The project document has identified activities that will be undertaken to strengthen capacity of national institutions, but these activities are not part of a comprehensive strategy to monitor and strengthen national capacities. • **2:** A capacity assessment is planned after the start of the project. There are plans to develop a strategy to strengthen specific capacities of national institutions based on the results of the capacity assessment. • **1.5:** There is mention in the project document of capacities of national institutions to be strengthened through the project, but no capacity assessments or specific strategy development is planned. • **1:** Capacity assessments have not been carried out and are not foreseen. There is no strategy for strengthening specific capacities of national institutions.	3 / 2.5 2 / 1.5 1 **Evidence**
25. Is there is a clear strategy embedded in the project specifying how the project will use national systems (i.e., procurement, monitoring, evaluations, etc.,) to the extent possible?	Yes / No
26. Is there a clear transition arrangement/ phase-out plan developed with key stakeholders in order to sustain or scale up results (including resource mobilization strategy)?	Yes / No

Evidence:		

Annex H. UNDP Risk Log

OFFLINE RISK LOG

Project Title: Accelerating Renewable Energy and Energy Efficiency Applications in Niue (AREAN)	**Project ID: 00117508**	**Date: 7 Feb 2019**

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Management Response	Owner	Submitted /updated by	Last Update	Status
1	The project activities may not be fully implemented due to inadequate local capacity	March 2017	Technical, Operational	P = 2 I = 4	**Prevention**: GoN will set up a capable project team comprised of competent local and international experts to expand the capacity of the local community people in the implementation of the relevant project activities. The proposed project will be coordinated closely with other relevant projects in the country mainly to make use of potential synergies in the management of the project implementation. This is in addition to the support from UNDP-Samoa MCO that GoN can request. **Alleviation**: UNDP-Samoa MCO, with the agreement of the implementing partner will manage and expedite the procurement process for external personnel that will work on the project activities. Potential modification of activities to allow for expeditious implementation will be done.	PMU, DoU, PMCU	Project Development Team	June 2018	No Change
2	The pre-identified and other anticipated co-financing for specific activities of the project may not be available on a timely manner	March 2017	Financial	P = 1 I = 4	**Prevention**: GoN assurance of co-funding shall be confirmed and secured prior to project launching. The project team will closely monitor and ensure the timely availability of co-financing from project partners and co-financers during project implementation. **Alleviation**: Reallocation of budget to support the implementation of activities that will be affected by	PMU, PMCU	Project Development Team	June 2018	Reducing

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Management Response	Owner	Submitted /updated by	Last Update	Status
					the delays in the availability of co-financing. In case co-financing will not happen, potential modifications of activities can be done to allow delivery of alternative outputs that are still contributing to the achievement of the relevant outcomes. Together with the NPD conduct follow-up meetings with co-financer, or alternatively find and negotiate with other potential co-financers.				
3	The follow-up/through work needed to sustain the achieved outcomes, and this may not happen	March 2017	Operational, Financial	P = 3 I = 2	**Prevention**: As part of the project activities, the development of a sustainable follow-up plan will ensure that follow-through from the key stakeholders (e.g., GoN) will happen by involving them in the planning process itself and getting their commitments when signing off on the plan implementation. The sustenance of the outcomes that are realized during the course of project implementation will form part of the follow-up plan. **Alleviation**: Agreement and regular follow up with the project partners involved in the implementation of completed activities in the sustained application of the systems/frameworks that will be established and operationalized by the project.	PMCU, DoU-MoI	Project Development Team	June 2018	No Change
4	RE-based energy generation (power and non-power purposes) installations can be seriously affected by adverse climate-related events	March 2017	Environmental	P = 2 I = 4	**Prevention**: It is already common in international design and engineering practices, as well as in the construction/installation of RE-based energy generation units to follow proper engineering and construction design and construction that ensure not only structural integrity but also climate resilience. This applies also in the procurement, design/engineering, installation and operation of the pertinent installations. **Alleviation**: Depending on the extent of the impacts	DoU, NPC, PMU, PMCU	Project Development Team	June 2018	No Change

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Management Response	Owner	Submitted /updated by	Last Update	Status
					of the adverse climate–related events, appropriate modifications in the installations (and budget) will be done. Potential reduction in the number of installations, or replacement with alternative demos will be done while taking into account the need to ensure the resulting interventions are still contributing to the realization of the project outcomes.				
5	Villages may not support the project implementation	March 2017	Operational, Organizational	P = 1 I = 3	**Prevention**: The coordination of the project implementation with the project partners will be the main responsibility of DoU-MoI and is expected to be supported by other departments of MoI. MoI good standing and rapport will be put to good use to actively promote the implementation of this project and ensure the support of the villages. **Alleviation**: In the first place, select villages that are willing to support the project. In case selected villages will withdraw support during the course of the project implementation, the demos will be redesigned for implementation within and in the fringes of the national capital.	DoU-MoI PMCU	Project Development Team	June 2018	Reducing
6	The recommended policies and regulations of the project by the pertinent GoN agencies may be delayed in approval and enforcement	March 2017	Political, Regulatory	P = 1 I = 3	**Prevention**: Advocacy campaigns will be included in the project to gain adequate support from the regulatory bodies on the adoption of the recommended policies and regulations. UNDP will assist if necessary. **Alleviation**: PB meetings and special meetings with the pertinent GoN agencies will be conducted to discuss and determine what it will take for the agencies to expedite the approval and enforcement of the recommended policies and IRRs and come up with the appropriate actions to resolve the	PMU, PMCU	Project Development Team	June 2018	No Change

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Management Response	Owner	Submitted /updated by	Last Update	Status
					issues/problems. Thereafter implement the action points accordingly.				
7	Change in national government administration may potentially reduce government support to the project	March 2017	Political	P = 1 I = 2	**Prevention**: DoU-MoI and other GoN departments involved in the project will monitor political dynamics and will try to resolve any misunderstanding within the project. If warranted, UNDP executive management intervention may be required. **Alleviation**: PB meetings and special meetings with the implementing partner and GEF OFP will be conducted to discuss courses of actions to take to sustain GoN's support to the project and carry out such plans accordingly.	DoU-MoI PMCU	Project Development Team	June 2018	No Change
8	Further reduction in petroleum fuel prices will reduce interest in RE-based power generation	March 2017	Strategic	P = 1 I = 3	**Prevention:** While the project has no control on the petroleum fuel prices, the project's awareness raising interventions are expected to sustain the overall interest of the country in transforming their power generation system to RE-based systems even when the petroleum fuel prices are relatively low. **Alleviation**: Although the petroleum fuel prices are currently in on an uptrend, which is good for RE promotion and application, in case prices go down, the project will emphasize the need to take advantage of the energy, environment and economic benefits of RE, and the country's obligation towards the realization of its CCM targets in its NDC to ensure that the interest of GoN in low carbon development is sustained.	DoU, NPC, NBF, PMCU	Project Development Team	June 2018	No Change

Annex I: Results of the Capacity Assessment

Submitted as a separate file.

Summary of the Objective and Risk Rating Profile for Niue Ministry of Infrastructure

HACT Micro Assessment of Niue Ministry of Infrastructure

This will be provided during the Project Inception.

Annex J. Additional Agreements

Annex K: Stabilization of the Electric Grid

K.1 Assessment of the existing grid system in Niue, focusing on grid stability and reliability of the system

The existing grid system in Niue is an 11 kV distribution grid system, which consists of two 11 kV feeders, the Northern feeder and the Southern feeder. The Northern feeder is underground cabling and the Southern feeder is mainly underground cabling with approximately 7 km overhead lines in South of Alofi to the diesel power station. The 7 km overhead line is soon to be decommissioned as the underground cabling is already laid for the entire Southern feeder. The underground cabling has been completed. *An EDF-11 funded program has provided the replacement of the existing lines with approximately 43 km of underground cabling, which contributes to improve the reliability of the existing grid system.*

The current generating units connected to the existing grid system are shown in below table.

Diesel Power Station:	**Rated Capacity (kW)**	**Operational setup**
Caterpillar C18 Diesel generator 1	508	Main and peak scenario. Providing the load base capability and peak loads
Caterpillar C18 Diesel generator 2	508	Main and peak Scenario. Providing the load base capability and peak loads
Caterpillar C18 Diesel generator 3	508	Reserve capacity and out of service capacity for maintenance.
Caterpillar C18 Diesel generator 4	508	Reserve capacity and out of service capacity for maintenance.
Solar PV Plants	**Rated Capacity (kW)**	**Operation / Not in operation**
Niue High School	20	In operation (June 2018)
Power Corporation Office	1,7	Not in operation (June 2018)
Hospital	30	Not in operation (June 2018)
Tuila Power Station	200	Not in operation (June 2018)
Airport	90	Not in operation (June 2018)
Fish Factory-Alofi South	40	In operation (June 2018)
Niue Primary School	20	In operation (June 2018)
PWD Main Building	20	In operation (June 2018)
Niue Hospital	40	In operation (June 2018)
Water Supply/PACC Shed	20	Not in operation (June 2018)
Tuila Power Station	60	Not in operation (June 2018)

The total installed solar PV capacity is ~543 kW. According to the NPC generation logbook (June 2018) a total of 140 kW solar PV capacity is currently connected to the existing grid system. The rest of the solar PV plants are disconnected due to grid instability.

According to the Niue Strategic Energy Road Map 2015–2025 (NiSERM), Niue targets 80% renewable energy (RE) generation by 2025.

The assessment of the existing grid system is divided into different technical categories (see below table) for the grid stability and reliability with focus on Niue's target of 80% RE electricity generation in the grid system. The assessment of the existing grid system is furthermore focused on the grid code requirements, system control for grid integration and operational requirements to support the

development of the regulatory frameworks and the Review of the Electrical Power Supply Act/1960 (EPSA). It is important for the existing grid system to focus on the frequency control and voltage control in order to avoid violations of the grid stability, reliability and the operating requirements for the system operation. It is therefore international common practice to have defined requirements, guidelines and frameworks to support the grid stability and reliability of the grid system and furthermore support to lower the grid system operation costs.

Technical category:	**Grid requirements of the existing grid system:**
Power system grid stability - Transient stability - Frequency stability - Voltage stability	Currently, there is no grid code requirements for the power system grid stability with RE-based power generation units (e.g., solar PV) integrated into the grid system. The grid stability of the existing grid system was assessed in 2012 by DNV KEMA. It is mentioned in the report that the diesel generators shall maintain the voltage and frequency level in the system. This is correct for the system characteristic in year 2012. However, with 80% RE generation, it will be difficult for the current diesel generators to maintain a stable voltage level in the system by itself. The existing diesel generators will be challenged to provide reactive power capability to the entire grid system with grid integration of 80% RE generation.
Control of reactive power (Voltage control)	Currently, there is no grid code requirements for control of reactive power with RE-based power generation units (e.g., solar PV) integrated into the grid system.
Control of active power (Frequency control)	Currently, there is no grid code requirements for control of active power with RE-based power generation units (e.g., solar PV) integrated into the grid system.
Reliability and system performance	The reliability, safety and availability of electricity in the existing grid system is very weak with limited support to isolate faults in the network. Currently a fault on a feeder, disconnects the whole feeder and increases the outage time. The capacity to cope with a major sudden failure (N-1) is possible with a total diesel capacity of 2.032 KW. Therefore, the reliability concerning the adequacy of the existing grid system is covered with the existing diesel generation capacity, which can cover the electricity demand at all times. The reliability concerning the security of the existing grid system with grid integration of RE is not defined in the ESPA. The grid system shall be able to withstand a sudden change, e.g. the tripping of a solar PV plant or power line. Furthermore, the capacity to cope with unbalances in the grid system is not covered in the current SCADA system, with no energy storage functionalities for the Solar PV plants.
SCADA system control	The existing diesel generators are controlled by a Woodward EasyGen 3200 controller and this monitors the performance of the diesel generators at the grid connection point. The current SCADA system does not monitor the entire grid system and there is no

	remote monitoring of the major electrical components. Furthermore, the current SCADA system does not show the separation between solar PV generation, diesel generation and the load in the system in order to cope with the planning procedures and grid integration of 80% RE power generation.
Forecasting RE-based power generation system tool.	No RE-based power generation forecasting tool is in place to handle the grid integration of 80% RE generation.
Battery energy storage system capabilities.	No battery energy storage system and power conversion system is installed in the existing grid system to support peak demand changes, integration of RE-based power generation, power quality improvement and regulation of frequency and voltage in the grid system.
Electrical asset management recording of the existing grid system.	NPC has no electrical recording and updated single line diagram of the grid network. For NPC to focus on stability and reliability, it's important that basic electrical data/information on the existing grid system is available and maintained with assets management procedures.

K.2 Assessment of potential improvement of existing grid system focusing on grid stability and reliability of the system

Technical Category:	Assessment of potential improvements:
Power system grid stability - Transient stability - Frequency stability - Voltage stability	Grid code requirements shall be defined for the power system stability with integration of RE-based power generation units (e.g., Solar PV power generation units). The requirements shall be based on supporting the grid system during normal operation and during grid failures. For the RE-based power generation units to be integrated into the current grid, these shall be equipped with low voltage ride through capabilities and voltage and frequency control capabilities. It is recommended in the DNV KEMA grid stability report that the solar PV inverters low voltage set points shall be reduced. However, it is important that any settings of the PV inverters shall be changed according to defined RE-grid code requirements in order to have same operation conditions for all PV inverters in the grid system. This approach will also assist NPC to follow up on grid stability issues and grid code compliance with the solar PV system suppliers.
Control of reactive power (Voltage control)	Grid code requirements shall be defined for the control of reactive power with integration of RE-based power generation units (e.g., Solar PV). This requirement will contribute to voltage control in the grid system during normal operation and during faults. The requirements shall be given as a constant reactive power Q, constant power factor and voltage control.

	The diesel generators can support the system voltage only for the current connected solar PV power generation units in the existing power grid. With 80% RE generation, the reactive power control in the grid system will be affected, as the current diesel generators in the powerhouse will have difficulty to maintain and control the system grid voltage. Therefore, any RE-based power system (e.g., solar PV) to be integrated into the current power grid shall be required and equipped to support with voltage control and reactive power control. The power factor is leading in the grid system between 0,85-0,90. The installation of underground cabling contributes to this and it is required that shunt-reactors are installed in the system to support to the correct the power factor to reach a target of min. 0,97 - 0,98 lagging.
Control of active power (Frequency control)	Grid code requirements shall be defined for the control of active power with integration of RE-based power generation units/ systems (e.g., Solar PV). The requirements will: • Contribute to lower the production during constrains in the power system, but also to minimize impacts on large foreseen events causing suddenly changes of all the solar PV plants, as hurricanes, dawn, sunset, solar eclipse, clouds etc. • Define the behavior of the grid system during faults. • Facilitate auxiliary services as secondary reserve. • Frequency support outside a specified limit.
Reliability and system performance	RMU units, RMU controllers and transformer with switchgears are required to improve the grid system reliability and system performance. Several old faulted transformers from the 1970's shall be replaced to also achieve a reliability with a higher efficiency and reduction of distribution losses.
SCADA system control	The operational procedure of the existing grid system needs to be improved for accommodating the grid integration of RE-based power generation units (e.g., solar PV). The existing SCADA system does not show the separation between solar PV generation, diesel generation and the load in the system in order to cope with the planning procedures and grid integration of a high amount of RE. In the future with large amount of RE-based power generation, it will be necessary to separate electricity production from load demand. In order to do that it is recommended that NPC establishes a system to handle the dispersed generation. This system should be able to at least handle the following two items: • Communication with RE-based power generation units (e.g. solar PV plants) and the RMU's in grid system. • Measurements from the generators connected to the grid system. The total RE real time production and the day-ahead forecasted generation production, should be an integral part of the SCADA system and be part of the planning phase. It will be essential that future grid codes for RE- units include a standard communication protocol

	interface. The protocol will allow voltage control, frequency control, delta power regulations, PQ regulation and Q regulation.
Forecasting RE-based power generation (e.g., solar PV) system tool.	The purpose of the forecasting generation system is to assist NPC to distinguish between variability and uncertainty when planning and operating the grid system with 80% solar PV. The forecasting tool will reduce the uncertainty of the solar PV generation, so that its variability can be more precisely accommodated in the grid system. The accuracy of forecasts and timely operational responses for up-ramps and down-ramps are critical in order for maintaining reliability and lowering the grid operation cost because of the high solar PV penetration level in the grid system.
Battery energy storage system capabilities.	In order to improve the grid stability, battery energy storage systems shall be added to the grid system along the new installed Solar PV plants. The battery energy storage system shall be able to operate in frequency control mode, smoothing control mode and voltage control mode. A battery energy storage system unit with power conversation will support the grid system with RE-based power generation smoothing, fast responding frequency regulation, load levelling, ramp support and power quality improvements. NPC is already implementing battery storage under a NZ funded project. It is important that the battery system can limit the ramp rates and avoid any large fluctuations from the solar output and responds to the changes in the system voltage and frequency. The battery storage settings and functionality shall be included for the battery system during normal operation and during grid faults operation in the system. The functionality of the battery system shall respond when voltages are higher/lower than normal it will absorb/inject reactive power to help control voltage. Similarly, with frequency it will discharge/charge when the frequency is lower/higher than normal.

K.3 Barriers and action option for development

Fact	Impact	Actions
Underestimating the importance of grid code requirements to support the regulatory frameworks to facilitate achievement of the 80% RE electricity generation target in NiSERM.	The grid stability will be negatively affected because of the missing features of a grid system that allows for proper voltage control, active and reactive power control by the integrated RE-based power generation units. The RE-units system suppliers have no uniform standards and grid code compliance to follow for the equipment and required ancillaries for grid integration.	Design and development of grid code requirements for smooth operation of the grid system to ensure that the RE-based power generation units can stay connected to the grid system and support the grid system during normal operation and during grid failures. At an early stage, the RE-based power generation system supplier (e.g., solar PV) and the NPC should engage to clarify the requirements

	NPC has no grid code compliance to follow for frequency, voltage and system control for the operation of the grid system with 80% RE generation.	for grid compliance of the RE-based power generation system and the operational requirements for grid system control and optimum load dispatch.
Old MV/LV transformers with no data loggers.	The old transformers contributes to faults in the grid system, poor energy efficiency with high distribution losses. The power quality and grid system loading cannot be assessed from the SCADA system. The system control procedures and power quality assessments will suffer with no remote data logging equipment to the NPC SCADA system.	Installation of new MV/LV transformers with data loggers will ensure security of supply, higher energy efficiency with reduction in distribution losses and it will allow assessment of power quality and grid system loading with visible data information in the SCADA system.
Leading power factor in the existing grid system.	The power quality and overall system efficiency is suffering with a leading power factor (0,85-0,90) and it will increase the cost of supply.	Installation of shunt-reactors to correct the characteristic leading power factor in the grid system.
Limited MV/LV isolation points in the grid system.	The grid system feeders will suffer from several outage and the NPC staff safety are at risk with no isolation points for network maintenance.	Installation of RMUs and transformers with switchgears will improve the network isolation. Currently the whole network feeders get disconnected when a fault occurs. This will not be optimal with large amount of RE-units connected along the feeders in the grid system.
No SCADA system capability for grid integration of RE-based power generation capacity for 80% RE-based electricity generation.	No capability for load dispatch planning for the solar PV grid integration. No capability for communicating with the Solar PV plants and the RMU's in grid system. No capability to show and estimate the production from each generator connected to the grid system and load in the grid system. No capability to monitor the voltage level, grid system loadings and frequency for the entire grid system.	Upgrade of the current SCADA system to control the system operation requirements of 80% RE electricity generation (e.g., from Solar PV systems). Furthermore, an integrated RE (e.g., solar) electricity generation forecasting tool shall be implemented in the SCADA system to perform day-ahead planning of the load dispatch planning and support the reliability and operational procedures for NPC.
No forecasting generation tool for grid integration of RE-based	With 80% RE-based power generation (e.g., through solar PV), the variability of changes in	Installation of an integrated RE generation forecasting tool to the SCADA System.

power generation (e.g., Solar PV) capacity for 80% RE electricity generation.	the generation output due to fluctuations of solar cannot be predicted. Furthermore, the uncertainty related to the inability to predict in advance the timing and magnitude of changes to the generation output, will affect the operation and reliability of the grid system.	Agree on and develop uniform standards for preparing and delivering RE-based power (e.g., solar PV) generation forecasts.
No technical skills to operate the SCADA system and energy storage functionalities.	Capacity training needs to be addressed towards the understanding of grid code requirements, operational system control procedures and system load dispatch strategies. Otherwise, The NPC staff will continue to rely on system knowledge and advice from the external supplier, Gough CAT. This is not sufficient for future operation of the grid system with RE-based power generation capacity for at least 80% RE electricity production.	Training in SCADA system operations with focus on grid integration of systems for 80% RE generation. This will increase the NPC staff knowledge in operational procedures, least-cost planning and in optimal dispatch strategy for the grid system.

K.4 Recommendations

An updated Electrical Power Supply Act/1960 (EPSA) shall include grid code requirements that reflects the operation of a grid system with RE-based power generation capacity that allows for at least 80% RE electricity production and it must be implemented to support the regulatory/policy frameworks. The grid codes must require measures for voltage control, active and reactive power control by the RE-based power generation units (e.g., Solar PV) and additionally be equipped with low voltage ride through capabilities. The grid code requirements shall be established to support the grid during normal operation and during grid failures. The grid codes will also provide NPC with a reliable grid connection procedure, to ensure that the suppliers of the solar PV plants have to install equipment which is strictly compliant with grid code requirements. This is to ensure a smooth operation of the grid system with no negative impact on the grid stability and reliability.

The general grid connection codes structure includes requirements to be fulfilled for the following technical areas:

- Stability impact and requirements related to facility size
- Requirements on facility robustness
- Requirements on power quality
- Requirements on controllability
- Requirements on information exchange & security
- Requirements on documentation & verification

The following below listed 9 key points shall be considered in the development and design of the grid codes requirements for the grid integration of RE-based power generation capacity (e.g., solar PV) that allows for at least 80% RE electricity production.

For example, the technical requirements for the grid code (assuming the RE-based power generation is solar energy-based) are the following:

1. Active and reactive power control of the Solar PV plant
2. Voltage range and regulation of the Solar PV plant
3. Low voltage ride through of Solar PV plant
4. Frequency control
5. Solar PV plant power quality and power factor
6. Protection requirements
7. Model and parameters of Solar PV Plant
8. Solar PV communication and signals
9. Grid integration compliance testing of the Solar PV plant

NPC is responsible for operating the existing grid system, the asset maintenance, the generating units (Solar PV, diesel generators), the distribution and the sale of the electricity to the consumers. With the grid integration of a high penetration level of RE, it creates a large burden on NPC to be able to perform on several different technical tasks in order to operate and analyze their grid system. NPC does not have enough skilled staff to perform these activities.
Therefore, from the identified barriers the following suggested technical recommendations and project activities shall be considered in the AREAN Project.

Barriers identified	**Technical recommendations**	**Planned/ongoing activities from GoN**	**Project activities to the AREAN Project**
Underestimating the importance of grid code requirements to support the regulatory frameworks to facilitate achievement of the 80% RE electricity target in NiSERM.	RE-grid codes shall be established for the grid code requirements and SCADA communication requirements for grid integration of RE-based power generation units (e.g., Solar PV), in order to support the regulatory frameworks and connection agreements. RE-grid codes shall be established for the operational system control of the grid system with operating RE-based power generation capacity that allows for at least 80% RE electricity production and to support the regulatory frameworks and connection agreements. With 80% RE generation, the reactive power control	No ongoing or planned activities to develop the RE-grid code.	**Design and development of the RE-grid code requirements.** **Approval and enforcement of the technical criteria's in the RE-grid code requirements.** The RE-grid code requirements shall be designed to support the grid system during normal operation and during grid failures. The RE-grid code requirements shall be designed to require the criteria for voltage/frequency control, active and reactive power control by the RE-based power generation units (e.g., Solar PV) and additionally require low voltage ride through capabilities. The RE-grid code requirements shall be designed to support NPC with a reliable grid connection procedure to ensure that the solar PV system suppliers installs equipment which is strictly compliant with RE-grid code

	in the grid system will be affected, as the current diesel generators in the powerhouse will have difficulty to maintain and control the system network voltage. The existing diesel generators will have difficulty to provide reactive power control capability with the grid integration of RE-based power generation capacity that allows for at least 80% RE electricity production. This will create further grid instability in the grid system. For example, if the RE-based power generation units are solar energy-based, the grid codes shall include requirements for the Solar PV inverters to support the grid.		requirements. This will support the operation of the grid system with no negative impact on the grid stability and reliability. The RE-grid code requirements shall be designed to require the criteria for capacity allocation, net-metering, power quality, protection, testing and documentation.
Old MV/LV transformers with no data loggers.	New energy efficient transformers with data loggers are required to improve the distribution losses, avoid faults, achieve higher efficiency and improve the communication between the SCADA system and the operating grid system. Several transformers are installed in 1970's and is at the end of their life-time.	Planned activities to replace old MV/LV transformers. The exact number of old transformers to be replaced has not been provided by GoN yet.	**Design, replacement & installation of energy efficient MV/LV transformers with data loggers.** **Design of communication protocol to be linked with the RE-code requirements for the SCADA system remote control functions.** The new energy efficient MV/LV transformers with data loggers will ensure security of supply and higher energy efficiency with reduction in distribution losses. It will also allow assessment of power quality and grid system loading with visible data information in the SCADA system to be interfaced with the RE-grid code.
Leading power factor in the existing grid system.	Shunt-reactors shall be installed to improve the power quality and power factor. The DNV KEMA grid stability report recommends 2 x 65 kVA shunt reactors for the	No ongoing or planned activities to install new shunt-reactors or replace the damaged shunt-reactors.	**Updated power system analysis with focus on assessment of the power factor operation criteria at the RE-based power generation units and with 80% RE electricity generation in the grid system.**

	capacitive effect of the underground cabling network. An updated assessment is required for the grid system with 80% RE electricity generation which also assess the power factor operation criteria's at the RE-units and recommends the specific siting locations of the shunt-reactors for further grid improvement. The current shunt-reactors on the Northern feeder is disconnected. NPC has informed that the shunt-reactors has been damaged and are not in operation.		**Design assessment of the shunt-reactor capacity size, siting and specifications required in the grid system with 80% RE electricity generation.** **Replacement and installation of shunt reactors in the grid system according to the design assessment.**
Limited MV/LV isolation points in the grid system.	The reliability, safety and availability of electricity in the existing grid system is very weak with limited support to isolate faults in the network. RMU units, RMU controllers, MV/LV transformers with switchgears are required in the grid system to improve the reliability and safety to isolate network faults and to improve the communication between the SCADA system and the operating grid system Currently the whole network feeders get disconnected when a fault occurs. This will not be optimal with large amount of RE connected along the feeders in the grid system. The grid system feeders will suffer from several outage and the NPC staff safety are at risk with no isolation points for	The GoN has from a NZ funded program received 2 x 200 kVA ABB transformers with switchgears. The units are at the diesel power house and yet to be installed.	**Updated power system analysis with focus on the current operation conditions and future defined operation conditions with 80% RE electricity generation in the grid system.** **Design assessment to determine the required specifications and siting of the RMU, RMU controllers, MV/LV transformers with switchgears in the grid system.** **Replacement and Installation of RMU, RMU controllers and MV/LV transformers with switchgears.** The installation of RMU's and MV/LV transformers with switchgears will reduce the outage time and support the safety of the NPC staff with isolation points for network maintenance. Furthermore, the implementation will support NPC to detect possible outages and communicate with the SCADA system in the control center where actions can be taken to solve or prevent grid problems.

	network maintenance.		
No SCADA system capability for grid integration of RE-based power generation capacity for 80% RE-based electricity generation.	The current SCADA system requires to be upgraded in order to control the system operation requirements to facilitate at least 80% RE. The current SCADA system does not monitor the entire grid system and there is no remote monitoring of electrical components. Furthermore, the current SCADA system does not show the separation between solar PV generation, diesel generation and the load in the system in order to cope with the planning procedures and grid integration of RE-based power generation capacity that allows at least 80% RE electricity production. The current SMA fuel save controller in the NPC diesel power house is only for the current installed solar PV systems. To reach 80% RE electricity production, the SMA fuel save controller needs to be further built with additional features to manage the grid integration and system requirements. Especially energy storage control functionality is lacking and will become more vital with the 80% electricity generation using intermittent RE resources. The battery storage settings and functionality shall be included for the battery system during normal operation and during grid faults operation in the system. In case the SMA Fuel Save Controller	The GoN has not provided any confirmed details on the contracted equipment to be delivered with the planned Solar PV plants. Tender technical specifications dated. Jun 2017 outlines specifications for the supply and installation of Solar PV in Niue, to contribute an increase of RE to 39% of annual electricity generation. The document also outlines specifications for battery energy storage system, grid forming power conversion system and a control system.	**Formulation of the design functions for the SCADA system to operate with a high penetration level of 80% RE electricity generation or higher in the grid system.** **Implementation/update of a SCADA system to control the system operation requirements of 80% RE electricity generation or higher (e.g., from Solar PV systems) in the grid system.** **Demonstration of the monitoring, operation and optimal load dispatch of the SCADA system with diesel generators and RE-based power generation units.** The SCADA system shall be designed and upgraded to have the capability: - for load dispatch planning for the RE-plants grid integration. - for communicating with the RE-plants and the RMU's in grid system. - to show and measure the production from each generator connected to the grid system and the load in the grid system. - to monitor the voltage level, grid system loadings and frequency for the entire grid system. The SCADA communication requirements for the RE-units shall be designed and defined in the RE-grid code with standard communication protocol interface. The protocol shall be designed to allow voltage control, frequency control, delta power regulations, PQ regulation and Q regulation.

	shall be useful for operation, it should be considered to upgrade the unit to a SMA-FSC-L system, which have the energy storage functionalities and can communicate with the installed Sunny PV solar inverters.		
No forecasting generation tool for grid integration of RE-based power generation (e.g., Solar PV) capacity for 80% RE electricity generation.	The accuracy of forecasts and timely operational responses for up-ramps and down-ramps are critical in order for maintaining reliability and lowering the grid operation cost because of the high RE penetration level in the grid system. A RE generation forecasting tool will support NPC to distinguish between variability and uncertainty when planning and operating the grid system with 80% RE generation. The forecasting tool will reduce the uncertainty of the RE generation, so that its variability can be more precisely accommodated in the grid system.	No planned activities.	**Installation of an integrated RE generation forecasting tool to the SCADA System.** **Design and develop uniform standards for preparing and delivering RE-based power (e.g., solar PV) generation forecasts.** **Demonstration of the monitoring, operation and performance of the RE-generation forecasting tool to support with day-ahead planning.** The integrated RE (e.g., solar) generation forecasting tool shall be implemented in the SCADA system to perform day-ahead planning of the load dispatch planning and support the reliability and operational procedures for NPC.
No technical skills to operate the SCADA system and energy storage functionalities.	Capacity training needs to be addressed towards the understanding of grid code requirements, operational system control procedures and system load dispatch strategies. The NPC staff rely on system knowledge and advice from the external supplier, Gough CAT. This is not sufficient for future operation of the grid system for producing at least 80% RE electricity. For example, if the RE-based system is 100% solar energy-based, the capacity training program shall be	Through a NZ funded program a capacity building program component is included. The details of this program has not been provided by GoN yet.	**Capacity training needs assessment for technical skills in:** - Grid code requirements for RE. - Solar PV capabilities for active and reactive control. - Grid connection procedures and follow up according to RE-grid code. - Utility practices and procedures for data collection and real time control. - Dispatch operations and planning. - SCADA system operations with focus on grid integration of systems for 80% RE

	related to creating an effective solar PV grid integration strategy. This Solar PV grid integration strategy shall include a detailed development of the technical requirements in the grid codes, development of a least-cost solar PV operation plan and an optimal dispatch strategy for the grid system with RE-based power generation (e.g., solar PV) capacity that allows for 80% RE electricity production.		electricity generation. - Battery storage settings & functionality. - Grid system analysis (load-flow, dynamic analysis, power quality analysis). **Capacity training in above mentioned topics.** - **Design of the training materials** - **Post-training evaluation**

Annex L: GHG Emission Reduction Estimates

L.1 *Status Quo* of the Energy Sector in Niue

Niue satisfies over 99% of its energy needs with imported fossil fuels and only generates locally less than 1% of its energy (solar energy and biomass). Table L.1 below summarizes the breakdown of the primary energy supply by energy source and fuel type over the period 2009-2017. Kerosene used for air transport is treated as both an energy import and export, since it is basically employed for international flights to and from New Zealand.

This large dependence on imported energy not only impacts significantly on the country's expenditures, imported fuels accounted for 15.3% of GDP in 2011 (NiSERM), but also exposes Niue to severe risks of energy disruption if the monthly shipment is delayed due to adverse weather conditions, especially during the cyclone season (November through April). Niue receives fossil fuels supplies via ship from New Zealand every 28 days. Currently, the country has 14 days of fuel supply security (defined as the number of days the following shipment can be delayed before Niue runs out of fuel reserves).

Table L.1 Niue Primary Energy Supply by Energy Source (NiSERM)

Primary Energy Supply (GJ)	2009	2010	2011	2012	2013	2014	2015	2016	2017
Local Generation*									
Solar PV Electricity	0	241	247	232	240	240	240	240	240
Solar Thermal (hot water systems)	16	16	16	16	16	16	16	16	16
Biomass**	532	532	532	532	532	532	532	532	532
Total Local Energy Generation	**548**	**789**	**795**	**780**	**788**	**788**	**788**	**788**	**788**
Imported Energy									
ADO (power generation)	29,523	28,074	31,879	33,674	36,460	36,502	37,125	37,496	38,452
ADO (land transport)	12,671	11,075	11,221	11,023	10,391	9,757	9,710	9,322	9,042
ADO (other uses***)	3,474	3,034	3,072	3,019	2,845	2,677	2,613	2,587	2,613
Petrol	20,193	19,478	23,069	25,071	27,525	30,050	31,350	32,500	35,000
Kerosene (aviation)	19,220	15,072	16,156	15,915	21,211	22,001	25,870	27,954	31,193
Kerosene (other uses)	56	48	61	121	22	69	42	11	24
LPG	1,328	1,183	1,299	1,415	1,551	1,628	1,597	1,707	2,049
Total Imported Energy	**86,465**	**77,964**	**86,757**	**90,238**	**100,005**	**102,684**	**108,307**	**111,577**	**118,373**
Total Primary Energy (GJ)	**87,013**	**78,753**	**87,552**	**91,018**	**100,793**	**103,472**	**109,095**	**112,365**	**119,161**

*: 2016-2017 values are estimates
**: Biomass is used for residential cooking
***: Water transport is bundled with other uses

L.2.1 *Land Transport Sector*[40]

The energy consumption in the land transport sector, as shown in Table L.2, has been increasing yr/yr at a nearly constant pace, except for a couple of years, of ~5% over the period 2011-2017.

[40] In this section air transport is excluded, because as stated above, kerosene for air transport is treated as both an energy import and export; therefore it has a nil net impact. Water export is also excluded, because 99% of energy consumption in the energy transport sector (excluding air) is for land, and only 1% energy use is for water transport (data that the NiSERM includes in "ADO – other uses"), sector for which no activities are planned by the GoN.

Specifically, demand for Automotive Diesel Oil (ADO) has been declining, but this reduction has been more than compensated by a larger increase in petrol consumption.

At the time of preparation of the Niue Strategic Energy Road Map (NiSERM) for 2015-2025 a yearly ADO decline of 3.0% and a yearly petrol increase of 6.0% had been forecasted until 2018. Assuming that these forecasted trends will continue throughout 2025, one can project the trends for land transport sector energy demand under a Business As Usual (BAU) scenario. Tables L.3 and L.4 summarize such forecasts in terms of energy content (in GJ) and fuel volumes (expressed in 10^3 liters), respectively.

Table L.2 Land Transport Sector (NiSERM)

Land Transport Fuels (GJ)	2009	2010	2011	2012	2013	2014	2015	2016	2017
ADO (land transport)	12,671	11,075	11,221	11,023	10,391	9,757	9,710	9,322	9,042
Petrol	20,193	19,478	23,069	25,071	27,525	30,050	31,350	32,500	35,000
Total Land Transport (GJ)	**32,864**	**30,553**	**34,290**	**36,094**	**37,916**	**39,807**	**41,060**	**41,822**	**44,042**
yr/yr change (%)		(-7.0)	12.2	5.3	5.0	5.0	3.1	1.9	5.3

Table L.3 Land Transport Sector Forecasts (GJ) - BAU

Land Transport Fuels (GJ)	2018	2019	2020	2021	2022	2023	2024	2025
ADO (land transport)	8,771	8,508	8,252	8,005	7,765	7,532	7,306	7,087
Petrol	36,988	39,207	41,560	44,053	46,697	49,498	52,468	55,616
Total Land Transport (GJ)	**45,759**	**47,715**	**49,812**	**52,058**	**54,461**	**57,030**	**59,774**	**62,703**

Table L.4 Land Transport Sector Forecasts (10^3 ltr) - BAU

Land Transport Fuels (10^3 ltr)	2018	2019	2020	2021	2022	2023	2024	2025
ADO (land transport)	243	236	229	222	215	209	202	196
Petrol	1,154	1,224	1,297	1,375	1,457	1,545	1,637	1,736

In 2014, a census on motor vehicles owned in Niue indicated that a total of approximately 1785 motor vehicles were registered, with the following breakdown: a) 31% cars; b) 24% vans; c) 23% light trucks; and d) 21% motor vehicles and scooters. GoN has set a goal for 2020 to have approximately 1% high fuel efficient vehicles, which might comprise fully electric vehicles (EVs), hybrid cars, or new fuel efficient vehicles with an engine of less than 1,300 cc.

The government has already started to incentivize this switch by waiving the import duties on such fuel efficient vehicles. Presently, there are three second hand electric vehicles privately owned, while GoN owns an Electric Light Fun (ELF) vehicles, a small sized PV powered EV used primarily for demonstration purposes, which was donated by IUCN (International Union for Conservation of Nature). Currently, the government has budgeted the purchase of 8 additional new EVs. In Section L.4 below the potential for further penetration of high fuel efficient vehicles until 2025 will be explored, together with its implication in terms of a switch in energy source used, from fossil fuels to electricity, which will inevitably impact on electricity consumption and the 80% target of electricity generated with renewable sources.

L.2.2 Electricity Sector

The only two types of power generation technologies currently utilized by the local utility, NPC (Niue Power Corporation), are diesel generators and solar PV panels. The country owns four diesel GenSets for a combined power generation capacity of 2,084 kW. One of them is used to provide the base load throughout the day, a second GenSet is in stand-by and provides peak loads, which generally occur in the evening from 8:00 pm to 9:00 pm (in 2014 peak demand reached 590 kWh), a third generator is kept as a back-up, and it kicks-in in case of malfunction of one of the other two GenSets. The fourth generator is usually rotated for maintenance.

In the period 2009-2016, Niue has also introduced several solar PV installations for a combined power generation capacity of 343 kWp, initially equipped with 200 kWh of lithium-ion battery capacity. Although the share of intermittent solar PV power generation was relatively low, also supported by batteries for electricity storage, the national grid has soon displayed severe issues of grid instability, which has been analyzed by DNV Kema in their 2012 report. However, the grid stability issues are yet to be solved and the provisional solution has been to disconnect most of the solar PV panels from the national grid. Early 2018, NPC has installed an additional 200 kWp of solar PV panels, donated by Japan as reparation for some faulty panels previously acquired from Mitsubishi with installation costs supported by the government of New Zealand.

Presently, NPC is planning on reconnecting all the PV installation to the grid, although the basic instability issues will be only faced and resolved as part of the proposed project. The battery bank has been decommissioned, but not disposed of as yet. The problems of grid instability have significantly contributed to instill in most people distrust towards this technology and has since hampered the development of PV installations in the private sector, which only accounts for few small sized installations (2-5 kWp), all off-grid.

The breakdown in terms of billed electricity demand in 2014 is the following: a) commercial sector 43%; b) residential sector 37%; and c) governmental sector 20%. Unbilled electricity refers to public services, such as streetlights and water pumping. Niue, until recently, also had issues with unpaid bills, which amounted to NZ$ 0.50M (~US$ 0.35M) in 2014, blamed by insolvent customers on faulty meters that allegedly gave wrong readings. GoN is solving this problem through the installation of prepaid meters, which is scheduled to be completed late 2018/early 2019.

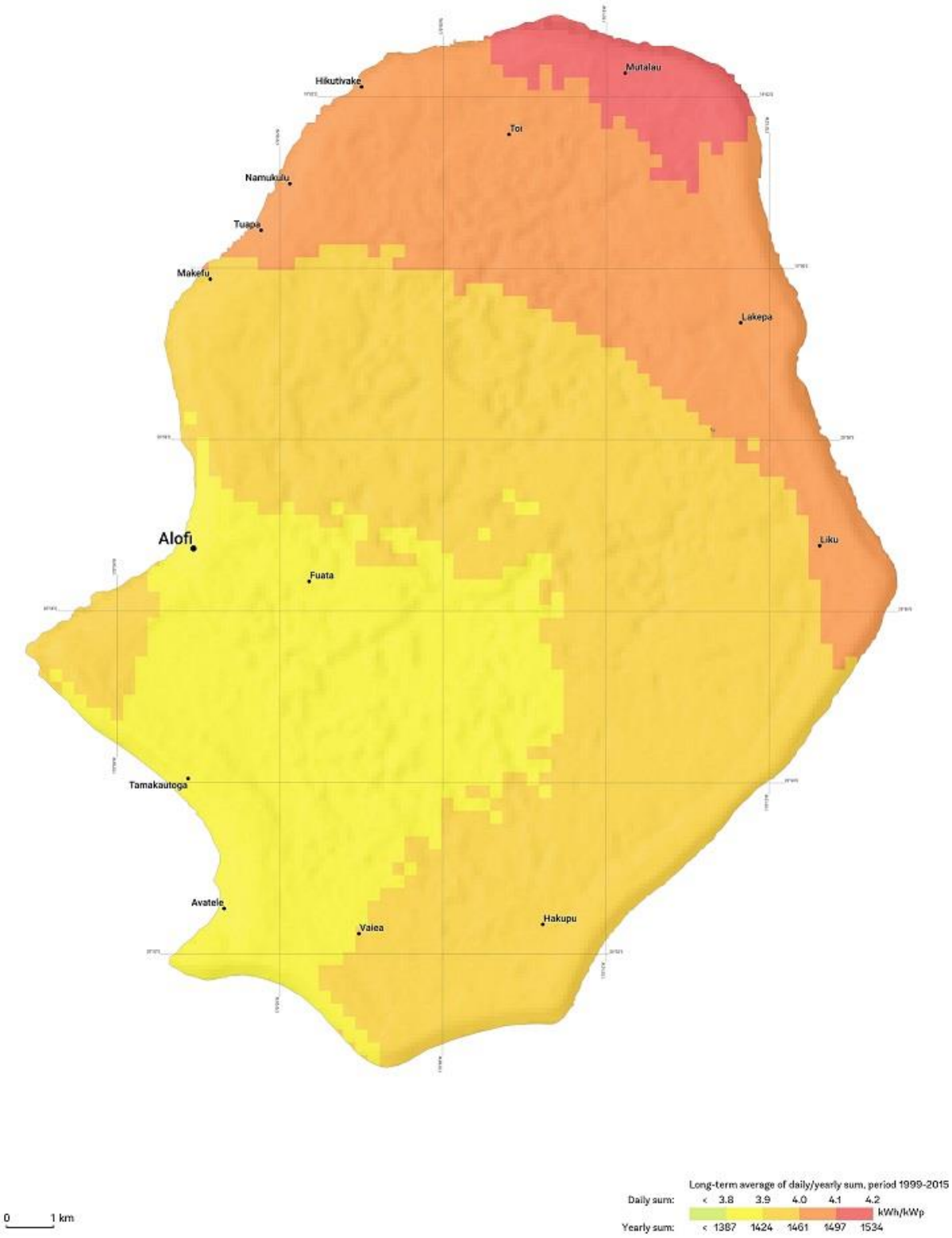
As shown in Table L.5, since the first solar PV installations in 2010, this technology has always contributed only ~2.0% to the total electricity needs, with the balance provided with the diesel GenSets.

Table L.5 Power Generation Sector (NiSERM)

Power Generation (GWh)	2009	2010	2011	2012	2013	2014	2015	2016	2017
Power from Diesel GenSets	3.138	3.081	3.201	3.265	3.285	3.160	3.324	3.357	3.443
Power from Solar PV	0	0.067	0.069	0.064	0.067	0.067	0.067	0.067	0.067
Total Power Generation (GWh)	**3.138**	**3.148**	**3.270**	**3.329**	**3.352**	**3.227**	**3.391**	**3.424**	**3.510**

Figure L.1 below shows that the annual potential photovoltaic production for Niue, averaged over the period 1999-2015, is in the 1390-1530 kWh/kWp range (World Bank).

Figure L.1 Niue Long-Term Daily & Annual Average Photovoltaic Production (World Bank - https://globalsolaratlas.info)



Let's consider an optimal location at the high end of the range capable of achieving an annual electricity generation of 1500 kWh/kWp. In addition, let's take into consideration that there will be some downtime due to maintenance and repair, and that the actual yearly power generation is 1400

kWh/kWp. If all the 543 kWp presently installed would be grid connected the potential contribution of solar PV electricity generation to Niue's demand would be the following:

543 kWp · 1400 kWh/kWp/year = 760,200 kWh/year

This would represent approximately 22% of the total electricity that was generated in 2017.
Niue does not have annual growth estimates, but it has forecasted electricity demand growth over multi-year periods. The expected demand growth is 33% over the period 2009-2020, and 75% over the period 2009-2025. Table L.6 shows the yearly growth forecasts, under a BAU scenario (the PV installations are still considered largely off-grid until the instability issues have been properly resolved) distributing the expected demand growth over the time period of reference (the yr/yr growth assumption is also shown in Table L.6).

Table L.6 Power Generation Sector Forecasts - BAU

Power Generation (GWh)	2018	2019	2020	2021	2022	2023	2024	2025
Power from Diesel GenSets	3.632	3.832	4.043	4.288	4.548	4.823	5.116	5.426
Power from Solar PV	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067
Total Power Generation (GWh)	**3.699**	**3.899**	**4.110**	**4.355**	**4.615**	**4.890**	**5.183**	**5.493**
yr/yr change (%)	5.4	5.4	5.4	6.0	6.0	6.0	6.0	6.0

In this discussion about the electricity sector, we are also including home cooking, since Niue has a proposed target to increase the use of LPG (Niue uses a blend of Propane/Butane in 60/40 proportion based on volume) for domestic cooking under the "LPG Rehabilitation Programme". Therefore the current and forecasted use of LPG, will allow us to determine the decline in electricity demand, since LPG stoves will substitute electric ones. Over the past decade, Niue has actually shifted back and forth between these two energy sources. Table L.7 shows the LPG consumption for domestic cooking.

Table L.7 LPG Consumption for Domestic Cooking (NiSERM)

	2009	2010	2011	2012	2013	2014	2015	2016	2017
LPG for Domestic Cooking (GJ)	918.0	818.2	898.1	978.1	924.1	891.3	852.0	852.0	852.0

L.3 Estimated Primary Energy Supply and GHG Emissions – Business As Usual Scenario

In this section, we will estimate the annual growth in primary energy supply, based on forecasts on energy demand made by GoN and its relevant ministries and departments. Business As Usual scenario is defined as expected growth due to continued changes in population, living habits and commercial activities if none of the energy targets set by GoN is pursued and achieved. This latter scenario will be described in Section L.4 and it is labeled as Alternative Scenario.

For all those energy sources for which no estimates have been made or for which there is no expectation of growth or decline under a BAU scenario, constant values compared to 2017 or alternatively the latest year in which energy supply was measured. The following assumptions have been made:

1. Power Generation: the INDC presented at the 2015 Paris UNFCCC meeting, Niue forecasts an increase in electricity generation of 33% over the period 2009-2020, and 75% over the period 2009-2025. Since most of the activities planned in the 2015-2025 NiSERM have not

started yet, in the estimates below, more focus have been posed on the longer term expectations.

2. Automotive Diesel Oil: this fuel is used for three main purposes, namely: a) power generation; b) land transport; and c) other uses. NiSERM has estimates for the period 2015-2018 of 2.0% growth, 3.0% decline, and 0% change for the three sectors, respectively. These percentage changes have been used as basis also for the annual estimates until 2025.
3. Petrol: similarly to ADO, the NiSERM also provides 2015-2018 growth estimates of 6% increase for the use of petrol for land transport, growth expectations that have been used as basis also for the estimates until 2025.
4. LPG: this energy source has a dual use in Niue, for domestic and for commercial use. The largest changes have been recorded in the latter, due to increasing commercial activities connected to the flourishing touristic sector. NiSERM forecasted an 8.0% annual increase over the 2015-2018 period. Since the major changes in domestic uses will be related to the adoption of more LPG stoves (considered under the Alternative Scenario), we assume that the expected growth in LPG use will be entirely absorbed by the commercial sector, and once again have extended these estimates until 2025.

Table L.8 below reports our estimates in primary energy supply by energy source until 2025 under the BAU scenario. As mentioned earlier, since jet fuel is treated both as an import and an export, it will not be included in this table.

For the same BAU scenario we have also estimated the amounts of GHG emissions that Niue is releasing into the atmosphere when burning its fossil fuels. The mass of CO_2 released by each fuel type has been taken from the USA government website: www.eia.gov. The results, which will be used as basis for comparison with the Alternative scenario to determine the GHG emission reductions due to the AREAN project, are reported in Table L.9. Emissions from the agricultural sector in terms of soil release of GHGs (i.e., CH_4 and N_2O are not included in the estimates).

Table L.8 Niue Estimated Primary Energy Supply by Energy Source (GJ) – BAU

Primary Energy Supply (GJ)	2018	2019	2020	2021	2022	2023	2024	2025
Local Generation								
Solar PV Electricity	240	240	240	240	240	240	240	240
Solar Thermal (hot water systems)	16	16	16	16	16	16	16	16
Biomass	532	532	532	532	532	532	532	532
Total Local Energy Generation	**788**	**788**	**788**	**788**	**788**	**788**	**788**	**788**
Imported Energy								
ADO (power generation)	40,567	42,798	45,152	47,889	50,791	53,869	57,133	60,595
ADO (land transport)	8,771	8,508	8,252	8,005	7,765	7,532	7,306	7,087
ADO (other uses)	2,639	2,665	2,692	2,719	2,746	2,773	2,801	2,829
Petrol	36,988	39,207	41,560	44,053	46,697	49,498	52,468	55,616
Kerosene (other uses)	24	24	24	24	24	24	24	24
LPG (domestic use)	852	852	852	852	852	852	852	852
LPG (commercial use)	1,210	1,223	1,236	1,249	1,263	1,277	1,291	1,305
Total Imported Energy	**91,051**	**95,277**	**99,768**	**104,791**	**110,137**	**115,825**	**121,875**	**128,308**
Total Primary Energy (GJ)	**91,839**	**96,065**	**100,556**	**105,579**	**110,925**	**116,613**	**122,663**	**129,096**
yr/yr change (%)		4.6%	4.79%	5.0%	5.1%	5.1%	5.2%	5.2%

Table L.9 Niue Estimated GHG Emissions (tCO_2) – BAU

GHG Emissions (tCO2)	2018	2019	2020	2021	2022	2023	2024	2025
Local Energy Sources								
Solar PV Electricity	0	0	0	0	0	0	0	0
Solar Thermal (hot water systems)	0	0	0	0	0	0	0	0
Biomass	49	49	49	49	49	49	49	49
Total Energy Sources Emissions	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**
Imported Energy Sources								
ADO (power generation)	2,813	2,968	3,131	3,321	3,522	3,735	3,962	4,202
ADO (land transport)	608	590	572	555	538	522	507	491
ADO (other uses)	183	185	187	189	190	192	194	196
Petrol	2,500	2,650	2,809	2,977	3,156	3,345	3,546	3,759
Kerosene (other uses)	2	2	2	2	2	2	2	2
LPG (domestic use)	52	52	52	52	52	52	52	52
LPG (commercial use)	73	74	75	76	77	78	78	79
Total Imported Energy Emissions	**6,231**	**6,520**	**6,827**	**7,171**	**7,537**	**7,926**	**8,340**	**8,781**
Total GHG Emissions (tCO_2)	**6,280**	**6,569**	**6,876**	**7,220**	**7,586**	**7,975**	**8,389**	**8,830**
yr/yr change (%)		4.6%	4.79%	5.0%	5.1%	5.1%	5.2%	5.2%

L.4 Energy Growth, GHG Emissions and GHG Emissions Reductions - Alternative Scenario (All Targets Achieved)

GoN has set several goals for the energy sector in general as well as the electricity sub-sector. These targets are summarized in Table L.10. The values and years used for both targets and baseline are taken from the NiSERM. Since GoN is significantly behind schedule for the implementation of the initiatives promoted in the NiSERM for the Energy Efficiency target (or decline in electricity demand) more emphasis has been put on achieving the longer term target (15% electricity demand reduction by 2025) rather than the shorter term target (10% electricity demand reduction by 2020).

Table L.10 GoN Energy and Power Sector Targets (NiSERM and updates from GoN)

Target	Target Year	Baseline
Generate 80% of electricity with renewable sources	2025	2% in 2014
Reduce electricity demand by 10%	2020	BAU
Reduce electricity demand by 15%	2025	BAU
Reduce power station losses to 4.5%	2020	5.2% in 2011
Reduce power station losses to 4.0%	2025	5.2% in 2011
Increase the power generation efficiency of the diesel GenSets to 4.0 kWh/ltr	2020	3.77 kWh/ltr (2014)
Introduce 1.0% of fuel efficient vehicles	2020	0% in 2014
90% of households use LPG for cooking	2025	34% in 2014
Keep the average forced outage below the regional average of 5.4%*	2020	
Keep SAIDI < 200 min/customer, the regional average goal*	2020	

*: Baseline values for these two targets have not been measured

To estimate the changes in energy supply under the Alternative Scenario, additional information was obtained from developing partners and GoN officials, and several assumptions have been made, which are here summarized:

1. To reach the target of 80% electricity generated from RE sources, NZHC has committed in 2017 a first tranche of NZ$ 5.0 million (~US$ 3.5 million), which includes the installation of 600 kWp of solar PV panels. In addition, 3.1 MWh of batteries will also be acquired.
   Early in 2018, NZ has also pledged a second tranche of approximately the same amount to help Niue achieve its target. The exact total capacity that will be installed during this phase has not been determined yet and it will also depend on the battery capacity that will be procured (the objective is to add 5.0 MWh of storage capacity). It is estimated that this should bring Niue to achieving approximately 55% RE electricity production by 2025 (provided that all other goals are achieved).
   NZHC has commented that in case this financial effort is not sufficient to achieve Niue's goal, they are willing to provide further financial support. We estimate that an additional 750 kWp of solar PV panels will have to be installed by 2025 in order to meet 80% of electricity demand with RE. We have distributed these additional solar PV panels in five 150 kWp installations over the period 2021-2025; naturally the total installation can be distributed differently, as long as the total stays at 750 kWp, a portion of which will be covered by the rooftop PV systems from the demo described in Section M.2.3 below. Our estimates take into consideration the expected electricity demand growth, all energy targets achieved, and all projects and demos described below completed; changes in station and transmission losses have also been taken into account.
2. Niue has set two Energy Efficiency (EE) targets through electricity demand reduction: a) 10% reduction by 2020; and b) 15% reduction by 2025. In our estimates we have focused on the longer term target, since the initiatives in this area have not been very aggressively pursued. The reduction of electricity demand will be achieved through the establishment of financing schemes for the adoption of efficient lighting and household appliances, as well as reduction in energy consumption in government and commercial building. Furthermore, Niue is compliting a switch to net metering, which has usually the dual purpose of guaranteeing that there will be no unpaid bills and it also causes a better electricity consumption management.
3. DNV KEMA, during their grid instability analysis, among other data have measured station losses of 5.19% at NPC powerhouse, which are deemed too high and should be reduced to 4.5% by 2020 and 4.0% by 2025. In addition, the power generation efficiency of the diesel GenSets has declined from 4.29 kWh/ltr in 2009 to 3.77 kWh/ltr in 2014. Since Niue uses among the best diesel quality available in the Pacific region and the diesel GenSets are regularly maintained and in good conditions (one was replaced in 2010), these two improvements can be achieved with better control and dispatch of the electricity load throughout the day.
4. The adoption of 1% fuel efficient vehicles by 2020 comprise Electric Vehicles (EVs), hybrid cars and new cars with engines smaller than 1,300 cc. Our estimate has been the most conservative in terms of electricity demand growth, which is assuming that the 1% of fuel efficient is all Evs. Currently in Niue there are already 3 Evs and other 8 have been budgeted by the government. Furthermore, we assumed that the adoption of Evs continues past 2020 and set at 5% Evs the target for 2025.
5. The installation of solar PV powered LED streetlights as well as solar water pumps, as designed in two of the proposed demo projects described below will also impact the demand of electricity, and they have been included in the estimates. Although both the lampposts and the water pumps will be grid-connected to guarantee their functioning even in the event of extended bad weather, the majority of the electricity consumed will be generated by the integrated solar PV panels.

6. Lastly, the gradual switch from electricity to LPG for domestic cooking has also been incorporated in our estimates. The target set by 2025 is 90% of households using LPG for domestic cooking with the remaining 10% coming from traditional biomass.

The assumptions made to determine the power generation forecasts under the alternative scenario in Table L.11 are: a) 80% power generated from RE sources; b) 5% Evs penetration; c) 90% LPG stoves for domestic uses; d) 4.0% power station losses; e) new transformers reduce by 65% the core losses of distribution (NiSERM states the core losses are 48.3% of the distribution losses, which account for 4.7%); f) implementation of a solar water pump demo project; g) implementation of the solar powered LED streetlights demo project; and h) 15% EE through electricity demand reduction.

Table L.11 Power Generation Sector Forecasts (GWh) – Alternative Scenario

Power Generation (GWh)	2018	2019	2020	2021	2022	2023	2024	2025
Power from Diesel GenSets	3.632	2.167	1.389	1.120	1.036	0.949	0.876	0.807
Power from Solar PV	0.067	1.600	2.440	2.650	2.860	3.070	3.280	3.490
Total Power Generation (GWh)	**3.699**	**3.768**	**3.829**	**3.771**	**3.896**	**4.020**	**4.156**	**4.298**
Solar PV (%)	1.8	42	64	70	73	76	79	81
Solar PV Installed & Connected (kWp)		1,143	1,743	1,893	2,043	2,193	2,343	2,493

Table L.12 uses the same power generation estimates to calculate the liters of diesel that will be used annually. In addition to all the assumptions used for Table L.11, in Table L.12 we are also assuming that the target to bring back up the electricity generation efficiency of 4.0 kWh/ltr of diesel is achieved. The stiff decline, especially for the first two years, is due to the installation of solar PV systems, which will replace a large portion of diesel consumption in the power generation sector.

Table L.12 ADO to Meet the Power Generation Sector Forecasts (ltr) – Alternative Scenario

	2018	2019	2020	2021	2022	2023	2024	2025
ADO for Power Gen. – Alt. Scen. (ltr)	1,124,071	541,838	347,208	280,093	258,965	237,365	218,906	201,861

Over the years Niue has switched back and forth between electric stoves and LPG stoves. At the end of 2010, 314 gas stoves were distributed through an EDF-9 project, and in 2011 about 2/3 of domestic stoves were LPG. In 2012, half of the LPG users for domestic cooking decided to switch back to electric stove, which at that point represented nearly 60% of all domestic stoves. GoN has set a target to switch back all electric stoves to LPG by 2025, a decision supported by the decline in LPG prices. The remaining 10%, as shown in Table L.13, will continue to use traditional cooking fuels, such as biomass and wood.

Table L.13 Number of Households per Energy Source Forecasts – Alternative Scenario

# of Stoves	2011	2012	2018	2019	2020	2021	2022	2023	2024	2025
LPG Stoves	320	160	163	219	276	308	340	372	404	437
Electric Stoves	116	276	281	224	167	135	103	71	39	0
Other (i.e., biomass)	41	41	42	42	42	42	42	42	42	42
Total # of Stoves	**477**	**477**	**485**	**485**	**485**	**485**	**485**	**485**	**485**	**485**

Table L.14 summarizes the primary energy supply forecasts under the alternative scenario, while Table L.15 shows the GHG emissions for the same scenario. Table L.15 also contains annual and cumulative GHG emission reductions achieved by implementing all the activities described in the AREAN project (i.e., comparing the Alternative Scenario to the BAU Scenario). Since the life expectation of solar PV installations is ~25 years, while cars life expectation is about 15 years, cumulative GHG emissions reductions have been calculated considering EVs to last for 15 years, and PV installations and home cooking to last for 25 years (the latter actually increases GHG emissions if electricity is obtained from solar PV, therefore represents a conservative estimate). These long term estimates are summarized in Table L.16.

Table L.14 Niue Estimated Primary Energy Supply by Energy Source (GJ) – Alternative Scenario

Primary Energy Supply (GJ)	2018	2019	2020	2021	2022	2023	2024	2025
Local Generation								
Solar PV Electricity	240	5,761	8,785	9,541	10,297	11,053	11,809	12,565
Solar Thermal (hot water systems)	16	16	16	16	16	16	16	16
Biomass	532	532	532	532	532	532	532	532
Total Local Energy Generation	**788**	**6,309**	**9,333**	**10,089**	**10,845**	**11,601**	**12,357**	**13,113**
Imported Energy								
ADO (power generation)	40,567	19,561	12,535	10,112	9,349	8,569	7,903	7,288
ADO (land transport)	8,771	8,465	8,170	7,860	7,561	7,274	6,998	6,733
ADO (other uses)	2,639	2,665	2,692	2,719	2,746	2,773	2,801	2,829
Petrol	36,988	39,207	41,560	44,053	46,697	49,498	52,468	55,616
Kerosene (other uses)	24	24	24	24	24	24	24	24
LPG (domestic use)	852	1,147	1,448	1,615	1,783	1,951	2,118	2,286
LPG (commercial use)	1,210	1,223	1,236	1,249	1,263	1,277	1,291	1,305
Total Imported Energy	**91,051**	**72,293**	**67,664**	**67,633**	**69,423**	**71,367**	**73,603**	**76,080**
Total Primary Energy (GJ)	**91,839**	**78,602**	**76,997**	**77,721**	**80,268**	**82,968**	**85,960**	**89,193**
yr/yr change (%)		(-14.4)	(-2.01)	0.9	3.3	3.4	3.6	3.8

Table L.15 Niue Estimated GHG Emissions & Yearly and Cumulative Reductions (tCO_2) – Alternative Scenario

GHG Emissions (tCO2)	2018	2019	2020	2021	2022	2023	2024	2025
Local Energy Sources								
Solar PV Electricity	0	0	0	0	0	0	0	0
Solar Thermal (hot water systems)	0	0	0	0	0	0	0	0
Biomass	49	49	49	49	49	49	49	49
Total Energy Sources Emissions	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**
Imported Energy Sources								
ADO (power generation)	2,813	1,356	869	701	648	594	548	505
ADO (land transport)	608	587	567	545	524	504	485	467
ADO (other uses)	183	185	187	189	190	192	194	196
Petrol	2,500	2,650	8,809	2,977	3,156	3,345	3,546	3,759

Kerosene (other uses)	2	2	2	2	2	2	2	2
LPG (domestic use)	52	70	88	98	108	119	129	139
LPG (commercial use)	73	74	75	76	77	78	78	79
Total Imported Energy Emissions	**6,231**	**4,923**	**4,595**	**4,587**	**4,705**	**4,833**	**4,982**	**5,146**
Total GHG Emissions (tCO_2)	**6,280**	**4,973**	**4,645**	**4,637**	**4,754**	**4,883**	**5,031**	**5,196**
Yearly GHG Reduction (tCO_2)	**0**	**1,596**	**2,231**	**2,583**	**2,831**	**3,092**	**3,358**	**3,634**
Cumulative GHG Reduction[41] (tCO_2)	**0**	**1,596**	**3,828**	**6,411**	**9,242**	**12,335**	**15,693**	**19,327**

Table L.16. Niue Estimated Long-Term Cumulative GHG Emission Reductions (tCO2) – Alternative Scenario

GHG Emissions (tCO2)	2030	2035	2040	2045	2050
Cumulative GHG Reduction (tCO_2)	37,497	55,667	73,788	90,359	99,633

Table L.17 below shows the potential fossil fuel savings under the alternative scenario. The numbers in red/parenthesis represent savings (both ADO for power generation and land transport), while LPG consumption is expected to increase due to the adoption of LPG stoves for domestic uses. The other fossil fuels are not included since their consumption is the same under the BAU and Alternative Scenario.

Table L.17 Niue Estimated Fossil Fuel Savings - Alternative Scenario

Primary Energy Supply (Lt.)	2018	2019	2020	2021	2022	2023	2024	2025
ADO (power generation)	-	(643,876)	(903,795)	(1,009,789)	1,127,106)	1,232,362)	1,348,041)	(1,467,792
ADO (land transport)	-	(1,179)	(2,281)	(4,015)	(5,629)	(7,129)	(8,520)	(9,809)
LPG (domestic use)	-	10,628	21,445	27,479	33,513	39,547	45,581	51,615

The total storage capacity that will be acquired with the NZ funds is 8.1 MWh (or 8,100 kWh) and the technology chosen is the lithium-ion PowerWall 2 produced by Tesla. PowerWall 2 provides a 100% Depth of Discharge (DoD), which means the full storage capacity can be used. According to our power generation estimates, in 2025 electricity demand will be ~4.3 GWh for the entire year (Table L.11), or ~12,000 kWh/day. On average 2,400 kWh/day will be generated with the GenSets and 9,600 kWh/day with solar PV panels.

As assumed in Section L.2.2, based on the World Bank Solar Atlas (https://globalsolaratlas.info), solar PV panels generate on average power for approximately 4 hours a day. Assuming that the distribution of electricity consumption is constant throughout the day (in reality it is higher during the day time, therefore our assumption is conservative), in those 4 hours 2,000 kWh will be used. This means that of the 9,600 kWh generated by the solar PV systems 2,000 are used directly and the difference, 7,600 kWh, is stored in the batteries, whose capacity of 8,100 kWh is therefore sufficient.

[41] Includes also the replication activities that the GoN will have to implement in order to achieve all the NiSERM targets.

Annex M: Description of EC&EE and LC Demonstrations

Proposed Investment Type Activity and Demo Projects

M.1 Investment Type Activity: Improvement of Power Grid Stability and Reliability

NPC has 74 transformers in place, distributed all around the electric grid, for a combined total capacity of 3,090 kVA. In 2012, DNV KEMA has prepared two assessment reports for NPC, one analyzing grid instability issues and one estimating all power system energy losses, including transmission losses. This latter report was based on 2010 and 1Q 2011 data.

At that time, technical losses due to the transformers were still within acceptable limits at ~4.7%, however it was not possible to determine the "age" and wear of many transformers, which have aged and their performance has deteriorated in these last 7-8 years. DNV KEMA advised NPC to replace over time all the transformers with more energy efficient and reliable ones, provided an assessment of the nameplate capacity requirements. Additionally, over the past few years, Niue has experienced several episodes of power outage caused by transformer failures. In 2014 alone, there have been 10 power outages (Support to Energy Efficiency in Niue – EDF11). Some of these outages only lasted few hours, while the most severe ones exceeded 24-hour duration.

The status and condition of the transformers have been recently reassessed, with the following results:

1. The government of New Zealand will provide a total of 9 transformers. 2 x 200kVA transformers have been already shipped to Niue and are already equipped with switchgears, the balance will be shipped and mounted during the implementation of their ***"Niue/NZ Renewable Energy Partnership – 1st Tranche"*** project.
2. The EU, as part of their EDF-11 funding initiative, will also provide 7 transformers and 8 switchgears. The shipment of the units is scheduled bye the end of 2018/beginning of 2019, and NPC will provide the installation of the units on the electric grid.
3. A report has been prepared showing the need for an additional 40 transformers (with different capacity of 50 kVA and 100 kVA, depending on the point of installation) to replace all the old ones with high efficiency ones.

This proposed project is designed to guarantee grid stability and optimal electric load dispatch. The benefits for replacing the old transformers with new ones will lead to several advantages, namely:

1. The European Copper Institute concluded that adopting new transformers can result in over 70% reduction in transmission losses. With a very conservative assumption that transmission losses are currently still at 4.7% and that the new transformers will only reduce 65% of such losses an electricity generation savings of 3.1% will be achieved, or ~132,000[42] kWh/yr (this value depends on the electricity demand growth forecasts over the lifespan of the transformers, and therefore will increase over time; here is conservatively taken constant after year 2025). NPC will benefit from this transmission losses reduction for long time, in fact the American Council for the Energy Efficiency Economy estimates that new transformers can operate reliably without maintenance of performance degradation for at least 30 years.
2. New transformers will considerably increase the reliability of the power grid by reducing the number of outages. In addition, the transformers should include –or in alternative be

[42] These electricity savings are provided by both baseline and incremental activities. The estimated number of new transformers is given by the sum of: 9 transformers by NZHC + 7 transformers by EDF-11 + 40 transformers by GEF = 56 transformers. Therefore, the estimated annual electricity due to the GEF incremental investment alone would be: (40/56) · 132,000 kWh/year = ~95,000 kWh/year

equipped with– switchgears, which can improve the safety of the NPC staff and reduce the duration of power outages by providing well defined isolation points for network maintenance. Currently, in case of a power outage, NPC needs to entirely disconnect the feeder where the fault takes place (Niue's power grid is separated in two feeders: North and South) in order to fix the grid problems affecting an unnecessary large number of customers. In the future when Niue will have a large amount of RE connected to the grid system, NPC will need isolation points in the grid to also make sure that the RE-units can be connected to the grid system when faults happen or maintenance is required in the grid. Furthermore, the new transformers have to be equipped also with data-loggers to allow assessments of the power quality, transformer loading and provide data information to the SCADA system for monitoring of the grid system performance, all operations that are not currently done.

3. Lastly, replacing the old transformers with new ones might also have significant environmental benefits, since old transformers tend to leak oil into the ground.

During the implementation stage of this investment activity, an evaluation of the assessment report should be done to assure that the number and size of transformers and ancillary equipment proposed (i.e., switch gears and data logger) are still the optimal choice with the changing power grid. This does not only refer to the 80% power generation from RE sources, but also the to the achievement of all the targets stated in Table 10 as well as the implementation of all the demo activities here described.

Estimated incremental costs for the proposed investment, which does not include the equipment procured through NZ and EDF-11 (budgets and descriptions of these baseline projects are given in **Section IX**), including also freight and installation costs are US$ 600,000.

<table>
<tr><td colspan="5"><u>Investment Type Activity:</u> Improvement of Power Grid Stability and Reliability</td></tr>
<tr><td colspan="4">Baseline Case: 9 transformers and 9 switchgears provided by NZHC; 7 transformers and 8 switchgears provided through EDF-11</td><td>Location: Whole Island</td></tr>
<tr><td colspan="5">LC Technology Application: High energy efficient transformers and switchgears</td></tr>
<tr><td colspan="5">Demo (Alternative Case) Description: This project is not a demo, but a standalone, full-scale project which aims to stabilize and increase the reliability of Niue's electric grid, especially after additional solar PV systems will be connected to the grid.
The equipment provided through the baseline projects will not be sufficient to stabilize the electric grid. Based on a feasibility study previously undertaken, additional transformers, to replace the existing ones, are necessary to stabilize the grid and improve its reliability. The feasibility study indicates that 40 new units will be required; however, a new assessment will be conducted during the implementation stage of AREAN as a preliminary activity to determine the exact number, location and capacity of the units to be installed. Together with the new transformers, switchgears will also be installed to improve the safety of the NPC staff and reduce the duration of power outages by providing well defined isolation points for network maintenance.</td></tr>
<tr><td colspan="5">Expected Results: Niue's electric grid is stable and reliable with 80% of its power generation provided by intermittent renewable energy sources.</td></tr>
<tr><td colspan="5">Economic Feasibility: In addition to cost savings, this project has also additional advantages which are not financially quantified, such as: improved stability and reliability of the electric grid; improved safety working condition of NPC staff; and reduced environmental impact of oil leaking into the ground.</td></tr>
<tr><td>Investment</td><td>Annual</td><td>Annual GHG</td><td>Annual</td><td>Economic Feasibility</td></tr>
</table>

Cost, US$	Energy Savings, toe	Emission Reduction, tCO_2	Energy Cost Savings, US$	NPV, US$	IRR, %
600,000	24[43]	76	74,700[44]	76,700[45]	11.6[46]

[43] As mentioned above, the electricity savings due to the high energy efficient transformers is a percentage of total demand. If demand grows, so it does in absolute terms the amount of electricity saved with the new transformers. Here we are making a very conservative assumption keeping the electricity savings constant (due to a 0 growth, or a demand growth compensated by improvements in energy efficiency)

[44] Based on the current estimated electricity cost in Niue of NZD 1.13/kWh (USD 0.80/kWh), including GoN subsidy.

[45] Based on a very conservative discount rate of 10% (as suggested by SPREP)

[46] Based on lifespan of the equipment, this cost savings will last 30 years.

M.2.1 Demo 1: Integrated[47] Solar Powered LED Street Lights

Niue has an inadequate system of public street lampposts scattered along the over 200 km of roads that surround and cut through the island. To improve the safety in villages, on the roads and along sea-tracks, GoN has set in the NiSERM a target of introducing 300 new integrated solar powered LED street lights, which will not be sufficient to provide all the needed public illumination, but it will add to the few existing conventional street-lights.

The GoN does have a recurring budget in place, funded by NZAid, for the management of its assets, including the roads. However, the budget cannot cover all the interventions that Niue requires, and considering the unsafe conditions of several of its roads, their repair and maintenance has been considered a higher priority for safety concerns. During consultation with the department of transportation, it has been indicated the need to get more streetlights deployed.

If Niue were to meet its need to increase the distribution of street lights with conventional light poles, this would increase the electricity demand from NPC. Furthermore, the power consumption for public illumination is not metered and not billed, impacting the financial deficit of GoN. Implementation of integrated solar PV street lights with batteries is becoming quite diffused throughout country islands in the Pacific region. Tonga, Nauru, the Federated States of Micronesia and Tokelau are only few examples of country islands that have adopted or have planned to adopt this kind of technology.

It is important to include a preliminary assessment, preferably in coordination with the Department of Transportation, about the exact locations where to install the lampposts and determine the adequate power for each LED bulb.

This kind of solar powered street lights come accessorized with batteries, since the panels will generate electricity during daytime when public illumination is not needed, and therefore has to be stored for the night hours. Although the sizing of the solar panels is done to assure that the power generated daily is sufficient to provide electricity throughout the night, there might be cloudy and rainy days when the batteries will not be fully charged. For this reason the lampposts must be still grid connected, to guarantee their proper operation in any conditions. On average, the street lights will draw a relatively small amount of electricity from the grid, and in other cases can even feed the grid with surplus power generated. In any case, since we are still adding to the grid a source of intermittent power generation, the street lights will affect the grid stability and this possibility has to be accounted for the design of the power grid, especially for the control and dispatch of electricity loads.

The power capacity of LED street lights is in the 70-100 W range and they operate on average approximately 10 hours a day. This means, that if we install 300 lampposts with a capacity of 100 W each, we have a total potential power capacity of 30 kW, which can be absorbed by the overcapacity of NPC in case of electricity withdrawal from the grid, for a total of maximum 300 kWh in a night.

It would be preferable that all the lampposts are purchased from the same vendor, not only to obtain bulk discounts on purchase and freight, but also because it would be easier to keep in stock spare parts and to train local electricians in maintaining and repairing this kind of technology. Some vendors even ship free of charge single unit to be tested on location.

[47] Here "Integrated" refers to the fact that all equipment (solar PV panels; LED light; rechargeable battery; pole; and cables and control system) is assembled into one integrated system.

With the advancement in LED and solar PV technologies, prices for integrated solar powered LED street lights have come down significantly over the past few years, and the total estimated cost of 300 100-W lampposts, including shipment, installation, spare parts and training of electricians for their O&M is US$ 150,000.

We also recommend that, although unbilled, electricity consumption for public illumination is metered, both for the old lampposts as well as the new LED street lights that will be installed (the net balance between electricity fed to the grid and drawn from the grid) since this information is useful to measure the power distribution losses.

<table>
<tr><td colspan="6">Demonstration 1: Integrated Solar Powered LED Street Lights</td></tr>
<tr><td colspan="4">Baseline Case: GoN recurring annual budget for infrastructure maintenance, which includes also roads.</td><td colspan="2">Location: Best location for the demo will be determined during the implementation stage. Urban areas should be prioritized.</td></tr>
<tr><td colspan="6">LC Technology Application: Integrated solar powered LED streetlights</td></tr>
<tr><td colspan="6">Demo (Alternative Case) Description: The GoN has undertaken an effort to improve the quality of the roads and the public illumination to increase safety. The budget available, however, is not sufficient to perform all the required intervention and the proposed demo wants to demonstrate the efficacy of implementing LED lighting. Since implementation of public illumination will increase electricity demand, solar PV panels with batteries are also provided. The lampposts will have to be grid-connected to guarantee public illumination even when bad weather prevents batteries from being fully charged, therefore, the demo has to be large enough to test also grid stability in the event that electricity is drawn from the grid.</td></tr>
<tr><td colspan="6">Expected Results: Improvements in public illumination and safer conditions for both drivers and pedestrians.</td></tr>
<tr><td colspan="6">Economic Feasibility: The analysis is based on 300 lampposts, 100 W each, operating 365 days a year for 10 hours a day, for a total of ~110,000 kWh/year. Assuming that 10% of the electricity will be drawn from the grid (when bad weather conditions will not allow the batteries to be recharged), use of solar LED streetlights would save a total of ~99,000 kWh/year, which are equivalent to US$ 78,000/year (currently electricity has a cost of NZ$ 1.13/kWh, and an exchange rate of 1 NZ$ = 0.7 US$).
Calculations are based on the lifespan of the solar PV panels of 25 years. Over this period other components will have to be replaced, specifically: batteries have to be replaced 2 times; LED light bulbs and electronic components have to be replaced 1 time.</td></tr>
<tr><td rowspan="2">Investment Cost, US$</td><td rowspan="2">Annual Energy Savings, toe</td><td rowspan="2">Annual GHG Emission Reduction, tCO_2</td><td rowspan="2">Annual Energy Cost Savings, US$</td><td colspan="2">Economic Feasibility</td></tr>
<tr><td>NPV, US$</td><td>IRR, %</td></tr>
<tr><td>150,000</td><td>25</td><td>80</td><td>78,000</td><td>439,900</td><td>51.5</td></tr>
</table>

M.2.2 Demo 2: Retrofit of Buildings with Energy Efficiency and Renewable Energy Technologies

The purpose of this demo project is to show to the general public that every building can be retrofitted to incorporate EE and RE technologies to reduce its carbon footprint and concomitantly save money by reducing the electricity use.

This demo is particularly important because it will help overcome a big hurdle in the widespread adoption of EE/RE technologies, which is people's diffidence towards these technologies. In fact, because of severe grid instability issues caused by solar PV systems, Niueans have grown very skeptical towards solar PV panels, with nearly no penetration in the private sector. Presently, there are only four solar PV installations privately funded and all are kept off-grid, with no financial incentives for the owners, such as net metering or feed-in tariffs. In addition, high-efficiency household appliances are perceived as too expensive, because the advantages of electricity, and therefore money, savings when compared to less efficient appliances has not been clearly explained to the people. Finally, the retrofitted building will allow to showcasing RE/EE measures yet to be introduced in Niue. The possibility to show in a real setting the functioning and advantages of these technologies will help stimulate investments in this sector.

The first step of this activity would be the selection of a demonstration building, preferably a public building where all Niueans have access to and can visit. This choice should also take into consideration the current investment plans of the GoN into its edifices, in order to use such project as a baseline for our proposed, GEF funded incremental activities. Although an existing building would be the preferred choice, the GoN is not retrofitting any of its structures. There is however a plan to build a new Assembly and Cabinet building, the Fale Fono. Therefore, for this demo instead of retrofitting an existing building it will be retrofitted the existing design of a building.

The site of the new Parliament House will be inland, far from the western coast where the current building is located and highly exposed to severe natural events and to cyclones, as during Cyclone Heta in 2004. While state of the art resilient and adaptation measures are incorporated in the building design, RE technologies and EE measures have not been adequately included and adopted.

Based on the existing design of the Fale Fono, the suggested interventions are the following;

1. Grid-connected, roof-mounted solar PV panels including a battery energy storage system. Accoring to the NiSERM data, the Government is responsible for ~20% of the electricity consumption, or 700,000 kWh/year based on the 2017 data. Although a breakdown of the electricity consumption for each building is not available, let's assume the the Govrnment building utilizes about 10% of the total electricity consumed by the Government sector, or 70,000 kWh/year. Since this is just a demo project, we do not need to provide 100% of the electricity needs with solar PV panels plus battery storage. We can estimate that approximately a solar PV system of 25 kWp (equivalent to 35,000[48] kWh/year) and a storage capacity of 54 kWh (equivalent to 4 Tesla Powerwall 2.0[49] battery packs) will be sufficient to satisfy 50% of the estimated electricity needs. This intervention can serve two purposes: a) it will show the reliability of grid connected solar PV systems (provided that the grid instability issues are concomitantly removed as amply explained in this proposal); and b) together with the introduction of financial and fiscal incentives, such as net-metering and feed-in tariffs as well as discounted or waived import duties, it can help demonstrate, supported by

[48] 25 kWp · 1400 kWh/kWp/year = 35,000 kWh/year

[49] https://instylesolar.com/blog/2018/02/08/battery-review-tesla-powerwall-2-0/

informational material explaining the monetary advantages of owning a PV power generation system.

2. All the appliances will be upgraded to high energy efficiency, including: a) inverter type air-conditioning system; b) freezer; c) refrigerator; d) washing machine; e) dish washer; f) LED lights; and g) solar water heater. Some of these technologies have been already acquired by several households; however, it is important to show all of them working together. Similarly to the PV system discussed above, informational material prepared for the EE scheme can be made available here.
3. Niue enjoys a warm tropical weather year-round, which suggests painting the exterior walls with light colors, which absorb less sun heat. This benefit can be further augmented by selecting special paint with infrared-reflective pigments, which significantly reduce heat absorption (a wall painted with light color, reflective paint reaches ~40 °C versus the ~80 °C of a wall painted with a dark color, conventional paint). Other measures will include natural ventilation, windows and roof shading with trees, and layered construction materials for walls that provide insulation and do not overheat.
4. To optimize the energy consumption and reduce the CO_2 emissions of the Fale Fono, a Building Energy Management System (BEMS) will also be incorporated. By connecting all appliances, lighting and electricity powered devices to a centralized system will allow to measure, control and optimize the overall energy consumption. The collected data is then used to manage and optimize the building's electricity consumption allowing to save energy and money, whilst reducing the CO_2 emissions. In addition, since a BEMS can be controlled remotely, the data could be used in the future for the development of a smart grid.
5. Lastly, because of the roof-mounted PV panels, the building foundation and the electric wiring have to be reinforced to support the heavier weight and for safety reasons.

Our estimated budget to turn the Fale Fono in an energy efficient building is US$ 200,000.

<table>
<tr><td colspan="2">Demonstration 2: Retrofit of Buildings with Energy Efficiency and Renewable Energy Technologies</td></tr>
<tr><td>Baseline Case: Construction of the new Parliament House (Fale Fono)</td><td>Location: TBD</td></tr>
<tr><td colspan="2">LC Technology Application: Rooftop solar PV system with battery storage; All-in-one application of high EE appliances and lighting; Infrared-reflective pigments painting; Natural ventilation; Windows and roof shading; layered walls; and Building Energy Management System.</td></tr>
<tr><td colspan="2">Demo (Alternative Case) Description: The design of the new Parliament House will not have all the modern features to make it an EE building. The proposed demo has the intent to retrofit the design to include all possible technologies and measures to turn the Fale Fono into a completely EE structure. Some of the incremental activities are not new for Niue (i.e., PV system and the EE appliances), while others will be showcased in this demo for the first time (i.e., battery storage for a private PV system, and all other proposed LC technologies and measures as listed above); however, the most important feature that is demonstrated here is that all the available technologies and measures are implemented together.</td></tr>
<tr><td colspan="2">Expected Results: The main purpose of this demo project is to show to the general public that an energy efficient building in technically sustainable and reliable as well as financially viable. This will spur people to retrofit their homes and commercial buildings with all or only part of the EE/RE technologies and measures here proposed.</td></tr>
<tr><td colspan="2">Economic Feasibility: The PV systems will generate 35,000 kWh/year, or US$ 27,600/year (at a cost of NZ$ 1.13/kWh and an exchange rate of 0.7 US$ = 1 NZ$) for 25 years.
The Fale Fono will have an estimated annual electricity consumption of 70,000 kWh. Let's assume</td></tr>
</table>

that all other measures will allow an EE of 15% (the same targeted by the GoN), and therefore provide annual electricity savings of 10,500 kWh, or US$ 8,300/year for 30 years (appliances will have to be replaced half way through).					
Investment Cost, US$	**Annual Energy Savings, toe**	**Annual GHG Emission Reduction, tCO_2**	**Annual Energy Cost Savings, US$**	**Economic Feasibility**	
				NPV, US$	**IRR, %**
200,000	**12**	**37**	**35,900**	**102,700**	**17.1**

M.2.3 Demo 3: Energy Efficiency Technologies Financing Scheme

The purpose of this demo project is threefold, it is meant to: 1) demonstrate the viability of EE appliances and lighting, fuel efficient cars and residential/commercial rooftop solar PV installations through the establishment of a financing scheme, which will also contribute to remove the financial barriers that hamper the use of RE/EE technologies; 2) contribute to the achievement of the 15% EE improvement by 2025 by favoring the adoption of high energy efficiency household appliances and efficient lighting; and 3) contribute to the establishment of a local market for RE/EE technologies both during the project implementation stage and afterwards for solar PV installers, PV and EVs service providers, and retailers of RE/EE technologies.

Niue has currently in place a high energy efficiency household appliances rebate program with the Low Carbon Islands Project through IUCN. The program was established in early 2017 with a budget of US$ 80,000 and has no deadline for the disbursement of the available budget. The only appliances covered by the rebate program are refrigerators, freezers and washing machines. The scheme is accessible to both private houses and commercial activities, with a limit of two appliances for each participant, and it offers a fixed rebate rate of 25% with no trade-in option. Alternatively, people can choose not to get a rebate, but a loan to purchase the appliance at 0% interest rate.

To date this rebate program has not been very successful and only about half of the funds have been spent. Consultations with local stakeholders have highlighted several reasons for the shortcomings of this initiative; the last two are interconnected with one another:

a. NDB and Kiwibank have not properly advertised the initiative to the general public.
b. Niueans do not fully understand the mid- to long-term financial advantages of purchasing high efficiency appliances since no information pamphlet showing the electricity savings vis-à-vis with low energy efficiency appliances were prepared.
c. Upfront disbursements for energy efficiency appliances are very high. This regardless of possibility to ask for a loan at 0% interest.

There is interest to expand the rebate program and possibly add other appliances, such as air conditioners, solar water heaters, efficient lighting, and electric bikes; however this has to be accompanied by activities that can expand people participation into it (it is particularly important that model and size of the appliances available for purchase through the scheme are properly selected, to attract consumers). This would help Niue to achieve a portion of the energy efficiency target set in the NiSERM.

As part of the demo, pamphlets comparing energy and financial savings of high EE appliances and lighting vs low efficiency ones will be prepared to show customers the advantages of EE technologies (for example compare a 3.5 or 4.0 star freezer versus a 2.0 or a 2.5 star one, common ratings for this appliance as reported in a recent household energy survey[50]). The pamphlets should compare the upfront prices of the two appliances (including the rebate for the energy efficiency one) and show the potential electricity and money savings and the payback period for the investment in more efficient appliances. The comparison between low and high efficiency appliances should also be used to establish an adequate rebate rate. If a 25% rebate does not provide a fast and satisfactory economic advantage, higher rates should be considered to attract more participants. An additional rebate, for example another 5.0%, will be extended to those participants who trade in old inefficient appliances. A budget for the safe disposal of these old appliances will be set aside.

[50] "Niue 2018 Household Electrical Appliances, Lights, and End-use Survey – Process and Findings", Thomas Lynge Jensen, UNDP Pacific – Fiji Office, 2018.

The awareness raising activities that will be implemented under Component 5 of the AREAN project (such as flyers, radio commercial, informative material at public offices and schools, etc), although not part of this demo, will also support the promotion of high EE technologies.

The aforementioned household energy survey shows that over 50% of the surveyed appliances (for which it was possible to determine the energy efficiency rating) have a low star rating of 2.5 stars and below; this translates into an estimate of approximately 250 households. If these appliances are replaced with efficient appliances with a star rating of 4.0 stars the potential annual electricity savings is estimated to be approximately 250,000 kWh (www.energywise.govt.nz/tools/running-costs-calculator/#!/). Similarly, using the number and power capacity of incandescent and halogen light bulbs present in households (a total estimated 1,800 low-efficiency light bulbs) and replacing them with LED light bulbs , an additional annual electricity savings of over 50,000 kWh could be achieved. Lastly, although surveys for commercial appliances are not available at the moment, one can conservatively estimate a grand total of ~400,000 kWh of electricity savings per annum including also the commercial sector and other appliances. This would be more than 11% of total electricity savings based on current power generation, or over 9% based on 2025 power generation estimates. The balance of the electricity demand reduction will be achieved via follow up programs, as well as changes in consumer behavior promoting initiatives to save electricity demand in all sectors, residential, commercial and governmental.

For this demo, the only option that will be made available to the public is the 25% fixed rebate plus the additional 5% trade-in discount; the 0% interest rate loan option will not be offered. Based on appliances prices in New Zealand and assuming that approximately half of the potential electricity demand reduction will be pursued (~5% EE) and achieved through this program an estimated budget of ~US$ 240,000 would be needed, which will allow electricity demand to be reduced by 200,000 kWh/year for 15 years (the average lifespan of an appliances or LED lightbulb). Since the discount covers only 30% of the prices, the total people's disbursement is US$ 560,000. The calculations do not include the existing LCF financing scheme.

The GoN has also set a target in the NiSERM to switch 1% of the country total fleet of motor vehicles (or 50 vehicles) to high fuel efficiency vehicles. The baseline for this portion of the demo is the purchase of 8 EVs that the GoN has recently planned (see **Section 3.2.1**). In addition, the government has also established to waive the import duties on high fuel efficient vehicles (which includes EVs, hybrid cars, and also conventional internal combustion engines 1,300 cc or smaller). Finally, since the GoN has already purchased 3 second-hand EVs, they are also installing a few fast-charging electric stations.

The component of the demo proposed here is meant to encourage the general public in purchasing high fuel efficient vehicles (including EVs and hybrid cars and excluding conventional internal combustion engines, regardless of the engine power capacity). Considering the high current price of EVs and hybrid cars, we are assuming that second-hand cars will be purchased. The only option extended to the public is for a flat 30% rebate.

The price paid by the GoN for the second-hand cars delivered to Niue is in the NZ$ 10,000-14,000 range. We are assuming that all participants to this scheme will also purchase second-hand EVs at an average price of US$ 10,000/car; considering the 30% rebate this translates into a discount of US$ 3,000/car. If the scheme aims to support the purchase of 20 vehicles (half of the 40 vehicles still required to reach the 50 vehicles target set in the NiSERM, considering the already purchased plus those planned by the GoN), the total budget required for this component of the demo is US$ 60,000. Once again this covers 30% of the total costs, while the people's investment will be US$ 140,000.

To estimate the energy savings associated with this component of the demo, let's assume that on average each car will be driven for 7,000 km/year (based on approximately 20 km per day). Due to the road conditions and aging of the cars, we assume that fuel consumption is 10 km/ltr, which translates into 700 ltr/year per car or 14,000 ltr/year for all 20 cars. On the other hand, energy efficiency for the EVs is assumed at 20 kWh/100 km (a conservative assumptions, considering that new cars only requires 15 kWh/100 km, to take into account that the cars will be acquired second-hand; for the same reason the lifespan of the cars is assumed to be only 10 years). To drive the same 7,000 km/year each EV will require 1,400 kWh/year, for a total of 28,000 kWh/year for all 20 cars. Based on the diesel genset power generation of 4 kWh/ltr of diesel (the goal set in the NiSERM), these 28,000 kWh are equivalent to 7,000 ltr of diesel per year. The difference between the two figures (14,000 ltr/year – 7,000 ltr/year) of 7,000 ltr/year is the volume of diesel[51] saved by purchasing the EVs instead of conventional cars.

The last component of this demo is a financing scheme for promoting residential and commercial rooftop solar PV installations. Since the cost of electricity is high, for this financing scheme we will provide the public with a flat 20% rebate. Assuming that each installation will be on average 5 kWp with no batteries, at the cost of US$ 10,000 per system, setting a budget of US$ 50,000 for the entire component will allow financing 25 PV systems. During installations, different size systems can be considered, establishing a ceiling of US$ 15,000 per single installation. Since this portion of the demo only considers a rebate that covers 20% of the capital investment, the total investment from the public is US$ 200,000.

25 solar PV systems, 5 kWp each, generating 1,400 kWh/kWp/year the total electricity generated will be 175,000 kWh/year for 25 years (the lifespan of PV panels).

The total budget requested from GEF for this program is US$ 350,000 (US$ 240,000 for the EE appliances and lighting; US$ 60,000 for the EVs; and US$ 50,000 for the rooftop PV systems). On the other hand, the total investment from the public is US$ 900,000 (US$ 560,000 for the EE appliances and lighting; US$ 140,000 for the EVs; and US$ 200,000 for the rooftop PV systems).

<table>
<tr><td colspan="2">Demonstration 3: Energy Efficiency Technologies Financing Scheme</td></tr>
<tr><td>Baseline Case: LCF financing scheme and the planned purchase of 8 EVs by the GoN</td><td>Location: N/A</td></tr>
<tr><td colspan="2">LC Technology Application: High EE households appliances and LED lighting; fuel efficient cars (EVs and hybrid cars); and residential/commercial rooftop solar PV systems.</td></tr>
<tr><td colspan="2">Demo (Alternative Case) Description: Provide more funds and include more types of appliances to the LCF financing scheme presently implemented in Niue. Extend the adoption of high fuel efficiency cars and rooftop solar PV systems to the general public. For a detailed description of the alternative case, please refer to the content of this section.</td></tr>
<tr><td colspan="2">Expected Results: Demonstrate the viability of LCT; establishing financing scheme to remove financial barriers to the widespread use of LCT; achieving the improvement in EE target set in the NiSERM; and contribute to the creation of a local marker for RE/EE technologies.</td></tr>
<tr><td colspan="2">Economic Feasibility: EE appliances and LED lighting will allow saving 200,000 kWh/year, or US$ 158,000/year (at a cost of NZ$ 1.13/kWh and an exchange rate of 0.7 US$ = 1 NZ$) for 15 years.
Fuel efficient vehicles will save an estimated 7,000 ltr of diesel/year, or US$ 13,000/year (at a price of NZ$ 2.65/ltr of diesel, petrol has the same price, and an exchange rate of 0.7 US$ = 1 NZ$) for 10</td></tr>
</table>

[51] Price of diesel or gasoline at the gas station is currently NZ$ 2.65/ltr.

years.

The PV systems will generate 175,000 kWh/year, or US$ 138,000/year (at a cost of NZ$ 1.13/kWh and an exchange rate of 0.7 US$ = 1 NZ$) for 25 years.

Investment Cost[52], US$	Annual Energy Savings, toe	Annual GHG Emission Reduction, tCO_2	Annual Energy Cost Savings, US$	Economic Feasibility[53]	
				NPV, US$	IRR, %
900,000	**102**	**322**	**310,000[54]**	**1,498,000**	**34.1**

[52] This is the portion of investment provided by the public

[53] Calculations for the NPV and IRR take into consideration the different duration of the benefits for the three components of this demo.

[54] This will drop to US$ 297,000 after 10 years (benefits from efficient cars will terminate) and to US$ 138,000 after 15 years (benefits from EE appliances and LED lighting will terminate).

M.2.4 Demo 4: Solar Energy Use in Water Pumping Systems

Niue has a large underground water basin that provides water for all uses, although recently have been raised concerns about a number of potential contamination sources, namely: a) salty water infiltrations from the bottom; b) potentially harmful elements leaking from landfills and waste disposal areas; and c) contamination through old piping systems (this was the case for the drinking water bottling facility during the field mission for this project).

Niue's water distribution system is made of about 20 bore pumps, over 50% of them are at least 20 year old, distributed around the island with power capacity in the 1.5-5.0 kW range (the majority are either 2.2 kW or 3.7 kW). The bore pumps transfer the water from the underground basin to overhead water tanks that distribute water to the dwellings by gravity. Electricity for water pumping is not billed nor efficiently metered and it is a loss in the balance taken by GoN.

In 2017, an assessment on several water pumping facilities has evidenced that since water consumption is not charged to consumers there is a lot of waste in households, especially with external taps often left open. In addition, the state of maintenance of the water distribution system is inadequate with many control sensors not working (these sensors should communicate to the bore pumps that the overhead water tanks are full and therefore the pumps should shut down until the level drops to a determined lower level). Lastly, consumption is constantly increasing, with the growth driven by the flourishing tourism industry.

As mentioned in the "Baseline Projects" **Section 3.2.1**, the GoN is implementing the Water Strategy Plan. Due to budget limitations, only a portion of the activities needed to improve capacity building in the water sector, reduce the energy consumption and achieve the water sector targets specified in the NiSERM will be implemented. Therefore, we are proposing this demo project in the water sector to support the GoN in the achievement if its targets.

In order to lower electricity consumption and consequently reduce GHG emissions associated with the use of diesel fuels for power generation, we are suggesting replacing the older bore pumps, a total of 10, with solar PV water pumps. These systems must include also storage batteries to assure the functioning of the solar pumps during night time. Naturally, considering the importance of guaranteeing water supply during periods of extended bad weather as well, when the solar PV systems do not provide the nameplate capacity, these pumps must be grid-connected. Also, in case of over-generation of electricity, this can be fed to the electric grid and reduce power generation from NPC.

During the initial stage the proper power capacity of the solar pumps, the solar PV systems and the battery storage units will be assessed. In addition, in order to avoid waste of water and electricity, all control systems will be checked and those defective will be either repaired or replaced.

Similarly to the LED street lights initiative in **Section M.2.2**, also for this demo activity all the equipment should be procured from the same vendors to reduce the number of spare parts and to simplify the training of the water department staff to maintain the new equipment. Furthermore, grid stability issues must be taken into consideration since similarly to other solar PV systems, also these pumps would be a source of intermittent electricity on the electric grid (having a demo with 10 solar water pumps should be large enough to test the grid stability as well).

We recommend electricity consumption for water to be measured (the net balance between electricity fed to the grid and electricity drawn from the grid), regardless of if it will be billed or not, since it will help to keep track of total consumption and therefore measure distribution losses.

Considering the total number of solar pumps needed and their size, their shipment and installations, and spare parts and staff training, a budget of US$ 150,000 is estimated for this activity.

<table>
<tr><td colspan="6">Demonstration 4: Solar Energy Use in Water Pumping Systems</td></tr>
<tr><td colspan="4">Baseline Case: The GoN is currently implementing the Water Strategy Plan. Due to budget limitations, only a portion of the activities needed to improve capacity building in the water sector, reduce the energy consumption and achieve the water sector targets specified in the NiSERM will be implemented.</td><td colspan="2">Location: The solar water pumps will replace the oldest water pumps currently used in the water distribution system.</td></tr>
<tr><td colspan="6">LC Technology Application: Solar water pumping system</td></tr>
<tr><td colspan="6">Demo (Alternative Case) Description: The demo proposed is to replace some of the existing water pumps, preferably the oldest currently installed unless there are some faulty ones, with solar water pumps. In order to avoid waste of water and electricity, all control systems will be checked and those defective will be either repaired or replaced. Similarly to the LED streetlight demo project, battery storage is also provided. The solar water pumps will be grid-connected to guarantee water distribution even when bad weather prevents batteries from being fully charged, therefore, the demo has to be large enough to test also grid stability in the event that electricity is drawn from the grid.</td></tr>
<tr><td colspan="6">Expected Results: Reduce diesel consumption for electricity generation and avoid wasting water</td></tr>
<tr><td colspan="6">Economic Feasibility: The analysis is based on 5 solar water pumps with a power capacity of 2.2 kW and 5 solar pumps with a power capacity of 3.7 kW. Each pump will operate on average 8 hours a day for 365 days a year, for a total of 86,000 kWh/year.
Assuming that 10% of the electricity will be drawn from the grid (when bad weather conditions will not allow the batteries to be recharged), use of water solar pumps would save a total of 77,500 kWh/year, which are equivalent to US$ 61,300/year (at a current electricity cost of NZ$ 1.13/kWh, and an exchange rate of 1 NZ$ = 0.7 US$).
Calculations are based on the lifespan of the solar water pumps and panels of 25 years. Over this period batteries have to be replaced 2 times; electronic component have to be replaced 1 time.</td></tr>
<tr><td rowspan="2">Investment Cost, US$</td><td rowspan="2">Annual Energy Savings, toe</td><td rowspan="2">Annual GHG Emission Reduction, tCO_2</td><td rowspan="2">Annual Energy Cost Savings, US$</td><td colspan="2">Economic Feasibility</td></tr>
<tr><td>NPV, US$</td><td>IRR, %</td></tr>
<tr><td>150,000</td><td>20</td><td>63</td><td>61,300</td><td>40.4%</td><td>347,400</td></tr>
</table>

M.3 Estimated Direct Emission Reductions (DER) from the Demonstration Projects

Table M.1 CO_2 Emission Reduction from Demo Projects[55]

Demo Project	Estimated Annual Diesel Reduction (toe)	Estimated Annual Emission Reduction (tCO_2)	Life Time (Yrs.)	Estimated Lifetime Diesel Reduction (toe)	Estimated Incremental Lifetime Direct Emission Reduction (tCO_2)	
					DER (during AREAN)[56]	DER (Lifetime)
Transformers	24.3	76.4	30	730	153	2,293
LED Streetlights	25.4	79.8	25	635	160	1,994
Fale Fono – PV	9.0	28.3	25	225	57	709
Fale Fono - EE	2.73	8.5	30	81	17	255
EE Scheme – Appliances	51.5	162.0	15	773	324	2,430
EE Scheme – Rooftop PV	45.1	141.7	25	1,127	283	3,543
EE Scheme – EVs	5.8	18.3	10	58	37	183
Solar Water Pumps	20.0	62.8	25	499	126	1,569
Total				**4,129**	**1,157**	**12,977**

Table M.2 CO_2 Emission Reduction from Baseline Projects[57]

Baseline Project	Estimated Annual Diesel Reduction (toe)	Estimated Annual Emission Reduction (tCO_2)	Life Time (Yrs.)	Estimated Lifetime Diesel Reduction (toe)	Estimated Lifetime Direct Emission Reduction (tCO_2)	
					DER (during AREAN)	DER (Lifetime)
NZ – PV Phase 1	216.5	680.3	25	5,412	2,721	17,008
NZ – PV Phase 2	216.5	680.3	25	5,412	2,041	17,008
NZ - Transformers	5.5	17.2	30	164	52	516
EDF11 - Transformers	4.3	13.4	30	128	40	401
GoN EVs	2.3	7.3	15	35	29	110
Low Carbon Fund	8.6	27.0	15	129	54	405
Station Losses Reduction	6.0	18.0	30	180	54	540
Existing PV[58]	195.9	615.7	25	4,897	2,463	15,392
Total				**16,356**	**7,454**	**51,380**

Table M.3 Total CO_2 Emission Reduction Attributable to AREAN (Table M.1 + Table M.2)

				Estimated Lifetime Diesel Reduction (toe)	Estimated Total Lifetime Direct Emission Reduction (tCO_2)	
					DER (during AREAN)	DER (Lifetime)
TOTAL				**20,485**	**8,611**	**64,356**

[55] Although AREAN will last 4 years, DER during AREAN depends on when the demos are completed
[56] This assumes that the demo projects are operating during the last 2 years of the AREAN Project.
[57] Although AREAN will last 4 years, DER during AREAN depends on when the baseline projects are completed; based on project schedules
[58] PV panels already installed, but the grid stabilization activities implemented by AREAN will allow to reconnect them to the grid

Table M.4 Additional CO_2 Emission Reduction Needed to Achieve All NISERM Targets

Follow-up Project	Estimated Annual Diesel Reduction (toe)	Estimated Annual Emission Reduction (tCO_2)	Life Time (Yrs.)	Estimated Lifetime Diesel Reduction (toe)	Estimated Follow-up Lifetime Direct Emission Reduction (tCO_2)	
					DER (during AREAN)	DER (Lifetime)
PV to Reach 80%[59]	225.5	708.7	25	5,637	510	17,717
Balance to 15% EE[60]				7,344	121	17,377
Additional EVs	5.8	18.3	10	58	0	183
Total				**13,040**	**631[61]**	**35,277**

Table M.5 Total CO_2 Emission Reduction to Achieve All NISERM Targets (Table M.3 + Table M.4)

				Estimated Lifetime Diesel Reduction (toe)	Estimated Gran Total Lifetime Direct Emission Reduction (tCO_2)	
					DER (during AREAN)	DER (Lifetime)
GRAND TOTAL				**33,525**	**9,242**	**99,633**

M.4 CO_2 Emissions Reduction Estimates

Direct CO_2 Emission Reductions (DER)

Within the project intervention period, there will be demonstration and replication activities for the application of RE & EE technologies. The above tables show that the estimated cumulative direct emission reductions (DER_{EOP}) during the AREAN Project implementation is about 8,611 tons CO_2 (9,242 tons of CO_2 if we consider additional interventions from the GoN and NZHC to achieve the NiSERM targets). The lifetime direct emission reductions ($DER_{LIFETIME}$) is about 64,356 tons CO_2 (90,633 tons of CO_2 if we consider additional interventions from the GoN and NZHC to achieve the NiSERM targets). These are directly attributable to the AREAN Project.

- **DER_{EOP}** = CO_2 emission reductions due to AREAN Project intervention (cumulative by end-of-project; both baseline and demo projects) = 8,611 tons CO_2
- **$DER_{LIFETIME}$** = CO_2 emission reductions due to AREAN Project intervention (cumulative during the lifetime; both baseline and demo projects) = 64,356 tons CO_2

Direct Post-Project CO_2 Emission Reductions (DPPER)

Lifetime DPPER = $DER_{AREAN} + DER_{ASSISTED\ BY\ AREAN\ BUT\ IMPLEMENTED\ AFTER\ AREAN}$ = 64,356 + 35,277[62] = 99,633 tons CO_2

[59] We estimate 625 kWp are needed to reach 80% electricity from RE; NZHC pledged to fund this additional PV systems

[60] 15% EE equals 0.8 GWh electricity demand reduction based on 2025 estimates; 0.225 GWh are reduced with the EE – Appliances demo and the Low Carbon Fund baseline project, the GoN will have to reduce the additional 0.575 GWh

[61] These are assisted by AREAN and will be achieved during AREAN lifetime

[62] 631 tons of CO_2 will be achieved during the lifetime of AREAN

For the AREAN Project, the GEF Contribution is US$ 3,321,563

Unit Abatement Cost = US$ 3,321,563/ 99,633 tons CO_2 (DER + DPPER) = 33.34 US$/ton CO_2

Consequential CO_2 Emission Reductions (CER)

Considering the reduced size of Niue as well as all the projects that will be implemented during the AREAN project and as follow-ups intervention to achieve all the targets stated in the NiSERM, the Lifetime Consequential Emission Reductions calculations as prescribed by the GEF would lead to unrealistically large estimates. We are here considering the potential replication projects that the GoN could implement after the completion of AREAN.

Table M.6 Consequential CO_2 Emission Reductions (CER)

Replication Project	Estimated Annual Diesel Reduction (toe)	Estimated Annual Emission Reduction (tCO_2)	Life Time (Yrs.)	Estimated Lifetime Diesel Reduction (toe)	Estimated Consequential Emission Reduction (tCO_2)
Solar PV (600 kWp)[63]	216.5	680.3	25	5,412	17,008
EVs (300 cars)[64]	108.2	274.6	15	1,623	4,118
LED Streetlights (300 lampposts)[65]	25.4	79.8	25	635	1,994
Solar Water Pumps (10 pumps)[66]	20.0	62.8	25	499	1,569
EE Improvements [67]	51.5	162.0	15	773	2,430
Total				**8,942**	**27,120**

[63] The 2,493 kWp installed during AREAN will provide the 80% of electricity needs by 2025. Considering that 20% of electricity will still be generated with diesel generators and taking into consideration the electricity demand growth past year 2025, the installation of additional 600 kWp of Solar PV systems is a realistic assumption.
[64] This would represent ~30% of total cars, or ~15% of total vehicles. Since this relatively large number of EVs will also increase electricity demand, we recommend implementing Solar PV Powered Electric Car Charging Stations.
[65] This would cover urban areas and sea-tracks but not the entire road system in Niue.
[66] This would convert the entire water distribution system of Niue into solar water pumps.
[67] The additional EE measures have been assumed to be of the same size as the EE scheme proposed by AREAN.

Annex N: Description of UNDP Country Office Support Services (Letter of Agreement)

Annex O. List of People Consulted

During the Project Development Team field mission in Alofi Niue, from May 22nd to June 5th, 2018, the following stakeholders have been consulted (in chronological order):

1. Mr. Andre Siohane, Director General – Ministry of Infrastructure – andre.siohane@mail.gov.nu
2. Mrs. Felicia Talagi, Project Management Support Officer – Project Management Coordination Unit – felicia.pihigia@mail.gov.nu
3. Dr. Josie Tamate, Director General – Ministry of Natural Resources: – josie.tamate@mail.gov.nu
4. Mr. Deve Talagi, Director of Utilities – Ministry of Infrastructure – deve.talagi@mail.gov.nu
5. Mr. Speedo Hetutu, Former Power Manager – Niue Power Corporation – speedo.hetutu@mail.gov.nu
6. Mr. Haden Talagi, Acting Director of Environment – Ministry of Natural Resources – haden.talagi@mail.gov.nu
7. Ms. Natasha Tohovaka, Senior Project Coordinator – Ministry of Natural Resources – natasha.tohovaka@mail.gov.nu
8. Ms. Rossy Mitiepo – Director of Niue Met Services – Ministry of Natural Resources – rossy.mitiepo@mail.gov.nu
9. Ms. Rae Finlay – Business Development Manager/CEO – Niue Chamber of Commerce – rae@niue.nu
10. Ms. Charlotte Pihigia, Environment Officer – Ministry of Natural Resources – charlotte.pihigia@mail.gov.nu
11. Mr. Haggard Tongatule, Environment Officer – Ministry of Natural Resources – haggard.tongatule@mail.gov.nu
12. Mr. Wayne McCaughan, General Manager of Niue Commercial Entities Ltd. (Niue Development Bank and Kiwibank Agency) – Commercial and Trading Arm –
13. Mr. Gabriel Varea, (Niue Development Bank and Kiwibank Agency)
14. Mr. Andre van Der Walt, Deputy High Commissioner – NZ High Commission in Niue – andre.vanderwalt@mfat.gov.nz
15. Ms. Sonya Talagi, Director of Transport – Ministry of Infrastructure – sonya.talagi@mail.gov.nu
16. Mr. Poitogia Kapaga, Financial Secretary – Treasury Department and Planning – poi.kapaga@mail.gov.nu
17. Ms. Gaylene Tasmania, Director General – Ministry of Social Services – gaylene.tasmania@mail.gov.nu
18. Ms. Peleni Talagi, Solicitor General – Crown Law – peleni.talagi@mail.gov.nu
19. Mr. Poi Okesene, Director of Agriculture, Forestry & Fisheries – Ministry of Natural Resources – poi.okesene@mail.gov.nu

20. Ms. Emi Hipa, Head of External Affairs, Office of the Secretary of Government – emi.hipa@mail.gov.nu
21. Mr. Samson Nelisi, Reticulation Manager – Niue Power Corporation – samson.nelisi@mail.gov.nu
22. Mr. Huipunu Paola, Generation Manager – Niue Power Corporation – huipunu.paola@mail.gov.nu
23. Ms. Sina Hekau, National Consultant and Attorney at Hekau Attorneys at Law
24. Mr. George Valiana, General Manager of Niue Bulk Fuel – Commercial and Trading Arm – george.valiana@mail.gov.nu
25. Mr. Darren Tohovaka, Secretary of Justice, Department of Justice, Lands and Survey – darren.tohovaka@mail.gov.nu
26. Mr. Richard Siataga, Technical Officer, Department of Justice, Lands and Survey – richard.siataga@mail.gov.nu
27. Mr. Justin Kamupala, Secretary to Government, Office of the Premier – justin.kamupala@mail.gov.nu

Annex P: Annual Targets

	Indicators	Baseline (Year 0)	Year 1	Year 2	Year 3	Year 4
Project Goal: Improved energy consumption index and reduced annual growth rate of GHG emissions in the country's energy supply and energy end-use sectors	Reduction in the overall national energy utilization intensity (toe/1,000 USD GDP)	0.109	0.097	0.095	0.091	0.089
	Cumulative GHG emission reduction from fossil fuel utilization, tons CO_2	0	1,596	3,828	6,130	8,611
Project Objective: Enabling the achievement of low carbon energy access, sustainable energy, and green growth targets of Niue	Cumulative fossil fuel savings due to sustainable energy and low carbon interventions implemented, toe	0	528	1,264	2,115	3,047
	% RE electricity production	1.8%	42%	64%	70%	73%
	No. of new jobs created in the application of sustainable energy and LC technologies and techniques in the energy supply and energy end-use sectors in Niue	0	1	3	5	8
Component 1: Improvements in Energy Integrated Development Policy and Planning						
Outcome 1: Improved policy and regulatory frameworks in the application of energy efficiency and renewable energy technologies in the energy end-use sectors	No. of approved and enforced RE and EC&EE policies, and associated guidance and implementing rules and regulations	0	1	2	2	2
	No. of formulated and approved policies and regulations incorporated in the country's Energy Act	0	1	2	2	2
Component 2: Institutional Capacity Building on Low Carbon Development						
Outcome 2: Effective enforcement of plans, policies and regulations, and implementation of programs/projects on the application of climate resilient and low carbon technologies in the end-use sectors	No. of sectoral integrated development plans that are implemented and managed through the established and adopted integrated institutional mechanisms	0	1	1	2	2
	No. of low carbon development initiatives facilitated by adopted and enforced institutional arrangements mentioned in Indicator 1	0	1	2	3	4
Component 3: Improvements in the Financing of Low Carbon Initiatives						
Outcome 3: Increased availability of, and access to, financing for sustainable energy, energy access and low carbon development initiatives in the energy supply and demand sectors	No. of developed and recommended financing schemes/mechanisms with Niue Development Bank for supporting climate resilient and low carbon development initiatives in the country	0	1	1	2	2
	No. of small-scale EE projects and RE technology projects financed either through the adopted financing scheme; or by private sector investment	0	1	2	4	6
	No. of recommended finance/fiscal policies for supporting initiatives on LC development	0	1	2	2	2
Component 4: Climate Resilient and Low Carbon Technologies Application						

Outcome 4.1: Climate resilient and low carbon techniques and practices adopted and implemented in the energy supply and energy end-use sectors	No. of completed feasibility assessments conducted for planned energy-integrated socio-economic development activities that feature RE and EE technology applications	0	1	2	3	4
Outcome 4.2: Enhanced confidence in the viability of climate resilient and low carbon technology applications in the energy supply and demand sectors	Cumulative amount of energy savings from the successfully installed and operational demonstrations (including replications) of sustainable energy and low carbon technology applications, toe	0	0	0	184	368
	No. of RE and EE technologies application projects designed and financed for implementation as influenced by the results and outcomes of the demonstrations	0	0	1	3	5
Component 5: Enhancement of Awareness on Low Carbon Development						
Outcome 5: Enhanced levels of awareness and attitude towards climate resilient and low carbon development in the energy supply and energy end use sectors	***Incremental*** no. of energy consumers (e.g., households) that will utilize EE appliances and RE-based energy generating and consuming equipment acquired through AREAN initiatives	0	10	40	100	160
	No. of local firms that can capably provide technical, engineering and maintenance services for sustainable energy and low carbon technology application projects	0	0	1	2	3

Annex Q: Gender Equality Analysis

This section will be based on the outcome of the Gender Specialist work. This is ready in Q1 2019

Annex R: Knowledge Management Plan

The knowledge management system that will be employed in the proposed GEF project will consists of the conduct of training courses for pertinent personnel in the energy and utilities sector, as well as those in the village communities that will participate in the project activities. Coordination with the implementers of ongoing climate change and energy projects will be carried out to determine potential synergies in the knowledge management activities, particularly in the approach and methodologies that will be applied. Based on the preliminary assessments made during the scoping mission to develop this PIF, it is necessary to setup a capable project team comprised of competent local and international experts to expand the capacity of the local community people in the implementation of the relevant project activities. In addition, there will be special training for people who will be tasked to operate and maintain the various demo RE-based energy systems (power and non-power) that are part of the project. Among these are the operations personnel in NPC particularly in operating and maintaining on-grid solar PV power generation systems, and in addressing grid stability problems. Among the outputs of this project is an established and operational information exchange network for the promotion and dissemination of knowledge on low carbon development within and outside of the country (including other PICs and SIDS). Part of the project activities will be the establishment and operationalization of an energy supply and consumption monitoring and reporting, database to be housed in the DOU. This aspect of knowledge management, which involve the drawing on of information from a wide variety of sources, will be implemented, not only for the purpose of the country's energy planning but also to achieve an organized usage of knowledge about the energy situation in the country. This will be made possible through the information exchange network that will be established and operationalized under the project. With such network, data/information on lessons learned and best practices in the application of low carbon development techniques and practices, as well as implementation of sustainable energy and low carbon technologies specifically in small island settings, can be obtained from other PICs and SIDS, and applied to specific situations and localities in the country. The results of the project activities will also be disseminated to other PICs and SIDS through the information exchange network.