United Nations Development Programme
Project Document

Project Title: Facilitating Renewable Energy & Energy Efficiency Applications for Greenhouse Gas Emission Reduction (FREAGER)		
Country: Papua New Guinea (PNG)	**Implementing Partner:** Climate Change and Development Authority (CCDA)	**Management Arrangements:** National Implementation Modality (NIM)
UNDAF/Country Programme Outcome*:* Government and civil society have enhanced their capacity to implement biodiversity conservation, low carbon, and climate resilient development initiatives for environmental sustainability and improved community livelihoods to reduce the vulnerability of women, girls, men, and boys to disaster risks		
UNDP Strategic Plan Output: 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:** 2	
Atlas Project ID/Award ID number: 00094483	**Atlas Output ID/Project ID number:** 00098601	
UNDP-GEF PIMS ID number: 5569	**GEF ID Number:** 9273	
Planned start date: June 1, 2017	**Planned End Date:** May 31, 2021	
LPAC Date: December 1, 2016		
Brief project description: PNG's greenhouse gas (GHG) reduction efforts to date have focused on the forestry sector. Yet, despite low per capita energy use at present, with only 15 percent of the population having access to electricity, the adoption of renewable energy (RE) and energy efficiency (EE) technologies in PNG has strong potential both to reduce current GHG emissions and avoid future, growing GHG emissions expected as rising per capita energy use and electrification accompany development of the nation. Analysis shows that community RE mini-grid and township diesel center based EE programs present particularly compelling win-win propositions for PNG. Over time, both will present substantial cost savings over the business-as-usual case, in which diesel is used, while at the same time lowering present or avoiding future GHG emissions. FREAGER will demonstrate the relevant technologies for and aim to achieve widespread replication of micro/mini-hydro mini-grids, solar PV mini-grids, and township EE programs. It will aim to do so by removing barriers to these technologies in the areas of policy and planning, technical and commercial viability, availability of financing, and information and awareness. In the policy and planning area, the project will promote these technologies via: capacity building programs for officials, through which the officials develop actual pipeline RE mini-grid projects and township EE programs; design of policy incentives; standards work; national roadmaps for community RE mini-grids and township EE programs; and provincial level RE and EE plans. Technical and commercial viability will be supported through capacity building for technical personnel on RE mini-grids and on building and industrial EE. It will also be supported through developing and disseminating information on best international sourcing channels for EE and RE and on the "honest," best costing for community RE mini-grids in PNG. Project demos will include two mini-hydro mini-grids and one PV mini-grid, with support also provided for productive use of RE at all three sites. In addition, demos of comprehensive EE programs (including building and industrial energy audits and retrofits, support for residential customers, support for future, large power customers, and street lighting retrofits) will be developed in two townships that are fully powered by diesel. The project will also support demonstration of PPAs and billing systems, as well as O&M training, for two mini-hydro projects that are already under development. Efforts related to financing EE and RE will include capacity building for the		

financial sector and the set-up of an ESCO fund to finance EE retrofits and a loan fund for community RE projects. Information and awareness work will include support to develop domestic manufacturing of RE mini-grid and EE products (and thus achieve lower cots) and briefings on the cost competitiveness of RE and EE as compared to diesel. It will further include a multi-channel media campaign for RE and EE and educational materials on RE and EE. It will also include RE mini-grid how-to handbooks tailored to PNG, pipeline RE mini-grid project listings, data from RE resource assessments, and curriculum from various project workshops, all available at a one-stop-shop website on RE and EE in PNG.

FINANCING PLAN	
GEF Trust Fund	USD 2,840,640
UNDP	USD 300,000
Total Budget administered by UNDP	**USD 3,140,640**
PARALLEL CO-FINANCING* (*all other co-financing that is not cash co-financing administered by UNDP)*	
PNG Power, Ltd	USD 18,000,000
CCDA	USD 4,000,000
Eastern Highlands Provincial Government	USD 1,630,000
East Sepik Provincial Government	USD 830,000
Total parallel co-financing	**USD 24,460,000**
Grand-Total Project Financing (1)+(2)	**USD 27,060,640**

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:**

*Additional parallel co-financing of USD 3.26 million is expected to become available during implementation and to be provided by the following district governments: (1) Daulo District, Eastern Highlands Province (USD1 million); (2) Lufa District, Eastern Highlands Province (USD 1 million); (3) Wewak District, East Sepik Province (USD 630,000); and (4) Maprik District, East Sepik Province (USD630,000). This will bring the grand total of parallel co-financing to USD 27,720,000 and the grand total of project financing to USD 30,860,640.

I. TABLE OF CONTENTS

II. DEVELOPMENT CHALLENGE

Papua New Guinea's (PNG's) greenhouse gas emission reduction efforts to date have focused on the forestry sector. This reflects that the Land Use, Land-Use Change, and Forestry (LULUCF) category currently accounts for about 95 percent of PNG's GHG emissions (80 to 97 M tons), which come mainly from deforestation and forest degradation. Yet, the remaining five percent of PNG's GHG emissions, including those from the energy sector, are expected to grow quickly as PNG develops. The current low level of development of PNG's energy sector, in which only 15 percent of the population has access to electricity, presents an opportunity to leapfrog old technologies and avoid a substantial portion of the expected growth of GHG emissions in the business-as-usual scenario. Renewable energy and energy efficiency technologies present a particularly compelling win-win opportunity in the case of PNG. Aside from the potential to reduce current and avoid future GHG emissions, these technologies may hold viable solutions to address: PNG's power-short situation, the nation's very low levels of energy access, the very high costs of diesel power generation in PNG that create losses in all of the national power provider's (PPL's) 29 township diesel centers, and local air pollution from combustion of fossil fuels.

With the largest population among South Pacific island nations (around 7.7 million in 2016) and a population growth rate of over two percent per year, PNG, as its economy develops, is an important target for GHG emission reduction/ avoidance work in the region. Further, RE technologies present a strong "fit" for PNG in terms of achieving electrification and increasing incomes through productive applications of power. This fit is due to the remoteness of many communities (whether on one of the nation's many islands or in its mainland highland or forest areas) that the utility grid is not expected to reach, the abundance of RE resources in PNG, coupled with currently low per capita incomes (per capita GNI of USD 2,240 per year in 2014), and the low level of access to electricity (estimated at 15 percent in 2016).

Background on Current and Projected GHG Emissions in PNG

This subsection presents PNG's 2010 baseline GHG emissions and 2030 projected emissions in different sectors. Overall estimates are shown in Exhibit 1. Between 2010 and 2030, 26 to 38 percent total growth (or a 1.1 to 1.6 percent compound annual growth rate, CAGR) in emissions is expected, taking PNG from baseline total annual GHG emissions of 113 to 130 million tons in 2010 to 142 to 179 million tons in 2030. The LULCF sector is projected to have 18 to 29 percent growth over the period, or a CAGR of 0.8 to 1.3 percent. This relatively low growth rate in the LULCF sector is driven by projected reductions in emissions from timber harvesting, currently PNG's largest source of GHG emissions. It is a much lower growth rate than the 300 percent expected growth in GHG emissions over the period from the non-LULCF sector, which implies a compound annual growth rate of 7.2 percent between 2010 and 2030 for the non-LULCF sector.

Estimates for non-LULCF sub-areas, which together made up about five percent of PNG's GHG emissions in 2010, are shown in Exhibit 2. These sub-areas include the oil and gas industry,[1] transport, power, oil palm, and "other." Power and "other". These are the sub-areas addressed most directly in the proposed project. The annual GHG emissions from these are highlighted in Exhibit 2. The power sector GHG emissions are projected in the business-as-usual scenario to rise from a range of 300,000 to 500,000 tons annually in 2010 to 1.4 to 2.0 million tons annually in 2030. This represents a quadrupling of current levels and, at 7.2 to 8.0 percent compound annual growth, which is much faster growth than for GHG emissions as a whole (1.1 to 1.6 percent growth). The "other" sub-area, including in particular direct (non-electricity) use of fossil fuels by industry and buildings, while estimated to account for less than one percent of 2010 annual GHG emissions, is expected to grow substantially. The main drivers of growth in this sub-area include projected population growth, development of the economy, and increasing production and sale of PNG's LNG resources.

[1] Oil and gas industry emissions are those associated with the production of oil and gas, such as those resulting from flaring. They are not those resulting from general use of oil and gas (other than that used to support oil and gas production).

Exhibit 1. PNG's 2010 Baseline and 2030 Projected Annual GHG Emissions

Category	Sector	2010 Annual GHG Emissions	2030 Projected Annual GHG Emissions	Total Growth 2010-2030 in GHG Emissions	Compound Annual Growth Rate 2010-2030 of GHG Emissions
Land Use and Land Use Change and Forestry (LULCF)	Timber Harvesting	68-69 M tons	51-59 M tons	-14% to -25%	-0.7% to -1.4%
	Subsistence Smallholder Agriculture	28-43 M tons	35-60 M tons	25% to 40%	1.1% to 1.7%
	Agricultural Lease	6 M tons	17 M tons	83%	5.3%
	Commercial Agriculture	3 M tons	22 M tons	633%	10.5%
	Other LULCF (mining, fire, etc.)	5 M tons	5 M tons	0%	0%
Sub-total	*Sub-total LULCF*	*110-126 M tons*	*130-163 M t*	*18% to 29%*	*0.8% to 1.3%*
Non-LULCF	Non land use related (non-LULCF)	3-4 M tons	12-16 M tons	300%	7.2%
Total	Total	113-130 M tons	142-179 M t	26% to 38%	1.1% to 1.6%

Sources: REDD+ Technical Working Group, CCDA, and World Bank online historical data.
Note: 2010 data extrapolated from 2008/2009 estimates.

Exhibit 2. PNG's 2010 Baseline and 2030 Projected Annual Non-LULCF GHG Emissions by Sub-Area

Non-LULCF Sub-Area	2010 Annual GHG Emissions	2030 Projected Annual GHG Emissions	Total Growth 2010-2030 in GHG Emissions	Compound Annual Growth Rate 2010-2030 of GHG Emissions
Transport	1.6 – 2.4 M tons	3.3 – 4.5 M tons	106% to 88%	3.2% to 3.7%
Oil Palm	0.7 M tons	1.9 – 2.3 M tons	171% to 229%	5.1% to 6.1%
Oil and Gas Industry	0.4 – 0.6 M tons	5.3 – 7.5 M tons	1,150% to 1,225%	13.5% to 13.8%
Power Sector	0.3 – 0.5 M tons	1.4 – 2.0 M tons	300% to 367%	7.2% to 8.0%
Other (including buildings and industry direct use of fossil fuels)	NA	NA, but expected to grow substantially	NA	NA
Total (without "other")	3.0 – 4.2 M tons	11.9 – 16.3 M tons	288% to 297%	7.0% to 7.1%

Sources: CCDA and World Bank online historical data.
Note: 2010 data extrapolated from 2008/2009 estimates.

PNG's Energy Sector

PNG's energy sector is characterized by substantial production and consumption of petroleum. Crude oil production while declining from its peak after 2007, in the past few years (2015 and 2016) has ramped up again and surpassed that peak. Natural gas production is growing rapidly in response to government policy to develop reserves for exports and domestic gas-fired power generation. Exhibit 3 summarizes background information on PNG's energy sector. It shows that PNG remains a net energy exporter, with about 19 percent of production exported in 2013. Projected compound annual growth in primary energy consumption between 2013 and 2040 is roughly six percent. The greatest share of primary energy consumption is represented by petroleum oil products, which made up roughly 57 percent of domestic consumption in 2011. The same year, traditional biomass made up roughly 37 percent of domestic consumption, leaving hydropower, natural gas, and geothermal as the "other" category to make up a combined six percent. In terms of end use, the industrial sector is PNG's largest end use sector of primary energy. Industrial energy consumption is expected to continue to expand at a substantial growth rate, so that its share in overall consumption will grow. The second largest end use sector of primary energy in PNG is the transportation sector. Residential and commercial buildings as well as the agricultural sector, make up a much smaller share of end use of primary energy, though growth in consumption in these sectors is expected as well.

Exhibit 3. Summary of Key Background Data on PNG's Energy Sector

Primary Energy Production and Consumption in 2013†					
Production		**Consumption**		**Net Exports**	
0.073 exajoules		0.059 exajoules		0.014 exajoules (19% of production)	
Primary Energy Supply in Domestic Market (Mtoe) (roughly equal to consumption)‡					
1990	**2013**	**2020**	**2030**	**2040**	**CAGR 2013-2020**
0.9 M toe	2.6 M toe	4.7 M toe	7.7 M toe	12.1 M toe	5.93%
Composition of Primary Energy Supply in Domestic Market (roughly equal to consumption) by Fuel or Other Energy Source, 2011‡‡					
Petroleum Oil Products		**Biomass**		**Hydro, Natural Gas, and Geothermal**	
57%		37%		6%	
End Use of Primary Energy††					
#1 Largest Consuming End Use Sector		**#2 Largest Consuming End Use Sector**		**#3 End Use Sector**	
Industry (consumption expected to continue to grow substantially, increasing its lead)		Transport		Other (such as residential and commercial buildings and agriculture)	

†Source: *International Energy Statistics*, Energy Information Administration, US Department of Energy, accessed in November, 2016, and converted from quadrillion BTU to exajoules using 1 quad = 1.055 exajoules.
‡Source: *APEC Energy Demand and Supply Outlook Sixth Edition 2016, Volume 1*, Asia Pacific Energy Research Center (APERC), May 2016.
‡‡Source: *National Energy Policy 2016 - 2030*, Department of Public Enterprises and Department of Petroleum and Energy, PNG, 2015.
††*Papua New Guinea National Energy Plan 2016 – 2020*, Department of Public Enterprises and Department of Petroleum and Energy, PNG, 2015.

PNG has a significant crude oil production industry and a growing natural gas production industry. Based on current reserves and growing domestic consumption, PNG may become a net oil importer in the early 2020s. In contrast, natural gas production is a newer industry for PNG and domestic production and exports are both expected to grow substantially in coming years. Exhibit 4 presents data on production and consumption in PNG of crude oil and natural gas, respectively. While the data shows growth in crude oil production over the past few years, the general consensus is that PNG will soon cease to have substantial petroleum exports, but will begin to have substantial LNG exports as natural gas production increases.

Exhibit 4. PNG's Petroleum and Natural Gas Production and Consumption over the Last Ten Years (2007 – 2016)

Item	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Crude Oil Production (bbl per day)	42,000	38,000	35,000	31,000	30,000	27,000	28,000	36,000	53,000	57,000
Petroleum Liquid Consumption (bbl per day)†	26,000	20,000	20,000	20,000	20,000	20,000	20,000	NA	NA	NA
Net Petroleum Exports (bbl per day)	16,000	18,000	15,000	11,000	10,000	7,000	8,000	NA	NA	NA
Net Petroleum Exports as % of Production	38%	37%	43%	35%	33%	26%	29%	NA	NA	NA
Natural Gas Production (bcf)	5.2	4.9	3.9	4.2	3.9	3.9	3.9	NA	NA	NA
Natural Gas Consumption (bcf)	4.8	4.6	3.5	3.9	3.5	3.5	3.9	NA	NA	NA
Net Natural Gas Exports (bcf)	0.4	0.3	0.4	0.3	0.4	0.4	0.0	NA	NA	NA
Net Natural Gas Exports as % of Production	7.7%	6.1%	10.3%	7.1%	10.3%	10.3%	0.0%	NA	NA	NA

Sources: *International Energy Statistics*, Energy Information Administration, US Department of Energy, accessed in November, 2016, for all data except March 2016. March 2016 data from tradingeconomics.com, accessed in November 2016.
†Because domestic petroleum consumption data from 2008 to 2013 is portrayed steady at 20,000 bbl per day, it is possible that the 2009 to 2013 numbers are all estimates based on the 2008 number and therefore not very accurate.

PNG's Power Sector

Within PNG's energy sector, the power sector is a particular area of interest for the proposed project. While some energy efficiency activities of the proposed project will address direct combustion of fossil fuels (such as in industrial facilities and buildings), most aspects of the project, whether EE or RE, will emphasize reduction/ avoidance of fossil fuel consumption in the generation of electric power. Exhibit 5 shows the breakdown of installed power generation capacity in PNG for 2014 by type of generation, according to data provided by the PNG Department of National Planning and Monitoring (DNPM). The total installed capacity of 471 MW indicated includes both that operated by the national power provider, PPL, and that operated by private parties, namely mining companies. The Asian Development Bank (ADB) in its *Energy Sector Assessment* for CAPE PNG (2015) indicates that about half of installed capacity in PNG belongs to PPL while the rest belongs to mining companies. Its estimate of total installed capacity, at 500 to 530 MW, is a bit higher than DNPM's. Of this capacity, the ADB indicates 250 MW belong to PPL; and the rest has been set up by the mining companies for their operation.

Exhibit 5. Breakdown of Installed Power Generation Capacity in PNG by Type of Generation, 2014

Type of Power Generation	Installed Capacity	Share of Total Installed Capacity
Hydropower	215 MW	45.6%
Diesel	100 MW	21.2%
Natural Gas	100 MW	21.2%
Geothermal	56 MW	11.9%
Total	**471 MW**	**100%**

Source: PNG Department of National Planning and Monitoring, *Papua New Guinea Mid-Term Development Plan 2, 2016-2017*, March 2015.
Note: Includes PPL operated capacity and capacity operated by private sector mining companies.

PPL operates three main power grids in the nation, which are not interconnected. And, beyond these grids, PPL also operates 29 diesel mini-grids in township centers that are not connected to one of the three main power grids. PPL's three main grids are: Port Moresby Grid, Ramu Grid, and Gazelle Peninsula Grid. Exhibit 6 summarizes the total capacity, areas served, and main power generation constituents of each of PPL's three main grids.

Exhibit 6. PNG's Three Main Power Grids

Grid (Total MW)	Areas Served	Main Constituents of Grid
Port Moresby Grid (116 MW)	Capital city, other parts of Central Province	62 MW Rouana Hydropower System (4 stations) 30 MW thermal power station 24 MW diesel-based IPP
Ramu Grid (87+ MW)	Momase Region and highland areas	75 MW Ramu I Hydropower Station 12 MW hydropower station in Western Highlands Province Small hydropower IPPs and diesel plants for shortfall/backup
Gazelle Peninsula (18.9 MW)	townships in New Britain Province (an island)	10 MW hydropower station 8.4 MW diesel power station 0.5 MW diesel power station

Source: PPL corporate website and *Energy Sector Assessment* for CAPE PNG (2015), Asian Development Bank.

Reflecting PNG's low electrification rate, in which only 15 percent of the population has access to electricity, large areas of the nation are without connection to one of the three main grids or to one of the township diesel centers. Many of those locations that do have connection to the power grid suffer from power shortages, known as "load shedding" or "blackouts." As an example, the Ramu Grid simply does not have enough capacity to serve all the areas it is supposed to serve. Ramu services about eleven substations. When there is a shortage of power, which there frequently is, the Ramu control team, located at Ramu 1 Hydropower Station, will call various substations and ask them to cut off various loads. This is why some places (particularly more remote areas) have frequent

blackouts. They are simply too low priority and are among the first to be cut off when power is short. Some such locations have a blackout situation much more often than they have power.

Ramu 2 Hydropower Station, a planned addition to the Ramu Grid, is targeted to be 240 MW, and thus almost three times the current capacity of the Ramu Grid. Yet, the situation of Ramu 2, in the planning pipeline, highlights the need for other power solutions in addition to such large-scale, new power plants. For Ramu 2, key issues are that: (a) it is unlikely to come online soon; and, (b) if/when it comes online, it will be prioritized to serve profitable commercial customers and there will not be enough power to serve other areas that are power short today. Large hydropower projects in PNG have many barriers to overcome, which makes their development quite slow. Some experts suggest that it may take 15 years from the present (late 2016) to realize Ramu 2. One of the main roadblocks is land, as negotiations must be carried out with many different landowners in the case of large projects. Further, Ramu 2 is expected to have limited coverage in comparison to demand, suggesting that demand and demand growth are simply too high for a major project, such as Ramu 2, to address all needs. For example, Eastern Highlands Province, in which Ramu 2 will partly be located, is not expecting the installation to solve its power shortage problems in the provincial capital of Goroka and beyond, as the Ramu 2 power will be prioritized for mining areas in Morobe Province.[2]

Diesel power generation in PNG is particularly costly, while hydropower is considered more cost effective. While PPL is tasked with operating on a for-profit basis, it is also required to serve certain areas that are not profitable for it. As in many other countries, it must sell power at no higher than state regulated prices for various groups. In general, sales of power from its hydropower stations create profits for PPL, while sales from its diesel mini-grids create losses. Indeed, PPL's 29 township diesel centers are all considered "loss centers" when it comes to the company's bottom line. Losses are due to the high cost of diesel fuel and its transport, in comparison to revenues generated. In many cases, the cost of diesel alone (before other operational expenses are considered) is higher than power revenues in these centers. Aside from high diesel costs, the need to rent diesel generators in locations where the old ones are broken is also a major factor leading to losses in PPL's diesel centers.

Institutional Structure and Legislative Framework of the Energy Sector

At the national level, key government-related entities of relevance to the energy sector include the Department of Petroleum and Energy (DPE), the Department of Public Enterprises (which oversees PPL), Papua New Guinea Power Ltd. (PPL), the Climate Change and Development Authority (CCDA), the Independent Consumer and Competition Commission (ICCC), and the Department of Transportation. Other agencies, such as the Department of Lands and Physical Planning (DLPP) and the Department of National Planning and Monitoring (DNPM) are also relevant.

In the past and continuing to the time of project design (e.g. through October 2016), there has been an issue of overlapping mandates between DPE and the Department of Public Enterprises, which oversees PPL. Each had independently prepared a National Energy Policy (NEP) in the past. The World Bank worked with DPE and the Department of Public Enterprises to draft a unified version of the National Energy Policy in 2015. Yet, as of the preparation of this proposal (up to October 2016), it was reported that agreement had not yet been reached between the two agencies on this policy. The challenge of ensuring legislation drafted under a project has real impact, in light of institutional problems, has been considered in the design of the proposed project.

Other relevant policies and plans have also recently been drafted. With the support of a World Bank-GEF project, a draft National Energy Plan (2016 to 2020) was prepared under DPE and the Department of Public Enterprises in 2015. Further, a National Electrification Roll-Out Plan (NEROP), which focuses on grid extension rather than off-grid initiatives, is being prepared in 2016 with support from the same project. Lastly, work on a National Energy Efficiency Policy and a National Energy Efficiency Plan had been commissioned under that project as of 2016.

[2] The proposed Ramu 2 was planned to service the Wafi and Harmony Gold operators in Morobe Province.

DPE is considered the overarching agency responsible for energy sector policy and planning. Yet, because of the importance of the oil and gas sector in the national economy and DPE's close ties to that sector, the agency's prioritization of energy efficiency and renewable energy may be low. DPE oversees the Electricity Management Committee (EMC) and, as such, is targeted to take over technical regulation of the power sector from PPL.

The Department of Public Enterprise, formerly known as the Independent Public Business Corporation (IPBC), oversees state-owned enterprises, including PPL. It has management oversight of and may require operational actions in the companies it oversees. PPL is a utility that is state-owned and vertically integrated. It provides generation, transmission, distribution, and retail services in most of the nation's grid connected urban/ township areas. PPL is asked by the state to operate on a for-profit basis. At the same time, it is required to provide electric power services in a number of locations which are not profitable for it, namely, its 32 township diesel centers.

CCDA is a relatively new and active player in the energy sector. While its climate change mitigation work to date has focused mainly on the LULUCF area, particularly forestry, it has been involved in standards work related to energy efficiency. And, with this proposed project, for which it will be the implementing partner (IP), the agency is moving towards more comprehensive mitigation work via EE and RE technologies. CCDA has a mandate in the climate change mitigation area and therefore could potentially develop and issue legislation limiting GHG emissions from the energy sector. Yet, it has not been active in energy sector related legislation to date. Through its "Mitigation Branch," CCDA is taking a sectoral approach in giving advice to government departments. As such, it is working closely with the Department of Transport in developing energy-related policies and is working with industrial sectors to develop their energy-related emission mitigation plans. CCDA's first regulation on fuel standards, stipulated under its *Climate Change (Management) Act* of 2015, is anticipated to be issued by June, 2017.

ICCC is responsible for setting electricity tariffs and for issuing licenses for those (aside from PPL) that wish to generate and sell power. According to the relevant regulations, those that wish to sell power within a certain distance of PPL's grids must sell the power at the retail rates set by ICCC or lower. Those further away from the grid may set their own rates, but are still required to be licensed by ICCC. Licensing requirements, reflecting safety considerations, will be more stringent for those power producers that operate at higher voltages. Such producers will need to have personnel with certain qualifications on staff. So far, ICCC has issued licenses to some of the mining companies who generate power for themselves and sell excess power to nearby neighbors. It has also issued licenses to some IPPs that are connected to the grid and sell their power at wholesale rates to PPL.

Given the role of the transportation sector as the second largest end user of energy in nation, PNG's Department of Transportation is a relevant player for energy matters. Yet, to date, the Department has not been involved in working in the areas of energy efficiency and renewable energy and has no policies related to energy use in transportation. Instead, their focus to date has been on roads/ highways and safety aspects. During the proposed project's PPG phase, the project design team found stronger political will and economic urgency for EE and RE in other sectors and decided it would be more effective to focus the project's efforts in those other areas, rather than in the transport sector. Yet, as mentioned, CCDA is now beginning to cooperate with the department on energy related policy.

The Department of Lands and Physical Planning is also relevant to the energy sector, particularly with regard to land issues and siting of power infrastructure. In PNG, most of the land is traditionally owned. As a result, infrastructure projects routinely face special challenges in negotiating land use issues with the many parties involved. These issues can delay the progress of projects considerably. The DLPP could be an important partner in facilitating land use for RE power generation, even if on a small scale, by ensuring that effective templates for agreements about the land and the proper regulatory framework are in place.

DNPM, as the planning agency, takes the input of various sectoral departments and incorporates this into its comprehensive mid-term and long-term plans for the economy. Typically, DNPM will first set targets (including some energy and power-related targets). Then the various departments responsible for sectors are tasked with coming up with plans to achieve these targets. At times, the DNPM targets are considered too ambitious by the

sectoral ministries and need to be adjusted. DNPM also has a capital investment program (CIP). These funds are most likely to be used for large infrastructure projects, rather than small ones. The overall approach to planning in PNG is that there is a long-term plan, *Vision 2050*, which is issued by the Prime Minister's Office. PNG has just started preparing five-year plans to support achievement of *Vision 2050*. These are designed by DNPM. The current DNPM-prepared plan, the *Strategic Plan for Responsible Sustainable Development*, is just for the years 2016 to 2017, so that the next plan (2018-2023) can be synchronized with the office-holding cycle of elected officials.

In addition to the forgoing national-level organizations, important elements of the institutional structure relevant to the proposed project are at the provincial, district, local-level government ("LLG"), and ward levels. PNG has 22 province-level divisions and each of these is, in turn, divided into a number of districts. Districts are further divided into local level governments (LLGs). At the lowest level of government, below the LLG, is the ward, which consists of a small number of natural villages. These levels of government (ranging from the province down to the ward) will be important for local energy-related projects, such as in the power sector, and for local funding of such projects. While PPL has responsibility for providing power to the provincial centers and some district centers, power provision to most district centers and to lower level locations lies with the provinces, districts, LLGs, and wards. Even when it comes to the provincial centers, the provinces have a responsibility of working with PPL to ensure the smooth and rational provision of power. There is substantial local-level funding that might be leveraged for RE and EE projects. This is in the form of the Provincial Support Improvement Program (PSIP) funds and the District Support Improvement Program (DSIP) funds, transferred from the central government to the respective provincial or district governments. The districts each receive PGK 10 million (about USD 3.2 million) per year. Provincial funds are in the range of PGK 45 million (USD 14.2 million) per year. At the LLG and ward level, local officials and ward counselors can be important in mobilizing local people to participate in and agree to provide land for community based RE power projects.

Aside from the organizations described above, multilateral and bilateral donor organizations and content expertise organizations are important in the development of PNG's energy sector, and in particular of RE and EE in that sector. Organizations of particular note are the Asian Development Bank (which is supporting work in large hydropower in PNG), the World Bank (which is supporting work in wind power resource assessment, national energy policy and planning, and energy efficiency policy and planning in PNG), the International Finance Corporation (which is supporting PV lighting work in PNG), and the Government of New Zealand (which is supporting a small hydropower project in PNG). Agencies such as IRENA (the International Renewable Energy Agency) can play an important role in providing information on RE and EE. Lastly, church missionary organizations are quite active in PNG and can play an important role in providing local sources of power, particularly micro/ mini-hydro. Historically, technical personnel from such organizations were active in setting up some small power stations, but since PNG independence in the 1970s, they have been less active in this area. Yet, missionary organizations, with their strong capabilities in general and financial management, remain today a promising partner for such projects and a means of avoiding problems with corruption.

Experience with and Potential for RE in PNG

RE resources are abundant in PNG. Estimates indicate the technical potential is enormous. Many of the resources are in remote locations with limited demand and are not readily exploitable. Yet, there are believed to be substantial RE resources that have economic potential. Little of this has been exploited to date. Exhibit 7 summarizes known information on RE resources of different types in PNG, as well as experience with those types to date in the nation. Additional information on the hydropower and solar energy areas are given below in the text.

Exhibit 7. RE Resources in PNG – Potential and Experience to Date

RE Resource and Application	Potential of RE Resource in PNG	Experience with RE Resource in PNG
Hydropower	Potential of 15,000 MW	Installed capacity of around 165 MW. Most is hydropower stations of 10 MW or more in capacity.

		New Zealand bilateral aid now pursuing project in 1 MW range. Over the years, tens of systems in the micro/ mini-hydro range (5 kW up to 1 MW) installed, mostly by missionaries, but many not operating now.
Solar Energy	Potential of 1,244 TWh per year	Significant solar PV home system (SHS) installation and donor and government programs to support these, but no clear inventory of installed capacity to date. Use of solar PV by Telikom PNG for microwave repeater dual power supply. Solar hot water heaters in some locations, but no inventory. No solar PV mini-grids or grid-scale PV installations.
Wind Energy	Wind mapping activity underway under World Bank - GEF project	None.
Geothermal	Potential of 21.92 TWh per year	Installed capacity of 52.8 MW on Lihir Island by mining operation, currently in decline.
Biomass Energy	Main practical potential of modern biomass is in logging and agricultural areas, using either crop output or residues. Liquid biofuels also considered to have huge potential. PNG, of course, has extensive use of traditional biomass in open hearth fires in village huts.	Some palm oil mills and sugar mills are utilizing oil processing waste as fuel. Oil Search and PPL have a joint venture biomass power project in the pipeline for 2 x 15 MW using plantation trees they are developing. Issues on PPL's side have delayed progress. Biodiesel produced from coconut is used in Bougainvillle. Pacific Adventist University has launched biofuel products (2015) made from used vegetable oil (UVO); and Madang Provincial Government is planning to use coconut based fuel for its vehicles.
Biogas Energy	Highest potential seen in palm oil manufacturing. Given warm climate, household or village biogas systems may also have good potential.	A few palm oil mills are utilizing the palm oil mill waste to generate biogas energy to power operations. This includes 3 MW at New Britain Palm Oil Limited (NBPOL), which sells excess energy to PPL's Kimbe Grid. Hargy Oil Palm Ltd. has pipeline project.
Ocean Thermal Energy Conversion, Tidal Energy, and Wave Energy	Very limited knowledge of potential in these areas	NA

Sources: DPE and Department of Public Enterprises, *Papua New Guinea National Energy Plan, 2016 – 2020*; FREAGER team inception mission in March 2016. *Energy and Demand Supply Outlook – 5th Edition, PNG*, APEC, 2013. *PNG Power Sector Development Plan Final Report*, ADB, 2009.

Hydropower in PNG

With its many rivers and streams and mountainous and hilly terrains, PNG has extensive potential for hydropower. As a relatively low cost RE power source, hydropower is an attractive option in locations that have the appropriate natural resources. In PNG's highland areas, in particular, where solar resources are relatively less attractive (due to rainy days and mountains that reduce the hours per day of direct sunlight), hydropower is usually the most appropriate option for local, small-scale RE power systems.

PNG's larger scale hydropower systems (e.g. 10 MW or more) are included in the grid constituent listings in Exhibit 6. PNG has a few large hydropower projects in the pipeline as well, such as the 240 MW Ramu 2, mentioned earlier as potentially taking up to 15 years to be realized. The ADB is providing some support for this project. Donors are working with the government on other large projects, as well, such as the 80 MW Naru Bay Station, which has World Bank support for the feasibility study and which would be part of the Port Moresby Grid.

As for smaller hydropower systems, there are many fewer than might be expected in PNG given the abundance of suitable sites and the very low reach of the power grid. Micro-hydro (5 kW to 100 kW) and mini-hydro (100 kW to 1 MW) systems, in particular, could be a good fit for community scale RE power provision via mini-grids to off-grid areas. The overall characteristics of PNG's micro/mini-hydro sector are that: There are a very limited number of projects; churches/ missions dominate the field; and most existing projects were established long ago.

Unfortunately, there is no good database of micro/ mini-hydro plants installed in PNG to date. A GIZ inventory from 2004 identified 60 stations (including pico[3], micro, and mini-hydro), though not all were still operating at the time the inventory was published. The total capacity of the listed installations was computed to be 2.2 MW, though data on capacity was lacking for nine of the stations. Experts suggest that the rate of construction of micro and mini-hydro plants in PNG slowed down precipitously after the colonial period (ending in 1975) and that much of what has been built since was (as before) built by missionaries via their technical experts in the 1980s and early 1990s. Yet, this model of utilizing missionary technical experts is now diminishing in PNG. The missions are no longer sending as many of this type of personnel. And, while PNG since has developed substantial engineering capacity among its citizens, PNG's engineers are mostly unfamiliar with micro/mini-hydro technology. As a result, there has been little micro/ mini-hydro activity in PNG in the 2000s and 2010s. From the 2004 GIZ database of 60 pico, micro, and mini hydropower stations, there is information available on the date of establishment of 35 of those stations. Of those 35, eight were established in the 1960s, ten in the 1970s, seven in the 1980s, and nine in the first part of the 1990s.

Micro and mini-hydropower systems have the potential to provide power at a much lower cost over time than diesel generators. Upfront costs are higher for hydropower than for diesel systems, but there is no ongoing fuel cost for hydropower. And, because the land issues and planning issues of micro/ mini-hydro are much less complex than those of large hydropower projects, they have the potential to be realized on a much faster scale than the large hydro projects. For these reasons, the proposed project will include micro and mini-hydro in its areas of focus for RE work.

Exhibit 8 shows international data from IRENA on the costs per kW installed for hydropower systems of different scales. The largest systems generally have a lower average cost per kW. Yet, this may not necessarily be the case in PNG due to land issues and cost overruns with large projects. Rough estimates of the cost of PNG's pipeline Ramu 2 project are around USD 3,000 per kW. This is in the range of the low end of costs for micro/mini-hydro stations internationally. The figures given in Exhibit 8 for the latter are from the UK. Other sources indicate a somewhat lower end to the micro/mini-hydro per kW cost range in countries that have lower labor costs. And, PNG experts have suggested that, if costs are tightly controlled, mini-hydro stations may be established in PNG in the cost range of USD 2,000 to USD 3,000 per kW.

Exhibit 8: Average Investment Cost Worldwide for Hydropower Plants

Scale of Hydropower Station	Source of Information	Installed Costs (USD /kW)	Annual Operation and Maintenance Costs (% of installed costs)	Capacity Factor	Levelized cost of electricity (USD/kWh
Large hydro (over 20 MW)	IRENA worldwide literature review	USD 1,050 – 7,650/ kW	2% – 2.5%	25% - 90%	USD 0.02-0.19
Ramu 2 (240 MW)	Reports that total investment amount is PGK 2.3 billion and that capacity will be 240 MW	USD 3,024/ kW	NA	NA	NA
Small hydro (1 – 20 MW)	IRENA worldwide literature review	USD 1,300 to 8,000/ kW	1% - 4%	20%-95%	USD 0.02-0.027
mini/ micro (5 kW to 1 MW)	Study of United Kingdom installations	USD 3,400 to USD 10,000/ kW	NA	NA	NA

Source: *Renewable Energy Cost Analysis Series: Hydropower*, IRENA, 2012.

Solar Energy in PNG

PNG is gradually developing experience with solar home systems (SHSs) and solar water heaters, but has no experience to date with PV mini-grids or large grid-connected PV systems. Solar home systems (SHSs), which

[3]Less than 5 kW.

provide solar photovoltaic (PV) power (via conversion of sunlight to electricity) to a single household or building, have been successfully demonstrated many times. As such, new programs are focusing on achieving more widespread dissemination of SHSs. A partnership between the Kumul Foundation and UNDP Solar Mamma Project, for example, is setting up a financing mechanism that allows households to pay for their SHSs gradually over a period of about 1.5 years by making small weekly power payments of PGK 10 (USD 3.16). Despite the significant level of activity with SHSs and their availability for purchase in stores in PNG, no survey has been conducted to determine the extent of installation of and experience with such systems. Similarly, there is experience with solar water heaters (SHSs), which use heat from the sun to heat water, in PNG, but no inventory of the extent of installation.

To the knowledge of the PPG team, PNG has not had a single demonstration to date of a PV mini-grid. Like SHSs, a PV mini-grid uses solar PV technology via installation of solar panels to provide power via the conversion of sunlight to electricity. Yet, PV mini-grids, which can serve multiple buildings, are a completely new concept to PNG. They can incorporate a substantial battery system to provide power at night or at other times lacking sunlight. Given their scale, PV mini-grids can also support substantial income generating uses of electricity, whereas SHSs are too small to support many such applications. PV mini-grids may be a good solution for island communities that lack access to the grid, as well as for coastal provinces with good sunlight resources. While PV mini-grids will generally be more expensive per kW installed capacity than micro/ mini-hydro, PV mini-grids can be a good solution for areas that lack appropriate hydropower resources. Further, analysis shows that, with the ongoing drops in the prices of PV cells and lithium ion batteries, PV mini-grid systems in PNG could potentially save much money over time as compared to diesel generator alternatives. For this reason, community-scale PV mini-grids, in addition to micro/mini-hydro, have been selected as a key area of focus for RE aspects of the proposed project.

Experience with and Potential for EE in PNG

PNG has neither national nor local level energy efficiency programs and does not have much experience with energy efficiency in general. Given the lack of energy efficiency measures to date, “low hanging fruit” or energy efficiency projects that generate a high return on investment and fast payback are thought to be substantial. Thus, energy efficiency projects in PNG present the potential for win-win results, reducing greenhouse gas emissions while at the same time providing financial returns via reduced power bills. Once the investment for energy efficiency retrofits is paid back through such savings, ongoing savings will put more money in the end user’s pocket over the remaining lifetime of the equipment. For PPL, which operates at a loss in areas where power is provided exclusively by diesel generation, energy efficiency, in addition to benefiting end users’ bottom lines, will reduce the utility’s losses. And, for citizens living in areas with diesel generators, energy efficiency will provide the benefit of improved air quality, as less diesel will be burned.

While PNG has no national energy efficiency programs, lighting retrofit initiatives have been carried out at five sites under a recent ADB project. Results have shown substantial savings and fast payback. At the same time, there have been challenges in measuring energy savings and associated GHG emission reductions. Among the five ADB lighting retrofit projects, one was for PPL’s own National Office building in Port Moresby. The monthly lighting power use of the building was previously 120,000 kWh per month and dropped to 90,000 kWh per month after retrofits, thus realizing a 25 percent savings in lighting power consumption. The money saved on power, had this been a PPL business category customer instead of PPL itself, would have been enough to fully pay for the investment in new lights within three months. After three months, savings in the power bill, due to improvement in lighting would have added about PGK 29,400 (USD 9,275) per month to the bottom line. The other four lighting retrofits under the ADB project are: energy efficient street lighting in Hohola and Alotau and energy efficient lighting and control systems at Port Moresby General Hospital and at the Science Faculty building at University of PNG, also in Port Moresby. While energy audits are quite new in PNG, PPL obtained training in how to conduct lighting aspects of building energy audits under the recent ADB project. Yet, PNG has not yet conducted much work in other areas of building energy efficiency, such as evaluating the energy performance of installed air conditioning and refrigeration systems in buildings, and coming up with recommendations to improve such systems as retrofits, or in industrial energy efficiency audits and retrofits.

Barriers to the Use of EE and RE Technologies in PNG

Renewable energy and energy efficiency technologies present a compelling win-win GHG emission reduction opportunity that addresses PNG's issues of power shortage, very low levels of energy access, and very high costs of diesel power generation, as well as its direct uses of liquid petroleum fuels. Yet, adoption of RE and EE to an extent substantially greater than the very limited level described above will require that a number of barriers be removed. Barriers include those in the areas of (1) policy, planning, and institutions; (2) technical and commercial viability; (3) financing; and (4) information and awareness. Each of these areas is covered, in turn, below.

Policy, Planning, and Institutional Barriers

PNG has a number of policy, planning, and institutional related barriers to the wide-scale adoption of RE and EE. First of all, policy makers and planners at the national, provincial, district, and local levels lack experience with RE and EE. They do not know how to develop RE projects or EE programs. In the RE area, they lack experience with the steps for developing micro/ mini-hydro and PV mini-grid projects, the areas of community RE systems on which the proposed project hopes to focus. They further lack experience with township EE programs in diesel centers, the mechanism through which the project hopes to promote EE.

Further, there is a lack of national policies and regulations to promote RE and EE. Key areas in which such regulations are needed are in the area of waiving tariffs for the import of key RE and EE equipment and components, ICCC policies for regulating the licensing of and billing by IPPs that operate community RE systems, and Department of Lands policies for facilitating such community RE mini-grid projects. Beyond these key, pre-identified areas, there is a lack of understanding of what other gaps exist (i.e., in terms of the nature of such gaps and their magnitude/extent) in the areas of policies and regulations for example in the promotion of RE and EE technologies applications in PNG, particularly in the provision of incentives. And, there is a lack of policies for addressing such gaps.

In addition, in order to promote community RE projects and township EE programs on a wide scale, national roadmaps for both of these areas are needed. At present, there is a lack of national direction on how to achieve wide-scale adoption of RE and EE and a lack of identified funding sources.

There is a lack of standards and implementation of standards that can ensure RE and EE are promoted with quality approaches and products. For example, there is a need to refine national building energy efficiency standards and ensure their adoption into the national building code. And, there is a need for provincial level building energy efficiency standards and enforcement. There is a problem with low efficiency building equipment (e.g. air conditioners and refrigeration) entering the PNG market and a need for standards and a certification and labelling program to ensure that end users can assess products properly. There is also a need for provincial level EE product standards and enforcement. Similarly, in the RE field, there is a lack of national standards and certification to ensure equipment purchased is of high quality. In particular, standards are needed with regard to equipment used in micro/ mini-hydro systems and in PV mini-grids to ensure successful dissemination of these community RE technologies on which the project plans to focus.

Institutionally, as mentioned, there is a problem of overlapping mandates in the energy field. There is a need for coordination among various bodies. Cooperation in the areas promoted by this project, including micro/mini-hydro, PV mini-grids, and township EE programs, is needed if promotion is to be successful. Within organizations, there is also a need for institutional support, such as setting up the structure of PPL's energy efficiency department and programs.

Finally, to achieve actual community-based RET projects and township EE programs on a wide scale, there needs to be detailed plans for community RE and township EE applications and practices at the provincial level. These plans will need to identify and designate specific pipeline of RE and EE projects, and more importantly, the funding sources to support their implementation and operation.

Technical and Commercial Viability Barriers

At present, the know-how, tools, and experience needed to prove and replicate the technical and commercial viability of RE and EE in PNG are lacking. Considering the areas of focus of the proposed project, in particular, there is a lack of ability in PNG to achieve commercially and technically viable micro/ mini-hydro systems, PV mini-grid systems, and township EE retrofit programs. In each of these areas, there is a need for technical capacity in how to design and construct projects. In the EE area this will include, as a first step, capabilities in energy audits that cover areas in which PNG lacks experience, namely air conditioning, refrigeration, and various aspects of industrial energy efficiency.

A key technical and commercial challenge is the lack of good sourcing information for needed equipment. PNG entities lack information, for example, on which micro/mini-hydro related products, PV mini-grid related products, and energy efficient equipment products have the quality needed to achieve technical goals. Further, PNG lacks information on how to procure such products internationally, when needed, at the lowest possible price, while still ensuring quality.

In addition to lack of good information on reasonable prices and channels for preferred imported products, PNG entities that wish to carry out micro/mini-hydro projects or solar PV mini-grid projects lack information on the "honest, fair" price for such projects in PNG. This information includes what the reasonable price would be for each of feasibility studies, civil works, electrical works, and construction needs. Given the lack of information, there is a tendency in the market for providers to wildly overcharge so that projects no longer provide true economic benefits over diesel options. During the project design phase, for example, the team came across a mini-hydro project seeking funding of an amount almost ten times that of a similar project with more "honest" costing.

There are a number of other technical and commercially related areas in which PNG lacks what is needed to achieve successful adoption of community RE projects. For example, there is a lack of skills in O&M for micro/mini-hydro systems and PV mini-grid systems. There is also a lack of experience with billing systems for community RE mini-grids and a lack of precedent for PPAs (power purchase agreements) with PPL as one means of selling power. (In some cases, community RE system owners may sell the power directly to retail customers, while in others they may, based on a PPA, sell the power wholesale to PPL, which will, in turn, handle billing.) Yet, in order to achieve sustainability, community RE mini-grids will most likely need to be able to charge for power and use revenues to pay back investment and to pay for any repairs or maintenance needed. In PNG, there is further a lack of know-how in how to promote "productive applications," uses of RE that generate income and that could, in turn, generate greater revenues from billing for RE power.

Finally, in addition to the lack of all the foregoing commercial and technical tools and capacities, there is a lack of successful demonstration of commercially and technically viable RE and EE systems. Without demonstration, there is both a lack of proof of concept and a lack of experience to build on to promote such systems on a wider scale. In the area of micro/ mini-hydro, while there is some limited experience, systems have not been developed in a well-defined way. What is needed are: systems that prove they can achieve a targeted, low per kW price; a technical level that assures a roughly 40-year lifetime; and proven cost effectiveness far superior to diesel systems. In the area of PV mini-grids, as mentioned, there is not known to be a single successful example in PNG and certainly not one that proves superior cost effectiveness to diesel systems. Lastly, there has not been significant demonstration of productive use of RE that shows how productive use can both increase local incomes and improve the sustainability of community RE power systems by increasing system revenues. In the EE area, aside from the handful of lighting demonstrations mentioned, there has not been substantial demonstration of building EE and industrial EE initiatives. In particular, there has not been demonstration of a comprehensive EE program in a diesel township center, covering buildings, industry, street lighting, and the residential sector. In the building area, in particular, there has not been demonstration of EE audits and retrofits that cover air conditioning and refrigeration. In the industrial area, there have been no known demonstrations of industrial EE audits and retrofits. And, there have not been any initiatives in working with new, future large power users to reduce their future power consumption via recommendations for their design and equipment purchase decisions.

Financing Barriers

Adoption of community RE systems and township EE initiatives on a wide scale will require strong financing. Although RE and EE present PNG with a bottom line solution potentially far superior to diesel power generation over time, their up-front costs can be higher than the alternative of diesel power generation. Thus, financing of the upfront costs of RE and EE is an important way to stimulate their adoption. Financing mechanisms are needed both to stimulate the market (by providing a critical mass of initial projects in the market) and also to provide the relatively large up-front financing required of RE and EE when funds would otherwise not be available. Yet, at present there is an absence of financing of and financing mechanisms for RE and EE.

Before any such financing can be realized on a substantial scale, it will be necessary to address the lack of capacity of the financial sector and other potential investors and creditors with regard to assessing RE and EE projects. The banks and other potential investors and creditors, such as PPL and private sector companies, are not familiar with community RE mini-grids and their potential for profitability. They are also not familiar with how EE projects can be good investments for owners of buildings and industrial facilities.

While financing mechanisms have been developed elsewhere in the world for EE and RE, PNG lacks experience with such mechanisms. For EE, a popular concept is “ESCO” financing, in which a party providing EE retrofits finances the up-front costs of those retrofits and is paid back gradually by the client through its ongoing savings on its energy bills. PPL has experience with a similar type of financing, having set up a fund for the up-front-costs of its customers in equipment for power factor correction. Yet, PPL management is not very aware of ESCO financing and has not implemented such a mechanism for financing client EE initiatives.

In the area of community RE mini-grids, adoption on a large scale will require substantial up-front financing from various sources. If the financial viability of such systems is proven, loans may be a good way to partially support up-front costs of future systems. Yet, the banking sector is unfamiliar with such projects and has no loan funds to support them. Some PNG banks have SME funds, but these are not equipped to support the start-up of community RE mini-grid projects.

Lastly, while there are some special sources of funding that may support community RE mini-grid and township EE programs in PNG in the early stages of promotion, potential project proponents are unfamiliar with such sources and how to apply to them. These sources include, in particular, international funding focused on climate change and the environment. Examples include the Green Climate Fund and various social impact funds that encompass climate change and/or the environment in their scope.

Information and Awareness Barriers

Finally, there is limited information and awareness in PNG for RE and EE generally and for community RE mini-grids and township EE initiatives, in particular. A key area in which there is a lack of information and awareness is that of the potential superior cost performance of community RE systems and township EE as compared to diesel systems and business-as-usual. Were policy makers, in particular, to be briefed in a clear fashion about the cost superiority of RE and EE, this would substantially enhance the potential for the widespread adoption of relevant technologies.

Further, there is a lack of materials available in PNG on how to implement community RE projects, especially in the micro/mini-hydro and solar PV mini-grid areas. While such resources may exist internationally, there is a lack of materials in PNG and particularly of materials that are tailored to the situation of PNG and explain how to develop such systems at reasonable cost and with high quality levels in the country.

PNG also lacks information on RE resources and potential community RE mini-grid projects, as well as a channel for conveniently accessing such information. So far, a World Bank-GEF project in PNG is developing a database of information from assessment of PNG’s wind resources. Yet, assessment work has not been done in either a comprehensive or province-by-province basis for micro/mini-hydro or solar resources in PNG. And, whether it be

wind or micro/mini-hydro or solar resources, there is not a single, good channel for accessing information on RE resources in PNG.

In the education sector, there is a need for building the information base on and awareness of RE and EE. This is needed to address the specific barriers of: (1) the next generation being unaware of RE and PE (i.e. those in their primary and secondary education years); and, (2) lack of knowledge of students who might otherwise in the future contribute to the fields of RE and EE (i.e. those in their tertiary education years). While some courses have been developed on RE already at the tertiary level, none address specifically the development of micro/mini-hydro power stations or PV mini-grids. Further, there is a lack of coursework in the EE sector, such as in how to conduct building and industrial energy audits. At the primary and secondary school levels, there is a lack of materials to incorporate into existing coursework to ensure that the nation's youth are aware of RE and EE and their benefits.

With regard to general public awareness, there is a lack of attention paid to RE and EE in various types of media in PNG. This includes television, radio, print media, online new articles, social media, and text messaging. There is a need to reach out to these various media channels to promote the positive aspects of RE and EE, attracting the media to promote them through articles, shows, etc., to the general public.

Another area in which there is a lack of awareness and information is in the domestic manufacturing sector. Domestic manufacturers are unaware of potential opportunities in RE and EE equipment and components and lack the knowledge to develop business in this area. Lack of domestic manufacturing, in turn, keeps the costs of RE and EE higher in PNG than they might be otherwise. Yet, PNG has significant domestic manufacturing, particularly in the industrialized area of Lae, and to some extent in the Port Moresby area, that might be leveraged to produce cost-effective RE and EE technology system components. Metal-working capabilities in the prefabricated steel construction materials area may be leveraged, as may be capabilities machine parts fabrication.

Lastly, while PNG is beginning to have initiatives in the RE and EE sectors, there is a lack of a single good channel of information on RE and EE in PNG. What is needed is a convenient channel via which those with an interest in developing projects can access technical information, information on RE resources, information on pipeline projects, information on legislation and standards, information on sourcing channels and domestic products, information on reasonable costing of feasibility studies, civil works, etc., and other information relevant to deploying RE and EE technologies in PNG.

III. STRATEGY

Strategies Adopted

The overall goal of the proposed project is reduction in GHG emissions from the energy production and energy end use sectors in PNG. The objective, or end to which the proposed project and other efforts are expected to contribute, is the enabling of the use of renewable energy and energy efficiency technologies for achieving greenhouse gas emission reduction in PNG. The project adopts a number of key strategies to realize contribution to this objective. The main, overall strategy is (1) a multi-pronged barrier removal approach. Other key strategies include: (2) well-reasoned selection of specific RE and EE technologies, scales of use, and locales on which to focus in order to best facilitate an initial wave of replication; (3) strong emphasis and stakeholder education on the cost advantage of RE and EE as compared to diesel; (4) emphasis on facilitating sourcing and "honest best cost" for installation of RE and EE technologies; and (5) a dual top-down bottom-up approach, so that policy and planning gridlock at the central government level can be inspired by successes in the provinces.

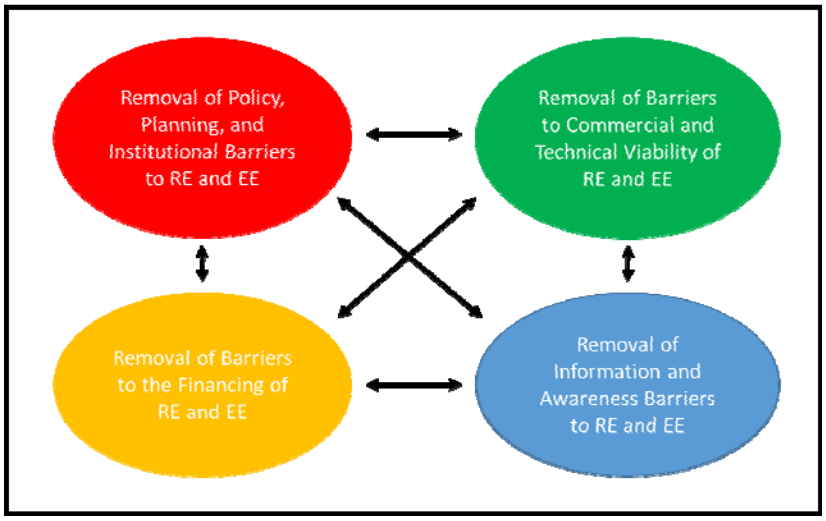


Exhibit 9. The Project's Multi-Pronged Barrier Removal Approach in which Synergies between Barriers Removal in Different Realms Create the Needed Leverage for Widespread Adoption of RE and EE in PNG

The overall strategy, a multi-pronged barrier removal approach, reflects the theory of change ("ToC") on which the structure of the project design is based. The approach is "multi-pronged," because it seeks to remove barriers in four key areas: (1) policy, planning, and institutions; (2) technical and commercial viability; (3) financing; and (4) information and awareness. The project will have four components, one for each of these barrier removal areas. The theory of change underlying this approach is that addressing one area alone will not reliably generate progress towards the project objective, but that a multi-pronged approach will. In other words, synergies between progress in multiple areas are needed to really move the dial to a level at which substantial replication can occur, so that RE and EE technologies are adopted on a wide scale in PNG. For example, policy and planning is needed that is conducive to RE and EE, but policy makers, in turn, need to be convinced of the value of RE and EE by good information. They also need to be convinced of the viability of RE and EE by demonstration of commercial and technical viability. Similarly, greater financing of RE and EE is needed to achieve wide-spread adoption, but substantial financing will not occur without proof of viability and reliable information on the technologies. Further, strong policy support of RE and EE is important to raise the confidence level of financiers. Exhibit 9 presents a diagram depicting the interaction between the project's four main barrier removal areas, which form the basis of the project's multi-pronged barrier removal approach.

A second strategy important to the proposed project's design is the well-reasoned selection of specific technologies, scales of their use, and types of locales on which to focus. In the case of RE, in particular, project design work began by considering the full range of RE technologies and applications. This ranged from large-scale grid-connected technologies, to small community mini-grid systems, to even smaller household scale systems. It also included consideration of hydropower, solar, wind, biomass (including biofuels), biogas, and tidal power. Lastly, both urban and rural applications were considered. In the end, for RE, it was determined that the project could have the greatest impact by focusing resources on a few high potential areas within these ranges. Namely, it was determined the most strategic focus within RE would be on the scale of community RE mini-grids, with the selected resource areas being solar PV and hydropower. Explanation of this determination is as follows: Due to the considerable uncertainty associated with large projects in PNG, where land issues can result in years of delay, it was concluded that smaller scale projects have higher potential for success and replication and thus may be the appropriate place to start in developing a substantial first wave of RE installations in PNG. Given that 85 percent of PNG's population lacks access to electricity and that the rate of power grid extension to new areas is slow, success in developing community RE mini-grids can provide a viable option for township and rural electrification. Further, while significant experience has already been gained at the smallest scale (household systems, such as SHSs), there is a lack of experience with community RE mini-grid systems in PNG and therefore a need for demonstration. Such systems are also attractive because the greater amount of power available can be used for productive applications that generate incomes. This is in contrast to smaller, household system, where the power level is too low for most such applications. In some cases, depending on location and amount of excess power generated, community RE systems, if located near the main power grid, may have the potential to sell power to the grid and generate additional income in this way. Within the community RE mini-grid area, micro/mini-hydropower mini-grids and solar PV mini-grids have been selected as the most strategic areas of focus. Analysis shows that these two types of RE installations fit with the resources available in many parts of PNG that are in need of power. Micro/mini-hydro is especially appropriate to mountainous/ hilly areas with abundant water resources, such as the highlands, while PV mini-grids (though somewhat higher cost than micro-/mini-hydro) may be suitable to areas lacking mini-hydro resources, but with strong sunlight, such as island and coastal communities. Analysis shows that both micro/mini-hydro (which has the greatest cost advantage) and PV mini-grids can provide proponents with cost effectiveness far superior to diesel generation, which is the main conventional alternative and currently the option that tends to be adopted in off-grid or power-short situations in PNG.

As for EE, with regard to this project strategy of specifying area of focus, the selected focus will be in terms of locale rather than in terms of type of technology. The project proposes a focus on township EE programs. The township scale is selected as a more manageable scale than PNG's largest cities (e.g. Port Moresby and Lae) on which to carry out a comprehensive EE program. Because EE work is very new in PNG, lighting is really the only area in which there is significant experience. The project design of the township EE programs focuses on key types of users and key types of equipment. Thus, these programs will emphasize the largest power users in the respective township (including building and industrial users), large new power users expected to come online soon, street lighting, and residential aspects (outdoor lighting and refrigerator replacement). Because PPL has 29 township diesel generated power centers, which are all financial loss centers for the company, these will be high potential locales for replication of the project's township EE work.

A third key aspect of the project strategy is to emphasize building awareness of the potential cost savings that RE and EE will bring over the current business-as-usual diesel option. Analysis conducted during the PPG phase projects strong cost savings for each of mini-hydro mini-grids and PV mini-grids as compared to diesel generation over the long run, due mainly to diesel fuel costs. (Operation and maintenance costs are also much lower for these types of RE mini-grids as compared to that of diesel generators.) Analysis also suggests a fast payback via reduced diesel use from EE retrofits, after which savings continue, accruing to the bottom line. Yet, in PNG, most officials, building and facility owners, and other relevant persons are unaware of the potential strong economic benefit of EE and RE in PNG as compared to diesel. Clear conveyance and proof of this information will play an important role in stimulating replication of the project's EE and RE demos.

A fourth key aspect of project strategy is an emphasis on facilitating best cost sourcing of quality EE and RE equipment, as well as on providing information needed to achieve "honest best cost" information for engineering,

civil works, and construction aspects of RE projects. For RE, this work will focus on equipment and work relevant to micro/ mini-hydro stations and PV mini-grids. At present in PNG, a key issue is that there is a lack of good information on how to achieve EE and RE projects (and other types of projects, for that matter) at good quality and reasonable costs. Due to the lack of information, various parties take advantage of project proponents, resulting in projects that are too expensive and/or of poor quality. While this is one of many different areas to be addressed by the project, it is critical and thus emphasized here as a key strategy of the project design.

A fifth strategy the project will adopt is a dual top-down and bottom-up approach. That is, the project will work to emphasize policy, plans, and institutions at the central government level. Yet, at the same time, the project will pursue a number of provincial level initiatives. These will include capacity building in the provinces on how to develop RE projects, demo of RE and EE projects, design of provincial pipeline RE and EE projects and plans, and support of various other provincial-level initiatives, such as RE resource assessments. This dual strategy is adopted to address gridlock that can sometimes occur with donor policy initiatives at the central level in PNG due to overlapping mandates and lack of proof of concept. By carrying out initiatives in the provinces for central level officials to observe, such officials are more likely to be brought on board once technical and economic viability is proven and replication is initiated, regardless of their institution.

Approach to Full Project Design

The full project design is based on a logical framework analysis approach. Within each of the four main barrier areas, stakeholders, during a logical framework analysis workshop, identified key problems, which were then arranged in a cause and effect "problem tree" configuration. Problems were then converted into results that could overcome the respective problems, creating "result trees." The theory of change reflected here is that lower level results ("outputs") can feed into higher level results ("outcomes") that ultimately contribute to the project objective. Activities were then designed to achieve each of the targeted outputs. Details on targeted outcomes and outputs, as well as planned activities are given in Section IV of this document. Exhibit 10 below depicts the full project design strategy. It shows how several outputs feed into each of the four main barrier areas, or five associated outcomes. These five outcomes, in turn, enable the project as a whole to contribute to the project objective, via the widespread adoption of micro/mini-hydro mini-grids, PV mini-grids, and township EE programs.

Expected Difference with the Business-as-Usual (No Project) Situation

The project strategy calls for the leveraging of a limited amount of GEF funds, in conjunction with co-financing, to create a situation quite different than would occur in the business-as-usual (no project) scenario. This sub-section compares the business-as-usual situation, by the year 2021 (after the proposed project's closing date), to the situation in which the project is implemented. In the business-as-usual case, it is expected that, while donors continue to make efforts to support PNG in developing national-level policy and plans for RE and EE, not many real results are seen on the ground. And, without real results, policy makers hesitate, so that proposed policies and plans remain under discussion rather than being fully adopted. In addition, policy-makers remain unclear about the cost advantage of RE and EE over diesel. Large-scale potential RE installations, such as large hydro and wind, continue to be stalled by land negotiation issues and high and opaque costs. While a few micro or mini-hydro station projects may be initiated, these will struggle with technical issues and ill-defined costs, as well as lack of funding. While solar PV home systems (SHSs) continue to be deployed in the market, no larger-scale systems, namely solar PV mini-grids, have been set up. Potential project proponents continue to lack information on how to cost-effectively source quality equipment for RE mini-grids; and providers of engineering, civil works, and construction services continue to quote them prices far higher than is reasonable. Provinces continue to be uninvolved in planning for RE projects and EE initiatives. In the EE area, a limited number of lighting retrofit projects continue with the support of trained staff from PPL, but PNG continues to lack capacity for EE audits and retrofits involving air conditioning, refrigeration, and industrial EE initiatives.

In the case in which the FREAGER project is implemented, by the end of project in the year 2021, policy makers at the central level in PNG will be quite aware of the cost advantage of RE and EE over diesel. They will have seen actual proof on the ground that micro/mini-hydro mini-grids and PV mini-grids are technically and commercially

viable means of bringing power to communities at costs much lower than that of diesel generators. They will also have seen that the incomes of local communities can be enhanced by the productive use of the power from these RE mini-grids. In this scenario, with the success of the project's community RE mini-grid demonstrations, selected provinces by the time of project close will have already supported the construction of a good number of replications, with more planned projects in the pipeline. Township EE Program demos will have similarly shown central policy makers and provincial officials the commercial and technical viability of a range of EE measures. By the time of project close, similar township EE programs will have been initiated in other of PPL's township diesel power generation centers. With their enhanced level of awareness and the success of the project demos, national level policy makers will have come on board and begun to adopt policies, standards, and plans supportive of community RE mini-grids and township EE. In addition, at this point, they will be starting to consider broader RE and EE policies, such as those that cover large-scale RE installations. In the FREAGER scenario, provinces will have been proactive in developing comprehensive RE and EE plans and will have allocated funding to realize specific projects included in those plans. Financing mechanisms to support RE and EE will have been successfully launched and in the process of being expanded, thus serving the needed purpose of stimulating the market and providing up-front funds that would otherwise not be available. This includes an ESCO fund for financing the up-front costs of EE measures and a loan fund for community RE mini-grids. Further, at the time of project close, good information will exist on community RE mini-grid development, RE pipeline projects, RE resources, and EE technologies, so that the group of stakeholders involved in the development of RE and EE projects in PNG is expanding. Larger scale RE projects will have been slower to develop. Yet, with the confidence gained via experience with community scale RE mini-grids, by 2021, more serious plans will have been developed for large-scale RE projects. In all, as a result of project RE and EE demos, GHG emissions in PNG will have been reduced from the baseline level by 16,879 tons CO_2 during project implementation. Over the lifetime of the equipment installed, emission reductions from the project demos and direct post project replications (specifically stimulated by project activities) will total 698,060 tons CO_2. In addition, indirect replication (that replication not facilitated directly by any project activities) in the ten years after the project will result in consequential emission reductions estimated to range from 2,094,179 tons CO_2 (bottom-up approach) to 4,409,597 tons CO_2 (top-down approach).

Innovativeness and Replication

The proposed project adopts several innovative approaches and incorporates a replication strategy across multiple components. First, the project is innovative in its selection of RE installation types and EE program type. For RE, the project will focus on mini-hydro and PV mini-grids. The project's PV mini-grid will be the first to date in PNG, so the project is clearly innovative in that regard. While there have previously been mini-hydro stations, the project's approach to ensuring these are installed in a methodical way demonstrating a well-defined and low cost is also innovative. In general, the project's focus on raising awareness of the cost competitiveness of RE and EE (with a well-defined return on investments) as compared to diesel in PNG is also innovative. Past projects have not endeavored to raise awareness of this issue on a large scale. Further, the project's approach of ensuring that there is good information on sourcing and on honest pricing of engineering, construction, and civil works services is an innovative way of addressing a key problem plaguing many different types of projects in PNG – lack of knowledge by proponents of the fair price and of measures to take to be sure and get it. In addition, the project's introduction of an electronic billing system to enhance the sustainability of RE mini-grids is innovative. Further, the project takes an innovative approach in its capacity building programs for government officials.

To ensure more results-oriented capacity building programs, these will each be carried out as a series of three workshops. Following each workshop in the series of a program, participants will be required to do "homework" after their return home that includes key steps in the project development process. The end result will be that each participant will develop one or two projects by the end of the workshop series. This will enable them to take the next step of securing funds from either their local government (PSIP or DSIP funds), local investors (e.g. business houses), or financial institutions (i.e. bank loans) to develop these projects. Finally, another innovative aspect of the project is its multi-channel media campaign, which aims to promote RE and EE, particularly community RE mini-grids and township EE programs, via various media channels, such as television, radio, print media, online news, social media, and text messaging.

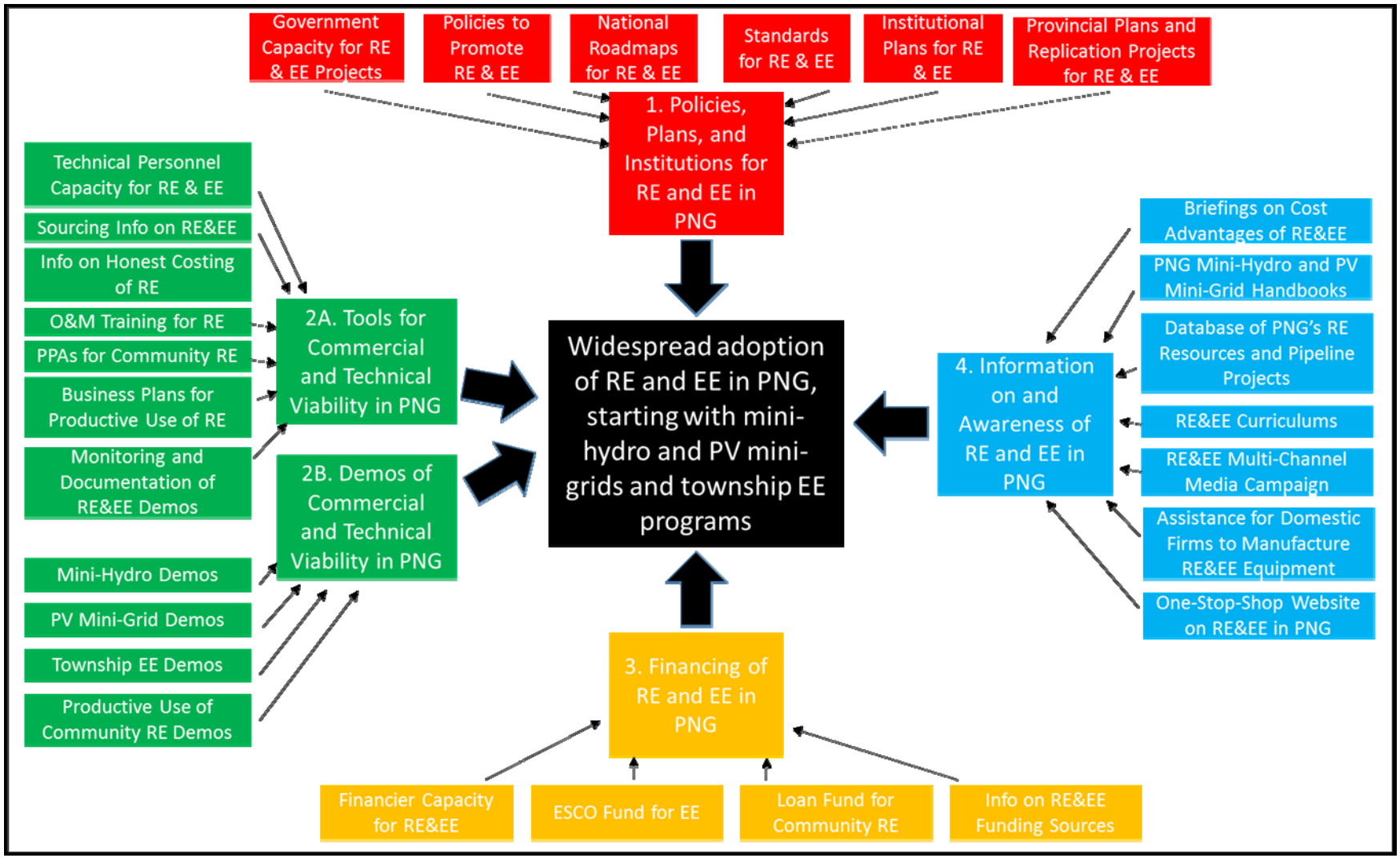


Exhibit 10. Full Project Design Strategy: Several outputs feed into each of the four main barrier areas, or their five associated outcomes. The project's five outcomes, in turn, enable the project as a whole to contribute to the project objective via the widespread adoption of the RE and EE technologies selected as focus areas for the project.

Instead of relegating replication efforts to just one component, the project has strategically designed support to promote replication of the project demos in all four of its components. Further, the project puts strong emphasis on its demo provinces of Eastern Highlands Province, Milne Bay Province, and East Sepik Province, as well as on its other partners of Morobe Province and the Evangelical Lutheran Church, as channels for achieving replication of the project demos. As mentioned above, capacity building work with government officials in the planning, policy, and institutional component of the project takes a "learn by doing" approach in which actual pipeline projects will be the results of training. Such programs will be held not only in PNG's capital city of Port Moresby, but also in partner provinces, with district officials in attendance. The component further supports preparation of provincial level RE and EE plans, which will include specific pipeline projects and funding sources for them. The project's commercial and technical viability component supports replication by generating needed information on sourcing and honest costs, while at the same time implementing and documenting the results of the demos themselves. The financing component develops funds for both EE and community RE mini-grids, another element needed to promote replication. Finally, the information and awareness component has various aspects supporting replication, such as a listing of pipeline RE projects, RE resource assessments in partner provinces, and a one-stop-shop website to bring together all available information on RE and EE in PNG.

IV. RESULTS AND PARTNERSHIPS

i. Expected Results

This sub-section translates the strategy and theory of change described in the preceding section into a detailed framework of outcomes, outputs, and activities. After listing the project goal and objective, the sub-section describes each of the project's four major components in turn: (1) Energy Policy, Planning, and Institutional Development; (2) Renewable Energy and Energy Efficiency Technology Applications (commercial and technical viability); (3) Financing of Renewable Energy and Energy Efficiency Projects; and (4) Energy Development and Utilization Awareness Enhancement (RE and EE information and awareness). For each component, a description of the component is first presented, followed by the associated targeted outcome(s). Under each outcome, the outputs that are targeted to contribute to its achievement are listed. Under each output are descriptions of the activities that will be carried out to achieve the output. While Components 1, 3, and 4 each have one targeted outcome, Component 2 (commercial and technical viability) has two outcomes, an investment outcome (the project demos) and a technical assistance outcome (tools for achieving commercial and technical viability of RE and EE). A summary of the Component 2 demos is provided in Annex 1 of this document. Detailed information on the demos is provided in a separate document prepared during the PPG phase, *FREAGER Project Demos – Background and Details*. The latter document provides much background on the rationale, approach, and cost advantages of the demos as compared to diesel. Much of the analysis carried out to select and design the demos, presented in that document, is central to the larger design and strategy of the project.

Project Goal and Objective

Goal: Reduction in GHG emissions from the energy production and energy end use sectors in PNG.

Objective: Enabling the application of feasible renewable energy and energy efficiency technologies for achieving greenhouse gas emission reduction in PNG.

Project Components, Outcomes, and Outputs

Component 1: Energy Policy, Planning, and Institutional Development: This component focuses on energy policy, planning, and institutional development for RE and EE in PNG, specifically on community RE mini-grid systems and township center EE programs to address policy, regulatory and institutional barriers to the application of feasible RE and EE technologies for achieving GHG emission reduction in PNG. The expected outcome, from the outputs that will be delivered under this component, is the rigorous implementation and enforcement of approved

national and provincial energy policies, plans, and standards to promote the application of renewable energy and energy efficiency technologies.

Outcome 1: Rigorous implementation and enforcement of approved national and provincial energy policies, plans, and standards to promote the application of renewable energy and energy efficiency technologies.

Output 1.1. Completed government capacity building programs for the design and development of RE and EE technology projects. Five capacity building programs (each consisting of a series of three workshops) will be carried out, two in Port Moresby and three in partner provinces. Attendees, including national, provincial, and district level officials, will, via homework assignments, prepare RE mini-grid projects and township EE programs. Each government capacity building program will have a target of 40 percent of the trainees being women.

Activity 1.1.1. Organization and conduct of a series of three progressive training workshops for national and provincial development planning officials on the planning and development of community micro/mini-hydro and solar PV mini-grids. In this activity, a program curriculum focusing on the step-by-step process for developing RE mini-grid projects will be designed and relevant training materials prepared. Methods of achieving low-cost, technically sound micro/ mini-hydro and/or PV mini-grid projects will be emphasized. Facilitation of ILGs (indigenous landowner groups) as managers and operators of the systems will also be addressed. Participants will be given assignments after each session, which they will complete after returning home and bring to the subsequent session. In the end, they will each have developed one to two potential projects.

Activity 1.1.2. Organization and conduct of a series of three progressive training workshops for national and provincial development planning officials and PPL staff on the planning and development of township-wide EE programs. In this activity, a program curriculum focusing on the step-by-step process for developing township-wide EE programs will be designed and relevant training materials prepared. Methods of calculating the cost-effectiveness of EE investments will be emphasized. Participants will be given assignments after each session, which they will complete after returning home and bring to the subsequent session. In the end, they will each have developed at least one township energy efficiency program.

Activity 1.1.3. Organization and conduct of a series of three progressive workshops in Milne Bay Province (MBP) for MBP district and provincial development planning officials on the planning and development of community solar PV mini-grid projects. Same description as Activity 1.1.1 except focus is on solar PV mini-grid projects only.

Activity 1.1.4. Organization and conduct of a series of three progressive workshops in Eastern Highlands Province (EHP) for EHP district and provincial development planning officials on the planning and development of community micro/mini-hydro projects. Same description as Activity 1.1.1 except focus is on mini-hydro mini-grid projects only.

Activity 1.1.5. Organization and conduct of a series of three progressive workshops in Morobe Province for Morobe district and provincial development planning officials and for Evangelical Lutheran Church (ELC) development officials on the planning and development of community micro/mini-hydro projects. Same description as Activity 1.1.1 except focus is on mini-hydro mini-grid projects only.

[GEF incremental funding for the delivery of Output 1.1 is required for technical and logistical assistance for the program curriculum design, teaching of each of the five capacity building programs, and partial support of attendee travel.]

Output 1.2. Approved national-level policies or regulations that promote RE and EE. Approved policies will include tariff elimination for RE and EE equipment, ICCC policies for licensing of and billing by community RE mini-grids, and other incentive policies, as identified by gap analysis, to promote community RE mini-grids and building and industrial EE in PNG.

Activity 1.2.1. Design and promotion of regulations that eliminate import tariffs on key types of renewable energy and energy efficiency equipment. This activity involves conduct of review of current import duty taxation,

formulation of recommended policies/regulations to eliminate (or significantly reduce) levies on key types of equipment and components that are used in RE and EE projects. Key types of equipment that will be targeted are: (1) equipment for PV mini-grids, including panels, inverters, and battery systems; (2) equipment for micro/ mini-hydro systems, including generators, turbines, load controllers, and penstocks; (3) energy efficiency equipment for buildings, including energy efficient lighting, energy efficient air conditioning equipment, and energy efficient refrigerators and other refrigeration equipment.

Activity 1.2.2. Design of policies for ICCC for promoting and supporting community-based renewable energy mini-grids. Policies to be designed will involve the regulation of licensing and billing by community based IPPs (independent power producers) that develop RE mini-grid projects.

Activity 1.2.3. Design of policies that promote community-based renewable energy mini-grids via ILG involvement. This activity involves working with the Department of Lands and Physical Planning on designing policies that enable ILGs to negotiate community RE mini-grid establishment agreements and to be responsible for the management and operation of such systems. The proposed policies will also define the roles of the provincial, district, and local-level government departments of land and physical planning in social mapping and facilitation of ILGs, as needed to develop community-based RE mini-grids.

Activity 1.2.4. Conduct of policy gap analysis and preparing of relevant proposed policies to promote RE in PNG. This activity involves the review of existing policies and development of appropriate policies on financial incentives and other regulatory mechanisms for community-scale RE mini-grids, such as grants, preferential tax regimes, low-interest loans, power purchase prices that ensure profitability, etc. These new policies will be other than those covered in Activities 1.2.1, 1.2.2, and 1.2.3. Once drafted, policies will be promoted to relevant officials via face-to-face meetings.

Activity 1.2.5. Conducting of policy gap analysis and preparing of relevant proposed policies to promote EE in PNG. This activity entails the conduct of policy review and development of suitable policies on financial incentives and other regulatory mechanisms to promote building and industrial energy efficiency retrofits, including grants, preferential tax regimes, low-interest loans for projects, etc. These new policies will be other than those included in Activity 1.2.1. Once drafted, policies will be promoted to relevant officials via face-to-face meetings.

[GEF incremental funding for the delivery of Output 1.2 is required for technical and logistical assistance for policy design and promotion and gap analysis work.]

Output 1.3. National-level RE and EE roadmaps, with proposed funding allocations for projects, submitted, approved, and implemented. The roadmaps will focus on community RE mini-grids and township EE programs, respectively, and indicate funding sources.

Activity 1.3.1. Design and promotion of a national-level energy roadmap for community-based RE power systems. This activity involves the conduct of studies/research on various aspects of community-based RE power systems in PNG and other SIDS. Data/information gathered will be used in preparing a national level energy roadmap for community-based RE power systems in PNG. The roadmap will have key sub-sections on community-based micro/ mini-hydro mini-grids and solar PV mini-grids. It will include proposed funding sources and funding allocations for projects. After the roadmap is drafted, it will be promoted for adoption to relevant officials in one-on-one meetings.

Activity 1.3.2. Design and promotion of a national-level energy roadmap for township EE programs. This activity involves the conduct of studies/research on various aspects of township EE initiatives in PNG and other SIDS. Data/information gathered will be used in preparing a national level energy roadmap for township EE programs. The roadmap will focus on township-based programs that encompass energy efficiency retrofits for top power consuming customers, energy efficiency related advisory services to new PPL customers on their design and construction stages for new buildings, residential energy efficiency programs, and street lighting in PPL's 32 diesel

centers across the country. The roadmap will propose funding mechanisms and funding allocations. After the roadmap is drafted, it will be promoted to relevant government officials and relevant senior management of PPL.

[GEF incremental funding for delivering Output 1.3 is required for technical and logistical assistance for each of the two roadmap design initiatives, as well as for the promotion of the respective roadmap to government officials.]

Output 1.4. Formulated, adopted, and effectively enforced standards to promote adoption of RE and EE. Standards will include building energy efficiency standards, product energy efficiency standards, and standards for RE equipment at the national level and, for EE, in one pilot province. Enforcement support will include certification and labelling programs.

Activity 1.4.1. Refinement of draft national building energy efficiency standards, facilitation of their adoption into the national building code, and facilitation of their enforcement. This activity entails relevant research and analysis to refine draft standards and collaborative working arrangement between CCDA, Department of Works, NISIT, National Housing Corporation, and the National Building Board. The work will involve a comprehensive review of the draft building EE standards prepared by CCDA. The refinement, official status, and enforcement of the revised draft building EE standards will then be pursued.

Activity 1.4.2. Design of and facilitation of enforcement of building energy efficiency standards for East Sepik Province's provincial building code. This activity entails a review of the existing building code of ESP to determine the possible options for the incorporation of EE standards in the design, construction, operation and maintenance of buildings and building systems. The pertinent ESP authorities will be guided and assisted in incorporating energy efficiency requirements into the existing provincial building code. Enforcement assistance will include facilitation of setting up (or revitalizing) a District Planning Board in Maprik (which currently lacks an active board) that will handle enforcement in the township center.

Activity 1.4.3. Formulation (as needed), refinement, and facilitation of the adoption and enforcement of national energy efficiency standards for key types of equipment. This activity entails working with NISIT in EE standards design for various equipment and systems that are installed in buildings. Targeted research will be carried out for various types of equipment used in buildings such as lighting, air conditioning, and refrigeration system equipment. The standards formulation will also involve consultations and coordination with relevant stakeholders, such as building practitioners and equipment manufacturers/suppliers. Enforcement work will involve design and implementation of a certification and labelling program.

Activity 1.4.4. *Design and facilitation of enforcement of provincial energy efficiency standards in East Sepik Province for key types of equipment*. This activity involves the conduct of targeted research/study for various types of equipment/appliances used in the province such as those used for lighting, air conditioning, and refrigeration. Enforcement work will involve design and implementation of a certification and labelling program.

Activity 1.4.5. Formulation (as needed), refinement, and facilitation of the adoption and enforcement of national standards for key types of renewable energy equipment used in community mini-grid systems. This activity involves close working arrangements with NISIT for the development of energy performance standards for RE equipment used in community mini-grid systems. The equipment includes micro/mini-hydro turbines, generators, load controllers and penstocks, and PV panels, PV inverters, and batteries for PV systems. The development of standards will also involve the conduct of targeted research as well as consultations with relevant stakeholders, particularly the manufacturers and suppliers of such RE system equipment. Enforcement work will involve design and implementation of a certification and labelling program. PV standard and certification work, in addition to benefiting community PV mini-grid efforts, will also benefit the growing number of solar (PV) home system (SHS) purchasers in the country.

[GEF incremental funding for delivering Output 1.4 is required for technical and logistical assistance for the design, adoption, and enforcement of each of the five types of EE and RE standards outlined in the above activities.]

Output 1.5. Formulated, approved, and implemented effective institutional plans for promoting RE and EE, detailing responsibilities of relevant agencies and coordinating mechanisms among them. This includes a multi-agency coordination plan, the focus of which will be RE mini-grids and township EE. The output will also include an EE Department institutional plan for PPL. Plans will include measures for ensuring the equitable involvement of women in developing RE and EE in PNG.

Activity 1.5.1. Design of an institutional plan for PPL to strengthen its capabilities in supporting its customers to implement energy efficiency initiatives. Consultation with PPL will be conducted to understand the current structure of its EE department and initiatives, as well as needs for the future. An institutional plan for PPL's EE work will be drafted, covering the areas of: staffing, organizational structure, and energy efficiency programs to be adopted. Further consultation with PPL will be conducted to refine and finalize the draft plan.

Activity 1.5.2. Design of plan for relevant national level organizations to cooperate in promoting community-based RE power systems and township EE programs. Consultation with national level government organizations involved in the energy sector will be undertaken to understand current responsibilities and challenges to inter-agency coordination. A national level institutional coordination plan for the energy sector that details responsibilities of relevant agencies and mechanisms by which these agencies will coordinate their work to achieve the common cause of promoting community-based RE systems and township EE programs will be prepared. Follow up consultation with relevant government agencies will then be conducted to refine and finalize the draft plan, as well as achieve buy-in from these agencies. On the RE side, in addition to energy and standards related agencies, such as CCDA, DPE, ICCC, NISIT, and PPL, the Department of Lands and Physical Planning will be included to address the need to involve ILGs in the planning, management, and operation of community RE systems.

[GEF incremental funding for delivering Output 1.5 is required for technical and logistical assistance for the development of EE and RE related institutional plans, including institutional planning for PPL's EE department and a central government multi-agency coordination plan for community-based RE systems and township EE programs.]

Output 1.6. Detailed adopted provincial plans for promoting RE and EE in townships (provincial and district centers) and villages, including specific pipeline projects that will replicate the project demos. This includes an RE and EE plan for each of the project's four partner province; and an RE plan for the Evangelical Lutheran Church (ELC). RE plans will focus on RE mini-grids; and EE plans will focus on comprehensive township EE programs.

Activity 1.6.1. Design and promotion of Milne Bay Province RE and EE plan. Consultation will be conducted with relevant provincial and district level officials regarding the proposed RE and EE plan. Information will be gathered on the current status and potential funding sources of relevant pipeline projects. Based on findings, a draft RE and EE plan for Milne Bay Province will be prepared. The draft plan will emphasize community RE power systems, especially replication of the project's Samarai Island PV Mini-Grid and possibly micro/ mini-hydro mini-grids. It will also include plans for a township-wide energy efficiency program in Alotau and possibly in other district centers. It will include specific pipeline projects and proposed funding sources. This activity involves promotion of the plan in one-on-one meetings with officials and gathering of their feedback for finalization of the plan.

Activity 1.6.2. Design and promotion of Eastern Highlands Province RE and EE plan. Consultation will be conducted with relevant provincial and district level officials regarding the proposed RE and EE plan. Information will be gathered on the current status and potential funding sources of relevant pipeline projects. Based on findings, a draft RE and EE plan for Eastern Highlands Province will be prepared. The draft plan will emphasize community RE power systems, especially replication of the project's Gotomi and Miruma mini-hydro demos. It will also include plans for a township-wide energy efficiency program in Goroka and possibly in some district centers. It will include specific pipeline projects and proposed funding sources. This activity involves promotion of the plan in one-on-one meetings with officials and gathering of their feedback for finalization of the plan.

Activity 1.6.3. Design and promotion of East Sepik Province RE and EE plan. Consultation will be conducted with relevant provincial and district level officials regarding the proposed RE and EE plan. Information will be gathered on the current status and potential funding sources of relevant pipeline projects. Based on findings, a draft RE and

EE plan for East Sepik Province will be prepared. The draft plan will emphasize both community RE power systems and township energy efficiency programs. The RE systems will include micro /mini-hydro mini-grids and PV mini-grids. The township energy efficiency programs will include expansion/ replication of the project demos in Wewak and Maprik to a wider group of power users and extension to other district centers in the province. The plan will include specific pipeline projects and proposed funding sources. This activity involves promotion of the plan in one-on-one meetings with officials and gathering of their feedback for finalization of the plan.

Activity 1.6.4. Design and promotion of Morobe Province RE and EE plan. Consultation will be conducted with relevant provincial and district level officials regarding the proposed RE and EE plan. Information will be gathered on the current status and potential funding sources of relevant pipeline projects. Based on findings, a draft RE and EE plan for Morobe Province will be prepared. The draft plan will emphasize community RE power systems, especially micro/ mini-hydro systems, but also possibly include PV mini-grid systems. Further, it will include plans for township-wide energy efficiency programs in Lae and/or some district centers. The plan will include specific pipeline projects and proposed funding sources. This activity involves promotion of the plan in one-on-one meetings with officials and gathering of their feedback for finalization of the plan.

Activity 1.6.5. Design and promotion of ELC PNG-wide RE Plan. Consultation will be conducted with relevant ELC management and leadership regarding the proposed RE plan. Information will be gathered on the current status and potential funding sources of potential pipeline projects. Based on findings, a draft PNG-wide RE plan for the ELC will be prepared. The draft plan will include a strategy of how ELC can leverage its nation-wide network, management strengths, and technical skills to bring community-based RE mini-grid systems to off-grid populations in PNG. The plan will emphasize micro/ mini-hydro systems, but also possibly include PV mini-grid systems. Plan will include specific pipeline projects and proposed funding sources. The activity involves promotion of the draft plan in one-on-one meetings with ELC management and leadership and gathering of their feedback for finalization of the plan.

[GEF incremental support for Output 1.6 is required for technical and logistical assistance for the development of provincial plans for promoting RE and EE in townships (provincial and district centers) and villages, including specific pipeline projects that will replicate the project demos.]

Component 2: Renewable Energy and Energy Efficiency Technologies Applications (Commercial and Technical Viability, including Project Demos): This component focuses on facilitating the achievement of technical and commercial viability for RE and EE projects in PNG (TA portion of component), as well as demonstrating that technical and commercial viability (investment portion of component). The priority will be to enable PNG to achieve and replicate "honest," low-cost, technically sound community RE systems and township center EE retrofits. As such, the component will address both technical and commercial barriers to achieving community RE systems and township EE retrofits in PNG. The targeted outcome of the TA portion of the component will be enhanced technical-commercial viability and capacity in the application of energy efficiency technologies and development of feasible RE-based energy systems in the country. The targeted outcome of the demo portion of the component will be increased installed capacity of RE based power systems and implementation of viable EE technology applications in PNG. Demos will be carried out in four main areas: mini-hydro mini-grid systems, PV mini-grid systems, productive use of renewable energy to raise incomes, and township energy efficiency programs.

Outcome 2A: Enhanced technical-commercial viability and capacity in the application of energy efficiency technologies and development of feasible RE-based energy systems in the country.

Output 2A.1. Completed capacity building program for technical personnel in the private and public sectors on the detailed technical preparation and implementation of community-based RE mini-grids and township EE programs. The program will include separate workshops on each of solar PV mini-grids, micro/mini-hydro mini-grids, building energy audits and retrofits, and industrial energy audits and retrofits. The technical capacity building program will have a target of 40 percent of the trainees being women at each of its four workshops.

Activity 2A.1.1. Organization and conduct of workshop for selected technical personnel on costing, sourcing, and technical aspects of preparing and implementing solar PV mini-grid projects. This activity involves the design of a workshop curriculum that will focus on preparing participants to handle the technical and commercial aspects of PV mini-grid design and establishment. It also involves the preparation of associated training materials. Methods of achieving honest (defined as fair and not excessive, given provider expenses) low-cost and technically sound PV mini-grids will be emphasized. The aim of the workshop is to promote the development of a core of honest providers (defined as those who do not take excessive profits and have the appropriate capabilities) of PV mini-grid systems in PNG. Test will be designed and administered at end of workshop to certify those candidates mastering materials.

Activity 2A.1.2. Organization and conduct of workshop for selected technical personnel on costing, sourcing, and technical aspects of preparing and implementing micro/ mini-hydro mini-grid projects. Same description as Activity 2A.1.1 except focus is on micro/mini-hydro mini-grids.

Activity 2A.1.3. Organization and conduct of workshop for selected technical personnel on building energy audits and building energy efficiency retrofits, including costing, sourcing, and technical aspects of preparing and implementing the retrofits. This activity involves the design of a workshop curriculum that focuses on preparing participants to handle the technical and commercial aspects of building energy audits and retrofits. It also involves the preparation of associated training materials. Methods for carrying out building energy audits, sourcing cost-effective equipment, carrying out retrofits, and verifying energy savings will be covered. Test will be designed and administered at end of workshop to certify those candidates mastering materials.

Activity 2A.1.4. Organization and conduct of workshop for selected technical personnel on industrial energy audits and industrial energy efficiency retrofits, including costing, sourcing, and technical aspects of preparing and implementing the retrofits. Same description as activity 2A.1.3, except focus is on industrial energy audits and retrofits.

[GEF incremental funding for the delivery of Output 2A.1 is for technical and logistical support for each of the four workshops, including workshop curriculum design, teaching of workshops, and partial support of attendee travel to workshops.]

Output 2A.2: Well-researched and verified sourcing information on RE and EE products, including brands/ specifications, sourcing channels, and prices. Information provided will cover low-cost, high quality products needed for PV mini-grids, micro/ mini-hydro mini-grids, and various EE retrofits.

Activity 2A.2.1: Research, verification, and documentation of low-cost, high-quality products needed to construct solar PV mini-grids in PNG. This activity involves the preparation of a vetted list of brands/specifications, sourcing channels, and expected prices for all key items included in solar PV mini-grids in PNG. Items will include, but not be limited to, PV panels, inverters, and batteries.

Activity 2A.2.2: Research, verification, and documentation of low-cost, high-quality products needed to construct micro/ mini-hydro mini-grids in PNG. This activity involves the preparation of a vetted list of brands/specifications, sourcing channels, and expected prices for all key items included in micro/mini-hydro mini-grids in PNG. Items will include, but not be limited to, generators, turbines, load controllers, and penstocks.

Activity 2A.2.3: Research, verification, and documentation of low-cost, high-quality products needed for building energy efficiency improvements in PNG. This activity involves the preparation of a vetted list of brands/specifications, sourcing channels, and expected prices for all key items for building energy efficiency work in PNG. Items will include lighting products (indoor and outdoor), air conditioning products (of different scales, including home scale and large, institutional scale), and refrigeration products (both refrigerators for home use and refrigeration for businesses). In addition to building energy efficiency products, street lighting products will also be researched.

[GEF incremental funding for the delivery of Output 2A.2 is for technical support needed in the research, negotiation, and preparation of information on low-cost, high quality sourcing channels.]

Output 2A.3. Detailed information on "honest," best possible costing of community RE mini-grid projects. Information will be provided in the form of a user-friendly report with tables showing estimated cost break-downs for sample projects and tables listing "honest" price benchmarks for various cost components in PNG. Costing will encompass feasibility study, civil works, electrical works, and construction services. "Honest" is defined as without excessive profits and providing the services at a level of quality that ensures smooth operation and long lifetime of installed systems.

Activity 2A.3.1. Research, verification, and documentation on "honest," best possible costing of micro and mini-hydro projects in PNG. This activity covers costs of both the feasibility study and construction of micro/ mini-hydro systems, and focuses both on: (i) getting the honest price for services and (ii) special measures, such as local procurement of power poles or replacement of excavators with local labor, to reduce costs. (Note: This activity will leverage findings of Activity 2A.2.2 on sourcing of equipment for micro/ mini-hydro projects in PNG.) This activity also includes the development of benchmark costing per kW installed for various scales of micro/ mini-hydro projects in the PNG market. The costing information will be updated annually both during project implementation and after project close. PPL via its department responsible for RE will take the lead after project close in updating the database and coordinate with NISIT and CCDA in this work. To mitigate risks of costing that is artificially high or low, the costing information will address quality issues and will also provide information on best cost benchmarks for various power and engineering components/products in other countries, e.g., Australia.

Activity 2A.3.2. Research, verification, and documentation on "honest," best possible costing of PV mini-grid projects in PNG. This activity focuses both on: (i) getting the honest price for services and (ii) special measures, such as local procurement of power poles, to reduce costs. (Note: This activity will leverage findings of Activity 2A.2.1 on sourcing of equipment for PV mini-grid projects in PNG.) This activity also includes development of benchmark costing per kW PV installed and per kWh battery bank included for various scales of PV mini-grid and associated battery bank in the PNG market.

[GEF incremental funding for the delivery of Output 2A.3 is for technical and logistical assistance for preparation of each of the PV mini-grid costing and the micro/ mini-hydro mini-grid costing.]

Output 2A.4. Designed and trialed training program for developing capacity in O&M for RE mini-grid projects among local people and local officials in project areas, including certification program. This output covers O&M of both solar PV mini-grids and micro/ mini-hydro mini-grids. It will include a training curriculum for each that can be used on an ongoing basis, as well as a proven track record of the micro/ mini-hydro O&M program via trialing at two sites. The pilot O&M training program will have a target of 40 percent of trainees being women.

Activity 2A.4.1. Preparation of training course content for O&M of micro/mini-hydro mini-grid systems. This activity entails the design of a suitable training and certification program on the O&M of micro/ mini-hydro mini-grids. The program will be tailor-made in accordance with a capacity needs assessment that will be conducted. A standardized achievement test will be designed to measure skills and knowledge learned by the trainees from the planned instruction. Certification will be based on the results of the achievement test.

Activity 2A.4.2. Conduct of mini-hydro O&M training course for individuals associated with Gatop Mini-Hydro Station and Kabwum (District-owned) Mini-Hydro in Morobe Province. This activity will involve carrying out of the training program designed under Activity 2.4.1 for individuals associated with operational mini-hydro systems. The activity involves the administering of the achievement test designed under Activity 2.4.1 to certify those candidates mastering micro/ mini-hydro O&M.

Activity 2A.4.3. Preparation of training curriculum for O&M of PV mini-grid projects. Same description as Activity 2A.4.1 except focus is on O&M for PV mini-grid projects.

[GEF incremental funding for the delivery of Output 2A.4 is for technical and logistical assistance for the design of the two O&M training courses, and for the conduct of the trial micro/ mini-hydro O&M training program at Gatop and Kabwum.]

Output 2A.5: Proven system for power purchase agreements (PPAs) between PPL and independent power providers (IPPs) running community based RE mini-grids. This output includes a template PPA agreement and achievement of actual PPAs for two mini-hydro systems.

Activity 2A.5.1. Preparation of template for power purchase agreement (PPA) between PPL and the owners of community-based RE mini-grids. This activity includes research of RE mini-grid PPAs used in other countries and assessment of appropriate PPA features for the situation in PNG. The template will be developed in consultation with ICCC and PPL. Information about the power purchase agreement will be distributed to stakeholders, including provincial and district personnel with responsibilities related to energy and commercial sector organizations interested in developing RE mini-grid projects.

Activity 2A.5.2. Negotiation between Gatop Mini-Hydro Station, Morobe Province, and PPL of PNG's first mini-hydro mini-grid PPA with PPL. Assistance will be provided to Gatop in understanding the costs and benefits of an RE mini-grid PPA deal with PPL. Liaison support will be provided to facilitate negotiation between PPL and Gatop (as well as communication between ICCC and Gatop) as needed to realize a PPA. The PPA will enable Gatop to sell its power to PPL, which in turn will carry out billing and collection of revenues from customers.

Activity 2A.5.3. Negotiation between Kabwum (District-Owned) Mini-Hydro Station, Morobe Province, and PPL of a mini-hydro mini-grid PPA with PPL. Assistance will be provided to Kabwum in understanding the costs and benefits of an RE mini-grid PPA deal with PPL. Liaison support will be provided to facilitate negotiation between PPL and Kabwum (as well as communication between ICCC and Kabwum) as needed to realize a PPA. The PPA will enable Kabwum District to sell its power to PPL, which in turn will carry out billing and collection of revenues from customers.

[GEF incremental funding for the delivery of Output 2A.5 is for technical and logistical assistance for design of the template PPA, and for facilitation of negotiations between Gatop and PPL and between Kabwum and PPL for actual mini-hydro PPAs.]

Output 2A.6. Adopted business plans for productive use of renewable energy (PURE) that raise the incomes of local people, especially women. Plans will include business strategy, technical support, and marketing support in areas that local people have identified for potential new income generating activities or improvement of existing ones. At least 50 percent of the productive applications supported will be those specific to women.

Activity 2A.6.1. Development of various ideas for the productive uses of PV mini-grid power on Samarai Island, Milne Bay Province. Provision of planning, technical, and marketing support to local people to develop different ideas for the productive uses of PV mini-grid power. This activity includes development of ideas for productive use activities for women on the island.

Activity 2A.6.2. Development of various ideas for the productive uses of mini-hydro mini-grid power in Gotomi Ward, Lufa District, Eastern Highlands Province. Provision of planning, technical, and marketing support to local people to develop different ideas for the productive uses of mini-hydro mini-grid power. This activity includes development of ideas for productive use activities for women in the district.

Activity 2A.6.3. Development of various ideas for the productive uses of mini-hydro mini-grid power in Miruma Ward, Upper Asaro LLG District, Eastern Highlands Province. Same description as activity 2A.6.2.

[GEF incremental funding for the delivery of Output 2A.6 is for technical and logistical assistance for the advising of local people on business plans and technical and marketing aspects of productive use of renewable energy.]

Output 2A.7. Published and disseminated information on findings from monitoring of the project RE and EE demos. The information will include experiences, data, and lessons learned from the two mini-hydro mini-grid demos, one PV mini-grid demo, and two township EE program demos.

Activity 2A.7.1. Monitoring and documentation of project mini-hydro demos in Gotomi Ward and Miruma Ward, Eastern Highlands. Reporting will cover the project development period as well as the ongoing experience with operation of the system. It will further include information on productive use of the power to raise local incomes. Successes as well as lessons learned will be highlighted. Findings will be disseminated directly to relevant national level, provincial level, and district level officials, PPL staff and management, and other businesses with interest in the development of PNG's micro/ mini-hydro sector via hard copy and email distribution. The documentation developed will also be more broadly disseminated via posting on the project website developed under Output 4.7.

Activity 2A.7.2. Monitoring and documentation of project solar PV mini-grid demo on Samarai Island, Milne Bay Province. Same description as Activity 2A.7.1 except focus is on Samarai PV mini-grid demo.

Activity 2A.7.3. Monitoring and documentation of project township energy efficiency program demos in Wewak and Maprik, East Sepik Province. Reporting will cover all aspects and stages of the demos. This will range from energy audits in the early stages, to installation of retrofits, to ongoing measurements of energy savings. It will also cover financing of retrofits and experience with advising new customers, experience with residential customers, and experience with street lighting retrofits. Successes as well as lessons learned will be highlighted. Findings will be disseminated to relevant national level, provincial level, and district level officials, particularly those in PPL's 32 diesel centers. Findings will also be disseminated to PPL staff and management and other businesses with an interest in energy efficiency work.

Activity 2A.7.4. Monitoring and documentation of PPA, billing system, and O&M aspects of 200 kW mini-hydro station in Gatop, Tewai Siassi District, Morobe Province, with Evangelical Lutheran Church (ELC), and of 100 kW mini-hydro station at Kabwum District center, Morobe Province, with Kabwum District Government. For both locations, reporting will cover the experience with PPA and billing, the experience with O&M training, and experience with operations and maintenance.

[GEF incremental support is required for the technical and logistical support for the monitoring and reporting on the implemented demonstrations.]

Outcome 2B: Increased installed capacity of RE based power systems and implementation of viable EE technology applications in PNG.

Output 2B.1. Completed successful demos of commercially viable mini-hydro systems in PNG. This includes demo design, demo costing, and demo establishment. Successful installation and commissioning will be followed by three years of operation, for each of two systems in Eastern Highlands Province.

Activity 2B.1.1. Design, costing, and implementation of Gotomi Ward mini-hydro mini-grid demo in Lufa District, Eastern Highlands Province. This activity includes the conduct of a feasibility study, which will be followed by civil, mechanical, and electrical work. The selection of contractors and equipment providers to achieve high quality and lowest possible costing will be an important part of this work and will draw on findings from Activities 2A.2.2 and 2A.3.1. The activity will also include three years of operation of the demo during the project, after successful installation and commissioning.

Activity 2B.1.2. Design, costing, and implementation of Miruma Ward mini-hydro mini-grid demo in Upper Asaro, Daulo District, Eastern Highlands Province. Same description as Activity 2B.1.1 except site is Miruma Ward mini-hydro mini-grid demo in Upper Asaro, Daulo District, Eastern Highlands Province.

[GEF incremental funding for the delivery of Output 2B.1 is for the required technical assistance in the conduct of the feasibility study and for the civil, mechanical, and electrical work and equipment procurement of each of the two mini-hydro project demos.]

Output 2B.2. Completed successful demo of commercially viable off-grid solar PV mini-grid system in PNG. This includes demo design, demo costing, and demo establishment. Successful installation and commissioning will be followed by three years of operation of the PV mini-grid system on Samarai Island in Milne Bay Province.

Activity 2B.2.1. Design, costing, and implementation of Samarai Island solar PV mini-grid in Milne Bay Province. The PV mini-grid and associated battery system will be designed and needed equipment procured. Installation of the PV panels and battery bank will be carried out, including construction of a shelter for the battery bank. As the first PV mini-grid in PNG, strong emphasis will be put on achieving a cost-effective, quality system to replace the current diesel system on Samarai Island. As such, selection of contractors and equipment providers will be an important part of this work and will draw on findings from Activities 2A.2.1 and 2A.3.2. The options of a single EPC versus multiple contracts will be considered. The activity will also include three years of operation of the demo during the project after successful installation and commissioning.

[No GEF incremental funding is required for the delivery of Output 2B.2.]

Output 2B.3. Completed successful demo of commercially viable township energy efficiency programs. The output will include energy audits and retrofits for top power users, energy efficiency advising for new large users expected to come online soon, street lighting retrofits, and a credit program for residential users to replace refrigerators and outdoor lighting. The residential credit program will ensure that at least 20 percent of the homes supported are owned by women.

Activity 2B.3.1. Conduct of Wewak, East Sepik Province, Township Energy Efficiency Program. The Wewak program will include: (1) conduct of energy audits of largest electricity customers (as determined by monthly kWh consumed), in both the commercial and industrial sectors, and associated EE retrofits based on opportunities identified in energy audits (realized by design, planning, approval, and implementation of an energy audit sub-program). It will also include (2) EE advisory services of new large electricity users that are expected to come online soon (realized by design, planning, approval, and implementation of an EE advisory services sub-program). In addition, (3) support for replacement of residential refrigerators and lighting will be carried out (realized via design, approval, and implementation of a consumer EE credit scheme sub-program). Lastly, (4) street lighting EE retrofits will be conducted.

Activity 2B.3.2. Conduct of Maprik, East Sepik Province, Township Energy Efficiency Program. The same description as Activity 2B.3.1 except Maprik is the location, and no energy audits and retrofits will be conducted in the industrial area.

[GEF incremental funding for the delivery of Output 2B.3 is for the technical and logistical assistance required in the conduct of energy audits and energy efficiency advisory services, and the residential EE credit scheme. It will also provide equipment purchase support for the initial cases of EE retrofits.]

Output 2B.4. Completed demonstration of productive applications of RE mini-grid systems that raise the incomes of local people. Demonstrations will occur at two mini-hydro mini-grid sites and one PV mini-grid site. Productive use of RE-generated electricity applications specific to women owned and operated businesses will be included and make up at least 50 percent of PURE application initiatives supported by the project.

Activity 2B.4.1. Carrying out of productive applications of mini-hydro mini-grid generated electricity in Gotomi Ward, Eastern Highlands, including special applications carried out by women owned and operated businesses. This activity is based on the business advising provided under Output 2A.6. It involves local people setting up and operating income-generating activities that make use of RE power. For some of these businesses, small grants will be provided, with priority given to women operated businesses.

Activity 2B.4.2. Carrying out of productive applications of mini-hydro mini-grid generated electricity in Miruma Ward, Eastern Highlands, including special applications carried out by women. Same description as Activity 2B.4.1 except location is Miruma Ward, Eastern Highlands.

Activity 2B.4.3. Carrying out of productive applications of solar PV mini-grid power on Samarai Island, Milne Bay Province, including special applications carried out by women. Same description as Activity 2B.4.1, except location is Samarai Island, Milne Bay Province.

[GEF incremental funding for the delivery of Output 2B.4 is for the required cash grants for investment in PURE income-generating activities. These cash grants will be incremental to cash and in-kind investment by local people in activities that make use of RE generated power and provide income generating benefits. The GEF funding will not be a part of long term funding mechanisms (such as those designed in Component 3), but instead will be a one-time opportunity for support of demonstrations, which are meant, in turn, to stimulate replication without such cash grants.]

Component 3: Financing of Renewable Energy and Energy Efficiency Projects: This component focuses on facilitating the mobilization of financing for RE and EE in PNG, including both equity investment and loan financing. It aims to address barriers to such financing, namely the lack of awareness and capacity of banks and other investors in PNG with regard to RE and EE projects and the lack of precedent in PNG for financing of community RE mini-grids and township EE retrofits. The targeted outcome of the component is improved availability of, and access to, financing for renewable energy and energy efficiency initiatives in the energy generation and end-use sectors. The financing mechanisms introduced will serve to both stimulate the market and to provide funds for up-front investment that would otherwise not be available.

Outcome 3: Improved availability of, and access to, financing for renewable energy and energy efficiency initiatives in the energy generation and end-use sectors.

Output 3.1: Completed group capacity building program for the banking sector, investors in the commercial /private sector (including PPL), and the government sector on financing RE and EE via equity investment and loans. The output will consist of two series of two workshops each, one series on the financing of community scale RE power projects and one series on the financing of EE projects. The capacity building program on the financing of RE and EE will have a target of 40 percent of the trainees being women at each of its four workshops.

Activity 3.1.1. Organization and conduct of two workshops on financing of community scale renewable energy power projects, especially micro/mini-hydro mini-grids and PV mini-grids. This activity involves the design, organization and conduct of workshops on financing of community-based micro/mini hydro mini-grid and PV mini-grid projects. It includes the design and preparation of training content and materials. Participants will include those from the banking sector, the commercial/ private sector (including PPL), and the government sector. Content will emphasize financial attractiveness of community scale RE mini-grid projects as compared to diesel mini-grid projects (as documented under Activity 4.1.1), equity investments in such projects, and loans to such projects. An achievement test on topics/subjects covered will be prepared and administered at the end of the second workshop.

Activity 3.1.2. Organization and conduct of two workshops on financing of EE, including building and industrial retrofit projects and residential appliance and lighting replacement. This activity involves the design, organization and conduct of two workshops on commercial building, industrial, and residential EE projects. It includes the design and preparation of training content and materials. Participants will include those from the banking sector, the commercial/ private sector (including PPL), and the government sector. Content will emphasize financial attractiveness of investments in EE (as documented under Activity 4.1.1), equity investment in EE, and loans and ESCO financing of EE projects. An achievement test on topics/subjects covered will be prepared and administered at the end of the second workshop.

[GEF incremental funding for the delivery of Output 3.1 is for technical and logistical assistance for each of the two series of capacity building workshops, including both the preparation of the training content and the carrying out of the workshops.]

Output 3.2: Designed, funded, and launched special financing mechanism for EE projects. The mechanism will provide up-front funding for EE retrofits to be paid back via end user monthly savings on energy bills.

Activity 3.2.1. Design and operation of an "ESCO" fund to be set up within PPL to provide up-front investment for customer energy efficiency retrofit projects. This activity involves the design of the fund's mechanisms such that PPL's upfront investment in top power consuming customer retrofits will be paid back by the customer's monthly savings on its energy bill. It includes design of a monitoring protocol for verifying monthly energy savings due to the retrofits. The fund will be initially tested in the project's two East Sepik Province township energy efficiency demos, one in Wewak and one in Maprik.

[GEF incremental funding for the delivery of Output 3.2 is for the required technical and logistical assistance in the design of the "ESCO" fund, including the system for verifying energy savings.]

Output 3.3. Designed, funded, and launched special loan fund for RE projects, carried out by a PNG commercial bank. The loan fund will provide up-front financing for community RE mini-grid projects and will likely be a sub-fund of an existing SME fund at a PNG commercial bank. The project will ensure that the loan fund or sub-fund for community RE mini-grids will include as one of its loan criteria the active involvement of women in the funded mini-grid projects.

Activity 3.3.1. Design and operation of a special fund or sub-fund (attached to existing SME fund) to provide loans for the establishment of community RE mini-grids, especially micro/ mini-hydro and solar PV mini-grids. The fund or sub-fund will be established by a credible banking/ financial institution that can provide and manage the funds, probably through a pre-existing SME loan facility or rural loan fund. This activity involves the development of the guidelines for assessing the financial and technical viability of micro/ mini-hydro and PV mini-grids projects that need loans. Such mini-grids will set up billing systems and pay loans back via their power revenues.

[GEF incremental funding for the delivery of Output 3.3 is for the required technical and logistical assistance in the design of the community RE mini-grid loan fund (or SME sub-fund) and associated guidelines.]

Output 3.4. Publicly available information on sources of funding for RE and EE (e.g. Green Climate Fund, crowdfunding, social impact funds, etc.), including listing of sources and how-to-apply guide on effectively accessing funds. The guide will be provided in hard copy print format as well as being made available online. The guide will provide proponents information on the highest potential international and national sources of funding for PNG's EE and RE and strategic advice on how to apply to them.

Activity 3.4.1. Research and preparation of a reference guide on funding sources for RE and EE projects, including explanations of how to successfully apply to recommended sources. Potential sources may include the Green Climate Fund, crowdfunding, social impact funding, etc. As a first step, research will determine the best sources and the most effective ways to apply for them. This information will then be drafted into an easy to use how-to-apply guide. The information will be directly disseminated to interested officials, companies, and communities via hard copy and email distribution. The documentation developed will also be more broadly disseminated via posting on the project website that will be developed under Activity 4.7.1 (Output 4.7). A survey of likely users of the funding guide will be carried out under Activity 4.7.2 (Output 4.7) to assess actual level of applications stimulated by this activity.

[GEF incremental funding for the delivery of Output 3.4 is for the required technical assistance in researching and preparing the reference guide of funding sources suitable to RE and EE in PNG.]

Component 4: Energy Development and Utilization Awareness Enhancement (Information on and Awareness of RE and EE): This component focuses on increasing the availability of quality information on the development of RE and EE in PNG, as well as on raising the awareness among stakeholders of RE and EE. It addresses the key barriers that stakeholders in PNG lack information about RE and EE, particularly about RE mini-grids and township EE initiatives, and that there is a general lack of awareness among the public in PNG about RE and EE. With regard to information, a key area of note is lack of information among PNG stakeholders about the potential superior cost performance of RE and EE as compared to diesel. The targeted outcome of the component is improved awareness of, attitude towards, and information about renewable energy and energy efficiency applications in the energy generation and end-use sectors.

Outcome 4. Improved awareness of, attitude towards, and information about renewable energy and energy efficiency applications in the energy generation and end-use sectors.

Output 4.1. Convincing, analytic, and well-disseminated briefing materials for policy makers showing that RE in many cases is more cost effective than fossil fuel in PNG and that EE projects bring strong benefits to businesses' bottom lines. Briefing materials will be succinct written documents. Dissemination will emphasize face-to-face meetings with policy makers to discuss briefing materials.

Activity 4.1.1. Conduct of research, analysis, and drafting of briefings for policy makers that show the "win-win" potential of RE and EE for government, PPL, the private sector, and the people in PNG. Briefings will include data-based analysis; and briefings will be on: (i) comparison of costs of diesel mini-grids to micro/ mini-hydro mini-grids and PV mini-grids, showing that RE power generation in many cases is more cost effective than diesel; (ii) potential returns of building and industrial energy efficiency retrofit investments in the PNG context; (iii) comparison of the costs of grid extension to the alternative of off-grid RE mini-grids as a means of meeting *MTDP* and *Vision 2050* electricity access goals; and, (iv) GHG emission reduction benefits of sample RE mini-grid and EE initiatives.

Activity 4.1.2. Implementation of strategy for ensuring briefings for policy makers reach high-level decision makers as well as mid-level officials. High and mid-level decision makers will be identified and a strategy designed for getting the briefings to them, either through direct meetings or via their deputy personnel and assistants. A survey of involved policy makers will determine whether they support and endorse RE and EE initiatives in development plans. The result will be used to estimate the total number of policy makers influenced by this activity and other project activities. The estimate will be used to evaluate one of the indicators for Outcome 4. Briefing materials will also be used in all of the project's capacity building programs. Briefings will be disseminated directly to policy makers via hard copy distribution and email distribution. The briefings developed will also be more broadly disseminated via posting on the project website developed under Activity 4.7.1 (Output 4.7).

[GEF incremental funding for delivering Output 4.1 is for the required technical and logistical assistance in the conduct of research and preparation of briefing materials and in the conduct of one-on-one meetings to promote the materials to policy makers.]

Output 4.2. Guidebooks for enabling PNG engineers, officials, and communities to work together (without outside assistance) to develop quality community RE projects at low and well-controlled costs. One "how to" guide on developing micro/ mini-hydro in PNG and one on developing PV mini-grids in PNG are included.

Activity 4.2.1. Preparation and dissemination of "how to" guide on developing micro/ mini-hydro mini-grids in the PNG context. This activity involves the preparation of guidance tools for the development of micro/mini-hydro mini-grids in PNG. Instead of "reinventing the wheel," the guide will draw on other technical materials already available internationally. It will also, however, include new materials that address PNG-specific issues, such as expected "best, honest" costs (detailed breakdown) in PNG (see Activity 2A3.1), means of keeping costs low (see Activity 2A3.1), sourcing channels (see Activity 2A2.2), creating community buy-in and working with ILGs, billing systems, and productive applications. The "how to" guide will be disseminated directly to targeted individuals or organizations most likely to make use of the guide via hard copy distribution and/or email distribution. The guide

will also be more broadly disseminated via posting on the project website developed under Activity 4.7.1 (Output 4.7).

Activity 4.2.2. Preparation and dissemination of "how to" guide on developing PV mini-grids in the PNG context. Same description as for Activity 4.2.1, except focus is on PV mini-grids; and referenced activities are Activity 2A3.2 and Activity 2A2.1.

[GEF incremental funding for delivering Output 4.2 is for the technical and logistical assistance needed in the preparation of the "how to" guides that are tailored to the PNG context.]

Output 4.3. Database on RE resources and pipeline RE projects in PNG. In terms of RE resources, this database will include the results of new resource assessments conducted under the project on solar resources in Milne Bay Province and on micro/mini-hydro resources in each of Eastern Highlands and Morobe Province, as well as results of resource assessments conducted under other projects, especially the wind resource assessment of an ongoing World Bank-GEF project. The database will also include proposed community RE mini-grid projects developed via capacity building program homework carried out by government development planning officials. In line with the project website development in Activity 4.7.1, the data that will be generated in the resource assessment activities described below will be posted on the project website. As a part of each activity, potentially interested parties will be informed of the database and how to access it on the project website.

Activity 4.3.1. Conduct of solar resource assessment of Milne Bay Province and preparation and dissemination of associated data. This activity entails collection of relevant historical meteorological data and setting up and monitoring assessment equipment in the field as needed. Based on findings, a database of MBP's solar resources will be prepared.

Activity 4.3.2. Conduct of micro/ mini-hydro resource assessment of Eastern Highlands Province and preparation and dissemination of associated data. This activity entails collecting relevant data on rivers and streams in EHP and conducting liaison with stakeholders and/or carrying out field trips to gather further information. Based on findings, a database of EHP's micro/mini-hydro resources will be prepared.

Activity 4.3.3. Conduct of micro/ mini-hydro resource assessment of Morobe Province and preparation and dissemination of associated data. Same description as Activity 4.3.2, except focus is on Morobe's micro/mini-hydro resources.

Activity 4.3.4. Identification and aggregation of other PNG RE resource data already collected by other projects or organizations. This activity involves liaising with other organizations that have access to PNG RE resource data to obtain their buy-in to share this data. One key source of data will include the PNG wind resource data collected by the ongoing World Bank-GEF project.

Activity 4.3.5. Collection, organization, and dissemination of information on pipeline proposed community scale micro/ mini-hydro and PV mini-grid projects as developed under other activities of this project, especially Activities 1.1.1, 1.1.3, 1.1.4, and 1.1.5. This activity involves the systematic compiling of information on the proposed community scale micro/ mini-hydro and PV mini-grid projects that were identified and developed under Component 1 of FREAGER. This information will enable investors, engineering firms, and other relevant parties to access information on proposed RE mini-grid projects that follow FREAGER's guidance on planning of best-cost, quality micro/mini-hydro and PV mini-grid projects with strong community buy-in.

[GEF incremental funding for delivering Output 4.3 is for the required technical and logistical assistance in conducting the three targeted provincial RE resource assessments; aggregation of RE resource assessment data from other sources; and the collection and organization of information on pipeline community RE projects, including travel to partner provinces to gather updated information on such projects.]

Output 4.4: Designed RE and EE courses and course materials made available for the education sector. This includes tertiary education level courses on community RE mini-grid development and on building and industrial energy audits, and prepared RE and EE contents incorporated into primary school and high school courses.

Activity 4.4.1: Preparation of short, hands-on training courses on micro/ mini-hydro and PV mini-grid development and installation for university, technical college, and/ or technical vocational training centers. This activity includes preparation of content for micro/mini hydro mini-grid and PV mini-grid system courses for partner tertiary education institutions. While the curriculum will include basic theory of systems introduced by lecture and discussion, it will emphasize hands on work (learning by doing) in preparing designs of systems and in carrying out installation related activities. The identification of target institutions for offering the course and dissemination of materials to those institutions is also included in this activity.

Activity 4.4.2: Preparation of short, hands-on training course on energy audits (buildings and industrial facilities) for university, technical college, and/ or technical vocational training centers. This activity includes preparation of content for a course on building and industrial energy audits for partner tertiary education institutions. While the curriculum will include basic theory of energy audits introduced by lecture and discussion, it will emphasize hands on work (learning by doing) in carrying out different aspects of building and industrial energy audits. This also includes identification of target institutions for offering the course and dissemination of materials to those institutions.

Activity 4.4.3: Preparation of attractive materials on RE and EE developed expressly for PNG at the (i) primary school level and (ii) high school level and distributed widely to schools. This activity includes consultation with teachers to understand student needs, research on and comparison to existing materials for students elsewhere in the world, and preparation of learning materials. Materials shall be designed to be incorporated into other course work being taught at these levels. This activity will also include outreach to schools to ensure materials are utilized in courses.

[GEF incremental funding for delivering Output 4.4 is for the required technical and logistical assistance in the preparation of content for community RE mini-grid course and energy audit (building and industrial facility) course for tertiary institutions, consultations with primary school and high school teachers, and preparation of RE and EE content for inclusion in primary school and high school courses.]

Output 4.5: Completed RE and EE multi-channel media promotion campaign in PNG. The media campaign will emphasize the community RE mini-grid and township EE experience of the project. Media channels or strategies that will be included in the campaign are: TV, radio, print media, online news, social media, text messaging, and celebrity endorsement.

Activity 4.5.1 Design, filming, and airing of prime time TV show promoting RE and EE. This activity involves outreach to the television broadcast sector to promote the idea for the show and ensure a prime time slot is secured. The show will emphasize the benefits of community RE mini-grids and township EE programs. Specific content featuring women-owned and operated businesses powered by electricity from community RE mini-grids and women making use of energy efficient appliances and equipment in livelihood and income generating activities will be included in the TV show.

Activity 4.5.2. Design and airing of radio shows discussing and promoting RE and EE. This activity involves outreach to radio broadcast organizations to ensure airtime is secured. The shows will emphasize the benefits of community RE mini-grids and township EE programs. The radio show will include content featuring women's involvement in community RE mini-grids and township EE programs.

Activity 4.5.3. Design and implementation of outreach campaign to educate journalists about RE and EE, including emphasis on cost competitiveness, off-grid electrification potential, and environmental benefits. This activity involves the organization of group outreach meetings and one-on-one meetings with the press to promote RE and

EE, as well as preparation of relevant written materials for the press. The emphasis will be on community RE mini-grids and township EE programs, such as those carried out by the project.

Activity 4.5.4. Design and implementation of social media marketing campaign to promote positive discussions on the potential of RE and EE for PNG. This activity includes assessment of preferred social media channels in PNG, analysis of type and style of content that is successfully disseminated through social media in PNG, and design and implementation of a social media campaign on RE and EE that leverages these findings. Content will emphasize community RE mini-grids and township EE programs, such as carried out by the project. The social media campaign will include content featuring women's involvement in community RE mini-grids and township EE programs.

Activity 4.5.5. Design and implementation of mobile text messaging campaign to promote RE and EE. This activity includes brainstorming on, and analysis of, the best content to include in the text messages of the campaign and the associated best demographics to target.

Activity 4.5.6. Design and implementation of strategy to obtain free or low-cost celebrity endorsement of RE and EE in PNG. This activity includes identification of potential celebrities to be approached regarding endorsement of RE and EE in PNG. This may include outreach to famous actors or actresses who strongly support the environment, or athletes with similar inclinations. Once a celebrity agrees to provide the endorsement, work will be done in designing the endorsement activity and working with the celebrity's team to come up with a final plan.

[GEF incremental funding for delivering Output 4.5 is for a subcontract for filming and airing of a prime time TV show and technical and logistical assistance in carrying out promotion and outreach to radio shows, print and online media journalists, and the social media world, as well as design and implementation of the text media campaign, and the facilitation of celebrity endorsement of RE and EE in PNG.]

Output 4.6: Completed one-on-one TA for selected local equipment manufacturers/fabricators in the design and production of RE/EE technology equipment or components. The delivery of this output will entail one-on-one coaching for identified manufacturers in the local production of equipment and components for community RE mini-grids or of EE products.

Activity 4.6.1. Design and implementation of a technical assistance program for local equipment manufacturers/ fabricators on the design and production of RE/EE equipment or components. This activity involves first the identification of equipment and/or components for micro/mini-hydro mini-grids, PV mini-grids, and EE products for which substantial cost reduction could be achieved through domestic production. This will be followed by identification of potential domestic manufacturers and liaison work with them. Specific technical assistance scheme will be designed and implemented for selected interested companies. The TA may include liaison with overseas partners for co-production in PNG or technical guidance for independent domestic production.

[GEF incremental funding for delivering Output 4.6 is for technical and logistical assistance in the identification, vetting and selection of high potential local manufacturers and provision of one-on-one coaching and liaison support.]

Output 4.7. "One-stop-shop" website[4] providing range of information on RE and EE in PNG. Website will include range of materials related to RE and EE in PNG. It will include materials generated by the project and relevant materials generated by other initiatives.

[4] The link for the website will be disseminated to relevant parties. The website will include all materials developed under other activities of the project, including, but not limited to: briefing materials on win-win nature of RE and EE in PNG, sourcing information for RE and EE in PNG, costing information for community RE systems in PNG, guidebooks on developing micro/ mini-hydro mini-grids and solar PV mini-grids in PNG, RE resources data for PNG, pipeline RE projects in PNG, monitoring reports of project demos, listing and how-to-guide on applying for funding for RE and EE projects, and training materials for the project's various capacity building programs.

Activity 4.7.1. Development and establishment of a well-designed, user-friendly website that serves as a "one-stop-shop" for raising awareness and promoting investment in RE and EE in PNG. An attractive and user friendly website will be designed for a "one-stop-shop" on RE and EE in PNG. Design work will include efforts to ensure the website comes up frequently in relevant online searches. Relevant items for the website on RE and EE in PNG will be identified from all other project activities as well as from other sources. Items will be posted in organized, user-friendly fashion on website. Website will be maintained for ongoing posting of new items throughout the project. The design work will include close consultation with PPL's departments for demand side management and renewable energy, CCDA, and NISIT in order to ensure the approach fits with the long-term vision of these organizations, for the website. At the beginning of the fourth year of the project, the organizations contracted to design, update, and maintain the website will train the two PPL departments, so that responsibilities for posting new items on the website and otherwise maintaining the website can be transferred. From that time onwards, PPL will be responsible, in conjunction with CCDA and NISIT, for the website.

Activity 4.7.2. Conduct of follow up survey of persons to whom the website link has been disseminated or who have received project materials through other channels to determine how many active RE and EE developers and investors, including engineering and construction firms, communities, building and industrial facility owners, etc., have made use of project materials in developing specific EE and RE projects. Results will be used to extrapolate the total number of such parties and thus assess one of the project indicators for Outcome 4. The survey will also be used to estimate how many stakeholders have reviewed at least one of the project demo monitoring reports and made use, in particular, of the information therein. Findings from this specific item on the demo monitoring reports will be used to assess an indicator for Output 2A.7. The survey will further be used to assess the use level of the RE and EE funding guide and thus assess an indicator associated with Output 3.4. Finally, the survey will be used to estimate how many stakeholder organizations have made use of the project's how-to micro/mini-hydro or PV mini-grid guides in developing actual projects. Results with regard to the how-to guides will be used to assess one of the indicators for Output 4.2.

[GEF incremental funding for delivering Output 4.7 is for the technical assistance in the design and setting up of the one-stop-shop website, including the collection and incorporation of the many project materials targeted into the website.]

ii. Partnerships

Key partners for the proposed project and how the proposed project will work with them are described below.

- *Climate Change and Development Authority (CCDA)*: CCDA is the governmental authority in PNG responsible for climate change mitigation and adaptation. As the implementing partner (IP) of the project, CCDA will lead the project steering committee and work closely with the project team to ensure the project is well-implemented. CCDA is conducting baseline work in the climate change mitigation area, though this is mostly focused on the LULUCF area and not energy. In the energy area, it has drafted building energy efficiency standards. Through GEF funding and CCDA co-financing, FREAGER will substantially expand the scope of RE and EE policy and planning work in which CCDA is involved.
- *PNG Power Limited (PPL*): PPL is PNG's state-owned power company. PPL is responsible for PNG's grid-based power as well as for operating 32 township diesel mini-grid centers across the country. While PPL is mandated to operate as a for-profit company, it is also given responsibility to operate in certain locations that bring losses to it, particularly the 32 township diesel centers. PPL has completed some limited baseline EE activities (retrofits and training) working with ADB in the lighting area, but does not have ongoing baseline EE activities. PPL will be a key partner to FREAGER through many of the project's activities. In particular, GEF funds and PPL co-financing will be brought together to achieve the Samarai Island PV mini-grid demo and the East Sepik Township EE demo. For the FREAGER Samarai Island PV mini-grid demo, PPL co-financing will provide full funding for the hardware, installation, and construction. GEF funds will be used to provide support in sourcing, costing of installation and construction, monitoring and documentation, and productive applications of RE. In

the two FREAGER East Sepik Province Township EE Demos, PPL co-financing will be used for EE retrofits. Further, PPL will provide in-kind staff support for carrying out energy audits and advising companies building new facilities on EE. To provide FREAGER EE retrofit funding, PPL will set up an "ESCO" fund. GEF funding, in turn, will be used to provide international experts both to train PPL personnel in new EE areas, such as refrigeration, air conditioning, and industrial energy audits, and to conduct energy audits alongside the PPL team. FREAGER, via combined GEF funding and PPL co-financing, will assist PPL in strengthening the institutional structure for its EE team and in designing the ESCO fund that will finance customer EE retrofits. Lastly, FREAGER, via combined GEF funding and PPL co-financing, will provide assistance in developing a template PPA that PPL can use for the purchase of wholesale power from community RE mini-grid owners for resale to retail customers. An important aspect of the project's strategy for working with PPL in all these areas will be to ensure that PPL corporate level management is aware of the great benefits to PPL's bottom line that RE and EE can provide if replacing diesel. RE and EE may have the potential to turn current loss centers of PPL into profit centers and, at minimum, have the potential to substantially reduce losses. This potential, if understood, will ensure continued strong cooperation with PPL throughout the project.

- *Eastern Highlands Province (EHP):* In this partnership, EHP co-financing and GEF incremental funds will be used in developing and implementing two FREAGER mini-hydro mini-grid demos in the province. The FREAGER PMO will coordinate closely with the EHP Government in the conduct of training in micro/mini-hydro development as well as in the provision of sourcing and costing information. The training will take place in-province and include district officials who will be given "homework" assignments corresponding to the steps in the mini-hydro project development process. The FREAGER PMO and the EHP Government will also coordinate in the EHP mini-hydro resource assessment and in preparation of a province-wide RE and EE plan. GEF funds and EHP co-financing will be brought together to achieve the aforementioned FREAGER training, resource assessment, and RE and EE plan for EHP. Through this support, the project aims to stimulate replication of the FREAGER mini-hydro demos at other locations in EHP. (Note: EHP lacks significant baseline activities in the RE mini-grid and township EE areas.)
- *Milne Bay Province (MBP):* Building on the work of FREAGER in the Samarai Island PV mini-grid demo, FREAGER will collaborate with MBP in training in PV mini-grids for MBP's provincial and district officials. The FREAGER training will be supported by GEF funds and MBP co-financing. As with the EHP training, the MBP training will include homework assignments, in this case for developing PV mini-grid projects. GEF funds and MPB co-financing will also come together for FREAGER's MPB resource assessment work and in preparing an MBP provincial RE and EE plan. Through its support, FREAGER will aim in particular to stimulate replication of the PV mini-grid demos at other locations in MBP. (Note: Milne Bay Province lacks significant baseline activities in the RE mini-grid and township EE areas.)
- *East Sepik Province (ESP)*: FREAGER will cooperate with PPL and ESP in carrying out FREAGER township EE programs in ESP's Wewak and Maprik Districts. ESP co-financing will be combined with GEF funds and PPL co-financing to achieve these FREAGER demos. The programs will include energy audits and corresponding retrofits, support in planning for new large power users expected to come online soon, support for residential energy efficiency (via a credit program for EE refrigerators and lights), and street lighting retrofits. GEF funds and ESP co-financing will be brought together to achieve FREAGER targeted ESP provincial initiatives of incorporating EE aspects into ESP's building code, sourcing of EE equipment in ESP, and preparing a provincial EE and RE plan for ESP. Through these FREAGER initiatives, it is targeted that ESP province will work to expand the reach of the FREAGER EE programs in Wewak and Maprik and also take the initiatives to other townships in the province. (Note: East Sepik Province lacks significant baseline activities in the RE mini-grid and township EE areas.)
- *Morobe Province*: FREAGER, via GEF funds and co-financing from Morobe Province, will support billing, PPAs (power purchase agreement) between PPL and owners, and O&M for two in-progress baseline mini-hydro stations in Morobe Province. FREAGER will also partner with Morobe in training for mini-hydro development that will include attendance by district officials, each of whom will be given homework to develop a mini-hydro project. FREAGER will further cooperate with Morobe in provincial resource assessment and in developing a provincial RE and EE plan. GEF funding and Morobe co-financing will be brought together to realize these capacity building, resource assessment, and provincial RE and EE plan initiatives. Through this

support, the project will aim, in particular, to stimulate replication of the project's mini-hydro demos at various locations in Morobe Province.

- *Evangelical Lutheran Church (ELC)*: FREAGER support for billing, PPA, and O&M in Morobe Province will enable the existing (or "baseline") mini-hydro station ("Gatop") operated by the ELC to achieve expansion. FREAGER will bring together GEF funds and ELC co-financing in the aforementioned support. Historically, the ELC has experience with micro/mini-hydro stations in various locations across PNG. It also has a mission to support local economic development and a good reputation in fiscal management of projects. As such, it is an attractive partner through which effective replication of the project's mini-hydro demos could be achieved. In addition to supporting the "Gatop" station, FREAGER, via use of GEF funds and ELC co-financing, will support ELC in developing an RE plan to expand its activity and improve commercial and technical viability in the micro/ mini-hydro area. ELC participants will be encouraged to participate in the training program for mini-hydro project development that will be held in Morobe Province.

A number of recent or ongoing donor initiatives in PNG are relevant to the development challenges that FREAGER aims to address. The achievements and lessons learned from recent initiatives have been carefully considered in FREAGER's design. Synergies with ongoing initiatives will be pursued, as relevant, during project implementation. While none of the activities of these donor projects are targeted to be incorporated into FREAGER, FREAGER and the relevant initiatives will keep each other informed about project results and planned activities so that both sides can be more effective in their work through shared knowledge and experiences. Key recent or ongoing initiatives include:

- *World Bank-GEF Energy Sector Development Project*: This project includes a policy and wind resource assessment component and a large hydropower support component. The policy work has included support of the National Electrification Roll-out Plan (NEROP), for which the contract is to be completed by January 2017, and support for integrating PNG's two draft National Energy Policies (one prepared by Department of Public Enterprise and one prepared by PPL), which has already been completed. FREAGER design work has considered lessons learned from the policy work of this project. As for the World Bank-GEF project wind resource assessment work, expected to be completed by the end of 2017, the FREAGER project will endeavor that its own resource database work can promote access and dissemination of the PNG wind resource data generated by the World Bank project. This will involve making the World Bank-GEF PNG wind resource assessment data available on the FREAGER's one-stop-shop RE and EE website, along with resource assessment data generated under FREAGER activities.
- *IFC Lighting PNG Project*: IFC is focusing on solar PV lighting for off-grid areas in PNG and on ensuring the product quality of such lights. During project preparation field trips, the FREAGER team found that villagers in PNG had had disappointing results with solar PV lamps due to quality issues, thus reflecting the importance of this IFC project's quality assurance related work. Although the scale of the technology on which this project will focus is quite different than that of FREAGER (which will focus its RE work on RE mini-grids), FREAGER may have lessons to learn and/or synergies with the IFC project in the area of product standards and certification. Therefore, when implementing FREAGER's standards and certification related activities, implementers will review experience of the IFC project to date.
- *IFC Pacific Renewable Energy Generation Project*: This multi-country project started in 2014 and is mainly addressing grid-connected RE power generation of all types. One area of pursuit in PNG for this project is expected to be grid-connected rooftop PV in Port Moresby. While the FREAGER project will focus more on off-grid RE mini-grids, or RE where grid power is woefully inadequate, synergies between these two projects may arise as they each evolve. Therefore, during implementation, the FREAGER project team will endeavor to keep abreast of developments with the IFC project and look for opportunities for cooperation, as relevant.
- *UNDP Solar Mamma and Kumul Foundation financing of SHSs*: Building on previous successes of UNDP's Solar Mamma program in disseminating solar PV home systems (SHSs) in rural areas via the training of women, the Kumul Foundation and the UNDP Solar Mamma program are now planning more widespread dissemination of SHSs via a financing mechanism that they are setting up. The mechanism will allow households to pay for their SHSs gradually over a period of about 1.5 years, by making small weekly payments of PGK 10 (USD 3.16). While FREAGER's PV work will focus on PV mini-grids and UNDP Solar Mamma/ Kumul will focus on SHSs, the latter

may be able to leverage FREAGER findings with regard to sourcing low cost/ good quality PV panels for PNG and FREAGER work in the areas of standards and certification for PV panels. The Solar Mamma/ Kumul project, in essence, may benefit by being able to ensure that its stakeholders are able to identify and procure quality solar PV panels at good prices. As such, FREAGER will communicate its progress in these key areas to UNDP Solar Mamma via the UNDP PNG Country Office.

- *ADB Papua New Guinea Town Electrification Program*: This project is focused on the development of large hydropower installations and includes rehabilitation of Ramu 1 (an existing facility of 75 MW) and development of Ramu 2 (a planned facility of 240 MW). While FREAGER is focusing on much smaller systems, progress of these large-scale systems, which has tended to be very slow, is relevant to the overall RE strategy for PNG. Thus, the FREAGER project team will continue to keep abreast of developments with this project.
- *New Zealand mini/small hydro work in PNG*: The government of New Zealand is putting emphasis on the development of RE in PNG. Currently, they are working to develop a 1 MW off-grid mini/small hydro project in Enga Province, with investment both from New Zealand Government and the province. Community ownership is planned; and PPL will be involved in power distribution of the system. This project has a high level of relevance to FREAGER work. As such, the project team will keep abreast of developments with the New Zealand mini/small hydro system and work to develop synergies with the project as relevant.

iii. Stakeholder Engagement

Key project stakeholders and the means the project will use to engage them are given below.

- *PPL, CCDA, partner provinces, and ELC*: These stakeholders also serve as project partners. Background on them and means of their engagement in the project have been explained in the above sub-section on "partnerships."
- *Other central government agencies, including DPE, ICCI, NISIT, and Department of Lands*: The project will engage other central government agencies in various project activities, including policy and standards design and outreach, government capacity building in RE and EE, capacity building on financing RE and EE, outreach associated with briefing materials on the cost competitiveness of RE and EE as compared to diesel, and institutional coordination for RE mini-grids and township EE programs. In addition, the government agencies listed in this bullet will be more deeply involved in specific activities relevant to them. For DPE, given its general role in regulating the energy sector, this will include RE and EE policy gap analysis and policy design. For ICCI, given its role in licensing power provision and regulating power prices, this will include IPP licensing and billing. For NISIT, as the nation's standards authority, it will include design of EE and RE standards and associated certification programs. For Department of Lands, with its oversight of land related matters, it will include facilitation of land aspects of community RE mini-grids.
- *Other provincial governments*: In addition to the provincial governments designated as project partners, other provincial officials, as relevant, will be invited to government capacity building programs held in Port Moresby.
- *District governments in RE partner provinces*: District governments in partner provinces will be involved in capacity building programs held in those provinces for the development of RE mini-grids. As homework, they will carry out steps in the project development process. The aim will be that this capacity building will result in viable replication projects entering the project pipeline and securing funding.
- *Local communities and women in local communities*: Local communities will be closely engaged in the development of the project's two mini-hydro stations. They will be consulted on their opinions about potential environmental and social impacts of these stations. Further, along with inhabitants of Samarai Island (where there will be a PV mini-grid), the two mini-hydro demo communities will have access to project advising on opportunities for productive applications of RE, as well as to small grants to get such businesses started. In particular, there will be special outreach to women in demo villages to involve them in productive applications of RE.
- *Large power using organizations in township centers*: Via its ESP township EE demos in Wewak and Maprik, the project will involve current and future expected high power consumption organizations. It will offer the former energy audits free of charge and facilitate their procurement and installation of equipment for EE retrofits. It will offer the latter free advising on energy efficient design and equipment procurement. The

project will emphasize to current and future expected high power consumption organizations the potential benefits to their bottom line of EE retrofits and other EE measures.

- *Residential power customers in township centers:* Via the ESP township EE demos, residential power customers will be able to participate in the purchase of more efficient refrigerators and lighting for their homes through a residential credit program.
- *Banks*: Commercial banks will be involved in the project via their participation in the project's capacity building program on financial aspects of RE and EE. One bank with an SME sub-fund will receive assistance from the project in expanding the scope of that fund to include loans for community RE mini-grids.
- *General public in PNG*: The project will aim to engage the general public in PNG via its awareness raising activities. In particular, these activities will include a multi-channel media campaign. The campaign will include TV, radio, print media, online news, social media, and text messaging as means of reaching large segments of the PNG population and raising their awareness of RE and EE.

iv. Mainstreaming Gender

There are two key aspects to FREAGER's strategy for mainstreaming gender, one targeting high levels of participation of women and one targeting specific consideration of women in design of the content of initiatives. As for high levels of participation of women, this will be achieved by efforts with regard to all project training events and all project consultancy opportunities. Training events, including all capacity building programs, will target an at least 40 percent ratio of female attendees. Recruitment of both national and international consultants for the project will target, respectively, realization of an at least 30 percent proportion of women consultants. As for specific design of initiatives, the productive use of renewable energy advising and grants will include specific support of productive uses carried out by women. During the design phase of the project, in its visits to villages, the FREAGER team spoke with women to learn what type of productive applications of electricity they are most interested in. At times, the ideas the women proposed were different from those of men and representative of activities more specific to women. Such ideas proposed by women for productive use of RE power include electricity for: grating cassava, storing the vegetables they sell in a refrigerator, ovens in which to make cakes, scones, or buns to sell, and sewing machines to facilitate sewing business. The project's multi-channel media campaign will also work to include content that is targeted to attract the attention of women. This will be to ensure that the messages of the media campaign raise the awareness of both the men and women of PNG regarding the potential of RE and EE for the country. More information on gender analysis and plans for mainstreaming gender are provided in Annex 15.

v. South-South and Triangular Cooperation (SSTrC)

The project will pursue and promote South-South and Triangular Cooperation (SSTrc). This will include exchange and sharing of information among developing countries on EE and RE policies and strategies, regulations, institutional arrangements, financing, and sourcing. During implementation, the project will consider potential approaches for SSTrc in two directions. The first direction will consider opportunities for PNG to leverage the experience of other developing nations as it seeks to promote RE and EE via the FREAGER project. Already during the project design phase, the project development team has recognized the experience of China as the world leader by far in installed capacity of micro/ mini-hydro as a potential avenue via which to leverage South-South cooperation. China had 84 percent share of total world installed capacity of hydropower stations under 1 MW in scale in 2015.[5]

The second direction of South-South and Triangular Cooperation (SSTrc) that FREAGER will pursue will be for PNG to share its experience and knowledge base developed through the project with other island nations in the South Pacific. Of South Pacific island nations, PNG is the one with the largest population. As such, PNG is perhaps a natural candidate for leading the way in developing EE and community RE mini-grids in the region. PNG, through its one-stop-shop FREAGER website on RE and EE in PNG and through various events held in the region, will be able

[5] IRENA, *Renewable Capacity Statistics 2016,* 2016. (Capacities are estimated aggregate capacity at the end of 2015.)

to share its learnings with other countries. In particular, as it will work on lowering costs and determining high quality but lowest cost sourcing channels for EE and RE equipment for PNG, this information may be useful to nearby nations in the region, given the similarity in logistics. Also, similarities in terrain and natural resources may make the project's results with regard to community PV mini-grids and community micro/mini-hydro mini-grids of special interest to other South Pacific island nations.

V. FEASIBILITY

i. Cost Efficiency and Effectiveness

The proposed project's design aims to deliver a high level of cost efficiency and effectiveness in use of GEF funds. Cost efficiency and effectiveness will be achieved by strategies that leverage limited inputs of GEF funding to stimulate much greater investments by other parties, namely the government and the private sector. The project will invest in RE and EE demos, which will be critical in providing proof of concept and proof of costing, so that others will be willing to replicate them. At the same time, however, a majority of the proposed project's GEF funds will be used in technical assistance (TA) type activities that aim to use impact in the areas of policy, capacity, financing mechanism design, knowledge/ know-how, and awareness to facilitate extensive scale-up of RE and EE in PNG.

In all, the cost effectiveness aspect of the project's strategy may be divided into three parts. The first aspect of the cost effectiveness strategy is direct project co-financing. During the project design phase, extensive discussions were held with stakeholders regarding the win-win nature of RE and EE in PNG. That is, not only will RE and EE facilitate GHG emission reductions, but they will also facilitate cost reductions as compared to diesel. In addition, RE will present an opportunity for energy access in places without electricity or with highly inconsistent electricity provision. Cognizant of this cost-saving potential and other benefits, partners became quite interested in involvement and willing to put up strong co-financing. Thus, it was possible to obtain the vast majority of investment needed for the demos in two of the three project demo provinces from co-financing. In Milne Bay Province, the Samarai Island PV mini-grid equipment, installation, and construction will be financed fully by PPL. And, the investment portion of the East Sepik Province Township EE demos in Wewak and Maprik will be funded mainly by businesses themselves and by PPL. Thus, in these two cases, FREAGER can focus most of its demo related funding on TA aspects, such as productive application guidance on Samarai Island, or energy audits for existing power users and advising for future power uses in East Sepik Province. For the Eastern Highlands Province micro/mini-hydro demos, the project, the province, and the involved districts will jointly co-finance the two mini-hydro demos. The second key aspect of the project's cost effectiveness strategy is to stimulate replication of the project demos. All four of the proposed project's components have aspects designed to contribute to future replication. As discussed earlier, supporting partner provinces in capacity building, resource assessment, and preparing provincial RE and EE plans are key activities targeted to stimulate replication. In this way, investment in a limited number of project demos is leveraged to achieve many more RE and EE installations. As a third and last area of the project's cost effectiveness strategy, the project uses well designed technical assistance (TA) activities, which are relatively low in cost, to leverage funding from other sources for actual installations of RE and EE equipment, which is relatively high in cost. There are a range of ways the project does this. For example, it provides TA support in designing EE and RE financing mechanisms, but looks to other parties to set up the actual funds (EE) or to draw from existing SME funds (RE) for realization of these mechanisms.

As for effectiveness, the project design draws on lessons learned from other UNDP-GEF projects, other donor projects, and experiences in PNG in the past to ensure activities are well designed for maximum effectiveness. For example, it has been found in past GEF projects that multi-pronged approaches (addressing barriers in multiple areas, rather than in one single area, such as policy) are needed to achieve effectiveness. Thus, the project adopts a multi-pronged approach, conducting barrier removal in four areas: policy/ planning, technical and commercial viability, financing, and information and awareness. Further, the project design considers experience specific to PNG, such as challenges other projects have had in promoting EE and RE policy at the central government level. It

adopts an approach that emphasizes not only policy design, but also briefings of policy makers on the cost advantages of RE and EE and demos in the provinces, to prove that cost effectiveness. Lastly, in order to be effective, the project puts strong emphasis on a small number of provincial partners, providing a suite of support for them, including demos, resource assessments, capacity building, and designing of provincial EE and RE plans.

ii. Risk Management

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. Project risks are summarizes below in Exhibit 12. A Project Risk Log is provided in Annex 10.

Exhibit 12. Project Risks

Project Risks					
Description	**Type**	**Impact & Probability**	**Mitigation Measures**	**Owner**	**Status**
Government does not commit to promoting clean and affordable energy development in Papua New Guinea	Political	With lack of political leadership and commitment, there will be no direction and support for policy, legal, and institutional framework and for budgetary allocation for investment in RE/EE development in the country Probability = 3 Impact = 3 Risk = 3	The project will support CCDA and government-wide stakeholder engagement and outreach program to create awareness and advocate at the highest political and decision-making levels within and among state institutions	UNDP CO, CCDA	Improving
Government institutions at national and subnational levels do not communicate and cooperate effectively to plan and develop energy sector	Organizational	Poor coordination will create confusion over institutional mandates between key state institutions, thus negatively affecting investment in renewable energy and energy efficiency technologies Probability = 4 Impact = 4 Risk = 4	The project will support CCDA in conducting stakeholder mapping through its leading of the Low Carbon Growth Technical Working Group, which is comprised of development partners and public sector, private sector, and CSO stakeholders. It will further support CCDA in strengthening the existing coordination mechanism at the subnational level through Provincial Coordination and Monitoring Committees (PCMPs).	UNDP CO, CCDA	Improving
Government budgetary allocation for energy development is not sustained	Financial	Lack of ongoing budget allocations would result in ad hoc budgetary allocation, which would limit sustainable financing of renewable energy and energy efficiency initiatives.	The project will support building of government capacity in energy planning and budgeting to advocate and generate interest among decision-makers. This will result in design of	UNDP CO, CCDA	Improving

		Probability = 4 Impact = 4 Risk = 4	institutional energy plans, with corresponding investment plans. In addition, the project will support commercial banks and PPL in the establishment of credit/ loan facilities for renewable energy and efficiency.		
National technical capacity in renewable energy and energy efficiency is inadequate	Organi-zational	Limited pool of national experts will affect technical oversight for and operation and maintenance of renewable energy and energy efficiency investments. Probability = 4 Impact = 4 Risk = 4	The project will undertake capacity assessment and target capacity building in Port Moresby and in the pilot provinces in technical areas related to RE and EE projects and their O&M. This is expected to generate interest and mobilize support and partnership to promote cost-effective investment in technologies and human resources.	UNDP CO, CCDA	Improving
Project Staff not mobilized in a timely manner	Opera-tional	Any delay to establish the project management unit will affect scheduled implementation of project activities. Probability = 3 Impact = 3 Risk = 3	The project will utilize existing mechanisms for implementation and fast track recruitment arrangements to hire PMU staff.	UNDP CO, CCDA	Improving
Construction of solar PV mini-grids and micro/ mini-hydro mini-grids results in negative environmental and social impacts	Social - Environme ntal	Negative impacts from construction of solar PV mini-grids and mini-hydro mini-grid systems may alter the physical environment, potentially impacting current land use activities, including human settlements. Probability = 2 Impact =2 Risk =2	The project will conduct feasibility studies for its solar PV mini-grid and mini-hydro demos and these will include environmental and social assessment to ascertain potential environmental and social risks and impacts	UNDP CO, CCDA	Improving
Complex community social systems and landownership arrangement become counterproductive to promoting community leadership and ownership on communally agreed community initiatives	Social	Low levels of literacy and understanding may contribute to landowner misunderstanding and expectation in resource development leading to stalled demo projects that cannot be realized Probability = 2 Impact = 2 Risk = 2	A clear plan for community engagement, consultation, awareness, and advocacy will be undertaken by the project. During the demos' feasibility study stage, the project will consider landownership arrangements and work with local people and government officials to ensure challenges are overcome.	UNDP CO, CCDA	Improving
Non-enforcement	Regulatory	Without policy direction,	The project aims to advocate	UNDP	Improving

of formulated and approved energy policies negatively affects sectoral policy direction and commitment towards RE/EE development in PNG		institutional competition is likely to affect leadership and ownership of project results and negatively impact long-term sustainability Probability = 3 Impact = 3 Risk = 3	policy change through planned intensive communication and advocacy activities. Further it will take an approach of briefing policy makers on the cost advantages of RE and EE and showing them proof of concept with the project demos to ensure they will support RE and EE development.	CO, CCDA	
The high cost operating environment in PNG negatively affects the allocated project budget	Financial	Cost overruns would mean that not all the designed activities could be implemented unless additional co-financing is secured. Unforeseen currency fluctuation has the potential to inflate costs impacting planned implementation of activities. Probability = 3 Impact = 3 Risk =3	Co-financing from partners will be mobilized and utilization of national technical agencies considered as the most cost effective option will be carried out to promote their leadership and ownership of the project. In addition, the project has specific activities to determine lowest cost high quality sourcing channels and the true (uninflated) costs of doing PV mini-grids and mini-hydro mini-grids in PNG.	UNDP CO, CCDA	Improving
Provision of costing information on RE mini-grids negatively affects the market by providing cost estimates that are either too high or too low.	Financial and Technical	Pricing information that is too low may result in poor quality projects. Pricing information that is too high will enable providers to overcharge in the market. Mandatory price controls will in general distort the market. Probability=1 Impact=3 Risk=3	In addition to price, information on quality requirements will be included to ensure that price estimates are not too low. To ensure price estimates are not too high, current best prices in Australia will be provided as a benchmark. Pricing information will not be tied to price controls, but instead serve to increase transparency in the market.	UNDP CO, CCDA, PPL, NISIT	Improving

iii. Social and Environmental Safeguards

The social and environmental risk rating of the project is “moderate.” The Social and Environmental Screening carried out for the project and provided as Annex 8 of this document evaluated risks related to land, risks related to health and safety, and risks related to indigenous communities and found these to be moderate. Of all of the proposed project’s activities, the project demos and associated activities present the greatest risk of negative social and environmental impacts. Thus, these received special attention during the project design phase’s assessment of social and environmental risks. One of the greatest risks is considered to be that the RE mini-grid demos could have a negative impact on individual people, indigenous social groups, and/ or on social relations due to land requirements. Land ownership of indigenous groups tends to be the key social issue when it comes to infrastructure projects in PNG. Thus, during the project design phase, the project design team paid careful attention to land issues and carried out special consultation and design work with regard to this topic. As for the Samarai Island PV mini-grid demo, land will be allocated by the government to PPL for setting up the PV system.

There is not a problem of the selected site for the PV installation overlapping with traditional lands owned by local people. The two mini-hydro stations, in contrast, will be located on traditional land. During project design field work, the project development team carried out preliminary consultations with the involved villages. During these meetings, village leadership expressed that the villagers had been holding consultations on the issue of land and had come to agreement to provide the land free of charge to the project. One of the villages, having carried out previous work in water infrastructure (piping of spring water into the village), already has an ILG (indigenous landowners group) to coordinate liaison on this issue. The other village does not yet have an ILG and was advised to set up such a group. In addition, the project design team also decided, with regard to land issues, that it will be important to take further steps in the policy area to have a clear structure for such issues. Thus, a project activity was designed that will support the Department of Lands in preparing a regulatory framework for land issues associated with RE mini-grids.

In general, the selection of community scale RE mini-grids, instead of large scale grid-connected RE power, as the RE area of focus for the proposed project, results in much less environmental and social risk. While environmental impact assessments (EIAs) are legally required in PNG of power projects with investment of over PGK 50 million (USD 15.78 million), they are not required of smaller projects, such as the project demos and targeted replications of them. Yet, in order to ensure the lowest level of environmental and social risk and to address UNDP requirements vis-à-vis moderate ratings in the Social and Environmental Screening, the project will carry out limited, site-specific social and environmental assessments for each of the planned community RE mini-grid demos and the township EE demos. These assessments will be carried out prior to any physical work beginning on the demos. The limited, site-specific environmental and social assessments will include consultations with local communities to ensure that there are no negative environmental or social impacts of the demos. Beyond the consultations carried out so far, they will include consultations with individual households and separate meetings with men and women. The work will include FPIC processes and good documentation of those processes and their outcomes. It will also address potential negative impacts on the land and biodiversity. And, it will emphasize issues of pollution and waste proposal. In all these areas, the assessments will provide mitigation recommendations that will be adopted during implementation of the demos. The project will further aim to encourage this model of conducting standardized limited site-specific environmental and social assessments for community RE mini-grid projects and township EE programs so that this approach will be picked up and carried out not only in the initial project demos, but also in replications of those demos.

An important aspect of project design for the RE demos to reduce social risk is the promotion of productive applications of RE to raise local incomes. The project has allocated substantial TA funds to advising communities on productive applications of RE. In this work, the project will give special attention to productive applications in which women are the primary participants. During project design, the project design team consulted with women in local communities to understand the types of productive applications that might apply to women in particular. Ideas were raised, implying the feasibility of the project pursuing a subset of women-focused productive applications of RE. During full project design, women will again be consulted, this time in greater detail, to ensure substantial women-focused productive applications of RE are part of the final outputs of the project. Productive use work will also include special outreach to other marginalized groups.

The design of the township EE demos also incorporates some risk mitigation strategies. First, there are no land issues. EE retrofits will be installed within buildings or industrial facilities based on the request of the owners. While the EE demos will emphasize the largest power users, they will also address the residential sector. In this way, the project design reduces the social risk that benefits might only accrue to the better off. The residential sector initiatives will provide credit to households to help them buy more efficient refrigerators and lighting, which will in turn reduce their electricity bills and thus increase their disposable income.

For both the RE and EE demos, a means of citizens reporting environmental and social grievances will be set up. Environmental and social grievances will be reported to the GEF in the annual PIR. For the RE mini-grids, some areas of special attention for the grievances will be (1) equity in access to opportunities for involvement in productive use work or work opportunities related to establishment of the RE mini-grids and (2) confirmation of consent by community members to establishment of the mini-hydro stations.

iv. Sustainability and Scaling Up

The project's multi-pronged barrier removal approach, covering policy and planning, commercial and technical viability, financing, and information and awareness, is designed to stimulate ongoing replication of the project demos and, thus, scale-up of project results. While all outputs of the project are designed to contribute ultimately to replication and, thus, scale-up, of community RE mini-grids and township EE programs, a few key ones are worth emphasizing here. The project will facilitate the preparation of national RE and EE roadmaps for the areas of community RE mini-grids and township EE programs. The project further will facilitate policies that incentivize RE mini-grid and EE initiatives. It will also support preparation of RE and EE plans for four provinces and one organization for the areas of community RE mini-grids and township EE programs. These plans will have pipeline projects with designated funding sources. Capacity of local government officials will be built as they actively participate in capacity building programs by taking initial project ideas through the project development process. Capacity in technical aspects of such projects will be built among technical personnel. Information will be provided on lowest cost sourcing channels for quality equipment needed for community RE mini-grid and township EE programs, as well as on the "honest" cost of the engineering, civil works, and construction required for RE mini-grids. This information can be referenced again and again to ensure project costs of replications are reasonable. Lastly, the project will develop and disseminate to officials and decision-makers information on the cost advantages of RE mini-grids and EE over diesel. This information will play an important role in stimulating replication and thus scaling up of community RE mini-grids and EE installations in PNG.

The project's approach to sustainability has two main aspects. One is the replication work described above. That, is replication sustains (and expands) the project results even after project close. The other aspect of sustainability is ensuring that both demo and replication systems have a long life and are taken care of after project close. In this regard, the project design works to ensure there is strong ownership of systems by stakeholders and that mechanisms are put in place for ongoing success. On the financial sustainability side, the project will support the development of billing systems and PPAs, so that community RE systems have ongoing income to pay for repairs and pay for personnel to operate and maintain the systems. The project will promote the productive application of RE in the demo wards. In this way, not only will incomes of local people be raised by making income-generating use of the power, but the revenues of the systems will also be raised, thus enhancing their financial sustainability. Further, the project will develop O&M training curricula and train stakeholders in O&M so that the systems can be technically maintained. The installed EE retrofits present less sustainability risks than the community RE mini-grid systems. Yet, as a part of the recommendations of the energy audits, recommendations on human usage habits and maintenance of equipment that impact EE will also be included. Lastly, sustainability of the two funding mechanisms that the project will design are ensured in that the funds will be administered not by the project, but by organizations that have a vested interest in the success of the funds. PPL will administer the ESCO EE retrofit financing fund. The fund will be used in PPL's township diesel centers, where less power use translates directly into less diesel use and therefore less financial loss for PPL. The community RE mini-grid fund will be administered by a commercial bank that already has an SME fund. As the community RE mini-grids demonstrate long-term commercial viability via a steady stream of income, the commercial bank will be incentivized by the success of such loans to continue with them as a means to ensuring success of their SME fund.

Lastly, the project will emphasize that lessons learned during project implementation will be incorporated into broader stakeholder initiatives (i.e. replication) in community RE mini-grids and township EE programs, as well as their financing. To this end, the project will put a strong emphasis on knowledge management and information access through its one-stop-shop website for RE and EE in PNG. The project will carry out detailed monitoring and documentation of the project demos, which will be an important source of lessons learned and modifications in approach. Information on lowest cost sourcing channels and honest costs for engineering, civil works, and construction will also be an important source of lessons learned and iterations to improve the efficiency of results in the community RE mini-grids and township EE programs.

v. Economic and/or Financial Analysis

The detailed demo descriptions of *Project Demos – Background and Details*, a separate document prepared during the PPG phase, provide estimates of the costs and benefits of the project demos as compared to the diesel alternatives. For the PV mini-grid, the lifetime savings in diesel costs is compared to the investment in the PV mini-grid, which will have no ongoing fuel costs. As PPL already has diesel generators on Samarai Island, the cost of these generators is not used in the comparison. The comparison, then, essentially looks at the potential savings for PPL going forward, ignoring the sunk costs of the diesel generators. Based on preliminary cost estimates of the PV mini-grid and an assumed lifetime of 20 years (with battery system replacement after ten years), it is estimated that the costs of the PV mini-grid will be "paid back" by savings on diesel fuel within 4.25 years. After those 4.25 years and up until year 20, it is estimated the system will save PPL USD 96,288 in diesel fuel costs annually.

For the case of the project's two mini-hydro mini-grids (Miruma and Gotomi), two approaches are taken to analyze financial benefits. The estimated benefits are similar for each of the two systems, which are each proposed to be 200 kW. The first approach looks at the cost of a new diesel system and ongoing annual diesel costs and compares these to the up-front costs of the mini-hydro mini-grids, which will have no ongoing fuel costs. The other approach looks at potential systems revenues from billing for power. In both cases, a 40 year lifetime of the mini-hydro station is assumed, with some dredging work required in the interim. In the first approach, it is assumed a local mini-grid is required to be built for both the diesel system and the mini-hydro system, though the grid is a bit larger in the latter case, due to the mini-hydro station's location being further away from the population than the diesel generator would be. Estimates suggest that after 1.43 years, the mini-hydro station (which will have no fuel costs) will begin to have financial benefits over the diesel mini-grid system. After this time, lifetime savings over diesel reach about USD 10million for each of the two mini-hydro systems. In the second approach, looking at potential billing revenues only, the upfront costs of the mini-hydro system can be paid back after 3.3 years via billing revenues. Lifetime revenues after this payback period reach USD 5.6 million for each of the two mini-hydro systems.

For the project's two township EE programs, preliminary estimated annual diesel savings from the two programs combined are 1.6 million liters of diesel per year or 32 million liters of diesel over 20 years. At the current price of diesel of PGK 2.7 per liter, this translates into annual savings of about USD 1.36 million per year or USD 27 million over 20 years. These estimates include reductions in power consumption for 11 top consumers in each of Wewak and Maprik, as well as for streetlights and a portion of residential customers in Maprik. They do not include diesel expenditures avoided with regard to new power users expected to be coming online soon that may reduce their future power use by adopting recommendations of the project. These estimates are very rough, based on expected percentage reduction in power consumption by each user or user group. As the specific EE measures and their costs have not yet been identified, estimation of a payback period and net benefit (total savings minus cost of retrofits) were not made. Yet, as PNG has not done much work in EE to date, it is expected that there is much "low-hanging fruit" and that payback periods will be short and therefore attractive.

VI. PROJECT RESULTS FRAMEWORK

Exhibit 13. Project Results Framework

This project will contribute to the following Sustainable Development Goal (s): SDG7 - Ensure access to affordable, reliable, sustainable and modern energy for all					
This project will contribute to the following country outcome included in the UNDAF/Country Programme Document: Cluster 4 Outcome Government and civil society have enhanced their capacity to implement biodiversity conservation, low carbon and climate resilient development initiatives for environmental sustainability, and improved community livelihoods to reduce the vulnerability of women, girls, men, and boys to disaster risks					
This project will be linked to the following output of the UNDP Strategic Plan: 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)					
Strategy	**Objective and Outcome Indicators**	**Baseline**	**Mid-term Target**	**End of Project Target**	**Critical Assumptions**
Project Objective: Enabling of the application of feasible renewable energy and energy efficiency technologies for achieving greenhouse gas emission reduction in PNG	Cumulative tons of GHG emissions reduced from business as usual via adoption of community RE mini-grid projects and township EE programs in PNG (tons CO_2)[6]	0	4,517.2	16,878.5	Commitment of the government to RE&EE, irrespective of the party in power, will not change
	Number of new households in rural areas and townships that have access to RE mini-grid generated electricity service or make use of established EE programs[7]	0	1,710 (with at least 20% woman-headed households)	7,550[8] (with at least 20% woman-headed households)	Commitment of the government to RE&EE, irrespective of the party in power, will not change
	Total new reductions in or newly avoided amounts of annual diesel consumption achieved via installation of community RE mini-grid systems and total new reductions in annual diesel consumption from improved EE in industrial plants, commercial and institutional buildings, homes, and street lighting achieved via township EE programs (liters diesel per year)	0	2,308,319[9]	8,839,034[10]	---
Outcome 1: Rigorous implementation and enforcement of approved national and provincial energy policies, plans,	Government funding allocated for pipeline community RE mini-grid and township EE programs designated in national and provincial level RE and EE plans or	$0.0	$5 million	$20 million	Government puts high priority on budget allocated to community RE mini-grid projects and

[6]Based on direct greenhouse gas emission reductions that are achieved by the project demos during the lifetime of the project.
[7]Examples include EE appliance and lighting credit programs.
[8]Targets of the project demos for RE mini-grids: 1,250 persons in Miruma, 2,000 in Gotomi, 300 in Samarai, with assumption of 5 persons per household, so a total of 710 households; targets for project EE residential credit program: 2,500 persons in Wewak and 2,500 persons in Maprik, so, about 1,000 households total, if assuming 5 persons per household. Demo populations are assumed to be reached by end of year two of project. Replication for RE mini-grids is 4x and that for township EE programs is 3x, all assumed to be initiated by end year four/ end of project.
[9]Breakdown is as follows: Amount of diesel reduction resulting from RE mini-grid systems is 695,471 liters diesel per year and amount resulting for EE programs is 1,612,847.9 liters per year.
[10]Breakdown is as follows: Amount of diesel reduction resulting from RE mini-grid systems is 3,477,355 liters diesel per year and amount resulting for EE programs is 5,361,679.3 liters per year.

and standards to promote the application of renewable energy and energy efficiency technologies	roadmaps, including both equity and loan funding (USD)				township EE programs among all budget items
	Number of areas in which newly adopted policies and standards (since project launch) promote RE and EE.[11]	0	4	9	Government commits to promoting and implementing community RE mini-grids and township EE programs via improved policies, regulations, and standards
Outcome 2A: Enhanced technical-commercial viability and capacity in the application of energy efficiency technologies and development of feasible RE-based energy systems in the country	No. of new jobs created (or no. of new entrants in the labor force) in the RE or EE sectors in areas such as project development, engineering design, costing and business aspects, and operations and maintenance.	0	30 (of which, at least 20% are women)	100 (of which, at least 20% are women)	---
	Number of cases of high quality RE mini-grid systems achieved at low end international cost benchmarks[12]	0	3	12	Organizations providing civil works and construction services make selves available to provide needed services at reasonable costs/ with reasonable, but not excessive profit margins
Outcome 2B: Increased installed capacity of RE based power systems and implementation of viable EE technology applications in PNG	Total capacity of proposed community RE mini-grid systems that are financed (by banks) or approved by local government (for installation permit), kW	0	1,550[13]	4,650[14]	--
	No. of homes and other buildings that are supplied with power from RE mini-grid projects that have received financing or permits	0	7,500 (of which, at least 20% are owned by women)	22,500[15] (of which, at least 20% are owned by women)	---
	No. of proposed township EE programs that are financed by PPL and/or provincial	0	2	10	---

[11]The expected policy areas include: (1) waiving of tariffs for imported community RE mini-grid equipment and parts, (2) waiving of tariffs for energy efficient equipment, (3) ICCC policy for licensing of and selling of power by community RE mini-grid owners, (4) Department of Land and Physical Planning policy to support ILG development, operation, and management of community RE mini-grids, (5) other financial incentives for community RE mini-grids, (6) other financial incentives for EE retrofits, (7) new energy efficiency standards in building code, (8) new standards for community RE mini-grid equipment, (9) new standards for energy efficient lights, ACs, and refrigeration.

[12]One point should be allocated for each quality system that achieves one of the two following costing benchmarks: (1) mini-hydro: USD 3,000 per kW or less, (2) PV mini-grid including batteries: USD 6,000 per kW or less. Quality defined as those that operate well for ten months or more without substantial problems and that use quality equipment as identified in the project's sourcing work.

[13]This assumes there are a total of 10 systems, 7 of which are roughly 200 kW mini-hydro systems and 3 of which are roughly 50 kW PV systems.

[14]This assumes there are a total of 30 systems, 21 of which are roughly 200 kW mini-hydro systems and 9 of which are roughly 50 kW PV systems.

[15] Based on average of Miruma, Gotomi, and Samarai households projected to be powered by their RE mini-grids (1,250+2,000+300)/5 = 710 households on average powered per mini-grid; adding an average of 40 non-home buildings per mini-grid, results in an average 750 buildings powered per mini-grid.

	governments				
Outcome 3: Improved availability of, and access to, financing for renewable energy and energy efficiency initiatives in the energy generation and end-use sectors	Total committed new debt and equity financing of community RE mini-grid projects in PNG, including bank, private/commercial sector, or international funding but not including government funding (USD)	$0.0	$15 million	$75 million	Communities have the resources to pay tariffs for power services
	Total committed new debt and equity financing of township EE retrofits in PNG, including PPL, bank, private/commercial sector or other international funding, but not including government funding (USD)	$0.0	$3 million	$10 million	---
	No. of banks or other entities (aside from donors) that are providing debt financing for community RE mini-grids and EE technology application projects in PNG	0	1	3	---
Outcome 4: Improved awareness of, attitude towards, and information about renewable energy and energy efficiency applications in the energy generation and end-use sectors	Number of RE and/or EE project developers and investors, including engineering and construction firms, communities, building and industrial facility owners, etc., that have made use of project generated information found in its one-stop-shop information base or elsewhere[16] to develop and implement RE and EE projects	0	5	40	---
	Number of relevant policy makers that support and endorse RE and EE initiatives in development plans	0	5	20	---
	Number of manufacturers in PNG profitably producing RE and/or EE related equipment	0	2	5	Local equipment manufacturers have the capacity and interest to expand their product scope

[16] Including how-to guides, RE resource data, RE pipeline projects list, and project demo monitoring reports, etc.

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.

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.

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 national/regional institutes assigned to undertake project monitoring.

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 maintain 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 3, 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: The Project Board will take corrective action as needed to ensure the project achieves the desired results. The Project Board 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 Project Board will hold an end-of-project review to capture lessons learned and discuss opportunities for scaling up and to highlight project results and lessons learned with relevant audiences. This final review 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 any and 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 according to the schedule outlined in the annual work plan. Supervision mission reports will be circulated to the project team and Project Board 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 during implementation is undertaken annually; 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 in order 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 according to UNDP Financial Regulations and Rules and applicable audit policies on NIM implemented projects.[17]

Audit Arrangement:
The Government will provide UNDP Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds in accordance with UNDP Financial Regulations and Rules and Audit policies. The Audit will be conducted by a certified audit firm. UNDP will be responsible for making audit arrangements for the project in communication with the Project Implementing Partner. UNDP and the project Implementing Partner will provide audit management responses and the Project Manager and project support team will address audit recommendations.

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 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;
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 Project Board 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 Project Board.

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

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 Project Board. 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 Tracking Tools: The following GEF Tracking Tool will be used to monitor global environmental benefit results: Tracking Tool for GEF 6 Climate Change Mitigation Projects. The baseline/CEO Endorsement GEF Focal Area Tracking Tool – submitted in Annex 6 to this project document – will be updated by the Project Manager/Team and shared with the mid-term review consultants and terminal evaluation consultants (not the evaluation consultants hired to undertake the MTR or the TE) before the required review/evaluation missions take place. The updated GEF Tracking Tool 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 Project Board.

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 Project Board. The TE report will be publically 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 Project Board during an end-of-project review meeting to discuss lesson learned and opportunities for scaling up.

Exhibit 14: Mandatory GEF M&E Requirements and M&E Budget

GEF M&E requirements	Primary responsibility	Indicative costs to be charged to the Project Budget[18] (US$)		Time frame
		GEF grant	Co-financing	
Inception Workshop	UNDP Country Office	USD 7,600	USD 20,000	Within two months of project document signature
Inception Report	Project Manager	None	None	Within two weeks of inception workshop
Standard UNDP monitoring and reporting requirements as outlined in the UNDP POPP	UNDP Country Office	None	None	Quarterly, annually
Monitoring of indicators in project results framework	Project Manager	USD 16,000 (USD 4,000/year)	USD 40,000	Annually
GEF Project Implementation Report (PIR)	Project Manager and UNDP Country Office and UNDP-GEF team	None	None	Annually
NIM Audit as per UNDP audit policies	UNDP Country Office	USD 16,000 (USD 4,000/year)	USD 20,000	Annually or other frequency as per UNDP Audit policies
Lessons learned and knowledge generation	Project Manager Contractors for Outcome 4	Various activities under Outcome 4, budgeted separately from M&E	Various activities under Outcome 4, budgeted separately from M&E	Annually
Monitoring of environmental and social risks, and corresponding management plans as relevant	Project Manager UNDP CO	None	USD 20,000	On-going
Addressing environmental and social grievances	Project Manager UNDP Country Office BPPS as needed	None for time of project manager and UNDP CO	As needed	As needed
Project Board meetings	Project Board	USD 12,000	USD 25,000	At minimum

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

GEF M&E requirements	Primary responsibility	Indicative costs to be charged to the Project Budget[18] (US$)		Time frame
		GEF grant	Co-financing	
	UNDP Country Office Project Manager	(USD 3,000 per year)		annually
Supervision missions	UNDP Country Office	None[19]	USD 25,000	Annually
Oversight missions	UNDP-GEF team	None[19]	As needed	Troubleshooting as needed
Knowledge management as outlined in Outcome 4	Project Manager	Activity under Outcome 4, budgeted separately from M&E	Activity under Outcome 4, budgeted separately from M&E	On-going
GEF Secretariat learning missions/site visits	UNDP Country Office and Project Manager and UNDP-GEF team	None	USD 10,000	To be determined.
Mid-term GEF Tracking Tool	Project Manager Contracting organization	USD 10,000	USD 10,000	Before mid-term review mission takes place.
Independent Mid-term Review (MTR) and management response	UNDP Country Office and Project team and UNDP-GEF team	USD 21,250	USD 20,000	Between 2nd and 3rd PIR.
Terminal GEF Tracking Tool	Project Manager Contracting organization	USD 10,000	USD 10,000	Before terminal evaluation mission takes place
Independent Terminal Evaluation (TE) included in UNDP evaluation plan, and management response	UNDP Country Office and Project team and UNDP-GEF team	USD 26,200	USD 30,000	At least three months before operational closure
Translation of MTR and TE reports into English	UNDP Country Office	NA	NA	----
TOTAL indicative COST Excluding project team staff time, and UNDP staff and travel expenses		**USD 119,050**	**USD 230,000**	----

VIII. GOVERNANCE AND MANAGEMENT ARRANGEMENTS

Roles and Responsibilities of the Project's Governance Mechanism

The project will be implemented following UNDP's national implementation modality, according to the Standard Basic Assistance Agreement between UNDP and the Government of Papua New Guinea, and the Country Programme. UNDP will be responsible for overall project execution and will sign the project document with the Climate Change Development Authority (CCDA), which will be the implementing partner (IP).

The **Implementing Partner**, CCDA, 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. National Implementation Modality (NIM) will be used for implementation with UNDP's support to the project (CO support). A separate Letter of Agreement (LoA) for UNDP's support services to the project will be

[19] The costs of UNDP Country Office and UNDP-GEF Unit's participation and time are charged to the GEF Agency Fee.

signed between CCDA and UNDP. The draft of the LoA is attached an Annex 12. As Implementing Partner, CCDA will be responsible and accountable to UNDP for: (i) coordinating activities to ensure the delivery of agreed outcomes; (ii) certifying expenditures in line with approved budgets and work plans; (iii) facilitating, monitoring and reporting on the procurement of inputs and delivery of outputs; (iv) coordinating interventions financed by GEF/UNDP with other parallel interventions; (v) preparation of Terms of Reference for consultants and approval of tender documents for subcontracted inputs; and (vi) reporting to UNDP on project delivery and impact.

The **Responsible Party**, the Implementing Partner (CCDA) will engage PPL as responsible party following the government rules and regulations, e.g. Memorandum of Understanding (MOU) will be the basis of a written agreement to be signed by CCDA, PPL and UNDP. The MOU will outline the activities that PPL will be responsible for implementing.

Results of capacity assessment of the Implementing Partner and Responsible Party are provided in Annex 11.

The **project assurance** role will be provided by UNDP country office. Additional quality assurance will be provided by UNDP Regional Technical Advisor as needed. The project assurance role supports the project board by carrying out objective and independent project oversight and monitoring functions. The role ensures appropriate project outputs and milestones are managed and completed and proper use of UNDP/GEF Funds. Project assurance has to be independent of the project manager; therefore the project board cannot delegate any of its assurance responsibilities to the project manager.

The UNDP Country Office (CO) will be responsible for:

(i) providing financial and audit services to the project;
(ii) overseeing financial expenditures against project budgets;
(iii) ensure necessary audit and appointment of independent financial auditors and evaluators;
(iv) ensuring that all activities, including procurement and financial services, are carried out in strict compliance with UNDP rules and regulations (part of DPS);
(v) undertake quarterly financial and technical monitoring as part of its oversight functions;
(vi) In addition, the UNDP CO will be responsible for;
    a. coordinating with the UN Country Team in PNG with a view to mainstreaming in their interventions at the country level and funding as appropriate;
    b. coordinating an effective networking between stakeholders, specialized international organizations and the donor community;
    c. facilitating networking among the country-wide stakeholders;
    d. reviewing and making recommendations for reports produced under the project;
    e. contributing to technical reviews to ensure linkage to national policy goals, relevance, effectiveness and impartiality of the decision making process for the project

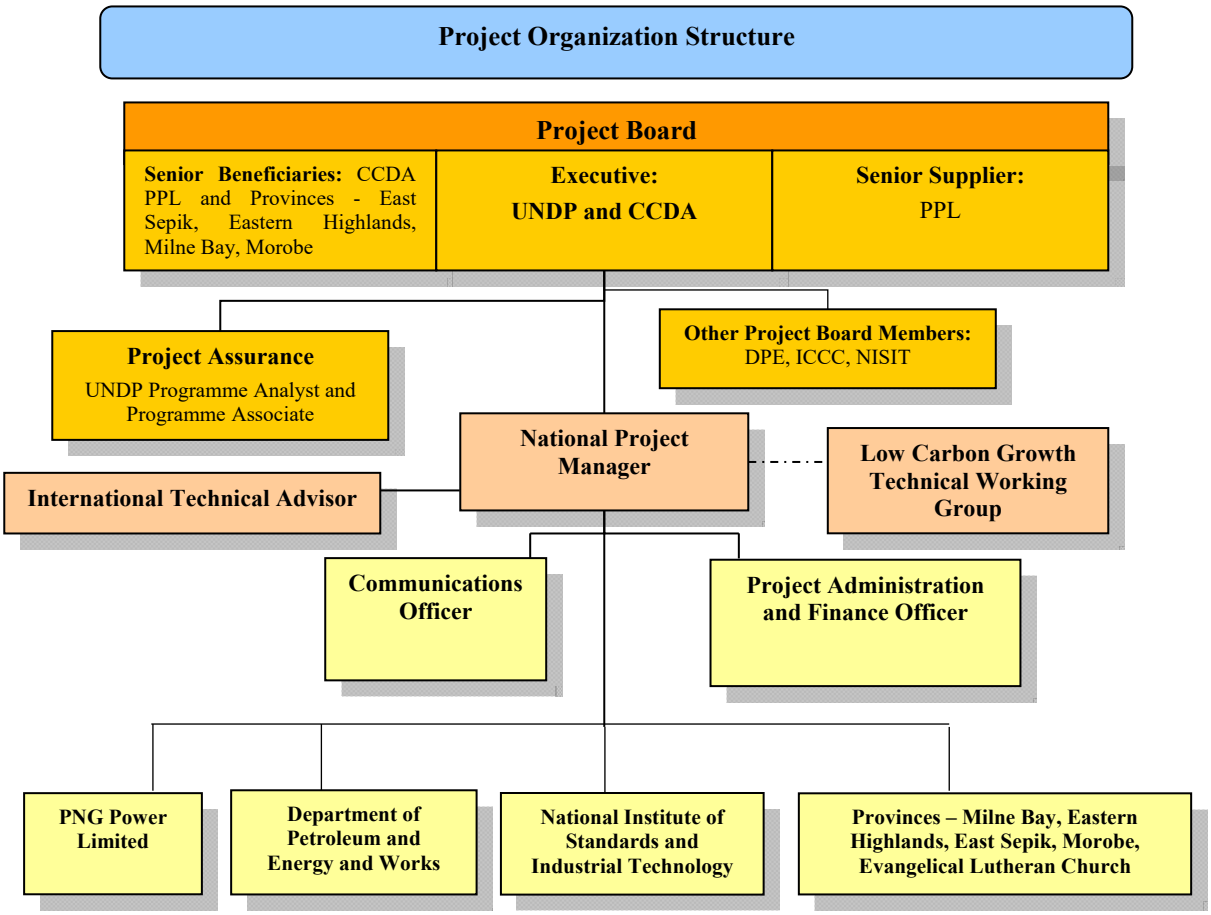
UNDP Direct Project Services (DPS) as requested by Government: The UNDP, as GEF Agency for this project, will provide project management cycle services for the project as defined by the GEF Council. In addition the Government of Papua New Guinea may request UNDP direct services for specific projects, according to its policies and convenience. The UNDP and Government of Papua New Guinea 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 _12_). 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”.

The project organization structure is shown in Exhibit 15.

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 recommendation for UNDP/Implementing Partner approval of project plans and revisions. 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, the final decision shall rest with the UNDP Program Manager.

The Project Board (PB) will be considered the key governing mechanism for technical and strategic guidance over project implementation. It will be constituted to serve as the project's coordination and high level decision-making body. The PB will ensure that the project remains on course to deliver the desired outcomes of the required quality. The PB will be chaired by CCDA and co-chaired by UNDP (the "executives"). The PB will include representation from (i) PPL ("senior supplier") and (ii) major project beneficiaries including the provinces ("senior beneficiaries"). Representatives of other stakeholder groups may also be included in the PB, as considered appropriate and necessary. Prospective membership of the PB will be reviewed, and recommended for approval, during the Project Inception workshop. The PB will meet at least twice per annum to review project progress, approve project work plans, and approve major project deliverables.

Exhibit 15. Project Organization



The **National Project Director** (NPD), will be the Director, Low Carbon Growth/Mitigation Division of CCDA, as delegated by the Managing Director (of CCDA). The NPD will be responsible for day-to-day oversight of the PMU including strategic oversight and guidance to project implementation in close collaboration with UNDP. The NPD

will not be paid from the project funds, but will represent a government in-kind contribution to the project. The NPD may sign and approve the project financial reports and the financial requests for advances or any contracts issued under NIM component of the project. The NPD may delegate the above activities to the National Project Manager. The NPD shall be assisted by a National Project Manager and key technical and administrative staff. The NPD and D/NPD will be responsible for provision of overall oversight and technical coordination of the project with PPL and other stakeholders. He/She will also participate in meetings of the UN/UNDP Coordination Mechanisms.

The **Project Manager** will run the project on a day-to-day basis on behalf of the Implementing Partner within the constraints laid down by the Board. The Project Manager function will end when the final project terminal evaluation report, and other documentation required by the GEF and UNDP, has been completed and submitted to UNDP (including operational closure of the project). The project manager will be recruited from the market. The project manager will oversee other project management office team members, who will be responsible for the overall management, monitoring, and coordination of project implementation according to UNDP rules on managing UNDP supported projects. Specifically, his/her responsibilities include: (i) contracting of and contract administration for qualified local and international experts who meet the formal requirements of UNDP/GEF; (ii) management and responsibility of all financial administration to realize the targets envisioned; (iii) organizing PB meetings; (iv) review and approval of the work and financial plan of the implementing partner and the responsible party; (v) and monitoring and support of the activities of the Implementing Partner and the Responsible Party.

The project will make use of the Low Carbon Growth Technical Working Group (TWG) currently managed by CCDA, comprising representatives from provincial governments, NGOs, and industry representatives. When necessary, the PMU will request the Low Carbon Growth TWG coordinate technical support for the implementation of project activities. This will include but not be limited to: (i) seeking consensus on the vision and objectives for the demonstration projects, (ii) facilitating the translation of these objectives into an integrated plan of action with other stakeholders for the demonstration sites; and (iii) ensuring consistency and convergence of stakeholder activities, plans and programs to support the achievement of the objectives and expected outcomes of plans.

The project will also extensively use a number of international and national consultants that will be selected based on UNDP principles.

Project Management

A **Program Management Unit** (PMU) will be established jointly by the UNDP and CCDA to be located within the latter's Low Carbon Growth/Mitigation Division. The primary role of the PMU is to oversee, support, administer and coordinate the implementation of the project under the guidance of the National Project Director (in CCDA). The PMU shall be supported by regular personnel of CCDA and PPL, to be complemented by staff to be recruited under this project. The PMU will be led by the national project manager, whose duties have been described above. He/She will be assisted by an international technical advisor who will provide technical assistance to the PMU/CCDA/PPL and mentor the project manager. A communications officer will lead and provide guidance on implementation, and update as required a communication, consultation, and participation strategy for the project. A procurement and administration assistant will focus on financial management and procurement to ensure effective and efficient implementation of project activities.

The implementing partner and the responsible party, with the support of the PMU, will prepare annual work plans for each year. The PMU will then consolidate these work plans into a single Annual Work Plan (AWP) and Annual Budget Plan (ABP) for the project. The AWP and ABP will be reviewed by the PB every year. These plans will provide the basis for allocating resources to planned activities. The IP's AWP and the Responsible Party's AWP will have to be signed with UNDP. The PMU will, with the inputs of the implementing partner and responsible party, respectively, produce quarterly operational reports and Annual Progress Reports (APR) or any other necessary reports. These reports will summarize the progress made by the project versus the expected results, explain any significant variances, detail the necessary adjustments, and be the main reporting mechanism for monitoring project activities.

The PMU under the guidance of NPD/DPD will work closely with PNG Power Limited as the main responsible party in close collaboration with the Department of Petroleum and Energy, the Department of Lands, the National Institute of Standards and Industrial Technology, and the provinces of the demonstration projects, namely Milne Bay, Eastern Highlands, East Sepik, and Morobe. The provinces will utilize their Provincial Climate Change Committees and Provincial Coordination and Monitoring Committees as the provincial coordination mechanisms for the project.

Governance Role for Project Target Groups

Provinces involved in the project (Eastern Highlands, Milne Bay, East Sepik, and Morobe) will be members of the Project Board. A key involved institution, the Evangelical Lutheran Church (ELC), will also be a member of the Project Board. Further, these organizations will be involved in decision-making for the demos and TA activities taking place in their province (or with their institution). For the mini-hydro demos, local communities will be involved in decision-making about the demos and productive application activities via their ILGs (Indigenous Landowner Groups). For the PV demo, the local community will be involved in decision-making about productive application activities.

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

In order 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[20] and the GEF policy on public involvement.[21]

Financial and Other Procedures

All procurement and financial transactions will be governed by national rules and regulations, and must be compatible with the UNDP rules and regulations.

IX. FINANCIAL PLANNING AND MANAGEMENT

The total cost of the project is USD 30,860,640. This is financed through a GEF grant of USD 2,840,640 and USD 300,000 in cash co-financing to be administered by UNDP and USD 27,720,000 in parallel co-financing. UNDP, as the GEF Implementing Agency, is responsible for the execution of the GEF resources.

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:

Exhibit 16. Project Co-Financing*

Co-financing source	Co-financing type	Co-financing amount	Planned Activities/Outputs	Risks	Risk Mitigation Measures
PPL	Cash and in-	USD 18 million	Samurai Island PV mini-	PPL management	Materials prepared

[20] See http://www.undp.org/content/undp/en/home/operations/transparency/information_disclosurepolicy/
[21] See https://www.thegef.org/gef/policies_guidelines

	kind		grid Wewak EE Program Maprik EE Program ESCO fund Billing TA support for RE mini-grids	changes and new management decides not to participate	in project will provide strong justification to PPL's bottom line for participation
Eastern Highlands Province	Cash and in-kind	USD 1.63 million	Gotomi mini-hydro station Miruma mini-hydro station Productive applications of RE in EHP Various TA work in EHP	Provincial administration decides to use funds for other purposes	High level liaison with provincial administration; involvement of province in Project Board
East Sepik Province	Cash and in-kind	USD 830,000	Wewak EE Program Maprik EE Program Various TA work in ESP	Provincial administration decides to use funds for other purposes	High level liaison with provincial administration; involvement of province in Project Board
UNDP	Cash co-financing	USD 300,000	National level policy and planning work	NA	NA
CCDA	Cash and in-kind	USD 4 million	National level policy and planning work; public awareness work	Full amount of promised co-financing does not materialize	Frequent documenting of co-financing; high level liaison to ensure high level support for project

The above stated parallel co-financing amounts totaling USD 24.76 million are fully confirmed as of the time of the submission of this ProDoc. The following co-financing amounts (Total = USD 3.26 million) from partner district governments are expected during project implementation, but for now are not included in the FREAGER Project financial plan.

Co-financing source	Co-financing type	Co-financing amount	Planned Activities/Outputs	Risks	Risk Mitigation Measures
Dauolo District, Eastern Highlands Province	Cash	USD 1 million	Miruma mini-hydro station, productive use support, related TA support, replication of mini-hydro demo	District administration decides to use funds for other purposes	High level liaison with province, which in turn will encourage district participation; direct liaison with district so it will understand high potential of benefits
Lufa District, Eastern Highlands Province	Cash	USD 1 million	Gotomi mini-hydro station, productive use support, related TA support, replication of mini-hydro demo	District administration decides to use funds for other purposes	High level liaison with province, which in turn will encourage district participation; direct liaison with district so it will understand high potential of benefits
Wewak District, East Sepik Province	Cash	USD 630,000	Wewak EE Program, including support for TA, EE retrofits, and consumer sub-program	District administration decides to use funds for other purposes	High level liaison with province, which in turn will encourage district participation; direct liaison with district so it will understand high

					potential of benefits
Maprik District, East Sepik Province	Cash	USD 630,000	Maprik EE Program, including support for TA, EE retrofits, and consumer sub-program	District administration decides to use funds for other purposes	High level liaison with province, which in turn will encourage district participation; direct liaison with district so it will understand high potential of benefits

Budget Revision and Tolerance: As per UNDP requirements outlined in the UNDP POPP, the project board 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 Project Board. 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. 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. At 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.

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 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:	00094483	Atlas Primary Output Project ID:	00098601
Atlas Proposal or Award Title:	Facilitating Renewable Energy & Energy Efficiency Applications for Greenhouse Gas Emission Reduction (FREAGER)		
Atlas Business Unit	PNG10		
Atlas Primary Output Project Title	Facilitating Renewable Energy & Energy Efficiency Applications for Greenhouse Gas Emission Reduction (FREAGER)		
UNDP-GEF PIMS No.	5569		
Implementing Partner	Climate Change and Development Authority (CCDA)		

GEF Component/Atlas Activity	Responsible Party (Atlas Implementing Agent)	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	See Budget Note:
OUTCOME 1: Rigorous implementation and enforcement of approved national and provincial energy policies, plans, and standards to promote the application of renewable energy and energy efficiency technologies	**CCDA**	**62000**	**GEF**	71200	International Consultants	80,325	80,325	80,325	80,325	321,300	1
				71300	Local Consultants	25,800	25,800	25,800	25,800	103,200	2
				75700	Training & Workshop	56,913	56,913	56,912	56,912	227,650	3
				74200	Printing and Publications	582	582	581	580	2,325	4
				Total Outcome 1		**163,620**	**163,620**	**163,618**	**163,617**	**654,475**	
OUTCOME 2A: Enhanced technical-commercial viability and capacity in the application of energy efficiency technologies and development of feasible RE-based energy systems in the country	**CCDA**	**62000**	**GEF**	71200	International Consultants	45,500	45,500	45,500	45,500	182,000	5
				71300	Local Consultants	39,000	39,000	39,000	39,000	156,000	6
				75700	Training & Workshop	26,938	26,938	26,937	26,937	107,750	7
				74200	Printing and Publications	375	375	375	375	1,500	8
				Total Outcome 2A		**111,813**	**111,813**	**111,812**	**111,812**	**447,250**	
OUTCOME 2B: Increased installed capacity of RE based power systems and implementation of viable EE technology applications in PNG	**CCDA**	**62000**	**GEF**	71200	International Consultants	115,500	0	0	0	115,500	9
				71600	Travel	34,250	0	0	0	34,250	10
				72100	Contractual Services	218,200	0	0	0	218,200	11
				72200	Equipment and Furniture	400,000	0	194,050	0	594,050	12
				Total Outcome 2B		**767,950**	**0**	**194,050**	**0**	**962,000**	
OUTCOME 3: Improved availability of, and access to, financing for renewable energy and energy efficiency initiatives in the energy generation and end-use sectors	**CCDA**	**62000**	**GEF**	71200	International Consultants	27,125	27,125	27,125	27,125	108,500	13
				71300	Local Consultants	6,750	6,750	6,750	6,750	27,000	14
				71600	Travel	15,750	15,750	15,750	15,750	63,000	15
				74200	Printing and Publications	150	150	150	150	600	16
				Total Outcome 3		**49,775**	**49,775**	**49,775**	**49,775**	**199,100**	

OUTCOME 4: Improved awareness of, attitude towards, and information about renewable energy and energy efficiency applications in the energy generation and end-use sectors	**CCDA**	**62000**	**GEF**	71200	International Consultants	48,125	48,125	48,125	48,125	192,500	17
				71300	Local Consultants	30,000	30,000	30,000	30,000	120,000	18
				71600	Travel	19,638	19,638	19,637	19,637	78,550	19
				72100	Contractual Services — companies	15,000	15,000	20,000	0	50,000	20
				74200	Printing and Publications	375	375	375	370	1495	21
				Total Outcome 4		**113,138**	**113,138**	**118,137**	**98,132**	**442,545**	
PROJECT MANAGEMENT	**PMO & UNDP**	**62000**	**GEF**	71200	International Consultants	0	14,000	0	17,500	31,500	22
				71300	Local Consultants	1,289.51	1,289.51	1,289.51	1,289.51	5,158.04	23
				71600	Travel	0	9,050	0	9,050	18,100	24
				74100	Professional services	4,000	4,000	4,000	4,000	16,000	25
				74200	Printing and Publications	117	117	118	118	470	26
				74596	Services to projects/DPC	16,010.49	16,010.49	16,010.49	16,010.49	64,041.96	27
				Total Management		**21,417**	**44,467**	**21,418**	**47,968**	**135,270**	
					PROJECT TOTAL	**1,227,713**	**482,813**	**658,810**	**471,304**	**2,840,640**	

GEF Component/Atlas Activity	Responsible Party (Atlas Implementing Agent)	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)
Project Management	**UNDP**	**04000**	**UNDP**	71400	Contractual services-individuals	52,000	52,000	52,000	52,000	**208,000**
				71600	Travel	15,000	15,000	15,000	15,000	**60,000**
				72500	Office supplies	2,000	2,000	2,000	2,000	**8,000**
				74100	Professional Services	5,000	5,000	5,000	5,000	**20,000**
				74500	Miscellaneous	1,000	1,000	1,000	1,000	**4,000**
				Total Outcome		**75,000**	**75,000**	**75,000**	**75,000**	**300,000**

Summary of Funds:

Sources of Funds	Amount Year 1	Amount Year 2	Amount Year 3	Amount Year 4	Total, USD
GEF	1,227,713	482,813	658,810	471,304	2,840,640
UNDP	75,000	75,000	75,000	75,000	300,000
PPL	9,000,000	3,000,000	3,000,000	3,000,000	18,000,000
CCDA	1,000,000	1,000,000	1,000,000	1,000,000	4,000,000
Eastern Highlands Province	800,000	280,000	280,000	270,000	1,630,000
East Sepik Province	300,000	180,000	175,000	175,000	830,000
TOTAL	**12,402,713**	**5,017,813**	**5,188,810**	**4,991,304**	**27,600,640**

Budget Notes:

Outcome 1

1. A total of USD 321,300 for international consultants for Outcome 1, the policy and planning outcome, reflects the strong utilization of international expertise throughout the outcome, in 22 of its 24 activities. Total international consultant days for Outcome 1 are 459, with an estimated USD 700 per day consultant rate. International consultants will work with national consultants to prepare curriculums for RE mini-grid and EE township program training workshops held at the national and provincial levels. They will also lead each workshop. There will be five different workshop series; and each series will have three workshops, for a total of 15 workshops under Outcome 1. International consultants will support RE and EE policy gap analysis and policy design work, national level RE roadmap and EE roadmap preparation, and national and provincial level RE and EE standard design, refinement, and enforcement. International consultants will advise on an institutional EE plan for PPL and on a plan for coordination among national level agencies on RE mini-grid and township EE program related policies. Lastly, international consultants will plan a key role in the preparation of five provincial level (or institutional level) RE and EE plans.

2. A total of USD 103,200 for national consultants for Outcome 1, the policy and planning outcome, reflects a strategy of strong utilization of national expertise throughout the outcome to work in a team with international consultants. Total national consultant days are 516, with an estimated USD 200 per day consultant rate. National consultants will participate in 23 of the outcome's 24 activities. In all activities in which international consultants are involved (see above note for the scope of such work), except an international consultant's advising for PPL's institutional EE plan, a national consultant will be recruited. In addition, national consultants, on their own, will support relevant community RE mini-grid policies at ICCC and at Department of Lands and Physical Planning.

3. Outcome 1 has a total allocation of USD 227,650 for meetings and workshop. This reflects that travel will be involved in 21 of Outcome 1's 24 activities. Travel expenses include international flights (benchmarked at USD 2,000 per roundtrip), domestic flights (benchmarked at USD 450 per roundtrip), ground transport, and per diems (with a maximum benchmark of USD 300, but adjusted downwards in many cases, e.g. to USD 200 or, in a few cases, to USD 100, where it is believed a lower amount can be achieved). FREAGER project management will be encouraged during implementation to look for means of reducing hotel costs. Travel expenses are especially heavy for the two series of workshops (three workshops per series) in Port Moresby for policy makers, as at least ten provincial level officials will be flown in on each three different occasions leading to a total of 30 person trips per workshop series. The three provincial level workshop series (with three workshops per series) will each bring in an estimated ten district level persons, though shorter distances will result in lower travel costs than for the Port Moresby workshops. Finally, significant travel expenses will be incurred in flying the international consultants in for most of the 22 activities in which they are involved. For some activities, such as those that entail a series of three workshops held at different times, multiple trips will be required. There may be some opportunities to consolidate international trips between activities (e.g. Eastern Highlands' mini-hydro workshops and Morobe mini-hydro workshops) to reduce costs, when the consultant for different activities is one and the same; and this has been reflected in the activity-wise budget prepared.

4. Printing costs of USD 2,325 reflect an emphasis of Outcome 1 on learning and dissemination. All 24 activities will have printing costs of USD 85 to USD 100. Learning materials will be prepared for all fifteen workshops (spread over five activities). Further, all draft policies, standards, roadmaps, provincial plans, and institutional plans prepared will be printed for dissemination to key policymakers.

Outcome 2A

5. Outcome 2A, which focuses on technical and commercial viability of community RE mini-grids and township EE programs, will utilize international consultants in 12 of 22 activities. Involvement of international consultants will be critical in bringing both technical skills/knowledge to PNG as well as commercial knowledge, particularly of sourcing channels. The total international consultant budget for Outcome 2 is USD 182,000 with an estimated 260 person days at USD 700 per day. International consultants will be involved in the preparation of curriculum and the delivery of four workshops for technical personnel (in the areas of mini-hydro, PV mini-grid, building EE, and industrial EE, respectively), with 20 person days allocated for each combination of curriculum preparation and leading the workshop. A very critical area of international consultant support for Outcome 2A will be expert input and liaison for sourcing work on each of mini-hydro, PV mini-grid, and EE equipment, opening up low-cost channels for PNG to get the most appropriate equipment. For this work, there are 30 international person days allocated to each of the three sourcing areas. International consultants will also be involved in determining the "honest," best possible costing for mini-hydro (30 person days) and PV mini-grid (15 person days) projects in PNG, including civil works and construction aspects. International consultants will support preparation of O&M curriculums for both mini-hydro (15 person days) and PV (10 person days) mini-grids and will contribute to the design of a PPA template (20 person days) for agreements between PPL and those running community RE mini-grids.

6. Outcome 2A's allocation for national consultants is USD 156,000, or an estimated 780 person days at USD 200 per person day. National consultants with technical expertise will be utilized for each of Outcome 2A's 22 activities. For the 12 activities in which international consultants are involved (see above note), there will be a matching number of days for national consultants to work with them, providing expertise on local conditions, technical input, and liaison/outreach support. For the "honest," best possible costing activities, the national consultant days will be double those of the international consultants (for the national consultant, 60 person days for mini-hydro and 30 person days for PV mini-grids), as these activities will require considerable local knowledge, local research, and liaison. These two activities are considered very important to the success of the project's commercial viability theme and thus a substantial number of consultant days are allocated for them. National consultants will also provide expertise to three types of Outcome 2A activities in which international consultants are not involved: provision of PPA negotiation support (20 person days for Gatop and 20 person days for Kabwum); productive applications support for local people, such as business plans and marketing advising (60 person days for Samarai, 60 for Gotomi, and 60 for Miruma); monitoring and documentation of the four types of demos (60 person days for mini-hydro in Gotomi and Miruma; 60 person days for PV mini-grid on Samarai Island; 60 person days for township EE programs in Wewak and Maprik; and 60 days for PPA, billing, and O&M aspects of Gatop and Kabwum).

7. Outcome 2A meetings and workshop, at USD 107,750, represents substantial expenditures for travel of technical personnel to workshops and for travel of consultants to the field to support productive applications and monitor and report on the demos. Travel expense benchmarks include USD 2,000 per international roundtrip air ticket and USD 450 per roundtrip domestic air ticket. Per diem estimates range from a maximum of USD 300 (international consultant in Port Moresby) to USD 100 for days spent doing field work for community RE mini-grids. Budgets for each of the technical workshops assumes an international consultant flies in from abroad. For the two RE related technical workshops, it is assumed that ten national trainees from outside of Port Moresby are flown in, while five national trainees are flown in for the EE related technical workshops. (It is assumed that many of the attendees at the EE technical workshop will be Port Moresby based PPL personnel.) Number of days spent in the field (and therefore generating per diems) will be particularly large for the productive use of RE support (30 days for each of the three sites) and the monitoring and documentation of the demos (25 days for each of four sets of sites). Each of these types of activities (productive use support and demo monitoring and reporting) will involve multiple trips by national consultants to the field sites.

8. Outcome 2A has USD 1,500 allocated to printing. The curriculum preparation/ workshops (both technical workshops and O&M training workshops) will all involve printing of materials. Further, documentation of results of sourcing work and "honest" best costing work will be printed to achieve dissemination on these important topics, considered critical to project success. The PPA template for community RE mini-grids will also be printed for dissemination, an important way to ensure results are well-known rather than "sitting on a shelf."

Outcome 2B

9. Outcome 2B, focused on implementation of the project demos, has an allocation of USD 115,000 (or an estimated 165 person days at USD 700 per day) for international consultants. This work is all focused on getting the project demos up and running and is targeted to occur in the first year of implementation. Fifteen person-days (45 total) are allocated for design, costing, and implementation of each of the Miruma mini-hydro, Gotomi mini-hydro, and Samrai PV mini-grids. The township energy efficiency demos have a much larger input of international consultant time, at 60 days each (120 total). For the township EE demos, consultants will lead PPL staff in carrying out industrial and building audits and advising future large power users on energy efficient design and equipment procurement aspects. The assignment will be part results-oriented and part training for PPL staff.

10. Outcome 2B's travel allocation of USD 34,250 is to support the involvement of international consultants in the demos as described in the note above. In addition to international airfare (at USD 2,000 per roundtrip), it includes ten days of travel/ per diems for support of start-up of each of the three mini-grid demos and 45 days of travel (and per diems) for each of the Wewak and Maprik EE demos. Two international roundtrip flights of the international consultants are also allocated for each of the Wewak and Maprik demos, for a total of four roundtrips.

11. Outcome 2B allocates USD 218,200 for contractual services, all of which involves work for developing and setting up the mini-hydro demos at Gotomi and Miruma, namely the limited, site specific environmental and social assessment, the feasibility study, and the civil works. This includes USD 9,100 for each of the two environmental and social assessments and feasibility studies (total cost of these for each site y is USD 18,200, but EHP will support the other half) and USD 100,000 for each of the two civil works contracts (total cost of each contract is USD 200,000, but EHP will support the other half of each contract's cost). This money will all be spent early in the project, currently targeted for the project's first year.

12. Outcome 2B allocates USD 594,045 for equipment. Early in the project, USD 300,000 will be spent on equipment for the Gotomi and Miruma mini-hydro stations, with USD 150,000 being spent on each. This represents half of the mini-hydro equipment and mini-grid costs of the systems, with the other half to be covered by EHP. The project will also in year one of the project support EE retrofits in Wewak (USD 55,000) and Maprik (USD 45,000). In about year three of the project, FREAGER will also invest USD 100,000 in equipment for productive applications in each of Samarai Island (USD 71,345), Gotomi (USD 61,350), and Miruma (USD 61,350). These funds will be invested a credit fund for various business ventures targeted at making productive use of RE power.

Outcome 3

13. Outcome 3, the financing outcome, will include a USD 108,000 allocation for international consultants, or an estimated 155 person days at USD 700 per day. International consultants will be instrumental in each of the five activities of Outcome 3. For the each of the two series of two workshops (one series on community RE financing and one on EE financing), international consultants will prepare the curriculum and travel to PNG twice to present the workshops. This will entail 25 person days for the community RE mini-grid series and 25 person days for the EE series. Further, 25 person days of international consultant services and one trip are allocated for the design of an ESCO fund for PPL to provide up-front financing for customer energy efficiency initiatives. Forty person days and two trips to PNG are allocated for international consultant work on the design of a loan sub-fund to support community RE mini-grids. And, 40 days (but no travel) is allocated for an international consultant to prepare a guide of RE and EE funding sources and how-to-apply guidance for PNG.

14. For national consultants, Outcome 3 allocates USD 27,000, or an estimated 135 consultant days at USD 200 per day. National consultants will work closely with international consultants on each of the five activities of Outcome 3. They will bring their own technical expertise, expertise on local conditions, and liaison and outreach support to the table. The number of days allocated for national consultants for each of the first four activities of Outcome 3 are the same as the number allocated for international consultants. For the last activity, preparation of the funding source and how-to-apply guide, the national consultant is allocated fewer days (20 days, as compared to 40 days for the international consultants), as it is expected the international consultant's research and writing work will require substantially more input than that to be provided by the national consultant.

15. Travel allocation for Outcome 3 is USD 63,000. This includes seven trips for international consultants, two the RE mini-grid financing workshops, two for the EE financing workshops, two for the community RE mini-grid loan fund design work, and one trip for the PPL ESCO fund design work. The travel allocation also includes ten domestic roundtrips for attendees at each of the four workshops, for a total of forty domestic roundtrips. Travel benchmarks are USD 2,000 per international roundtrip airfare, USD 450 per domestic roundtrip airfare, and USD 200 to USD 300 for per diems.

16. Outcome 3's printing allocation is USD 600, which will be used to support preparation of training materials for the two community RE mini-grid financing workshops and the two EE financing workshops.

Outcome 4

17. Outcome 4, the information and awareness outcome, has an allocation of USD 192,000 for international consultants. This will support roughly 275 person days at a rate of USD 700 per day. Thirteen of Outcome 4's 20 activities make use of international consultants. The largest allocation, with 50 person days, will be for TA support of domestic manufacturers to manufacturer RE and EE equipment and components. This will involve four international trips to PNG. International consultants will also be involved in: briefings on the cost-benefits of RE and EE as compared to diesel and outreach to policy makers with these briefings (35 person days and two trips), preparation of PNG-specific micro-hydro and PV mini-grid "how-to" guides (two guides to be prepared, involving 25 days each and one trip each), solar resource assessment of Milne Bay Province and mini-hydro assessment of EHP and Morobe Province (each involving 20 person days and one trip, for a total of 60 days and three international trips), aggregation of resource data collected by other projects (ten days international consultant input and no trip), curriculum and materials for tertiary education course on mini-hydro and PV mini-grids (25 days and one international trip) and building EE audits (25 days and one international trip), support for celebrity endorsement work (ten days international consultant work and no trip), and support for project website design (ten days international consultant work and no trip).

18. Outcome 4's allocation for national consultants is USD 120,000, which will support about 600 person days at a rate of USD 200 per day. National consultants will be involved in 19 of Outcome 4's 20 activities. These will include all of the 13 activities that international consultants are involved in and that are described in note 17. Person days input of the national consultant will be the same as those of the international consultant for some activities but not others. Those activities with differences include: briefings and outreach (ten extra days for national consultant to carry out more outreach to policy makers with the briefings), the three provincial resource assessments (15 extra days for the national consultant for each assessment, in order to carry out detailed on-the-ground assessment work), collecting and organizing RE resource data from other projects (25 extra days for the national consultant, who will be doing the bulk of the work for this activity), celebrity endorsement work (15 extra days for the national consultant), TA for manufacturers (15 less days for the national consultant as compared to the international consultant), and website design (30 more days for the national consultant, who will do the bulk of the work for this activity). Other activities fully led by the national consultant with no involvement of an international consultant will be: gathering of information on pipeline proposed mini-hydro and PV mini-grid projects (35 days), preparation of RE and EE content to be incorporated into high school and primary school courses (60 days), liaison and other work for radio show dissemination (20 days), journalist outreach campaign (40 days), social media campaign (35 days), and text messaging campaign (25 days).

19. Outcome 4's travel allocation is USD 78,550. Benchmarks include USD 2,000 for international roundtrip airfare and USD 450 for domestic roundtrip airfare. Per diem allocations range from USD 150 to USD 300. Trips for international consultants are mentioned above in note 17. Domestic trips include three round trip airfares and per diems for a national consultant to collect information on pipeline RE mini-grid projects and two domestic round trips with 30 days total in the field for each of the three resource assessments. The resource assessments will be field work intensive. Domestic travel will also include four roundtrips and 20 days in the field for each of the mini-hydro and PV mini-grid how to guides, as these guides will emphasize how to do projects in the context of PNG and thus require understanding of the local situation. Lastly, there will also be four domestic roundtrips and associated with a total ten days of travel for dissemination of the policy briefings (on the low cost of RE and EE as compared to diesel) to provincial level officials.

20. Outcome 4 has USD 50,000 of contractual services. This includes a USD 40,000 contract to prepare a documentary for television on RE and EE, ensuring that it is aired on primetime TV in PNG. It also includes a USD 10,000 sub-contract (separate from the 25 days of national consultant work) for the actual transmission of text messages in the RE/EE text messaging campaign.

21. The printing allocation for Outcome 4 is USD 1,500. This is for printing of the high-level briefings on the cost-benefits of RE and EE compared to diesel and the printing of materials for the outreach campaign to journalists.

Project Management

22. Project management includes USD 31,500 under the category of international consultant. This includes 20 days for the mid-term review and 25 days for the terminal evaluation estimated at a rate of USD 700 per day.

23. Project management includes USD 5,158.04 under the category of national consultant. This allocation is meant for staffing of the PMO, though the bulk of PMO staffing expenses will be covered by UNDP co-financing. Office space, another major PMO expense, is expected to be provided as an in-kind contribution by the implementing partner, CCDA.

24. Project management includes USD 18,100 in travel. This is primarily for travel during the mid-term review and terminal evaluation, including international and domestic airfares.

25. Professional services of USD 4,000 per year covers annual audit of the proposed project.

26. Project management includes USD 470 in printing costs for various documents.

27. UNDP Support Services provided to FREAGER are considered Direct Project Costs (DPC) and are budgeted at USD 64,041.96. Of this amount: USD 30,122.12 will be for the recruitment and management of PMO staff (with an estimated four staff at USD 7,530.53 per person); USD13,139.84 will be for procurement of goods and services (with an estimated 28 procurement cases at a rate of USD 469.28 per case); USD 18,447.00 will be for direct payments (with an estimated 400 payments at a rate of USD 40.60 per payment); and USD2,333.00 will be for administrative and support services (with an estimated 50 cases at a rate of USD 46.66 per case). The Letter of Agreement for these UNDP Support Services is provided as Annex 12.

XI. LEGAL CONTEXT

This Project Document shall be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement between the Government of Papua New Guinea and the United Nations Development Program, signed by the parties on 7 April, 1981. The host country-implementing agency shall, for the purpose of the Standard Basic Assistance Agreement, refer to the government co-operating agency described in that Agreement.

Consistent with the Article III of the Standard Basic Assistance Agreement, 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.

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 this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the 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/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

Consistent with UNDP's Programme and Operations Policies and Procedures, 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.

XII. ANNEXES

Annex 1. Project Demo Summaries

This annex provides summaries of the project demos including the Samarai Island PV mini-grid demo in Milne Bay Province, the Miruma Ward and Gotomi Ward mini-hydro mini-grid demos in Eastern Highlands Province, and the Wewak and Maprik township EE program demos in East Sepik Province.

1. Milne Bay Province

1.1 Samarai Island PV Mini-Grid Demo

Location: Samarai Island, Milne Bay Province

Description of demo: The proposed Samarai Island PV mini-grid demo will have a PV capacity of 50.1 kW and lithium battery bank storage of 150 kWh. The PV mini-grid will replace the two 80 kW Cummins diesel generators currently used on Samarai Island by PPL, which is responsible for providing power to the island population of 300. The Samarai PV mini-grid demo will be the first PV mini-grid to be demonstrated in PNG. Currently, Samarai is a financial loss center for PPL, as the cost of diesel and other expenses far exceeds revenues from power sales. Estimates show that the PV mini-grid will substantially reduce loses. As part of the demo, productive uses of renewable energy ("PURE") that increase incomes will be facilitated.

Investment cost: Based on preliminary proposals, the cost of the Samarai PV mini-grid is estimated at PGK 1,297,829 (USD 409,475). This assumes a system lifetime of 20 years and that the battery bank is replaced after about ten years. (The batteries have a lifetime of 4,000 cycles.) Of this cost, only about USD 34,000 is for the solar panels, while USD 163,000 is for the battery bank structure and initial set of batteries.

Benefits: The main benefits of the Samarai PV mini-grid include GHG emission reductions, as PV power replaces diesel power, and substantial net financial savings as compared to diesel over the 20 year lifetime of the system. PV replacement of diesel will also reduce local air pollution with benefits for the health of local people and, in particular, for the health of the PPL system operators, who have in the past suffered negative impacts from daily exposure to diesel fumes. There will also be an aesthetic benefit. As Samarai strives to increase tourism, a PV power system instead of a diesel one will make the island more attractive to tourists looking for a pristine and clean environment.

Economics: Preliminary estimates indicate that he Samarai PV mini-grid will have a payback period in terms of savings on diesel fuel of 4.25 years (when an assumed one time replacement of the batteries after ten years is incorporated into total PV system costs). After the system is paid back, savings in diesel costs are estimated to be USD 96,288 annually. For the 15.75 remaining years of the system's life after the payback on investment is achieved, this will amount to savings of 1.5 million USD from not having to purchase diesel.

GHG emissions reduction: Currently, the Samarai diesel mini-grid is emitting about 200 tons of CO_2 annually. Over its lifetime, the Samarai PV mini-grid will generate about 4,010 tons CO_2 in direct emission reductions. Assuming the mini-grid is replicated with similar scale in four other districts of Milne Bay Province after project close but due directly to project support in design and other areas, the associated direct post project emission reduction over these four replication systems' 20-year lifetimes

will total about 16,040 tons CO_2. This yields a grand total of about 20,050 tons CO_2 emission reduction due to the direct influence of the project.

2. Eastern Highlands Province

2.1 Miruma Ward Mini-Hydro Mini-Grid Demo

Location: Miruma Village, Miruma Ward, Upper Asaro LLG, Eastern Highlands Province

Description of demo: The proposed Miruma mini-hydro mini-grid demo will have a capacity of 200 kW and serve as much as possible of the seven villages of Miruma Ward, which have an aggregate population of 2,500. Miruma Ward currently does not have power, aside from some privately owned small diesel generators and solar lamps. The community of Miruma Village has agreed to provide the needed land and waterway for the installation. A key aim of the demo will be to demonstrate technical and commercial viability. On the commercial viability side, the demo will target system costs of USD 2,500 per kWh, supported by the project's TA work in sourcing and in delineating "honest costs" for services needed to establish micro/ mini-hydro systems in PNG. Loads will include schools, a day clinic, six to seven trade stores, churches, and an estimated 250 households, representing a population covered by household connection of 1,250. As part of the demo, productive uses of renewable energy ("PURE") that increase incomes will be facilitated. Preliminarily discussed productive applications include: coffee pulping machine, cassava grating equipment, electric oven for baking scones, etc., cold storage, light for poultry raising, power for clinic (used for sterilization etc.), and power for trade stores.

Investment cost: Total estimated cash cost of the mini-hydro mini-grid system is USD 518,200 or PKG 1.642 million kina. (USD 18,200 for feasibility study and USD 500,000 for civil works, electrical works, equipment, and installation combined, but excluding in-kind labor contributions.)

Benefits: When compared to a diesel system that might be used instead, benefits of the Miruma mini-hydro mini-grid include avoided greenhouse gas emissions and substantial savings in lifetime costs. In terms of revenues from power sold, the system brings in substantial net income (after investment is paid back) to the system owners. Because Miruma currently lacks power, the demo will have strong energy access benefits. Further, promotion of productive uses of the RE has the potential to increase local incomes.

Economics: Two approaches may be used to assess the economics of the system. One compares the lifetime costs of the mini-hydro mini-grid system to diesel mini-grid costs and computes the savings. The other compares revenues from mini-hydro mini-grid power generation and distribution to the investment costs of the mini-hydro mini-grid system. Comparing the mini-hydro mini-grid to an equivalent diesel power generation mini-grid system, the economic benefit of the mini-hydro system surpasses that of the diesel system after just 1.43 years. For the estimated 40 year lifetime of the system, the savings over an equivalent diesel station is USD 10.14 million, based on current diesel and diesel generator prices.

Assuming power used is sold at USD 0.15 (PKG 0.48) per kWh, annual revenues will be USD 155,162 (or PKG 491,803). The cost of the system will be paid back by billing revenues in just 3.3 years. Estimated lifetime net revenues, after investment is paid back and assuming some investment in desilting each decade (in 2016 prices and assuming 40 year life), are roughly USD 5.61 million (PKG17.8 million).

GHG emission reductions: Total direct GHG emission reductions over 40 year life of Miruma mini-hydro mini-grid system will be 33,266.6 metric tons CO_2. Assuming the mini-hydro mini-grid is replicated with similar scale four times after project close but due directly to project support in design and other areas, the associated direct post project emission reduction over these four replication systems' 40-year lifetimes will total about 133,066.5 metric tons CO_2. This yields a grand total of about 166,333.1 tons CO_2 emission reduction due to the direct influence of the project.

2.2 Gotomi Ward Mini-Hydro Mini-Grid Demo

Location: Sirupa Village, Gotomi Ward, Lufa District, Eastern Highlands Province

Description of demo: The proposed Gotomi mini-hydro mini-grid demo will have a capacity of 200 kW and serve as many as possible of the 6,000 to 7,000 population across the seven villages of Gotomi Ward. In 2008/2009, power was brought by PPL to three villages in the ward, with connections available to those close to the road. Roughly 200 (or 14 percent) of ward households have grid connections. Yet, more often than not, there are prolonged blackouts, with low prioritization of the area during power shortages and limited maintenance during line breakdowns due to the remote location and low overall load. The community of Sirupa Village (with a population of 600), located near the mini-hydro resource of a 60 to 70 m high waterfall, has agreed to provide the needed land and waterway for the installation. A key aim of the demo will be to demonstrate technical and commercial viability. On the commercial viability side, the demo will target system costs of USD 2,500 per kWh, supported by the project's TA work in sourcing and in delineating "honest costs" for services needed to establish micro/ mini-hydro systems in PNG. Loads will include Gotomi's four elementary schools, its two primary schools, its vocational training center, its health clinic, trade stores, and 400 households within the vicinity. Of the seven villages in Gotomi Ward, parts of five villages will be connected to the mini-grid. The population covered by household connection will be 2,000 out of the total population, including about 400 in Sirupa Village. As part of the demo, productive uses of renewable energy ("PURE") that increase incomes will be facilitated. Preliminarily discussed productive applications include: Coffee pulping machine; businesses related to building sturdier homes (carpentry and welding); refrigeration for vegetable selling business; use of electric oven to make cakes, scones, and buns to sell; and sewing machine to earn income (and for family use).

Investment cost: The same as for Miruma Ward mini-hydro mini-grid (please see above).

Benefits: When compared to a diesel system that might be used instead, benefits of the Gotomi mini-hydro mini-grid include avoided greenhouse gas emissions and substantial savings in lifetime costs. In terms of revenues from power sold, the system brings in substantial net income (after investment is paid back) to the system owners. Because Gotomi's current access to power is extremely unreliable and benefits only a small portion of the population, the demo will have strong energy access benefits. Further, promotion of productive uses of the RE has the potential to increase local incomes.

Economics: The same as for Miruma Ward mini-hydro mini-grid (please see above).

GHG emission reductions: The same as for Miruma Ward mini-hydro mini-grid (please see above).

3. East Sepik Province

3.1 Wewak Township Energy Efficiency Demo

Location: Wewak, East Sepik Province. (Note: Wewak is the provincial center of East Sepik Province.)

Description of demo: The Wewak township energy efficiency demo will demonstrate energy efficiency initiatives in the following key areas: (1) building energy audits followed by recommended building energy efficiency retrofits at top power consumers in Wewak (as measured by kWh monthly consumption); (2) industrial energy efficiency audit followed by recommended energy efficiency retrofits at top power consumer in Wewak (as measured by load); (3) advising to new large power consuming entities expected to come online soon on how to save energy via building design and via procurement of energy efficient equipment; (4) consumer credit program to facilitate purchase of energy efficient refrigerators and energy efficient outdoor lighting; and (5) retrofitting of street lights with more efficient ones. Taken together, Wewak and Maprik represent PPL's third largest diesel fuel using locale, after Port Moresby and Lae. Unlike Port Moresby and Lae, which also use hydropower and natural gas generated power, Wewak and Maprik both operate exclusively on diesel generated power. As such, they are major financial loss centers for PPL. Energy efficiency initiatives will reduce financial losses from diesel consumption.

Investment cost: Exact investment levels for specific retrofit projects will be determined after energy audits are conducted. At present, a total investment of USD 400,000 in PPL co-financing is expected to be allocated to the ESCO fund, which will provide loan-like money for retrofit projects that will be paid back by customers through energy savings. Initially, allocations from the fund will serve mainly Wewak and Maprik, before being extended to other locations. As the retrofit investments from the fund will be paid back, the fund can be considered a revolving one, so that total investments facilitated could be well over the USD 400,000 fund size.

Benefits: The main benefits as compared to business-as usual will be reduction in GHG emissions, reductions in financial losses to PPL, and decrease in power costs for end users, including businesses, institutions, and households. In addition, local air quality will be better than in the business-as-usual case in which more diesel fuel is burned.

Economics: Investments in energy efficiency retrofits often have an attractive payback period, after which they bring ongoing financial benefits to the involved parties. PNG is likely to have much "low hanging fruit" in energy efficiency (potential retrofits with short payback periods of a few years or less), as energy efficiency is a new area from PNG. PPL has demonstrated a building lighting project that had a payback of just three months and, with payback now achieved, is achieving substantial monthly savings. The energy efficiency retrofits to be carried out by the township energy efficiency programs are expected to provide paybacks of three years at most and generally less. After the payback period is over, companies' bottom lines will benefit from reduced power bills.

GHG emission reductions: Expected direct GHG emission reductions from the demos in Wewak over a period of 20 years are 64,989.5 tons CO_2. Assuming the Wewak Township EE Program is replicated with similar scale three times after project close but due directly to project support in design and other areas, the associated direct post project emission reduction over the 20-year lifetime of equipment installed under these three replication programs will total about 194,696 tons CO_2. This yields a grand total of about 259,686 tons CO2 emission reduction due to the direct influence of the project.

3.2 Maprik Township Energy Efficiency Demo

Location: Maprik, East Sepik Province. (Note: Maprik is a district center that is seeing strong growth due to its status of the main trading center in its area.)

Description of demo: The same as indicated above for Wewak township energy efficiency demo, except that there will not be an industrial energy audit and industrial energy efficiency retrofit included in the Maprik program.

Investment cost: The same as indicated above for Wewak township energy efficiency demo.

Benefits: The same as indicated above for Wewak township energy efficiency demo.

Economics: The same as indicated above for Wewak township energy efficiency demo.

GHG emission reductions: Expected direct GHG emission reductions from the demos in Maprik over a period of 20 years are 21,436.6 tons CO_2. Assuming the Maprik Township EE Program is replicated with similar scale three times after project close but due directly to project support in design and other areas, the associated direct post project emission reduction over the 20-year lifetime of equipment installed under these three replication programs will total about 64,309.8 tons CO_2. This yields a grand total of about 85,746.4 tons CO_2 emission reduction due to the direct influence of the project.

Annex 2. GHG Emission Reductions

This annex provides the methodology for and results of calculating the GHG emission reductions ("GHG ERs" or, simply, "ERs") expected to result from the FREAGER Project. ER estimates required for GEF projects may be divided into a number of categories, each of which is described below, with context from the FREAGER Project added when relevant.

1. Direct GHG emission reductions (DERs): Direct GHG ERs are ERs resulting directly from investments of the project (both GEF financing and co-financing). Direct ERs are calculated for the lifetime of the installed equipment. For indicators in the project results framework (which requires results at the time of project close), a subset of total direct ERs, "direct ERs during project," are also calculated. For FREAGER, the project demos are the source of direct ERs. They include:

- Miruma 200 kW new mini-hydro station, Eastern Highlands Province (EHP)
- Gotomi 200 kW new mini-hydro station, Eastern Highlands Province (EHP)
- Samarai Island 51 kW new solar PV mini-grid, Milne Bay Province (MBP)
- Wewak Township Energy Efficiency Program, East Sepik Province (ESP)
- Maprik Township Energy Efficiency Program, East Sepik Province (ESP)

Each of these demos are briefly described in in Annex 1. More detailed information about the demos is available in a separate document, *FREAGER Project Demos – Background and Details*. Calculations for all five of the demos' ERs are provided in this annex. ERs are first presented on a demo-by-demo basis and then aggregated.

2. Direct Post Project GHG Emission Reductions ("DPPERs"): DPPERs are defined as those GHG ERs that result from the direct support of project activities, but that occur after project close. In the case of FREAGER, in addition to support for the project demos, which will result in DERs, the provinces will receive extensive support in capacity building for and designing of pipeline projects. It is expected that this support will result in direct replication of the project demos shortly following project close. Project activities supporting the design of additional RE mini-grid projects (beyond the project demos) is estimated to have a four times replication effect, thus resulting in eight mini-hydro stations and four PV mini-grids installed after project close. Project activities supporting the design of additional township EE programs (beyond the project demos) is estimated to have a three times replication effect, thus resulting in three township EE programs initiated after project close. DPP ERs are calculated based on the number of direct replications and include ERs achieved for the full lifetime of the equipment installed.

3. Consequential GHG Emission Reductions – Bottom-up Approach: Consequential ERs (CERs) are those resulting from *indirect* replications that are stimulated by the project, its demos, and its directly supported replications. Replications generating CERs are those that do not receive any direct support from the project, either as TA or investment, and thus may be called "indirect replications." So, unlike those replications associated with DPP ERs, these indirect replications are those that have not received direct project support, such as in the planning and design of the installations. There are two approaches for calculating the CERs, the "bottom-up approach" and the "top-down approach." In both cases, installations occurring in the ten years after project close are considered. The bottom-up approach uses a simple replication factor (RF) deemed feasible by the project team to estimate CERs. In the case of FREAGER, an indirect replication factor of three is used, which is a typical conservative RF used for GEF projects.

4. Consequential GHG Emission Reductions – Top-down Approach: Top-down consequential ERs are those estimated based on a macro approach that begins with the overall market or overall emission reductions in the country and then breaks this down into the share for which the project may be deemed responsible. The period of influence for which top-down emission reductions are calculated is the ten years following project close. In the case of FREAGER, historical data on CO_2 emission from electricity generation is used as a baseline from which to estimate overall emission reductions.[22] The future trend of CO_2 emissions in PNG is then estimated for each of a business-as-usual (BAU) scenario and an alternative scenario, respectively. The BAU trend used is a continuation of historical growth rates. The selected alternative scenario used is based on PNG's national circumstances as reported in its *Intended Nationally Determined Contribution* (INDC) report and its two *National Communications* reports. Total emission reductions are the difference in GHG emissions from the electricity sector for these two scenarios over the ten years after project close. The share due to the project is then estimated in two steps. First, the share due to mini-hydro, PV mini-grid, and township EE is estimated. Second, a causality factor (CF), which estimates the role of the project in the growing ERs from these three specific areas, is applied.

1. Miruma (EHP) 200 kW Mini-Hydro GHG ERs

Exhibit 1 shows method used, parameters assumed, and estimates for direct ERs (DERs), direct post-project ERs (DPPERs), and bottom-up consequential ERs (BUCERs) for the Miruma (EHP) 200 kW min-hydro demo. Aside from a few private diesel generators, Miruma does not currently have power. The new mini-hydro power, however, is assumed to avoid diesel power generation that would be the most probable future power source for Miruma in the absence of the mini-hydro station. Exhibit 2 summarizes key results from Exhibit 1 (and also brings in the top down consequential ER estimate from sub-section 6) in order to facilitate later collation among all demos in Section 7 of this annex. A replication factor of four is assumed to estimate the DPPERs, because of the project's very focused support for replication of the mini-hydro demos via development of pipeline projects by provincial and district policy makers (in three different capacity building programs), via support for developing a loan fund financing mechanism for community RE mini-grids, and via support for provincial planning of RE.

[22] The historical trend on which the business-as-usual scenario is based is taken from World Bank online databank, accessed in December 2016 at http://data.worldbank.org/country/papua-new-guinea .

Exhibit 1: GHG Emission Reductions Due to Miruma (EHP) Mini-Hydro Mini-Grid, Four Direct Replications, and Indirect Replications – Parameters and Calculations

Item reducing GHG emissions	Average kW hours/day	Liters of DFO avoided/year	Years	Emissions reduction, tons CO_2
Direct ERs (DER) during project	2,834	310,323	2	1,663.3
Direct ERs during life of station[23]	2,834	310,323	40	33,266.6
Direct Post Project ERs (DPPERs)	2,834 x 4	1,241,292	40	133,066.5
DERs + DPPERs (lifetime)	--	---	--	*166,333.1*
Bottom-up CERs (=DERs + DPPERs) x3	--	---	---	498,999.3
Total ERs = (DERs + DPPERS) + BUCERS	---	---	---	*665,332.4*

NOTES:
Specific Fuel Consumption of equivalent Diesel Power Generator = 0.3 lit DFO/kWh
DFO emission factor = 2.68 kg CO2/lit
Emission reduction (ton CO2) = [DFO emission factor (kg CO2/lit) * Useful life (yr) * DFO avoided (lit/yr)]/1000 (kg/ton)
Replication: 4x direct replication assumed, 3x indirect replication assumed.

Exhibit 2. Summary of Miruma (EHP) Mini-Hydro Demo's ERs and Direct and Indirect Replication ERs (tons CO_2)

Direct ERs	During Project	After Project	During and After Project
Direct ERs	1,663.3	31,603.3	33,266.6
DPP ERs	0	133,066.5	133,066.5
Bottom-Up Consequential ERs	0	498,999.3	498,999.3
Top-Down Consequential ERs*	0	479,304.0	479,304.0

*Calculations for top-down presented in section 6 of this annex

2. Gotomi (EHP) 200 kW Mini-Hydro GHG ERs

Exhibit 3 shows method used, parameters assumed, and estimates for direct ERs (DERs), direct post-project ERs (DPPERs), and bottom-up consequential ERs (BUCERs) for the Gotomi (EHP) 200 kW min-hydro demo. Power from Gotomi's new mini-hydro station is assumed to allow avoidance of future adoption of diesel generators, the most likely future power source in the absence of the mini-hydro station. Given the very limited amount of power coming from the grid to Gotomi, the new power generated is not considered to replace grid-based hydropower, but to be in addition to that power and thus replacing diesel that may have in the future been added. Exhibit 4 summarizes the key estimates from Exhibit 3 (and brings in the top-down estimate from Section 6) to facilitate later collation among all demos in Section 7 of this annex. A direct replication factor of four is assumed to estimate the DPPERs, because of the project's very focused support for replication of the mini-hydro demos via development of pipeline projects by provincial and district policy makers (in three different capacity building

[23]This is the "lifetime DER." System lifetimes of 40 to 50 years are commonly projected for micro/ mini-hydro systems that are well-maintained. Because the turbine is now a relatively small proportion of costs as compared to the civil works and electrical works, which make up the bulk of system costs, we base the lifetime on that of the civil and electrical works, with allowance for perhaps one dredging event during the lifetime. Thus, a lifetime of 40 years is selected. It is recognized that poor quality or poorly design systems, systems that lack maintenance and dredging, and/or a lack of capacity among local people to operate and repair systems can lead to low sustainability and much shorter lifetimes. Yet, it is the aim of the project to ensure what is needed (high quality design and systems, ongoing maintenance and dredging as needed, and capacity among local people to operate and repair systems) to achieve a lifetime of 40 years, as compared to lifetime ranges of 40 to 50 years as found in the literature, is available.

programs), via support for developing a loan fund financing mechanism for community RE mini-grids, and via support for provincial planning of RE.

Exhibit 3: GHG Emission Reductions Due to Gotomi (EHP) Mini-Hydro Mini-Grid, Four Direct Replications, and Indirect Replications – Parameters and Calculations

Item reducing GHG emissions	Average kWh/year	Liters DFO avoided/year	Years	Emissions reduction, tons CO_2
Direct ER (DER) during project	2,834	310,323	2	1,663.3
Direct ER during life of station	2,834	310,323	40	33,266.6
Direct Post Project ERs (DPPERs)	2,834 x 4	1,241,292	40	133,066.5
DERs + DPPERs (lifetime)	--	---	--	*166,333.1*
Bottom-up CERs (=DERs + DPPERs) x3	--	---	---	498,999.3
Total ERs = (DERs + DPPERS) + BUCERS	---	---	---	*665,332.4*

NOTES:
Specific Fuel Consumption of equivalent Diesel Power Generator = 0.3 lit DFO/kWh
DFO emission factor = 2.68 kg CO2/lit
Emission reduction (ton CO2) = [DFO emission factor (kg CO2/lit) * Useful life (yr) * DFO avoided (lit/yr)]/1000 (kg/ton)
Replication: 4x direct replication assumed, 3x indirect replication assumed.

Exhibit 4. Summary of Gotomi (EHP) Mini-Hydro Demo's Direct ERs and Direct and Indirect Replication ERs (tons CO2)

Scope of ERs	During Project	After Project	During and After Project
Direct ERs	1,663.3	31,603.3	33,266.6
DPPERs	0	133,066.5	133,066.5
Bottom-Up Consequential ERs	0	498,999.3	498,999.3
Top-Down Consequential ERs	0	479,304.0	479,304.0

*Calculations for top-down presented in section 7 of this annex

3. Samarai Island (MBP) 50 kW Solar PV Mini-Grid GHG ERs

Exhibit 5 shows method used, parameters assumed, and estimates for direct ERs (DERs), direct post-project ERs (DPPERs), and bottom-up consequential ERs (BUCERs) for the Samarai Island (MBP) 50.1 kW min-hydro demo. As Samarai currently has diesel generation, the PV mini-grid (which has a battery system) is assumed to fully replace diesel generation at its current level of diesel consumption. Exhibit 6 summarizes the key estimates from Exhibit 5 (and brings in the top-down estimate from Section 6) to facilitate later collation among all demos in Section 7 of this annex. A replication factor of four is assumed to estimate the DPPERs, because of the project's very focused support for replication of the PV mini-grid demos via development of pipeline projects by provincial and district policy makers (in two different capacity building programs), via support for developing a loan fund financing mechanism for community RE mini-grids, and via support for provincial planning of RE.

Exhibit 5: GHG Emission Reductions Due to Samarai PV Mini-Grid, Four Direct Replications, and Indirect Replications: Parameters and Calculations

Item reducing GHG emissions	Liters DFO replaced/day	Liters DFO replaced/year	Years	Emissions reduction, tons CO_2
Direct ER (DER) during project	205	74,825	3	601.6
Direct ER during life of station	205	74,825	20	4,010.6
Direct Post Project ERs (DPPERs)	4 x 205	4 x 74,825	20	16,042.5
DERs + DPPERs (lifetime)	---	---	---	20,053.1
Bottom-up CERs (=DERs + DPPERs) x3	---	---	---	60,159.3
Total ERs = (DERs + DPPERS) + BUCERS	---	---	---	*80,212.4*

NOTES:
DFO emission factor = 2.68 kg CO2/lit
Emission reduction (ton CO2) = [DFO emission factor (kg CO2/lit) * Useful life (yr) * DFO avoided (lit/yr)]/1000 (kg/ton)
Replication: 4x direct replication assumed, 3x indirect replication assumed.

Exhibit 6. Summary of Samarai Island (MBP) PV Mini-Grid Demo's Direct ERs and Direct and Indirect Replication ERs (tons CO_2)

Scope of ERs	During Project	After Project	During and After Project
Direct ERs	601.6	3,409.0	4,010.6
DPP ERs	0	16,042.5	16,042.5
Bottom-Up Consequential ERs	0	60,159.3	60,159.3
Top-Down Consequential ERs*	0	255,628.79	255,628.79

*Calculations for top-down presented in Section 6 of this annex

4. Wewak (ESP) Township EE Program GHG ERs

Exhibit 7 shows method used, parameters assumed, and estimates for direct ERs (DERs), direct post-project ERs (DPPERs), and bottom-up consequential ERs (BUCERs) for the Wewak Township EE Program Demo. The approach for the DERs is based on the expected reductions in energy consumption for various main users and main use areas as a result of the demo. Estimates are based on estimated reductions in power consumption only. All reductions in power consumption lead to reductions in diesel power generation, as Wewak is powered by diesel generators alone. While there may be some reductions in direct use of burning of diesel (for heat applications), due to lack of information at this time on which initiatives will be identified during the energy audits, these are not included in GHG emission reduction estimates. Yet, it is expected that the majority of GHG emission reductions in the Wewak demo will be due to reduction in diesel generated power consumption. Direct replication after the project, but due to project activities (such as planning and program design) is estimated at three times. Exhibit 8 summarizes the key estimates for Wewak (and brings in the top-down estimate from Section 6) to facilitate later collation among all demos in Section 6 of this annex.

Exhibit 7: Estimates of Reductions in Energy Use and GHG Emissions to be achieved through Wewak Energy Efficiency Demonstration: Parameters and Calculations

User	Reduction in maximum load (kW)*	kWh per year reduction†	Liters of diesel avoided ††	Emissions reduction (tons of CO_2)
1. PNG Defense	162.0	799,920	5,279,472	14,149.0
2. Water PNG, Ltd.	111.3	549,148	3,624,374	9,713.3
3. Tang Mow (1960), Ltd.	90.9	448,081	2,957,336	7,925.7
4. St. Benedict Teacher College	81.3	401,616	2,650,666	7,103.8
5. General Hospital	58.8	290,779	1,919,143	5,143.3
6. Wewak Hotel	36.0‡	178,364‡	1,177,202	3,154.9
7. Papindo Trading, Ltd.	30.9	153,108	1,010,513	2,708.2
8. Wewak Bakery	29.1	143,770	948,879	2,543.0
9. Ela Motors	18.3	90,133	594,879	1,594.3
10. Digicel (PNG), Ltd.	18.0	88,546	584,401	1,566.2
South Sea Tuna	150.0	525,600	3,468,960	9,296.8
Total	**750.6**	**3,669,065**	**24,215,825**	**64,898.5**

Direct ERs during project: 9,734.8 tons CO_2 (takes total reductions of 64,898.5 tons over 20 years, assumes retrofits are completed at end of project's year 1, so that they are in place for 3 years during project)
Total Direct ERs: 64,898.5 tons CO_2 (based on total reductions indicated in table)
Direct Post-Project ERs (DPPERs): 194,695.5 tons CO_2 (assumes replication in three other centers of similar scale; calculation: 64,898.5 x 3
DERs + DPPERs (lifetime) = 259,594.0 tons CO_2
Bottom-Up Consequential ERs: 778,782.0 tons CO_2: Estimated by (DERs + DPPERS) x 3
Top-Down Consequential ERs: 2,396,519.9 tons CO_2: Based on calculations in section 6 of this annex. For the total top down consequential ERs for the township EE demos, 75% is attributed to Wewak and 25% to Maprik, based on each township's respective share of DERs for the township programs.

NOTES:
Useful life of installed EE system equipment = 20 years
Replication Factors: Direct Replication = 3x, Indirect Replication = 3x
Specific Fuel Consumption of equivalent Diesel Power Generator = 0.3 lit DFO/kWh
DFO emission factor = 2.68 kg CO2/lit
Emission reduction (ton CO2) = [DFO emission factor (kg CO2/lit) * Useful life (yr) * DFO avoided (lit/yr)]/1000 (kg/ton)
*Estimates of reduction in maximum load based on maximum load estimates provided in FREAGER's *Project Demos – Background and Details*, Annex 1-East Sepik Province Section, prepared as part of PPG work.
†For top ten users of PPL Wewak power, a reduction of 30 percent in annual power consumption via energy efficiency retrofit measures is targeted. For South Sea Tuna, a reduction in 10 percent of annual power consumption is targeted. Also, as data on annual consumption is not available for South Sea Tuna, consumption is estimated based on 0.66 load factor, as compared to maximum load. Also, as the liters of diesel used per kWh for South Sea Tuna is unavailable, the factor of 0.33 (based on data from Wewak PPL grid) is also used for South Sea Tuna
‡Due to lack of data on monthly power consumption of Wewak Hotel, computation of its kWh per year is based on the ratio of annual power bill to monthly average power use for user with most similar bill to Wewak Hotel. Similarly, due to lack of data on maximum load for Wewak Hotel and therefore of targeted 30 percent of that load for reduction, ratio of reduction in annual kWh to maximum kW for user with nearest level of consumption to Wewak Hotel is used.
††Method of calculation of liters of diesel consumed: In Wewak, the number of liters consumed per kWh is 0.33. This is computed based on PPL Wewak's 2015 fuel use of 4,876,914 liters to generate 14,816,807 kWh. So, to get liters of diesel

avoided, kWh per year reduced is multiplied by 0.33 liters per kWh and multiplied by 20 years for the period that the retrofit (or its similar replacement) is expected to be in service.

Exhibit 9. Summary of Wewak (ESP) EE Demo's Direct ERs and Direct and Indirect Replication ERs (tons CO_2)

Scope of ERs	During Project	After Project	During and After Project
Direct ERs	9,734.8	55,163.7	64,898.5
DPP ER	0	194,695.5	194,695.5
Bottom-Up Consequential ERs	0	778,782.0	778,782.0
Top-Down Consequential ERs*	0	2,396,519.9	2,396,519.9

*Calculations for top-down presented in Section 6 of this annex. Based on share in direct ERs among the township demos, 75 percent of the township top-down consequential ERs are attributed to Wewak and the other 25 percent to Maprik.

5. Maprik Township EE Program, ESP, GHG ERs

Exhibit 9 shows method used, parameters assumed, and estimates for direct ERs (DERs), direct post-project ERs (DPPERs), and bottom-up consequential ERs (BUCERs) for the Maprik Township EE Program Demo. The approach for estimating direct ERs is based on expected reductions in energy consumption by various main users and main use areas as a result of the demo. All reductions in power consumption lead to reductions in diesel power generation, as Maprik is powered by diesel generators alone. Exhibit 10 summarizes the key estimates in Exhibit 9 to facilitate later collation among all demos in Section 7 of this annex.

Exhibit 9. Estimates of Reductions in Energy Use and in GHG Emissions to be achieved through Maprik Energy Efficiency Demonstration: Parameters and Calculations

User	*Reduction in maximum load (kW)†	kWh per year reduction†	Liters of diesel avoided ††	Emissions reduction (tons of CO_2)
Top users at present				
1. Papindo Trading	12.3	60,012	480,096	1,286.7
2. Maprik High School	12.0	58,776	470,208	1,260.2
3. Noko No Pty., Ltd.	8.4	40,938	327,504	877.7
4. Mr. Eki Wallangas	6.3	31,279	250,232	670.6
5. Dept. of Police	3.9	23,638	189,104	506.8
Other major uses				
6. Residential	5.0	24,874	198,992	533.3
7. Street lights	3.2	14,016	112,128	300.5
Major new users expected				
8. Maprik Hospital	120	420,480	3,363,840	9,015.1
9. New Papindo	75	262,800	2,102,400	5,634.4
10. Maprik Airport	18	63,072	504,576	1,352.3
11. New Resource Center	1.5	5,256	42,048	1,12.7
Total	**265.6**	**1,005,141**	**8,041,128**	**21,436.6**

Direct ERs during project: 3,215.5 tons CO_2 (takes total reductions of 21,436.6 tons over 20 years,

assumes retrofits are completed at end of project's year 1, so that they are in place for 3 years during project)
Total Direct ERs: 21,436.6 tons CO_2 (based on total reductions indicated in table)
Direct Post-Project ERs: 64,309.8 tons CO_2: Based on 3x direct replication of project demos (= 3 x 21,436.6 tons)
DERs + DPPERs: 85,746.4 tons CO_2 (= 21,436.6 tons +64,309.8 tons)
Bottom up Consequential ERs: 257,239.2 tons CO_2: Based on 3x indirect replication of DERs plus DPPERs = 3 x 85,746.5 tons
Top Down Consequential ERs: 798,840.0 tons CO_2: Based on calculations in section 7 of this annex. For the total top down consequential ERs for the township EE demos, 25% is attributed to Maprik and 75% to Wewak, based on each townships respective share of direct ERs for the township programs.

NOTES:
Useful life of installed EE system equipment = 20 years
Replication Factors: Direct replication = 3x; Indirect replication = 3x
Specific Fuel Consumption of equivalent Diesel Power Generator = 0.3 lit DFO/kWh
DFO emission factor = 2.68 kg CO2/lit
Emission reduction (ton CO2) = [DFO emission factor (kg CO2/lit) * Useful life (yr) * DFO avoided (lit/yr)]/1000 (kg/ton)
*Estimates of reduction in maximum load based on maximum load estimates provided in FREAGER's Project Demos – Background and Details, Annex 1-East Sepik Province Section, prepared as part of PPG work.
†For top five users of PPL Maprik power, a reduction of 30 percent for both maximum load and annual power consumption via energy efficiency retrofit measures is targeted. For street lights, it is assumed the 50 operating lights of 96 W each are replaced by 32 W energy efficient lights and that these lights are on 12 hours per 24 hour period. For residential use, it is assumed that only ten percent of residential load and energy use is reached by the program and that a 30 percent reduction in energy consumption and maximum is achieved for these users, on average. For three of the four new, planned users, a reduction of 30 percent in maximum load and energy use from business-as-usual is targeted. For the Maprik Hospital, given that its projected maximum load is believed to be overestimated, a reduction of 20 percent (instead of 30 percent) of that load and estimated annual energy use are targeted. (For all the new users a 40 percent load factor is used with maximum load values to calculate annual power use.)
††Method of calculation of liters of diesel consumed: In Maprik, the number of liters consumed per kWh is 0.40. This is computed based on PPL Maprik's 2015 fuel use of 579,036 liters to generate 1,452,254 kWh. So, to get liters of diesel avoided, kWh per year reduced is multiplied by 0.40 liters per kWh and multiplied by 20 years for the period that the retrofit (or its similar replacement equipment) is expected to be in service.

Exhibit 10. Summary of Maprik (ESP) EE Demo's ERs Direct ERs and Direct and Indirect Replication ERs

Scope of ERs	During Project	After Project	During and After Project
Direct ERs	3,215.5	18,221.1	21,436.6
DPP ER	0	64,309.8	64,309.8
Bottom-Up Consequential ERs	0	257,239.2	257,239.2
Top-Down Consequential ERs*	0	798,840.0	798,840.0

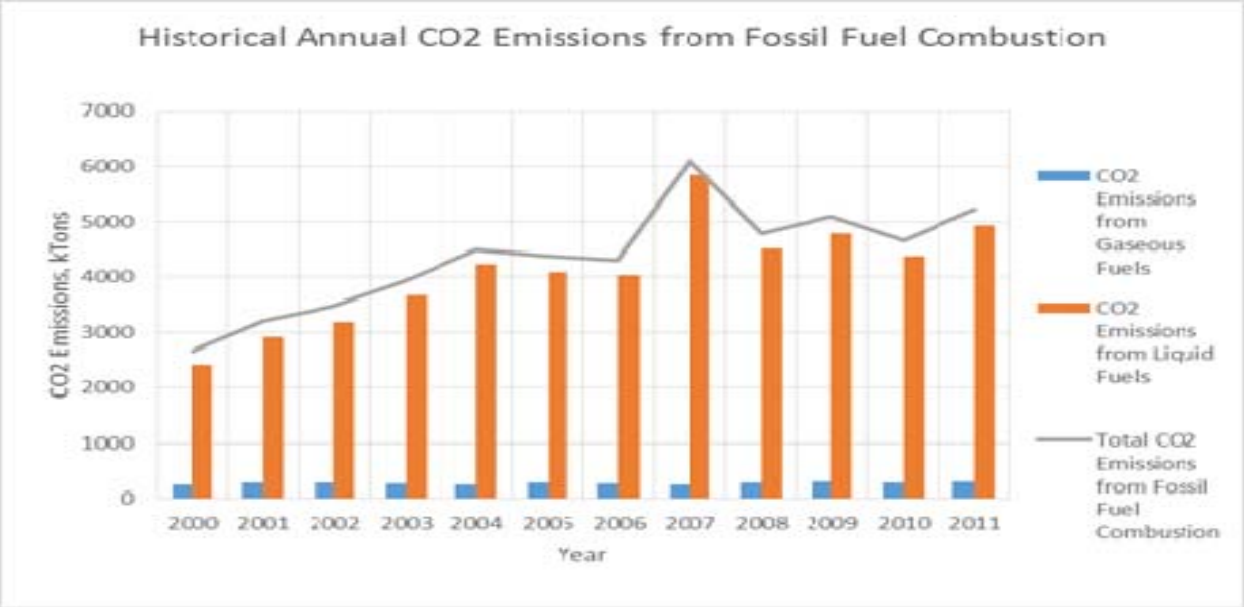
*Calculations for top-down presented in Section 7 of this annex. Based on share in direct ERs among the township demos, 75 percent of the township top-down consequential ERs are attributed to Wewak and the other 25 percent to Maprik.

6. Top-Down Consequential ERs for Each of the Demo Types

Top-down consequential ERs are based on a comparison of business-as-usual and alternative scenario estimates for future GHG emissions from PNG's power sector. The business-as-usual estimates of future emissions are based on the historical GHG emissions from PNG's power sector, with future growth assumed to be similar to recent growth rates. Exhibit 11 shows the historical trends. Exhibit 12 shows the projected trend in the business-as-usual case and in the alternative scenario. Exhibit 13 summarizes

the key data and computes the differences between baseline GHG emissions from the power sector and alternative scenario emissions, yielding overall ERs for the power sector in the alternative scenario during the ten years following project close.

Exhibit 11. Historical GHG Emissions from PNG's Power Sector



Source: World Bank Databank, accessed in December 2016.

Exhibit 12. Forecast GHG Emissions from PNG's Power Sector

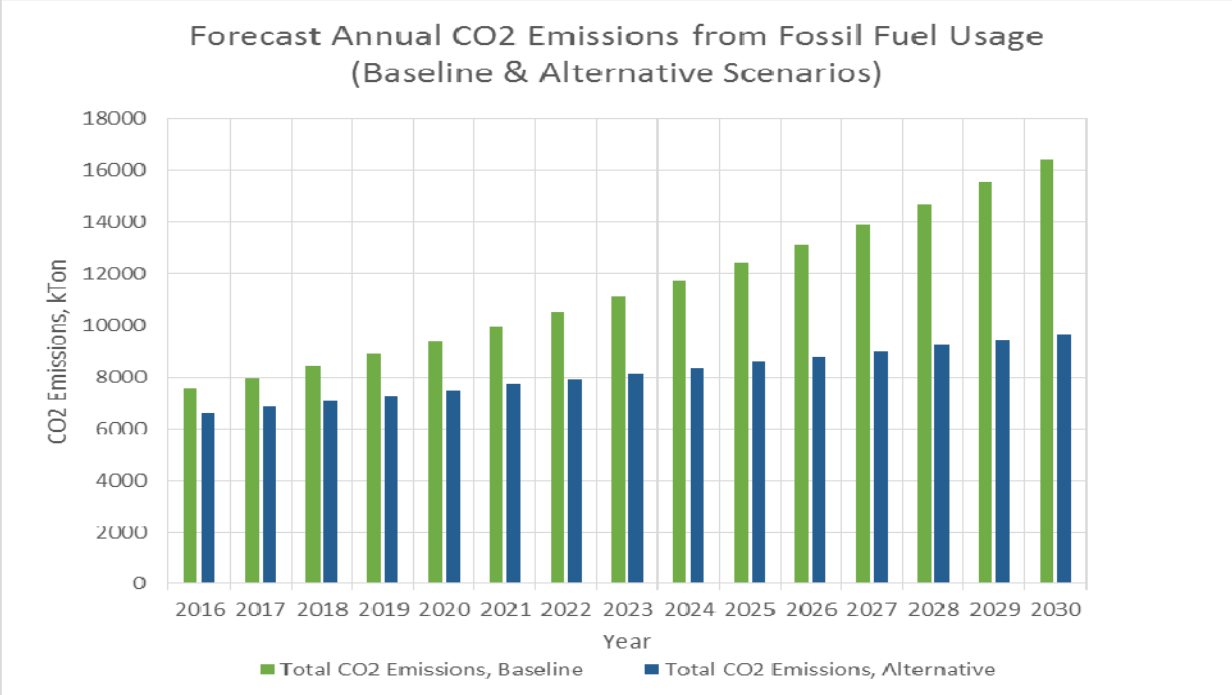


Exhibit 13. Total Emission Reductions from PNG's Power Sector in the Alternative Scenario (kton CO_2)

Year	PNG Power Sector GHG Emissions in Baseline Scenario	PNG Power Sector GHG Emissions in Alternative Scenario	Emission Reductions from PNG Power Sector in Alternative Scenario
2021	9,941.10	7,706.36	2,234.74
2022	10,508.25	7,921.88	2,586.37
2023	11,108.67	8,137.39	2,971.27
2024	11,744.31	8,352.91	3,391.40
2025	12,417.26	8,568.43	3,848.83
2026	13,129.70	8,783.95	4,345.76
2027	13,883.97	8,999.47	4,884.50
2028	14,682.51	9,214.98	5,467.52
2029	15,527.93	9,430.50	6,097.43
2030	16,422.99	9,646.02	6,776.97
Total (Influence Period)	**129,366.69**	**86,761.89**	**42,604.80**

Exhibit 14 shows the method and assumptions used for computing top-down ERs in each sub-sector represented by the project's different types of demos. The assumptions include share of the demo type in overall electricity generation and causality factor attributed to the project. A relatively high causality factor is used due to the demo types being quite new to PNG and quite extensively promoted by the project.

Exhibit 14. Computation of Top-Down ERs in Sub-Sectors Corresponding to Project's Different Types of Demos

Demo Type	Total ERs for PNG Electricity Sector 2021-2030 (tons CO2)	Assumptions	Total ER for Demo Type Sub-Sector 2021 – 2030 (tons CO2)	Causality Factor	Top-Down ERs 2021 – 2013 for Demo Type Sub-Sector (tons CO2)
Mini-hydro	42,604,800	Hydropower 30% of electricity generation in PNG; 10% of hydropower generation is mini/ micro-hydro	1,278,144	0.75	958,608
PV Mini-Grid	42,604,800	Non-hydro RE power generation is 8% of power generation and 10% of non-hydro generation if from PV mini-grids	340,838	0.75	255,629
Township EE	42,604,800	10% of ERs are due to township EE	4,260,480	0.75	3,195,360
Total	**42,605,800**	**---**	**5,879,462**	**0.75**	**4,409,597**

7. Total Project ERs

Total project direct ERs, DPPERs, bottom up consequential ERs, and top down consequential ERs during and after the project are given in Exhibit 15. To summarize assumptions: The PV mini-grid and township EE programs are assumed to being operation at the beginning of the second year of the project, while the two mini-hydro mini-grids begin operation at the beginning of the project's third year. Activities during the project, in areas such as RE mini-grid project design and township EE program design, are expected to stimulate direct replication post project. That direct replication is assumed to be four times for the RE mini-grids and three times for the township EE programs. Mini-hydro stations are assumed to have a lifetime of 40 years; the PV system is assumed to have a lifetime of 20 years; and the EE retrofits are assumed to have a lifetime of 20 years (or at least to be continued with replacements having the same level of efficiency over that period). Further, indirect replication in the bottom up scenario is assumed to be three times the sum of direct and direct post-project installations for all demo types and is assumed to occur in within the ten years following the project. Top down estimates are based on overall estimates of GHG emission reductions in PNG in the alternative scenario and the role of mini-hydro, PV, and township EE programs, respectively, in that reduction, multiplied by a causality factor. The causality factor, at 0.75, is relatively high, due to the newness of these demo types in PNG and the extensive promotion of them that FREAGER will carry out.

Exhibit 15. FREAGER ERs (Aggregating all Five Demos, in tons CO_2)

Scope of ERs	During Project	After Project	During and After Project
Direct ERs (DERs)	16,878.5	140,000.4	156,878.9
Direct Post Project ERs (DPPERs)	0	541,180.80	541,180.80
DERs + DPPERs (Sub-Total)	*0*	*698,059.7*	*698,059.7*
Bottom-Up Consequential ERs (BUCERs)	0	2,094,179.10	2,094,179.10
Top-Down Consequential ERs (TDCERs)	0	4,409,596.69	4,409,596.69
Range of ERs (DERs + DPPERs) + (BUCERs OR TDCERs)	**16,878.5**	**2,792,238.8 to 5,107,656.3**	**2,792,238.8 to 5,107,656.3**

Annex 3. Multi Year Work Plan

Outcomes/Outputs/Activities	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 1. Rigorous implementation and enforcement of approved national and provincial energy policies, plans, and standards to promote the application of renewable energy and energy efficiency technologies.																
Output 1.1. Completed government capacity building programs for the design and development of RE and EE technology projects. Five capacity building programs (each consisting of a series of three workshops) will be carried out, two in Port Moresby and three in partner provinces. Attendees, including national, provincial, and district level officials, will, via homework assignments, prepare RE mini-grid projects and township EE programs. Each government capacity building program will have a target of 40 percent of the trainees being women.																
Activity.1.1.1 Organization and conduct of a series of three progressive training workshops for national and provincial development planning officials on the planning and development of community micro/mini-hydro and solar PV mini-grids.																
Activity1.1.2. Organization and conduct of a series of three progressive training workshops for national and provincial development planning officials and PPL staff on the planning and development of township-wide EE programs.																
Activity 1.1.3. Organization and conduct of a series of three progressive workshops in Milne Bay Province (MBP) for MBP district and provincial development planning officials on the planning and development of community solar PV mini-grid projects.																
Activity1.1.4. Organization and conduct of a series of three progressive workshops in Eastern Highlands Province (EHP) for EHP district and provincial development planning officials on the planning and development of community micro/mini-hydro projects.																
Activity1.1.5. Organization and conduct of a series of three progressive workshops in Morobe Province for Morobe district and provincial development planning officials and for Evangelical Lutheran Church (ELC) development officials on the planning and development of community micro/mini-hydro projects.																
Output 1.2. Approved national-level policies or regulations that promote RE and EE. Approved policies will include tariff elimination for RE and EE equipment, ICCC policies for licensing of and billing by community RE mini-grids, and other incentive policies, as identified by gap analysis, to promote community RE mini-grids and building and industrial EE in PNG.																

Activity 1.2.1. Design and promotion of regulations that eliminate import tariffs on key types of renewable energy and energy efficiency equipment.																	
Activity 1.2.2. Design of policies for ICCC for promoting and supporting community-based renewable energy mini-grids.																	
Activity 1.2.3. Support of Department of Lands and Physical Planning in designing policies that promote community-based renewable energy mini-grids																	
Activity 1.2.4. Conduct of policy gap analysis and preparing of relevant proposed policies to promote RE in PNG.																	
Activity 1.2.5. Conducting of policy gap analysis and preparing of relevant proposed policies to promote EE in PNG.																	
Output 1.3. National-level RE and EE roadmaps, with proposed funding allocations for projects, submitted, approved, and implemented. The roadmaps will focus on community RE mini-grids and township EE programs, respectively, and indicate funding sources.																	
Activity 1.3.1. Design and promotion of a national-level energy roadmap for community-based RE power systems.																	
Activity 1.3.2. Design and promotion of a national-level energy roadmap for township EE programs.																	
Output 1.4. Formulated, adopted, and effectively enforced standards to promote adoption of RE and EE. Standards will include building energy efficiency standards, product energy efficiency standards, and standards for RE equipment at the national level and, for EE, in one pilot province. Enforcement support will include certification and labelling programs.																	
Activity 1.4.1. Refinement of national building energy efficiency standards, facilitation of their adoption into the national building code, and facilitation of their enforcement.																	
Activity 1.4.2. Design of and facilitation of enforcement of building energy efficiency standards for East Sepik Province's provincial building code.																	
Activity 1.4.3. Formulation (as needed), refinement, and facilitation of the adoption and enforcement of national energy efficiency standards for key types of equipment.																	
Activity 1.4.4. Design and facilitation of enforcement of provincial energy efficiency standards in East Sepik Province for key types of equipment.																	

Activity 1.4.5. Formulation (as needed), refinement, and facilitation of the adoption and enforcement of national standards for key types of renewable energy equipment used in community mini-grid systems.																		
Output 1.5. Formulated, approved, and implemented effective institutional plans for promoting RE and EE, detailing responsibilities of relevant agencies and coordinating mechanisms among them. The output will include a multi-agency coordination plan, the focus of which will be RE mini-grids and township EE. The output will also include an EE Department institutional plan for PPL. Plans will include measures for ensuring the equitable involvement of women in developing RE and EE.																		
Activity 1.5.1. Design of an institutional plan for PPL to strengthen its capabilities in supporting its customers to implement energy efficiency initiatives.																		
Activity 1.5.2. Design of plan for relevant national level organizations to cooperate in promoting community-based RE power systems and township EE programs.																		
Output 1.6. Detailed adopted provincial plans for promoting RE and EE in townships (provincial and district centers) and villages, including specific pipeline projects that will replicate the project demos. The output will include an RE and EE plan for each of the project's four partner province; and an RE plan for the Evangelical Lutheran Church (ELC). RE plans will focus on RE mini-grids; and EE plans will focus on comprehensive township EE programs.																		
Activity 1.6.1. Design and promotion of Milne Bay Province RE and EE plan																		
Activity 1.6.2. Design and promotion of Eastern Highlands Province RE and EE plan.																		
Activity 1.6.3. Design and promotion of East Sepik Province RE and EE plan.																		
Activity 1.6.4. Design and promotion of Morobe Province RE and EE plan.																		
Activity 1.6.5. Design and promotion of ELC PNG-wide RE Plan.																		
Component 2: Renewable Energy and Energy Efficiency Technologies Applications (Commercial and Technical Viability, including Project Demos)																		
Outcome 2A: Enhanced technical-commercial viability and capacity in the application of energy efficiency technologies and development of feasible RE-based energy systems in the country.																		
Output 2A.1. Completed capacity building program for technical personnel in the private and public sectors on the detailed technical preparation and implementation of community-based RE mini-grids and township EE programs. The program will include separate workshops on each of solar PV mini-grids, micro/mini-hydro mini-grids, building energy audits and retrofits, and industrial energy audits and retrofits. The technical capacity building program will have a target of 40 percent of the trainees being women at each of its two workshops.																		

Activity 2A.1.1. Organization and conduct of workshop for selected technical personnel on costing, sourcing, and technical aspects of preparing and implementing solar PV mini-grid projects.																	
Activity 2A.1.2. Organization and conduct of workshop for selected technical personnel on costing, sourcing, and technical aspects of preparing and implementing micro/ mini-hydro mini-grid projects.																	
Activity 2A.1.3. Organization and conduct of workshop for selected technical personnel on building energy audits and building energy efficiency retrofits, including costing, sourcing, and technical aspects of preparing and implementing the retrofits.																	
Activity 2A.1.4. Organization and conduct of workshop for selected technical personnel on industrial energy audits and industrial energy efficiency retrofits, including costing, sourcing, and technical aspects of preparing and implementing the retrofits																	
Output 2A.2: Well-researched and verified sourcing information on RE and EE products, including brands/ specifications, sourcing channels, and prices. Information provided will cover low-cost, high quality products needed for PV mini-grids, micro/ mini-hydro mini-grids, and various EE retrofits.																	
Activity 2A.2.1: Research, verification, and documentation of low-cost, high-quality products needed to construct solar PV mini-grids in PNG.																	
Activity 2A.2.2: Research, verification, and documentation of low-cost, high-quality products needed to construct micro/ mini-hydro mini-grids in PNG.																	
Activity 2A.2.3: Research, verification, and documentation of low-cost, high-quality products needed for building energy efficiency improvements in PNG.																	
Output 2A.3. Detailed information on "honest," best possible costing of community RE mini-grid projects. Costing will encompass feasibility study, civil works, electrical works, and construction services. "Honest" is defined as without excessive profits and providing the services at a level of quality that ensures smooth operation and long lifetime of installed systems.																	
Activity 2A.3.1. Research, verification, and documentation on "honest," best possible costing of micro and mini-hydro projects in PNG																	
Activity 2A.3.2. Research, verification, and documentation on "honest," best possible costing of PV mini-grid projects in PNG.																	

	Output 2A.4. Designed and trialed training program for developing capacity in O&M for RE mini-grid projects among local people and local officials in project areas, including certification program. This output will cover O&M of both solar PV mini-grids and micro/ mini-hydro mini-grids. It will include a curriculum for each that can be used on an ongoing basis, as well as a proven track record of the micro/ mini-hydro O&M program via trialing at two sites. The pilot O&M training program will have a target of 40 percent of trainees being women.																
Activity 2A.4.1. Preparation of training curriculum for O&M of micro/mini-hydro mini-grid systems.																	
Activity 2A.4.2. Provision of mini-hydro O&M training to individuals associated with Gatop Mini-Hydro Station and Kabwum (District-owned) Mini-Hydro in Morobe Province																	
Activity 2A.4.3. Preparation of training curriculum for O&M of PV mini-grid projects.																	
	Output 2A.5: Proven system for power purchase agreements (PPAs) between PPL and independent power providers (IPPs) running community based RE mini-grids. This output will include a template PPA agreement and achievement of actual PPAs for two mini-hydro systems.																
Activity 2A.5.1. Preparation of template for power purchase agreement (PPA) between PPL and the owners of community-based RE mini-grids.																	
Activity 2A.5.2. Negotiation between Gatop Mini-Hydro Station, Morobe Province, and PPL of PNG's first mini-hydro mini-grid PPA with PPL																	
Activity 2A.5.3. Negotiation between Kabwum (District-Owned) Mini-Hydro Station, Morobe Province, and PPL of a mini-hydro mini-grid PPA with PPL.																	
	Output 2A.6. Adopted business plans for productive use of renewable energy that raise the incomes of local people, especially women. Plans will include business strategy, technical, and marketing support in areas that local people have identified for potential new income generating activities or improvement of existing ones. At least 50 percent of the productive applications supported will be those specific to women.																
Activity 2A.6.1. Provision of planning, technical, and marketing support to local people on Samarai Island, Milne Bay Province, to develop different ideas for the productive uses of PV mini-grid power.																	
Activity 2A.6.2. Provision of planning, technical, and marketing support to local people in Gotomi, Lufa District, Eastern Highlands Province, to develop different ideas for the productive uses of mini-hydro mini-grid power.																	
Activity 2A.6.3. Provision of planning, technical, and marketing support to local people in Ward 3 (Miruma), Upper Asaro LLG, Daulo District, Eastern Highlands Province, to develop different ideas for the productive uses of mini-hydro mini-grid power																	

	Output 2A.7. Published and disseminated information on findings from monitoring of the project RE and EE demos. This information will include experiences, data, and lessons learned from the two mini-hydro mini-grid, one PV mini-grid, and two township EE program demos.																	
Activity 2A.7.1. Monitoring and documentation of project mini-hydro demos in Gotomi and Miruma, Eastern Highlands.																		
Activity 2A.7.2. Monitoring and documentation of project solar PV mini-grid demo on Samarai Island, Milne Bay Province																		
Activity 2A.7.3. Monitoring and documentation of project township energy efficiency program demos in Wewak and Maprik, East Sepik Province.																		
Activity 2A.7.4. Monitoring and documentation of PPA, billing system, and O&M aspects of 200 kW mini-hydro station in Gatop, Tewai Siassi District, Morobe Province, with Evangelical Lutheran Church (ELC), and of 100 kW mini-hydro Kabwum District center, Morobe Province, with Kabwum District Government.																		
	Outcome 2B: Increased installed capacity of RE based power systems and implementation of viable EE technology applications in PNG.																	
	Output 2B.1. Completed successful demos of commercially viable mini-hydro systems in PNG. Output will include demo design, demo costing, and demo establishment. Successful installation and commissioning will be followed by three years of operation, for each of two systems in Eastern Highlands Province.																	
Activity 2B.1.1. Design, costing, and implementation of Gotomi Ward mini-hydro mini-grid demo in Lufa District, Eastern Highlands Province.																		
Activity 2B.1.2. Design, costing, and implementation of Miruma/Ward 3 mini-hydro mini-grid demo in Upper Asaro, Daulo District, Eastern Highlands Province. Same description as for Activity 2B.1.1.																		
	Output 2B.2. Completed successful demo of commercially viable off-grid solar PV mini-grid system in PNG. Output will include demo design, demo costing, and demo establishment. Successful installation and commissioning will be followed by three years of operation of the PV mini-grid system on Samarai Island in Milne Bay Province.																	
Activity 2B.2.1. Design, costing, and implementation of Samarai Island solar PV mini-grid in Milne Bay Province																		
	Output 2B.3. Completed successful demo of commercially viable township energy efficiency programs. The output will include energy audits and retrofits for top power users, energy efficiency advising for new large users expected to come online soon, street lighting retrofits, and a credit program for residential users to replace refrigerators and outdoor lighting. The residential credit program will ensure that at least 20 percent of the homes supported are owned by women.																	

Activity 2B.3.1. Audits, advising, retrofitting, and financing of energy efficiency measures in Wewak, East Sepik Province, with focus on largest power users.																	
Activity 2B.3.2. Audits, advising, retrofitting, and financing of energy efficiency measures in Maprik, East Sepik Province, with focus on largest power users																	
Output 2B.4. Completed demonstration of productive applications of RE mini-grid systems that raise the incomes of local people. Demonstrations will occur at two mini-hydro sites and one PV mini-grid site. Productive applications specific to women will be included and make up at least 50 percent of productive applications initiatives supported by the project.																	
Activity 2B.4.1. Carrying out of productive applications of mini-hydro generated electricity in Gotomi, Eastern Highlands, including special applications carried out by women.																	
Activity 2B.4.2. Carrying out of productive applications of mini-hydro generated electricity in Miruma, Eastern Highlands, including special applications carried out by women																	
Activity 2B.4.3. Carrying out of productive applications of solar PV mini-grid power on Samarai Island, Milne Bay Province, including special applications carried out by women																	
Component 3: Financing of Renewable Energy and Energy Efficiency Projects																	
Outcome 3: Improved availability of, and access to, financing for renewable energy and energy efficiency initiatives in the energy generation and end-use sectors.																	
Output 3.1: Completed group capacity building program for the banking sector, investors in the commercial /private sector (including PPL), and the government sector on financing RE and EE via equity investment and loans. The output will consist of two series of two workshops each, one series on the financing of community scale RE power projects and one series on the financing of EE. The capacity building program on the financing of RE and EE will have a target of 40 percent of the trainees being women at each of its four workshops.																	
Activity 3.1.1. Organization and conduct of two workshops on financing of community scale renewable energy power projects, especially micro/mini-hydro and PV mini-grids.																	
Activity 3.1.2. Carrying out of two workshops on financing of EE, including building and industrial retrofit projects and residential appliance and lighting replacement.																	

	Output 3.2: Designed, funded, and launched special financing mechanism for EE projects. The mechanism will provide up-front funding for EE retrofits to be paid back via end user monthly savings on energy bills.																	
Activity 3.2.1. Design and operation of an "ESCO" fund to be set up within PPL to provide up-front investment for customer energy efficiency retrofits																		
	Output 3.3. Designed, funded, and launched special loan fund for RE projects, carried out by a PNG commercial bank. The loan fund will provide up-front financing for community RE mini-grid projects and will likely be a sub-fund of an existing SME fund at a PNG commercial bank. The project will ensure that the loan fund or sub-fund for community RE mini-grids will include as one of its loan criteria the active involvement of women in the funded mini-grid projects.																	
Activity 3.3.1. Design of a special fund or sub-fund (attached to existing SME fund) to provide loans for the establishment of community RE mini-grids, especially micro/ mini-hydro and solar PV mini-grids.																		
	Output 3.4. Publicly available information on sources of funding for RE and EE (e.g. Green Climate Fund, crowdfunding, social impact funds, etc.), including listing of sources and how-to-apply guide on effectively accessing funds. The guide will provide proponents information on the highest potential international and national sources of funding for PNG's EE and RE and strategic advice on how to apply to them.																	
Activity 3.4.1. Research and preparation of a reference guide on funding sources for RE and EE projects, including explanations of how to successfully apply to recommended sources.																		
	Component 4: Energy Development and Utilization Awareness Enhancement (Information on and Awareness of RE and EE):																	
	Outcome 4. Improved awareness of, attitude towards, and information about renewable energy and energy efficiency applications in the energy generation and end-use sectors.																	
	Output 4.1. Convincing, analytic, and well-disseminated briefing materials for policy makers showing that RE in many cases is more cost effective than fossil fuel in PNG and that EE projects bring strong benefits to businesses' bottom lines. Briefing materials will be succinct written documents. Dissemination will emphasize face-to-face meetings with policy makers to discuss briefing materials.																	
Activity 4.1.1. Conduct of research, analysis, and drafting of briefings for policy makers that show the "win-win" potential of RE and EE for government, PPL, the private sector, and the people in PNG																		
Activity 4.1.2. Implementation of strategy for ensuring briefings for policy makers reach high-level decision makers as well as mid-level officials																		
	Output 4.2. Materials that enable PNG engineers, officials, and communities to work together (without outside assistance) to develop quality community RE projects at low and well-controlled costs. Materials will include a "how to" guide on developing micro/ mini-hydro in PNG and a "how to" guide on developing PV mini-grids in PNG.																	
Activity 4.2.1. Preparation of "how to" guide on developing micro/ mini-hydro mini-grids in the PNG context.																		

Activity 4.2.2. Preparation of "how to" guide on developing PV mini-grids in the PNG context																		
Output 4.3. Database on RE resources and pipeline RE projects in PNG. In terms of RE resources, database will include the results of new resource assessments conducted under the project on solar resources in Milne Bay Province and on micro/mini-hydro resources in each of Eastern Highlands and Morobe Province, as well as results of resource assessments conducted under other projects, especially wind resource assessment under an ongoing World Bank-GEF project. The database will also include proposed community RE mini-grid projects developed via capacity building program homework carried out by government development planning officials.																		
Activity 4.3.1. Conduct of solar resource assessment of Milne Bay Province and preparation and dissemination of associated data.																		
Activity 4.3.2. Conduct of micro/ mini-hydro resource assessment of Eastern Highlands Province and preparation and dissemination of associated data																		
Activity 4.3.3. Conduct of micro/ mini-hydro resource assessment of Morobe Province and preparation and dissemination of associated data.																		
Activity 4.3.4. Identification and aggregation of other PNG RE resource data already collected by other projects or organizations.																		
Activity 4.3.5. Collection, organization, and dissemination of information on pipeline proposed community scale micro/ mini-hydro and PV mini-grid projects as developed under other activities of this project, especially Activities 1.1.1, 1.1.3, 1.1.4, and 1.1.5.																		
Output 4.4: Designed RE and EE courses and course materials made available for the education sector. Output will include tertiary education level courses on community RE mini-grid development and on building energy audits. It will also include preparation of RE and EE content to be incorporated into primary school and high school curriculums.																		
Activity 4.4.1: Preparation of short, hands-on training courses on micro/ mini-hydro and PV mini-grid development and installation for university, technical college, and/ or technical vocational training centers.																		
Activity 4.4.2: Preparation of short, hands-on training course on building energy audits for university, technical college, and/ or technical vocational training centers																		
Activity 4.4.3: Preparation of attractive materials on RE and EE developed expressly for PNG at the (i) primary school level and (ii) high school level and distributed widely to schools																		
Output 4.5: Completed RE and EE multi-channel media promotion campaign in PNG. The media campaign will emphasize the community RE mini-grid and township EE experience of the project. Media channels or strategies that will be included in the campaign are: TV, radio, print media, online news, social media, text messaging, and celebrity endorsement.																		
Activity 4.5.1. Design, filming, and airing of prime time TV show promoting RE and EE																		

Activity 4.5.2. Design and airing of radio shows discussing and promoting RE and EE																	
Activity 4.5.3. Design and implementation of outreach campaign to educate journalists about RE and EE, including emphasis on cost competitiveness, off-grid electrification potential, and environmental benefits.																	
Activity 4.5.4. Design and implementation of social media marketing campaign to promote positive discussions on the potential of RE and EE for PNG.																	
Activity 4.5.5. Design and implementation of mobile text messaging campaign to promote RE and EE.																	
Activity 4.5.6. Design and implementation of strategy to obtain free or low-cost celebrity endorsement of RE and EE in PNG																	
Output 4.6: Completed one-on-one TA for selected local equipment manufacturers/fabricators in the design and production of RE/EE technology equipment or components. This will entail coaching for identified manufacturers in the local production of equipment and components for community RE mini-grids or of EE products.																	
Activity 4.6.1. Design and implementation of a technical assistance program for local equipment manufacturers/ fabricators on the design and production of RE/EE equipment or components																	
Output 4.7. "One-stop-shop" website providing range of information on RE and EE in PNG.																	
Activity 4.7.1. Development and establishment of a well-designed, user-friendly website that serves as a "one-stop-shop" for raising awareness and promoting investment in RE and EE in PNG																	
Activity 4.7.2 Survey on use of project website and project materials																	

Annex 4. Monitoring Plan

The Project Manager will collect results data according to the following monitoring plan.

Monitoring	Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
Project Objective: Enabling of the application of feasible renewable energy and energy efficiency technologies for achieving greenhouse gas emission reduction in PNG	Cumulative tons of GHG emissions	Cumulative tons of GHG emissions reduced from business as usual via adoption of community RE mini-grid projects and township EE programs in PNG (tons CO_2)[24]	Revised Methodology for Calculating Greenhouse Gas Benefits of GEF Projects; Baseline GEF Tracking Tool available in the Project Document and CER EO Document.	After 2nd PIR submitted to GEF; After 4th PIR submitted to GEF.	Project Consultant	Completed GEF Tracking Tool. To be verified and reported in mid-term review and terminal evaluation reports, and DO tab of the GEF PIR.	Commitment of the government to RE&EE, irrespective of the party in power, will not change
	Number of new households	Number of new households in rural areas and townships that have access to RE mini-grid generated electricity service or make use of established EE programs[25]	Sociological survey	After 2nd PIR submitted to GEF; After 4th PIR submitted to GEF.	Project Consultant	Consultant's report on sociological survey	Commitment of the government to RE&EE, irrespective of the party in power, will not change
	Total reductions in, or avoided annual fuel consumption for RE systems	Total new reductions in or newly avoided amounts of annual diesel consumption achieved via installation of community RE mini-grid systems (liters diesel per year)	Revised Methodology for Calculating Greenhouse Gas Benefits of GEF Projects; Baseline GEF Tracking Tool available in the Project Document and CER EO Document.	After 2nd PIR submitted to GEF; After 4th PIR submitted to GEF.	Project Consultant	Completed GEF Tracking Tool. To be verified and reported in mid-term review and terminal evaluation reports, and DO tab of the GEF PIR.	---
	Total reductions or avoided annual fuel	Total new reductions in annual diesel consumption from improved EE in industrial plants, commercial and	Revised Methodology for Calculating Greenhouse Gas	After 2nd PIR submitted to GEF;	Project Consultant	Completed GEF Tracking Tool.	Strong and continuous government and PPL commitment to

[24]Inclusive of direct and bottom-up consequential greenhouse gas emission reductions that are attributable to the project.

[25]Examples include EE appliance and lighting credit programs.

Monitoring	Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
	consumption for EE Programs	institutional buildings, homes, and street lighting achieved via township EE programs (liters diesel per year)	Benefits of GEF Projects; Baseline GEF Tracking Tool available in the Project Document and CER EO Document.	After 4th PIR submitted to GEF.		To be verified and reported in mid-term review and terminal evaluation reports, and DO tab of the GEF PIR.	township EE programs is ensured, so that available financing support facilitated by the project is sustained
Outcome 1: Rigorous implementation and enforcement of approved national and provincial energy policies, plans, and standards to promote the application of renewable energy and energy efficiency technologies	Government funding allocated for RE and EE Programs, including both equity and loan funding (USD)	Government funding allocated for pipeline community RE mini-grid and township EE programs designated in national and provincial level RE and EE plans or roadmaps, including both equity and loan funding (USD)	National statistics Consultations with policy makers Field visits Workshops Meetings Periodic media	Annually, reported in DO tab of the GEF PIR.	Project Manager	Government reports on government funding allocations for RE and EE. Periodic media articles reporting government funding allocations for RE and EE.	Government prioritizes budgetary allocations to community RE mini-grid projects and township EE programs among all budget items
	Number of RE&EE Policy & Standards adopted	Number of areas in which newly adopted policies and standards (since project launch) promote RE and EE.[26]	National statistics Consultations with policy makers Field visits Workshops Meetings Periodic media	Annually, reported in DO tab of the GEF PIR.	Project Manager	Government reports Periodic media articles reporting on RE&EE policies and standards	Government commits to promoting and implementing community RE mini-grids and township EE programs via improved policies, regulations, and standards
Outcome 2A: Enhanced technical-commercial viability and capacity in the application of energy efficiency technologies and development of feasible RE-based energy systems in the country	Number of RE&EE related jobs created	No. of new jobs created (or no. of new entrants in the labor force) in the RE or EE sectors in areas such as project development, engineering design, costing and business aspects, and operations and maintenance.	Sociological survey	To be reported in DO tab of the GEF PIR *twice* throughout the project implementation period, i.e.: -at the mid of the project, after 2nd PIR submitted to	Project Consultant	Consultant's report on sociological survey	---

[26]The expected policy areas include: (1) waiving of tariffs for imported community RE mini-grid equipment and parts, (2) waiving of tariffs for energy efficient equipment, (3) ICCC policy for licensing of and selling of power by community RE mini-grid owners, (4) Department of Land and Physical Planning policy to support ILG development, operation, and management of community RE mini-grids, (5) other financial incentives for community RE mini-grids, (6) other financial incentives for EE retrofits, (7) new energy efficiency standards in building code, (8) new standards for community RE mini-grid equipment, (9) new standards for energy efficient lights, ACs, and refrigeration.

Monitoring	Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
				GEF; -at the end of the project, after 4th PIR submitted to GEF.			
	Reduced cost of RE&EE solutions, in %	Number of types of RE or EE products or equipment available at 25% or more less than cost at start of project, with reduction in cost achieved via better international or domestic sourcing channels	Market survey	To be reported in DO tab of the GEF PIR *twice* throughout the project implementation period, i.e.: -at the mid of the project, after 2nd PIR submitted to GEF; -at the end of the project, after 4th PIR submitted to GEF.	Project Consultant Project Manager	Consultant's report on market survey	---
	Number of RE mini-grid systems	Number of cases of high quality RE mini-grid systems achieved at low end international cost benchmarks[27]	Market survey	To be reported in DO tab of the GEF PIR *twice* throughout the project implementation period, i.e.: -at the mid of the project, after	Project Consultant Project Manager	Consultant's report on market survey	Organizations providing civil works and construction services make selves available to provide needed services at reasonable costs/ with reasonable, but not excessive profit margins

[27]One point should be allocated for each quality system that achieves one of the two following costing benchmarks: (1) mini-hydro: USD 3,000 per kW or less, (2) PV mini-grid including batteries: USD 6,000 per kW. Quality defined as those that operate well for ten months or more without substantial problems and that use quality equipment as identified in the project's sourcing work.

Monitoring	Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
				2nd PIR submitted to GEF; -at the end of the project, after 4th PIR submitted to GEF.			
Outcome 2B: Increased installed capacity of RE based power systems and implementation of viable EE technology applications in PNG	Number of approved financing for RE developments & EE Programs	No. of proposed community RE mini-grid systems that are financed (by banks) or approved by local government (for installation permit)	Market survey	To be reported in DO tab of the GEF PIR *twice* throughout the project implementation period, i.e.: -at the mid of the project, after 2nd PIR submitted to GEF; -at the end of the project, after 4th PIR submitted to GEF.	Project Consultant Project Manager	Consultant's report on market survey	--
	Number of electricity users	No. of homes and other buildings that are supplied with power from RE mini-grid projects that have received financing or permits	Sociological survey	To be reported in DO tab of the GEF PIR *twice* throughout the project implementation period, i.e.: -at the mid of the project, after 2nd PIR submitted to	Project Manager	GEF PIR UNDP APR	---

Monitoring	Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
				GEF; -at the end of the project, after 4th PIR submitted to GEF.			
	Number of EE Programs	No. of proposed township EE programs that are financed by PPL and/or provincial governments	National statistics Consultations with policy makers Field visits Workshops Meetings Periodic media	Annually, reported in DO tab of the GEF PIR.	Project Manager	Government reports on government funding allocations for RE and EE. Periodic media articles reporting government funding allocations for RE and EE.	---
Outcome 3: Improved availability of, and access to, financing for renewable energy and energy efficiency initiatives in the energy generation and end-use sectors	Amount of approved financing available for community RE mini-grid projects in PNG, except governmental funding	Total new debt and equity financing of community RE mini-grid projects in PNG, including bank, private/commercial sector, or international funding but not including government funding (USD)	Market survey	To be reported in DO tab of the GEF PIR *twice* throughout the project implementation period, i.e.: -at the mid of the project, after 2nd PIR submitted to GEF; -at the end of the project, after 4th PIR submitted to GEF.	Project Consultant Project Manager	Consultant's report on market survey	Communities have the resources to pay tariffs for power services
	Amount of approved financing available for EE retrofits in PNG, except	Total new debt and equity financing of township EE retrofits in PNG, including PPL, bank, private/commercial sector or other international funding, but not including government funding (USD)	Market survey	To be reported in DO tab of the GEF PIR *twice* throughout the project implementation	Project Consultant Project Manager	Consultant's report on market survey	---

Monitoring	Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
	governmental funding			period, i.e.: -at the mid of the project, after 2nd PIR submitted to GEF; -at the end of the project, after 4th PIR submitted to GEF.			
	Number of approved financing facilities & organizations	No. of banks or other entities (aside from donors) that are providing debt financing for community RE mini-grids and EE technology application projects in PNG	Market survey	To be reported in DO tab of the GEF PIR *twice* throughout the project implementation period, i.e.: -at the mid of the project, after 2nd PIR submitted to GEF; -at the end of the project, after 4th PIR submitted to GEF.	Project Consultant Project Manager	Consultant's report on market survey	---
Outcome 4: Improved awareness of, attitude towards, and information about renewable energy and energy efficiency applications in the energy generation and end-use sectors	Number of RE and/or EE project developers and investors, that have made use of project generated information to develop and implement RE	Number of RE and/or EE project developers and investors, including engineering and construction firms, communities, building and industrial facility owners, etc., that have made use of project generated information found in its one-stop-shop information base or elsewhere (including how-to guides, RE resource data, RE pipeline projects list, and project demo monitoring	Website analytics Stakeholder questionnaires Field visits Workshops Meetings Periodic media	Continuous data collection, reported in DO tab of the GEF PIR *twice* throughout the project implementation period, i.e.: -at the mid of	Project Consultant Project Manager	Consultant's report, summarizing website analytics, field visit reports, workshop minutes, meeting minutes, social media.	---

Monitoring	Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
	and EE projects	reports, etc.) to develop and implement RE and EE projects		the project -at the end of the project			
	Number of RE and EE initiatives included into development plans	Number of relevant policy makers that support and endorse RE and EE initiatives in development plans	Consultations with policy makers Field visits Workshops Meetings Periodic media	Continuous data collection, reported in DO tab of the GEF PIR *annually*	Project Manager	Copies of development plans with RE and EE initiatives included	---
	Number of RE&EE product manufacturers	Number of manufacturers in PNG profitably producing RE and/or EE related equipment	Market survey	Continuous data collection, reported in DO tab of the GEF PIR *twice* throughout the project implementation period, i.e.: -at the mid of the project -at the end of the project	Project Consultant Project Manager	Consultant's report on market survey	Local equipment manufacturers have the capacity and interest to expand their product scope
Mid-term GEF Tracking Tool	N/A	N/A	Standard GEF Tracking Tool available at www.thegef.org Baseline GEF Tracking Tool included in Annex.	After 2nd PIR submitted to GEF	Project Consultant	Completed GEF Tracking Tool	Commitment of the government to RE&EE, irrespective of the party in power, will not change
Terminal GEF Tracking Tool	N/A	N/A	Standard GEF Tracking Tool available at www.thegef.org Baseline GEF Tracking Tool included in Annex.	After final PIR submitted to GEF	Project Consultant	Completed GEF Tracking Tool	Commitment of the government to RE&EE, irrespective of the party in power, will not change
Mid-term Review	N/A	N/A	To be outlined in MTR inception report	Submitted to GEF same year as 3rd PIR	Independent evaluator	Completed MTR	Commitment of the government to RE&EE, irrespective of the party

Monitoring	Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of Verification	Assumptions
							in power, will not change
Project Terminal Evaluation	N/A	N/A	To be outlined in Terminal Evaluation inception report	Submitted to GEF same year as 4th PIR	Independent evaluator	Completed Terminal Evaluation Report	Commitment of the government to RE&EE, irrespective of the party in power, will not change
Environmental and Social Risk Management Plans	N/A	N/A	Updated SESP and management plans	At the mid- and at the end of the project	Project Manager UNDP CO	Updated SESP	Commitment of the government to RE&EE, irrespective of the party in power, will not change

Annex 5. 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
Terminal Evaluation	January 2021	March 2021	Yes	USD 17,500	USD 8,700	NA
			Total evaluation budget	USD 26,200		

Annex 7. 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, the National project Director (NPD) and the Project Board (PB).

A separate document has been prepared for use of the PMO in the preparation of the TORs for the key personnel requirements for the implementation of the various activities in each of the components of the FREAGER Project. Such document contains preliminary TORs for consultants/experts/specialists, whose services will be engaged in the implementation of the activities in each project component. The TORs are presented in "skeleton" style, or "mini-TORs," each consisting of two main parts: (1) tasks and (2) qualifications. The consultant TORs are presented by project component. While there are many different consulting assignments represented, among the "mini-TORs" based on specific project activities and their needs for consultants, it is expected that many of the mini-TORs will eventually be merged into larger TORs. Thus, in the end, a typical consultant hired by the project may be handling two or three of the mini-TORs provided in this section. The project team will be responsible for the merging of the mini-TORs based on the skill sets of the candidates they observe in the market. Once they determine the proper aggregation of the mini-TORs, fully specified TORs will be prepared in more detail before recruitment. For most project activities involving consultants, an international consultant will be paired with a national consultant. While the two will be cooperating on key end deliverables, in all cases the international consultant and the national consultant will have separate intermediary deliverables to ensure that each contributes strongly to results. During project implementation, when TORs are elaborated, strong attention will be put on delineating these separate intermediary deliverables for consultants hired to work together on similar end deliverables.

A. PROJECT MANAGEMENT OFFICE (PMO)

1. National Project Manager (NPM)

Duties and Responsibilities

The National Project Manager (NPM) will be accountable to both the National Project Director and to UNDP PNG for the overall management of the FREAGER project for the quality, timeliness and effectiveness of the: (a) Services provided; (b) Activities carried out; and, (c) Use of funds.

1. *Quality, timeliness and effectiveness of the services provided*
   - Working directly with the NPD/D-NPD, and supervising the PMU for the implementation of the FREAGER project;
   - Being the focal point for communications to the participating partners, national and regional organizations, and others concerning the implementation of the project;
   - Providing a coordination and management structure for the implementation of the project, functioning in accordance with the rules and procedures of UNDP;
   - Based on agreed regular reporting and review schedule, (minimally annually, but recommended quarterly), submitting a report to the Low Carbon Growth TWG and the project board, incorporating reports received from contractors; and
   - Agreeing in advance with the project executive board on the exact progress reporting format and periodicity.

2. *Quality, timeliness and effectiveness of the activities carried out*

- Maintaining constructive relations with key project stakeholders, including Government institutions, donors and NGO partners, informing them and consulting with them as appropriate regarding strategic project decisions, and, in discussion with the international and national technical advisors, promoting the balanced participation of different Government entities in project activities and benefits;
- Providing support to UNDP in the preparation of annual reports, incorporating inputs provided by project contractors in relation to each of the project's components;
- Supporting contractors in the preparation of Annual Work Plans and Budgets (AWPBs) and review of the AWPBs prior to their presentation to the Project Board for approval, in order to ensure their feasibility, relevance, correspondence with project resource availability and the harmonization of the activities proposed under each component; and
- Working together with international and national technical advisors review and updating of project risk log and corresponding mitigations strategies.

3. *Quality, timeliness and effectiveness of the use of funds*
   - Reviewing quarterly work plans, expenditure reports and disbursement requests prepared by contractors, and recommendation to UNDP regarding their approval or, where necessary, modification prior to approval; and
   - Overseeing the work of the finance and procurement officer.

4. *Supervision, Teamwork and Administrative Support*

The National Project Manager will be supervised by the National Project Director. Administrative support will be supplied by the FREAGER Team, and where needed by UNDP (e.g. regarding contractual issues). The individual will also work closely with stakeholders from other relevant ministries/agencies, provincial and district representatives, and bilateral and multilateral development partners.

Required Skills and Experience

- Diploma (Master's degree preferable) in Engineering, Environment, Climate Change or other relevant discipline
- At least 5 years' experience with the management of complex projects and programs (UN experience a distinct advantage).
- Experience working with Government counterparts as well as representatives from development agencies.
- Experience in working in the energy sector is an advantage.
- High computer literate with experience of website design and maintenance and working with graphic design packages is an advantage.
- Fluency in spoken and written Tok Pidgin and English.

2. International Technical Advisor

Duties and Responsibilities

Summary of key functions:

1. Support the day-to-day management of the FREAGER project through provision of technical advice, including coordination across agencies and with other programs.

   - Provide close and regular technical backstopping to National Project Manager and PMU, and

other implementing entities;
- Review of relevant policies and development of policy frameworks as well as the institutional arrangements for Renewable Energy and Energy Efficiency development;
- Organization of and substantive contributions to a high level policy dialogue on Renewable Energy and Energy Efficiency development in PNG;
- Support the National Project Manager and PMU in coordinating and supervising activities of national and international experts /consultants to secure timely production of planned outputs and the review of these outputs;
- National Project Director and National Project Manager to coordinate and liaise with stakeholders – including line ministries, development partners, civil society, indigenous peoples and the private sector;
- Ensure coordination with other FREAGER related initiatives;
- Ensure communication between different government agencies, national and international initiatives and stakeholders.

2. Provide advice to Government counterparts and facilitate knowledge building activities among stakeholders

- Provide support and technical advice to the development of policy options and strategy for the design and implementation of the FREAGER project to GoPNG and other development actors including support on the development of:
  - Renewable Energy Technical Guidelines
  - Energy Efficiency Technical Guidelines
  - Other elements of national Renewable Energy and Energy Efficiency development as required
- Share knowledge on Renewable Energy and Efficiency by documenting lessons learnt and best practices from the FREAGER project and contributing to the development of knowledge based tools (including policies, strategies, guidelines, etc.);
- Provide timely quality information and technical advice to the GoPNG, UN Country Team, implementing partners, line ministries and other partners to ensure effective development and delivery of the FREAGER project;
- Coordinate institutional capacity assessments of relevant national, provincial and local entities along the Renewable Energy and Energy Efficiency supply chain;
- Assist in the identification of technical expertise and lead on the preparation of TORs, identification and evaluation of experts, and reviewing reports produced; and
- Support to UNFCCC negotiations relating to Energy sector.

Required Skills and Experience

- Master degree in Engineering, Environment, Climate Change or other relevant discipline, or similar;
- At least 7 years of working experience on energy sector specifically on renewable energy and energy efficiency in developing countries is preferable;
- Strong facilitation and coordination skill;
- Experience of working in multinational teams to implement programs involving different funding and implementing agencies;
- Experience of implementing programs across the UN agencies and across Government are definite advantages;
- Experience the Renewable Energy and Energy Efficiency developments at international, national and local levels;

- Knowledge on the UNFCCC negotiations, decisions and guidelines for national systems in the context of energy as well as national and international best practices within RE/EE and other initiatives; and,
- Proficiency in both spoken and written English

3. Communications Officer

Duties and Responsibilities

To lead in ensuring that information on the FREAGER project and PNG Energy Sector including efforts towards SDG7 (Clean and Affordable Energy) is communicated effectively to other stakeholders in PNG and internationally.

- Lead and provide guidance on implementation, and updating as required a communication, consultation and participation strategy for the FREAGER project
- Set up and develop communication tools and information for the FREAGER and national coordination and communication mechanism
- Coordinate engagement with the media and act as a focal point for enquires
- Support measures to ensure full and effective participation of all stakeholders in the FREAGER project and other relevant forums
- Support the FREAGER, CCDA and UNDP Teams in other relevant activities.

a) Set up and develop communication tools for the FREAGER:
- Manage the FREAGER site (oversight of development, responsible for maintenance)
- Manage the FREAGER Facebook page and Twitter account
- Prepare project updates
- Prepare and assist in providing radio broadcasts or other communication outputs

b) Coordinate engagement with the media and act as a focal point for enquires:
- Coordinate with other organizations and initiatives in the dissemination of information on the FREAGER project;
- Provide regular updates on the FREAGER progress to stakeholders at the sub-national, national and international level;
- Design and produce key outputs and their dissemination to stakeholders;
- Develop and review quality of outputs intended for wider circulation produced by consultants or other contracted entities;
- Develop and translate information for distribution to key stakeholder groups;
- Work closely with the consultation and participation technical working group to identify communication needs and lead the development and updating of the communication, consultation and participation plan;
- Ensure the transparency and availability of the information to the various stakeholder groups
- Develop communication materials that can reach the different stakeholders group on the different national and international issues (policies, standards, RE and EE technology, investment opportunities etc.)

c) Support the FREAGER Team in other relevant activities:
- Assist in preparation of work plans;
- Support the preparation of minutes for wider circulation, and translate and interpretation for foreign project staff and consultants when required

Required Skills and Experience

- Diploma (Bachelor's degree preferable) in English, Information technology, media or other relevant discipline.
- At least 5 years of professional experience in developing and implementing communication strategies.
- Experience utilizing communication tools to reach varied audiences from rural communities to successful business representatives and international representatives.
- Experience working with Government counterparts as well as representatives from development agencies.
- Experience in working on energy sector is an advantage.
- High computer literate with experience of website design and maintenance and working with graphic design packages is an advantage.
- Fluency in spoken and written Tok Pidgin and English.

4. Project Administration, Finance, and Procurement Officer

Duties and Responsibilities

The overall objective of the assignment is to ensure efficient and effective implementation of the FREAGER project through the development of effective systems and the building of staff capacity. Specifically, the Officer's role will focus in on financial management and procurement using funds provided by government and development partners for administration by the PMU:

1. Provide support to Programme Planning and Coordination

- Work with the National Project Manager and International Technical Advisor of the PMU and UNDP program support and operations staff in the preparation of work plans, allocation of budgets and request for budgets;
- Prepare documentation to ensure the flow of funds for project implementation occurs on a timely basis – this will require development of specific financial documentation and provision of support to exiting government staff in developing similar documentation;
- Participate in work planning and progress reporting meetings with the Chair of the Low Carbon Growth Technical Working Group under the guidance and supervision of the National Project Manager/International Technical Advisor of the PMU;
- Coordinate financial management between participating agencies as well as coordination with other relevant development partner or government funds.

2. To develop, implement and improve Accounting and Reporting Procedures

- Review and update Standard Operating Procedures for procurement, inventory and financial management
- Ensure the establishment of an effective inventory system for all equipment purchased by the PMU
- Provide oversight of financial management and procurement process processes to ensure they are conducted in accordance with partner guidelines
- Ensure that petty cash transactions are effectively maintained. This includes writing of receipts, preparation of payment request form, receipt and disbursement of cash and clearance of advances;

- Prepare project financial reports and submit to relevant officials for clearance;
- Enter financial transactions into the computerized accounting system;
- Reconcile all balance sheet accounts and keep a file of all completed reconciliation.

3. Ensure strong financial and operational control

- Check and ensure all expenditures of project are in accordance with relevant procedures. This includes ensuring that receipts are obtained for all payments and that correct procurement procedures are followed;
- Check budget lines to ensure that all transactions are correctly booked to the correct budget lines;
- Ensure documentation relating to payments are duly approved;
- Ensure Petty Cash is reviewed and updated and records are kept up-to-date;
- To continuously improve system & procedures to enhance internal controls and satisfy audit requirements.

4. Conduct Bank reconciliation

- Bank accounts should be reconciled and reported on a monthly basis

5. Develop Procurement processes and Inventory Register

- Establish a procurement system and ensure all procurement is conducted according to relevant guidelines;
- Establish and maintain a proper inventory of project assets register, including numbering, recording, and reporting;
- Maintain the inventory file to support purchases of all equipment/assets.
- Ensure program staff are able to maintain inventory of equipment and are updating and managing information on a timely basis

6. Support program administration and coordination

- To provide oversight to the calculation and preparation of staff time records;
- Provide assistance to organization of events, including workshops, seminars, and meetings
- Identify potential opportunities for linkages and synergies between existing programs.

Required Skills and Experience

- Diploma (Bachelor's degree preferable) in Finance, Economics, Accounting, Administration or a related field.
- At least 7 years of experience in positions relating to providing administrative support and/or with financial and procurement systems, portfolio and administration preferably for foreign funded environmental projects.
- Excellent knowledge of the administrative, finance and procurement procedures of the Government, and development agencies.
- Experience working with Government agencies to build their capacity and support them in the development of nationally implemented programs.
- Experience working in a multinational multi-skilled team and to coordinating activities with other partners to achieve the best long-term results for the program and the Ministries and Agencies with whom they are working.
- Experience in the usage of computers and office software packages for data analysis and technical reports; ability and willingness to work in remote areas.
- Fluency in spoken and written Tok Pidgin and English.

B. NATIONAL PROJECT DIRECTOR (NPD)

The NPD will be responsible for daily oversight of the project management unit (PMU).

Tasks
- Guidance to the PMU team in implementation
- Handling of financial requests and review of financial reports
- Technical coordination in project implementation with PPL and other stakeholders
- Coordination with the project's provincial partners
- Participation in meetings of the UN/ UNDP coordinating mechanisms
- 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

Qualifications
- Senior official of CCDA
- Experience in management of development projects
- Strong knowledge on climate change and energy sector
- Knowledge of financial management
- High level of enthusiasm for RE and EE

C. PROJECT BOARD

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 and, in particular, reviewing of outcome-level and objective-level progress of the project
- Decision-making with regard to 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
- 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 Project Board Members
- Roles as senior level officials and managers within government and other organizations
- Expertise in areas relevant to project, such as energy, power sector, provincial planning, etc.

Annex 8. UNDP Social and Environmental Screening Assessment

Project Information

Project Information	
1. Project Title	Facilitating Renewable Energy and Energy Efficiency Applications for Greenhouse Gas Emission Reduction (FREAGER)
2. Project Number	PIMS 5569
3. Location (Global/Region/Country)	Papua New Guinea

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

QUESTION 1: How Does the Project Integrate the Overarching Principles in order to Strengthen Social and Environmental Sustainability?
Briefly describe in the space below how the Project mainstreams the human-rights based approach
A human-rights based approach to programming has been integrated into the design of the project, particularly with regard to indigenous peoples and other local communities. Throughout project design, consultation was carried out with involved communities, particularly in the case of the mini-hydro stations, which are expected to be located on land belonging to clans of local indigenous peoples. Further, the project design ensures that additional, in-depth consultations will be carried out during project implementation to ensure that each of the demo demonstrations reflect the will of indigenous peoples and other local communities. During the design phase, the project team met with communities to discuss the two proposed mini-hydro mini-grids in their villages and to assess their interest in such projects and potential productive applications in the use of RE. To ensure full respect of the rights of local communities and according to UNDP Standard 7, an FPIC ("Free Prior Informed Consent") will be carried out and documented according to UNDP requirements at each demo site. This work will be a part of the limited site specific environmental and social ("E/S") assessments that will be carried out for each of the project demos, including the two mini-hydro demos, the PV mini-grid demo, and the EE retrofit demos. Because the mini-hydro mini-grids are expected to be established on land belonging to local clans, the E/S assessments for these installations will be the most in-depth. Building on the agreement expressed by the communities in full community meetings during the PPG phase, the more in-depth social assessments during implementation (as a part of the limited E/S assessments) will include household by household consultations as well as separate men's and women's groups consultations within each relevant community. The project also emphasizes human rights by promoting livelihood improvement/ income generation via use of the newly available renewable energy enabled by the project demos. In this regard, activities have been designed to stimulate productive use of RE at the mini-hydro and PV mini-grid sites. These activities are designed to specifically include women and other marginalized/disadvantaged groups. Finally, implementation of the demos will also provide members of local communities in which the demos are located access to a grievance redress mechanism. The mechanism will have particular emphasis on ensuring that access to opportunities for involvement in productive use initiatives and work opportunities are equitable and that consent for use of the clan land is indeed genuine.
Briefly describe in the space below how the Project is likely to improve gender equality and women's empowerment
The project incorporates principles of gender equality and women's empowerment. Part of the project design strategy is the involvement of women working in both management and technical departments of the PNG Government agencies/institutions who can play important roles in the design, development and implementation of the project. Another part is ensuring that benefits from RE and EE are enjoyed by women, in addition to by men. The design of the project activities takes into consideration the opportunity for the country to further enhance the role of women in deployment of low carbon technologies and mitigation options, and come up with gender-sensitive policies in the energy sector and the energy end-use sectors of the country, recognizing the possible contributions of women in the management and implementation of climate change mitigation measures. The design and preparation of this project has taken into account the contributions, impacts and benefits of productive applications from community based EE and RE technology applications, including for women, men, youth and children. In the project's many capacity building and training activities, high rates of participation from women are targeted. Further, the support of the productive applications of RE by the project will target for at least

half of the benefits to flow to women led and women operated businesses. Lastly, a certain proportion of women will be targeted among consultants recruited for the project.
Briefly describe in the space below how the Project mainstreams environmental sustainability
The proposed project is also within the context of sustainable development in PNG particularly in the rural areas of provincial and district centers. In that regard, it will bring about local benefits mainly through contributions to not only the improvement of the living conditions of rural citizens in the highland areas and islands areas and allow them to contribute more productively to the economy, but will also contribute to the protection of the natural environment. In terms of resources, this project will also promote diversification of the resource base of the economy; and, improvement in the country's future foreign exchange reserves due to reductions in petroleum products import bill that will be brought about by substitution of fossil energy generation by RE resources. The global environmental benefits from the project will mainly come from GHG emission reductions from fossil fuel displacement by RE resources in electricity generation, and in the improvement of the specific energy consumption of each energy end use sector in PNG through improved energy utilization efficiency, and these will be facilitated by the barrier removal approach that this proposed project will employ. Environmental sustainability will also be assured through the synergistic aspect of the integrated way the key stakeholders will be working together, and the higher chances of scaling-up/replication of whatever low carbon development techniques/practices will be introduced, demonstrated, and promoted under the project. Lastly, for the project RE mini-grid demos, while the investment scale is less than would require by law and EIA, the project will adopt and demonstrate the best practice of carrying out limited, site specific environmental/ social assessments as a part of the mini-grids' feasibility studies, prior to any construction or installation work. Limited site-specific environmental and social assessments will also be carried out prior to implementation of the EE retrofit demos.

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.***
Principle 1 – Risk 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?	I=3 P=1	Low	The three RE mini-grids proposed by the project may involve use of land for which indigenous peoples have rights	Project design calls for extensive consultation with local people and also calls for involvement of the national government agency responsible for land rights to develop relevant legislation for community mini-grids to ensure land rights are protected. For each demo project, FPIC processes will be carried out and documented according to UNDP Standard 7 and as part of limited, site-specific environmental and social assessments. For development of legislation, there will be full participation of indigenous representatives to determine regulations and processes for siting RE mini-grids on indigenous peoples' lands.
Principle 2- Risk 2: Would the Project	I=3	Low	The project will present	The project is taking special measures to ensure that any

potentially reproduce discriminations against women based on gender, especially regarding participation in design and implementation or access to opportunities and benefits?	P=1		opportunities for individuals and groups, including opportunities for support in productive use of renewable energy, opportunities to attend workshops and training, and opportunities to be hired as a consultant or contractor to the project. Thus, if care is not taken, existing discrimination in PNG towards woman could be continue to come to play through the project.	discrimination against women met with in the project is countered and that, beyond this, the project makes special efforts to enhance the role of women. Thus, there will be special efforts to involve women in productive use of RE efforts, to involve women with strong representation at workshops, and to ensure a significant proportion of project consultants are women.
Principle 3 –Standard 1 – Risk 1 Would the project potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services Principle 3 – Standard 1 – Risk 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)	I=2 P=3	Moderate	Mini-hydro and PV projects will be sited on areas of habitat that could be adversely affected. There will be some change in land usage due to the installation of PV mini-grid and battery station and the installation of mini-hydro systems. This means that some land (at present unused) will be unavailable for other uses.	Project partners have committed their physical environment to develop the project's renewable energy mini-grid demos and will demarcate areas for setting up the mini-hydro and solar PV mini-grid systems. The demarcated areas for different land uses associated with RE development will employ mitigation measures including establishing buffer zones and other sustainable land use practices. The detailed feasibility studies to be carried out during full project implementation will clearly articulate mitigation measures for any alternation to the physical environment that is necessary to establish the mini-hydro and solar PV mini-grid systems. Land use planning with communities will be an essential approach adopted to demarcate areas for ongoing and planned community activities including the coffee gardens/plantations and family gardens. Any other potential impacts and risks including mitigation measures will be elaborated in the limited environmental and social assessments to be commence during project implementation for each of the project demos and to be completed prior to any physical work beginning on the establishment of the demos.
Principle 3 – Standard 3 – Risk 1: Would elements of Project construction, operation, or decommissioning pose potential safety risks to local communities? Principle 3 – Standard 3 – Risk 2: Would the Project pose potential risks to community health and safety due to the transport, storage, and use and/or disposal	I=2 P=4	Moderate	Construction safety risks for the mini-hydro mini-grids, the PV mini-grid, and the EE retrofits will be a main safety risk. Further, lithium batteries for the PV mini-grid will also be a key potentially dangerous product to be	The limited, site-specific environmental and social assessments for each of the project demos will address these safety risks and determine mitigation measures to be adopted. Relevant training will be provided and thus will minimize or avoid any community health risks and safety issues for the communities with regard to construction work and the lithium batteries. Further, the batteries will be located on state land, rather than indigenous land, so the risk of related problems will thus be lessened.

of hazardous or dangerous materials (e.g. explosives, fuel and other chemicals during construction and operation)?			introduced.	
Principle 3 – Standard 6 – Risk 1: Are indigenous peoples present in the Project area (including Project area of influence)? Principle 3 – Standard 6 – Risk 2: Is it likely that the Project or portions of the Project will be located on lands and territories claimed by indigenous peoples?	I=3 P=5	Moderate	The PV mini-grid will be located on state-owned land. However, the two mini-hydro mini-grids will be located on indigenous land.	UNDP Standard 7 is applicable in the case of the two mini-hydro mini-grids. Thus, FPIC processes will be required and documented during project implementation as a part of the limited, site specific environmental and social impact assessments to be completed prior to any physical work beginning on the installations. For the FPIC process, extensive consultations, building on initial consultations during the PPG process, will be conducted with local indigenous people communities. These more extensive consultations will include consultations with individual households and separate consultation meetings for women and men of the relevant clans. The FPIC processes and mutually agreed outcomes will be well documented as part of project implementation.
Principle 3 – Standard 7 – Risk 2: Would the proposed Project potentially result in the generation of waste (both hazardous and non-hazardous)?	I=3 P=5	Moderate	Construction of mini-hydro and PV projects will generate wastes. PV panels and batteries will require disposal at end of life. EE retrofit will generate wastes.	Project will ensure proper disposal of wastes from construction of the RE mini-grids and from the EE retrofits. Disposal plans will be one of the requirements of the limited site-specific environmental and social impact assessment that will be conducted for each of the demos. Those plans, for example, will include a disposal plan for the PV panels and batteries, which contain hazardous wastes, once their useful life is expired. For the EE retrofits, refrigerators are one example of an area that will require special plans for waste disposal in the E/S assessments. The refrigerators require proper disposal and may involve hazardous substances, particularly the refrigerant.

	QUESTION 4: What is the overall Project risk categorization?		
	Select one (see SESP for guidance)		**Comments**
	Low Risk	☐	
	Moderate Risk	√☐	The risks for Principle 3's Standards 1, 3, 6, and 7 are all rated moderate. Further, the need to apply UNDP Standard 7 and conduct FPIC call for a minimum moderate rating.
	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	☐	Low risk only
	Principle 2: Gender Equality and Women's Empowerment	☐	Low risk only

	1. ***Biodiversity Conservation and Natural Resource Management***	√☐	Moderate risk: Limited site-specific environmental and social assessments will be conducted for each of the potential project demo sites and include in their scope biodiversity conservation and natural resource management issues. The assessments will recommend mitigation measures which will be undertaken during demo implementation.
	2. ***Climate Change Mitigation and Adaptation***	☐	No risk identified
	3. ***Community Health, Safety and Working Conditions***	√☐	Moderate risk: Limited site-specific environmental and social assessments will be conducted for each of the potential project demo sites and include in their scope community health, safety, and working condition issues. The assessments will recommend mitigation measures, which will be undertaken during demo implementation.
	4. ***Cultural Heritage***	☐	No risk identified
	5. ***Displacement and Resettlement***	☐	No risk identified
	6. ***Indigenous Peoples***	√☐	Moderate risk: Limited site-specific environmental and social assessments will be conducted for each of the potential project demo sites. In the case of the mini-hydro demos, they will include, according to UNDP Standard 7, FPIC with necessary documentation of FPIC process and agreed outcome. The assessments will also recommend mitigation measures related to indigenous peoples and local communities, which will be undertaken during demo implementation. Further, indigenous peoples will be actively involved in the process of developing regulations for land use in the development of RE mini-grids in the country.
	7. ***Pollution Prevention and Resource Efficiency***	√☐	Moderate risk: Limited site-specific environmental and social assessments will be conducted for each of the potential project demo sites and include in their scope pollution prevention aspects. The assessments will recommend mitigation measures, which will be undertaken during demo implementation and also when parts of the demos (such as the PV mini-grids lithium batteries) are old and need to be disposed of.

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? [28]	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?	Yes
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?	Yes
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*	Yes
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)	Yes
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
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

[28] 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.

1.11	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[29] 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?	Yes
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)?	Yes
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?	No
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
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?[30]	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)?	Yes

[29] 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.]

[30] 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.

6.2	Is it likely that the Project or portions of the Project will be located on lands and territories claimed by indigenous peoples?	Yes
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.*	Yes
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?	Yes[31]
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
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

[31] Initial consultations conducted. Full FPIC process to be carried out during project implementation.

Annex 9. UNDP 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. *Note: Management Action or strong management justification must be given for a score of 1	3 2 1	**Evidence:**

Evidence:

PNG Government aims to achieve 70% nationwide electrification in the country by 2030 and 100% by 2050 as outlined in the Development Strategic Plan (2010-2030). According to PNG Power, 13% of PNG's total population has electricity mainly from the current grid services that it provides. Thus, the government has developed the National Electricity Roll-Out Plan (NEROP) and still using the Electricity Industry Policy while the National Energy Policy has been pending since completion of a draft.

To achieve government's target would require improved investment in energy development particularly on renewable energy (RE) sources and energy efficiency (EE) technologies which will reduce reliance on fossil fuels because it contributes to greenhouse gas emissions which ultimately affect the global climate. The government's vision is to be carbon neutral through the reduction of GHG emissions in the non-land use land use change and forestry (LULUCF) sector by 2050.

In this context, United Nations Development Programme is assisting Climate Change Development Authority to develop a project titled "Facilitating Renewable Energy and Energy Efficiency Application for Greenhouse Gas Emission Reduction (FREAGER)" to be funded by the Global Environment Facility with the main objective to enable the application of feasible renewable energy and energy efficiency technologies to achieve greenhouse gas emission reduction in PNG. The project is keen to trial community-based socio-economic development with improved access to clean energy, facilitate improvements to policy, legal/regulatory and investment barriers to promote RE and EE development, create awareness and advocacy for clean energy use and develop a pool of national RE and EE experts in the country.

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[32] as specified in the Strategic Plan; it addresses at least one of the proposed new and emerging areas[33]; 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 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:** The main objective of the project is to enable the application of feasible innovative renewable energy and energy efficiency technologies to achieve greenhouse gas emission reduction in PNG. The project is keen to trial community-based socio-economic development with improved access to clean energy, facilitate improvements to policy and legal/regulatory barriers to promote renewable energy and energy efficiency development, create awareness and advocacy for clean energy use and develop a pool of national renewable energy and energy efficiency experts in the country.	3	2
	1	
	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. *Note: Management Action must be taken for a score of 1, or select not applicable. **Evidence:** The beneficiaries have been clearly identified during the project design phase have also been considered under the project governance and management arrangements which will be reviewed and agreed upon during the inception phase.	3	2
	1	
	Select (all) targeted groups: (drop-down) **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. *Note: Management Action or strong management justification must be given for a score of 1	3	2
	1	
	Evidence	

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

[33] 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

Evidence: Lessons learnt from previous project have informed the preparation of the project document.

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 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.

*Note: Management Action or strong management justification must be given for a score of 1

3	2
1	
Evidence	

Evidence:
Gender concerns have been considered in the design of the project.

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.

*Note: Management Action or strong management justification must be given for a score of 1

3	2
1	
Evidence	

Evidence:
The project aims to demonstrate community-based mini-hydro and mini solar PV mini grid system in the country as energy services in the PNG have been highly dependent on fossil fuel. The current system is primarily focused on the main electricity grid which does not necessarily reach the rural areas in the country. The provision of this service will enable development of new socio-economic activities to improve peoples' livelihoods.

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.

3	2
1	
Evidence	

• **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. *Note: Management action or strong management justification must be given for a score of 1 **Evidence:** The project design uses a human-rights based approach wherein all potential adverse impacts were considered and mitigation measures incorporated in the design.		
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-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. *Note: Management action or strong management justification must be given for a score of 1 **Evidence:** The project design has considered potential impacts on the physical environment and will conduct detail feasibility studies of renewable energy/energy efficient options to ascertain potential risks and impacts and identify mitigation measures.	3	2 1 **Evidence**
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.] **Evidence:** The Social and Environmental Screening Procedure was completed for the project concept. The SES for the new project is currently being prepared for the full size project.	Yes	No SESP Not Required
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. *Note: Management Action or strong management justification must be given for a score of 1 **Evidence:** The project has focused on a particular niche in mini-hydro and mini solar PV targeting rural areas in PNG hence applying the Theory of Change towards the design of the project results framework.	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? **Evidence:** The project has a costed monitoring and evaluation plan.	Yes (3)	No (1)
12. Is the project's governance mechanism clearly defined in the project document, including planned composition of	3	2

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)* • **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. *Note: Management Action or strong management justification must be given for a score of 1 **Evidence:** Key stakeholders have been identified to form the project Board who will play an oversight role under the project's governance and management arrangements.	1 **Evidence**	
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. *Note: Management Action must be taken for a score of 1 **Evidence:** All risks have been identified and are captured in the Project Risk Log that is currently being prepared for further stakeholder validation and endorsement during the inception phase.	3 1 **Evidence**	2
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. **Evidence:** The project plans to use whole-of-government approach using the existing technical agencies like PNG Power, Department of Works and Department of Petroleum and Energy to be cost-effective in implementation of activities	Yes (3)	No (1)
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?) **Evidence:** The project has identified relevant stakeholders and considered lessons learnt from similar experiences in the past into the design highlighting use of existing mechanisms such as the Low Carbon Growth Technical Working Group to monitor coordination and effectiveness of joint project delivery opportunities.	Yes (3)	No (1)
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. **Evidence:** The project design has considered all the least cost options to implement the activities.	3 1 **Evidence**	2
17. Is the Country Office fully recovering the costs involved with project implementation? • **3:** The budget fully covers all project costs that are attributable to the project, including programme	3 1	2

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. *Note: Management Action must be given for a score of 1. The budget must be revised to fully reflect the costs of implementation before the project commences. **Evidence:** The project design is guided by the UNDP Programming and Operational Guidelines including the cost-recovering policy.	**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. *Note: Management Action or strong management justification must be given for a score of 1 **Evidence:** The project will be using the NIM modality with CO support for implementation of activities	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. **Evidence:** All relevant stakeholders were consulted during the stakeholder consultation phase	3 2 1 **Evidence**
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? **Evidence:** The project has a Monitoring and Evaluation Plan to be implemented after project begins implementation	Yes (3) / No (1)
21. The gender marker for all project outputs are scored at GEN2 or GEN3, indicating that gender has been fully mainstreamed into all project outputs at a minimum. *Note: Management Action or strong management justification must be given for a score of "no" **Evidence:** Gender considerations were acknowledged and integrated into the design of the project.	Yes (3) / No (1) **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. **Evidence:** A multi-year work plan and budget has been prepared for 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. **Evidence:** Climate Change Development Authority took the lead in project design with the support of UNDP.	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 are planned. • **1:** Capacity assessments have not been carried out and are not foreseen. There is no strategy for strengthening specific capacities of national institutions. **Evidence:** The project has planned a capacity assessment of renewable energy and energy efficiency experts in the country including available 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? **Evidence:** The NIM modality with CO support to consistent with national procurement guidelines while IPs will be involved in monitoring and evaluation to enhance national capacities and promote results driven development planning and reporting.	Yes (3)	No (1)
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)? **Evidence:** The project has considered an exit strategy to commence at the onset of project implementation.	Yes (3)	No (1)

Annex 10. UNDP Risk Log

#	Description	Date Identified	Type	Impact & Probability	Counter measures / management response	Owner	Submitted /updated by	Last Update	Status (stable/ improving)
1	Government does not commit to promoting clean and affordable energy development in Papua New Guinea	Project Formulation Phase (2015)	Political	With lack of political leadership and commitment, there will be no direction and support for policy, legal, and institutional framework and for budgetary allocation for investment in RE/EE development in the country Probability = 3 Impact = 3 Risk = 3	The project will support CCDA and government-wide stakeholder engagement and outreach program to create awareness and advocate at the highest political and decision-making levels within and among state institutions	UNDP CO, CCDA	Project Design Team	November 2016	Improving
2	Government institutions at national and subnational levels do not communicate and cooperate effectively to plan and develop energy sector	Project Formulation Phase (2015)	Organizational	Poor coordination will create confusion over institutional mandates between key state institutions, thus negatively affect investment in renewable energy and energy efficiency technologies Probability = 4 Impact = 4 Risk = 4	The project will support CCDA in conducting stakeholder mapping through its leading of the Low Carbon Growth Technical Working Group, which is comprised of development partners and public sector, private sector, and CSO stakeholders. It will further support CCDA in strengthening the existing coordination mechanism at the subnational level through Provincial Coordination and Monitoring Committees (PCMPs).	UNDP CO, CCDA	Project Design Team	November 2016	Improving
3	Government budgetary allocation for energy development is not sustained	Project Formulation Phase (2015)	Financial	Lack of ongoing budget allocations would result in ad hoc budgetary allocation, which would limit sustainable financing of renewable energy and energy efficiency	The project will support building of government capacity in energy planning and budgeting to advocate and generate interest among decision-makers. This will result in design of institutional energy plans, with corresponding	UNDP CO, CCDA	Project Design Team	November 2016	Improving

#	Description	Date Identified	Type	Impact & Probability	Counter measures / management response	Owner	Submitted /updated by	Last Update	Status (stable/ improving)
				initiatives. Probability = 4 Impact = 4 Risk = 4	investment plans. In addition, the project will support commercial banks and PPL in the establishment of credit/ loan facilities for renewable energy and efficiency.				
4	National technical capacity in renewable energy and energy efficiency is inadequate	Project Formulation Phase (2015)	Organizational	Limited pool of national experts will affect technical oversight for and operational and maintenance of renewable energy and energy efficiency investments. Probability = 4 Impact = 4 Risk = 4	The project will undertake capacity assessment and target capacity building in Port Moresby and in the pilot provinces in technical areas related to RE and EE projects and their O&M. This is expected to generate interest and mobilize support and partnership to promote cost-effective investment in technologies and human resources.	UNDP CO, CCDA	Project Design Team	November 2016	Improving
5	Project Staff not mobilized in a timely manner	Project Formulation Phase (2015)	Operational	Any delay to establish the project management unit will affect scheduled implementation of project activities. Probability = 3 Impact = 3 Risk = 3	The project will utilize existing mechanisms for implementation and fast track recruitment arrangements to hire PMU staff.	UNDP CO, CCDA	Project Design Team	November 2016	Improving
6	Construction of solar PV mini-grids and micro/ mini-hydro mini-grids results in negative environmental and social impacts	Project Formulation Phase (2015)	Social/ Environ-mental	Negative impacts from construction of solar PV mini-grids and mini-hydro mini-grid systems may alter the physical environment, potentially impacting current land use activities, including human settlements. Probability = 2	The project will conduct feasibility studies for its solar PV mini-grid and mini-hydro demos and these will include environmental and social assessment to ascertain potential environmental and social risks and impacts	UNDP CO, CCDA	Project Design Team	November 2016	Improving

#	Description	Date Identified	Type	Impact & Probability	Counter measures / management response	Owner	Submitted /updated by	Last Update	Status (stable/ improving)
				Impact =2 Risk =2					
7	Complex community social systems and landownership arrangement become counterproductive to promoting community leadership and ownership on communally agreed community initiatives	Project Formulation Phase (2015)	Social	Low levels of literacy and understanding may contribute to landowner misunderstanding and expectation in resource development leading to stalled demo projects that cannot be realized Probability = 2 Impact = 2 Risk = 2	A clear plan for community engagement, consultation, awareness, and advocacy will be undertaken by the project. During the demos' feasibility study stage, the project will consider landownership arrangements and work with local people and government officials to ensure challenges are overcome.	UNDP CO, CCDA	Project Design Team	November 2016	Improving
8	Non-enforcement of formulated and approved energy policies negatively affects sectoral policy direction and commitment towards RE/EE development in PNG	Project Formulation Phase (2015)	Regulatory	Without policy direction, institutional competition is likely to affect leadership and ownership of project results and negatively impact long-term sustainability Probability = 3 Impact = 3 Risk = 3	The project aims to advocate policy change through planned intensive communication and advocacy activities. Further it will take an approach of briefing policy makers on the cost advantages of RE and EE and showing them proof of concept with the project demos to ensure they will support RE and EE development.	UNDP CO, CCDA	Project Design Team	November 2016	Improving
9	The high cost operating environment in PNG negatively affects the allocated project budget	Project Formulation Phase (2015)	Financial	Cost overruns would mean that not all the designed activities could be implemented unless additional co-financing is secured. Unforeseen currency fluctuation has the potential to inflate costs impacting planned implementation of activities.	Co-financing from partners will be mobilized and utilization of national technical agencies considered as the most cost effective option will be carried out to promote their leadership and ownership of project. In addition the project has specific activities to determine lowest cost high quality sourcing changes and the true (uninflated) costs of doing PV mini-grids and mini-hydro mini-	UNDP CO, CCDA	Project Design Team	November 2016	Improving

#	Description	Date Identified	Type	Impact & Probability	Counter measures / management response	Owner	Submitted /updated by	Last Update	Status (stable/ improving)
				Probability = 3 Impact = 3 Risk =3	grids in PNG.				
10	Provision of costing information on RE mini-grids negatively affects the market by providing cost estimates that are either too high or too low.	April 2017	Financial and Technical	Pricing information that is too low may result in poor quality projects. Pricing information that is too high will enable providers to overcharge in the market. Mandatory price controls will in general distort the market. Probability=1 Impact=3 Risk=3	In addition to price, information on quality requirements will be included to ensure that price estimates are not too low. To ensure price estimates are not too high, current best prices in Australia will be provided as a benchmark. Pricing information will not be tied to price controls, but instead serve to increase transparency in the market.	UNDP CO, CCDA, PPL, NISIT	Project Design Team	May 2017	Improving

Annex 11. Capacity Assessments of Implementing Partner and Responsible Party

11-1. Capacity Assessment of Implementing Partner: Climate Change Development Authority (CCDA)

AREAS FOR ASSESSMENT	ASSESSMENT QUESTIONS	REFERENCE DOCUMENTS AND INFORMATION SOURCES
PART I. BACKGROUND INFORMATION		
1. History	Date of establishment of the organization November 2015. Effective January 2016, Climate Change Development Authority was established having transitioned from Office of Climate Change and Development established in 2010	Climate Change Management Act (2015), Gazettal Notice No. G22 Climate Change & Development Corporate Plan 2014-2015, OCCD Annual Report 2015.
2. Mandate and constituency	What is the current mandate or purpose of the organization? Who is the organization's primary constituency? The primary mandate of Climate Change Development Authority is to provide a regulatory framework to promote and manage climate-compatible development through climate change mitigation and adaptation activities in the country.	Office of Climate Change and Development Corporate Plan 2014-2016, CCDA Management Act (2015) and Climate Change Development Policy (2014)
3. Legal status	What is the organization's legal status? Has it met the legal requirements for operation in the programme country? Climate Change Development Authority is a government institutions legally established by Parliamentary Act referred to as the Climate Change Development Management Act (2015)	CCDA Management Act (2015), Climate Change Development Policy (2014)
4. Funding	What is the organization's main source (s) of funds? The main sources of funding is from the government development funds for recurrent and program functions. CCDA also receives bilateral and multilateral funding agencies.	www.treasury.gov.pg OCCD/CCDA Annual Reports Project Documents, Annual Work Plans
5. Certification	Is the organization certified in accordance with any international standards or certification procedure? The CCDA Management Act (2015) certifies the organization as a national government institutions which aligns to appropriate international standards to perform its roles and responsibilities.	CCDA Management Act (2015), Climate Change Development Policy (2014)
6. Proscribed organizations	Is the organization listed in any UN reference list of proscribed organizations?	No
PART II. PROJECT MANAGEMENT CAPACITY		
2.1 Managerial Capacity		
1. Leadership Commitment	Are leaders of the organization ready and willing to implement the proposed project? The CCDA management is supportive of this project as this is in response to national development plans and climate change priorities of the government.	Letter of Commitment, Interviews, PC (personal communication).
2. Management experience and qualifications	Which managers in the organization would be concerned with the proposed project? What are their credentials and experience that relate to the proposed project? Do these managers	CVs of managers.

AREAS FOR ASSESSMENT	ASSESSMENT QUESTIONS	REFERENCE DOCUMENTS AND INFORMATION SOURCES
	have experience implementing UNDP or other donor-funded projects? The project will be under the leadership and direction of CCDA's Managing Director with the support and guidance of the CCDA Director Mitigation/Low Carbon Division and Manager, Low Carbon Growth Branch. These management team have relevant qualification and experiences having worked with other donor support climate change projects	Interviews with managers. Reports of past projects.
3. Planning and budgeting	Does the organization apply a results-based management methodology? Are there measurable outputs or deliverables in the strategies, programmes and work plans? Are budgets commensurate with intended results? How do planners identify and accommodate risks? CCDA Management Act (2015) outlines it core functions supported by the Climate Change Development Policy (2014) that are consistent with national development plans and strategies. The CCDA Corporate Plan guides the annual implementation plans towards achieving the national climate change goals and targets The annual national budget allocations reflects the annual implementation plans and targets. Risks are monitored on a quarterly basis including divisional and project board meetings to ensure appropriate mitigation measures are in place.	• Vision2050, Development Strategy Plan (2010-2030), Medium-Term Development Plan (2010-2017), Strategy for Responsible Sustainable Development (2015) • Framework for the National Climate Change Strategy and Action Plan (2010) • Climate Compatible Development Strategy (CCDS) (2010) • Interim Action Plan (IAP) for Climate-Compatible Development • Project and programme documents. • Annual Work plans and budgets and Annual Progress Reports
4. Supervision, review, and reporting	How do managers supervise the implementation of work plans? How do they measure progress against targets? How does the organization document its performance, e.g., in annual or periodic reports? How are the organization's plans and achievements presented to stakeholders? Does the organization hold regular programme or project review meetings? Are such meetings open to all stakeholders? Are the organization's activities subject to external evaluation? How does the organization learn and adapt from its experience? The managers supervise staff and oversee implementation of work plans based on approved guidelines and standards for monitoring progress accordingly agreed implementation schedule and review timelines. Assessment of work plans progress is reflected in staff key result areas. CCDA performance is captured in annual reports, meetings reports and project board meeting minutes while communication of development results is through the formally established Low Carbon Technical Working Group and similar working groups for climate change mitigation and adaptation. CCDA promotes stakeholder inclusive engagement in all its planned annual activities including period annual reviews and evaluations.	• Annual reports, presentation to stakeholders. • Internal reports. • Evaluation reports. • Lessons-Learned reports.
5. Networking	What other organizations are critical for the successful functioning of this organization? How does the organization conduct relations with these organizations? Is the organization a party	• CCDA Long-term Strategic Planning for Organizational Restructuring-Final Report

AREAS FOR ASSESSMENT	ASSESSMENT QUESTIONS	REFERENCE DOCUMENTS AND INFORMATION SOURCES
	to knowledge networks, coordinating bodies, and other fora? CCDA has an extensive network with government agencies, private sector, and civil society organization, bilateral and multilateral partners. Engagement with these stakeholders is through various national, regional (Secretariat of Pacific Community, Pacific Islands Forum, Secretariat of the Pacific Regional Environment Programme) and international forums (Coalition of Rainforest Nations) including CCDA led Technical Working Groups for Low Carbon Growth, REDD+, National Communications, Climate Change Adaptation and Mitigation	and Recommendations: October 2016: OCCD Corporate Plan 2014-2016. • Terms of References for Technical Workings Groups

2.2 Technical Capacity		
1. Technical knowledge and skills	Do the skills and experience of the organization's technical professionals match those required for the project? Would these professionals be available to the project? Does the organization have the necessary technical infrastructure (e.g., laboratories, equipment, software, technical data bases, etc.) to support the implementation of the project? How do staff members of the organization keep informed about the latest techniques and trends in their areas of expertise? What external technical contacts and networks does the organization utilize? What professional associations does the organization and/or its professional staff belong to? CCDA has limited expertise required for the project however capacity development is ongoing and relevant staff currently engaged in project design will be available for implementation phase. Consistent with the mandate of CCDA to coordinate climate change initiatives in the country, relevant technical agencies have been identified to collaborate for the implementation of the project. The project will utilize the Low Carbon Growth Technical Working Group, GHG Technical Working Group and National Communications Technical Working Group. Thus, certain technical functions are outsourced to the relevant institutions.	• See information on CVs of technical personnel/staff. • Knowledge network membership. • Technical library facilities. • Reports from participation in international, regional, national or local meetings and conferences and workshops or trainings and online research. • Members of Technical Working Groups (i.e. REDD+, Low Carbon Growth, Adaptation and National Consultation) • Facilities description: Information on facilities.
PART III. ADMINISTRATIVE AND FINANCIAL MANAGEMENT CAPACITIES		
3.1 Administrative capacity. Note: Answer only questions that are relevant to the proposed project.		
1. Facilities, infrastructure and equipment	Does the organization possess sufficient administrative facilities, infrastructure, equipment and budget to carry out its activities, particularly in relation to the requirements of the project? Can the organization manage and maintain the administrative and technical equipment and infrastructure? CCDA has all adequate technical and administrative capacities to deliver its mandate on climate change in PNG. It has well established units handling technical and operational functions of the office including office equipment.	• Equipment and facilities available for project requirements. • CCDA Management Act (2015), Divisional work plans, Summary of financial performance on budget.
2. Procurement and contracting	Does the organization have the legal authority to enter into contracts and agreements with	• CCDA Climate Change Management Act

	other organizations? Does the organization have access to legal counsel to ensure that contracts are enforceable, meet performance standards, and protect the interests of the organization and UNDP? Does the organization have dedicated procurement capacity? Do procurement personnel have skills and experience that are appropriate to the requirements of the project? Does the organization have written procurement procedures? Is there evidence that the organization conducts procurement on the basis of best value for money, transparency, and effective international competition? Does the organization have a system and procedures for asset management and inventory control? Yes to all the questions above.	(2015) • Public Service Management Act 2014. • Public Finance Procurement Manual. • Audit reports, Department of Personal Management. • CVs of procurement personnel or Capacity Needs Analysis (Procurement Personnel). • CCDA HR Manual (ref CCDA Act PSGO). • CCDA Assets Inventory.
3. Recruitment and personnel management	Does the organization have the legal authority to enter into employment contracts with individuals? Yes Does the organization have dedicated personnel capacity? Do recruitment personnel have skills and experience that are appropriate to the requirements of the project? Does the organization have written recruitment procedures? Yes Is there evidence that the organization conducts recruitment objectively on the basis of competition, fairness, and transparency? Yes Does the organization have a salary scale that would apply to project personnel? Yes Would that scale inhibit the hiring of the best candidates? No	• Climate Change Management Act (2015) provides the basis of legal authority. • Public Service General Orders. • Job descriptions or Personal specification profile. • Documentation of recruitment processes. • Files of Potential job candidates • CVs of recruitment personnel. • Human Resource Documents on Salary Classification.

3.2 Financial Management Capacity		
1. Financial management organization and personnel	Does the organization have written rules and regulations for financial management that are consistent with international standards? Does the organization have a dedicated finance unit? Yes Do finance managers and personnel have skills and experience that are appropriate to the requirements of the project? Is the existing financial management capacity adequate to meets the additional requirements of the project? Yes Do finance personnel have experience managing donor resources? Yes	• Department of Personnel Management, Public Service General Orders- International reporting guidelines. • A bank account or bank statements • Interviews with financial management staff • Finance manual (ref CCDA Climate Change (Management) Act, Public Service General Orders) • Information on Annual Financial Report
2. Financial position	Does the organization have a sustainable financial position? What is the maximum amount of money the organization has ever managed? If the proposed project is implemented by this organization, what percentage of the organization's total funding would the project comprise?	• See information on Organizations Annual Financial Reports and statements • K25 million less financial statements on Adaptation Fund • Amount minus gov't grant
3. Internal control	Does the organization maintain a bank account? Does the organization have written rules	• Information on Operating Trust Account

	and procedures on segregation of duties for receipt, handling and custody of funds? How does the organization ensure physical security of advances, cash and records? Does the organization have clear written procedures and internal controls governing payments? How does the organization ensure that expenditures conform to their intended uses? Does the organization have a policy requiring two signatures for payments over a defined limit? Is there any evidence of non-compliance with financial rules and procedures?	• Public Finance Management Act-Financial rules and regulations under the Financial Management Manual • Acquittals-financial statements • Payment processing • Less than K300 000
4. Accounting and financial reporting	Are accounts established and maintained in accordance with national standards or requirements? When and to whom does the organization provide its financial statements? Can the organization track and report separately on the receipt and use of funds from individual donor organizations? Is there any evidence of deficiencies in accounting or financial reporting?	• Yes, description of accounting system and reporting arrangements- Department of Personnel Management & General Orders • Public Service Financial Management Manual
5. Audit	Is the organization subject regularly to external audit? Is audit conducted in accordance with international audit standards? Are audit findings public? If so, have the organization's financial audits produced any significant recommendations for strengthening of financial systems and procedures? Have audits identified instances non-compliance with rules and procedures or misuse of financial resources? What has been done to carry out audit recommendations?	• Audit reports- External audit by the PNG Auditor General's Office • Audit follow up reports

Additional Questions		
Topic	Question	Responses
Legal Status	What is the organization's legal status? Has it met the legal requirements for operation in the programme country?	• Yes, the organization's legal status is defined by the Climate Change (Management) Act 2015, • Ratification of Paris Agreement has become PNG Domestic Law
Proscribed Organizations	Is the organization listed in any UN reference list of proscribed organizations?	• No
Leadership Commitment	Are leaders of the organization ready and willing to implement the proposed project?	• Leadership is willing to implement the proposed project.
Management Experience and Qualifications	Which managers in the organization would be concerned with the proposed project? What are their credentials and experience that relate to the proposed project? Do these managers have experience implementing donor-funded projects?	• Managers have qualifications and experience- Manager Mitigation Branch
Technical Knowledge and Skills	Do the skills and experience of the organization's technical professionals match those required for the project? Would these professionals be available to the project?	• Organization Technical personnel lack skills and experience related to the proposed project however will be available for the proposed project.
Procurement	Does the organization have the legal authority to enter into contracts and agreements with other organizations? Does the organization have access to legal counsel to ensure that contracts are enforceable, meet performance standards, and protect the interests of the	• The Climate Change (Management) Act 2015 provides the legal authority to enter into any contracts and agreement.

	organization and UNDP?	
Recruitment	Does the organization have the legal authority to enter into employment contracts with individuals?	• The Climate Change (Management) Act provides that legal authority.
Financial Management	Does the organization maintain a bank account? Does the organization have written rules and regulations for financial management that are consistent with international standards? What is the maximum amount of money the organization has ever managed? If the proposed project will be implemented by this organization, what percentage of the organization's total funding would the project comprise? Can the organization track and report separately on the receipt and use of funds from individual donor organizations? Is the organization subject regularly to external audit?	• Organization does not have a bank account but it has Trust Accounts with Bank of South Pacific. • PNG's Public Financial Management Act governs financial management of CCDA. • Proposed project budget amounts to over 80% of organization's total funding on climate change mitigation • Organization does not have the capacity to track and report separately on receipt and use of funds from donor organizations. • Yes, CCDA is subject to regular audit by PNG Auditor General's Office.

11-2. Capacity Assessment of Responsible Party: PNG Power, Ltd. (PPL)

AREAS FOR ASSESSMENT	ASSESSMENT QUESTIONS	REFERENCE DOCUMENTS AND INFORMATION SOURCES
PART I. BACKGROUND INFORMATION		
1. History	Date of establishment of the organization: Electricity Commission was established in 1963 and was Privatized under the Electricity Commission Act 2002 and corporatized as PNG Power Ltd (Company No 1-44680)	Annual Reports, Media Kit, Website
2. Mandate and constituency	What is the current mandate or purpose of the organization? PPL is now a fully integrated power authority responsible for generation, transmission, distribution and retailing of electricity throughout Papua New Guinea and servicing individual electricity consumers. Who is the organization's primary constituency? PPL services customers in almost all urban centers throughout the country encompassing industrial, commercial, government and domestic sectors. Where possible, the services extend to rural communities adjacent to these urban centers.	Annual Reports, Media Kit, Website
3. Legal status	What is the organization's legal status? PPL is also undertaking a regulatory role on behalf of the Independent Consumer and Competition Commission (ICCC) Has it met the legal requirements for operation in the programme country? PPL as a corporatized entity operates in accordance with the Companies Act 1997. The Constitution of PPL has been established in compliance with this Act. The Constitution establishes the functions and responsibilities of the Board to the shareholders and the general administrative and reporting requirements.	Charter, legal registration

AREAS FOR ASSESSMENT	ASSESSMENT QUESTIONS	REFERENCE DOCUMENTS AND INFORMATION SOURCES
4. Funding	What is the organization's main source (s) of funds? Revenue from Sale of Electricity & Assets and national government's development budget	Annual Reports www.treasury.gov.pg
5. Certification	Is the organization certified in accordance with any international standards or certification procedure? PPL has met all certification requirements and procedures to be corporatized in 1997 undertaking engineering, financial & administrative management of electricity generation, transmission, distribution & retailing.	ISO, Project Management standard, other standards
6. Proscribed organizations	Is the organization listed in any UN reference list of proscribed organizations? http://www.un.org/sc/committees/1267/consolist.shtml	No
PART II. PROJECT MANAGEMENT CAPACITY		
2.1 Managerial Capacity		
1. Leadership Commitment	Are leaders of the organization ready and willing to implement the proposed project? Yes, PPL also implemented projects by other donor & funding agencies.	Interviews
2. Management experience and qualifications	Which managers in the organization would be concerned with the proposed project? The management would come under the Chief Operating Officer's Office Division with responsible managers appointed to manage the projects. What are their credentials and experience that relate to the proposed project? All credentials are within PPL Human Resources Business Unit Do these managers have experience implementing UNDP or other donor-funded projects? Yes	CVs of managers Interviews with managers Reports of past projects
3. Planning and budgeting	Does the organization apply a results-based management methodology? Yes Are there measurable outputs or deliverables in the strategies, programmes and work plans? Yes Are budgets commensurate with intended results? Yes How do planners identify and accommodate risks? Through lesson learnt from past internal & external projects	Strategy documents Project and programme documents Sample proposals, work plans and budgets
4. Supervision, review, and reporting	How do managers supervise the implementation of work plans? Weekly & Monthly Meetings, Site visitations, Daily Communication via emails and by utilizing MS Office Project Skills How do they measure progress against targets? Using MS Office Project & Excel How does the organization document its performance, e.g., in annual or periodic reports? Each Business Units has its own documentation processes depending on its functions How are the organization's plans and achievements presented to stakeholders? Monthly & Annual Reports Does the organization hold regular programme or project review meetings? Yes Are such meetings open to all stakeholders? Yes Are the organization's activities subject to external evaluation? Yes How does the organization learn and adapt from its experience? Since most of the programs & project are similar in nature, experiences are usually shared internally by employees.	Annual reports, presentation to stakeholders Internal reports Evaluation reports Lessons-Learned reports
5. Networking	What other organizations are critical for the successful functioning of this organization? All organizations in the country How does the organization conduct relations with these organizations? Through our marketing & customer services divisions Is the organization a party to knowledge networks, coordinating bodies, and other fora? Yes	Descriptions of network and stakeholder fora

2.2 Technical Capacity		
1. Technical knowledge and skills	Do the skills and experience of the organization's technical professionals match those required for the project? Yes Would these professionals be available to the project? Yes Does the organization have the necessary technical infrastructure (e.g., laboratories, equipment, software, technical data bases, etc.) to support the implementation of the project? Yes How do staff members of the organization keep informed about the latest techniques and trends in their areas of expertise? By subscriptions from international organizations What external technical contacts and networks does the organization utilize? Service & product providers What professional associations does the organization and/or its professional staff belong to? IEPNG, CPA, Auditors, Human Resources	CVs of technical staff Knowledge network membership Technical library facilities Reports from participation in international, regional, national or local meetings and conferences Facilities description
PART III. ADMINISTRATIVE AND FINANCIAL MANAGEMENT CAPACITIES		
3.1 Administrative capacity. Note: Answer only questions that are relevant to the proposed project.		
1. Facilities, infrastructure and equipment	Does the organization possess sufficient administrative facilities, infrastructure, equipment and budget to carry out its activities, particularly in relation to the requirements of the project? Yes Can the organization manage and maintain the administrative and technical equipment and infrastructure? Yes PPL has 32 Operational Centers nationwide	Facilities and equipment available for project requirements Maintenance personnel and budget
2. Procurement and contracting	Does the organization have the legal authority to enter into contracts and agreements with other organizations? Yes Does the organization have access to legal counsel to ensure that contracts are enforceable, meet performance standards, and protect the interests of the organization and UNDP? Yes Does the organization have dedicated procurement capacity? Yes Do procurement personnel have skills and experience that are appropriate to the requirements of the project? Yes Does the organization have written procurement procedures? Yes Is there evidence that the organization conducts procurement on the basis of best value for money, transparency, and effective international competition? Yes Does the organization have a system and procedures for asset management and inventory control? Yes	Procurement manual Standard contracts Documentation on procurement processes, sample contracts Supplier data base Audit reports Interview with legal counsel CVs of procurement personnel
3. Recruitment and personnel management	Does the organization have the legal authority to enter into employment contracts with individuals? Yes Does the organization have dedicated personnel capacity? Yes Do recruitment personnel have skills and experience that are appropriate to the requirements of the project? Yes Does the organization have written recruitment procedures? Yes Is there evidence that the organization conducts recruitment objectively on the basis of competition, fairness, and transparency? Yes Does the organization have a salary scale that would apply to project personnel? Yes Would that scale inhibit the hiring of the best candidates? Yes, PPL has a very attractive salary scale/grades.	Personnel manual Standard contracts and agreements Job descriptions or terms of reference Documentation of recruitment processes Roster files of potential job candidates CVs of recruitment personnel

3.2 Financial Management Capacity		
1. Financial	Does the organization have written rules and regulations for financial management that are consistent with international	CVs of financial personnel

management organization and personnel	standards? Yes Does the organization have a dedicated finance unit? Yes Do finance managers and personnel have skills and experience that are appropriate to the requirements of the project? Yes Is the existing financial management capacity adequate to meets the additional requirements of the project? Yes Do finance personnel have experience managing donor resources? Yes	A bank account or bank statements Interviews with financial management staff Finance manual Financial sector review report
2. Financial position	Does the organization have a sustainable financial position? Yes What is the maximum amount of money the organization has ever managed? Currently, PPL stands at K2.8 Billion If the proposed project is implemented by this organization, what percentage of the organization's total funding would the project comprise? Less than 10%	Financial statements
3. Internal control	Does the organization maintain a bank account? Yes Does the organization have written rules and procedures on segregation of duties for receipt, handling and custody of funds? Yes How does the organization ensure physical security of advances, cash and records? PPL has an established financial mechanism in place with the financial institution for security. Does the organization have clear written procedures and internal controls governing payments? Yes, its procedural How does the organization ensure that expenditures conform to their intended uses? PPL uses Oracle System it expenditures and each managers & executive management are responsible for accountability. Internal & External Auditors ensures process & procedures are followed. Does the organization have a policy requiring two signatures for payments over a defined limit? Yes, in fact three signatures are required Is there any evidence of non-compliance with financial rules and procedures? Terminated Employees Records with PPL HR Business Units	Finance manual Financial rules and regulations
4. Accounting and financial reporting	Are accounts established and maintained in accordance with national standards or requirements? Yes When and to whom does the organization provide its financial statements? Kumul Holdings formerly Independent Public Business Corporation of PNG Can the organization track and report separately on the receipt and use of funds from individual donor organizations? Yes Is there any evidence of deficiencies in accounting or financial reporting? No, usually donor or funding agencies monitors & manages its own funds.	Description of accounting system and reporting arrangements Financial reports
5. Audit	Is the organization subject regularly to external audit? Yes Is audit conducted in accordance with international audit standards? Yes Are audit findings public? Not, necessarily and is controlled If so, have the organization's financial audits produced any significant recommendations for strengthening of financial systems and procedures? Have audits identified instances non-compliance with rules and procedures or misuse of financial resources? Yes What has been done to carry out audit recommendations? Depends on the nature of the recommendations and which business unit it is related to	Audit reports Audit follow up reports

Additional Questions		
Topic	Question	Response
Legal Status	What is the organization's legal status? Has it met the legal requirements for operation in the	PPL has is a legally established entity in PNG

	programme country?	
Proscribed Organizations	Is the organization listed in any UN reference list of proscribed organizations?	No
Leadership Commitment	Are leaders of the organization ready and willing to implement the proposed project?	Leadership is ready and willing to implement the proposed project.
Management Experience and Qualifications	Which managers in the organization would be concerned with the proposed project? What are their credentials and experience that relate to the proposed project? Do these managers have experience implementing donor-funded projects?	Managers have qualifications and experience related to the proposed project.
Technical Knowledge and Skills	Do the skills and experience of the organization's technical professionals match those required for the project? Would these professionals be available to the project?	Technical personnel have sufficient skills and experience related to the proposed project. Technical personnel with required skills will be available to the proposed project.
Procurement	Does the organization have the legal authority to enter into contracts and agreements with other organizations? Does the organization have access to legal counsel to ensure that contracts are enforceable, meet performance standards, and protect the interests of the organization and UNDP?	Organization has legal authority to contract or access to legal counsel. (if relevant to the proposed project)
Recruitment	Does the organization have the legal authority to enter into employment contracts with individuals?	Organization has legal authority to contract or access to legal counsel. (if relevant to the proposed project)
Financial Management	Does the organization maintain a bank account? Does the organization have written rules and regulations for financial management that are consistent with international standards? What is the maximum amount of money the organization has ever managed? If the proposed project will be implemented by this organization, what percentage of the organization's total funding would the project comprise? Can the organization track and report separately on the receipt and use of funds from individual donor organizations? Is the organization subject regularly to external audit?	Organization does have a bank account. Organization has written financial procedures or procedures consistent with international standards. Organization can provide separate accounts for donor funds. Organization is regularly audited.

Annex 12. Additional Agreements

Standard Letter of Agreement for Provision of Support Services

LETTER OF AGREEMENT

BETWEEN UNDP AND THE GOVERNMENT OF PAPUA NEW GUINEA

For "Facilitating Renewable Energy and Energy Efficiency Application for Greenhouse Gas Emission Reduction (FREAGER) Project" – Award ID: 00094483; Project ID: 00098601

Dear Mr. Yamuna,

1. Reference is made to consultations between officials of the Government of Papua New Guinea's Climate Change Development Authority (CCDA) (hereinafter referred to as "the CCDA") and officials of UNDP with respect to the provision of support services by the UNDP Country Office (CO) for the new project titled ***"Facilitating Renewable Energy and Energy Efficiency Application for Greenhouse Gas Emission Reduction (FREAGER)*** - Award ID: 00094483; Project ID: 00098601**".** UNDP and the CCDA hereby agree that the UNDP country office may provide such support services at the request of CCDA through its institution's designated unit or division in the relevant project document, as described.

2. The UNDP CO may provide support services for assistance with reporting requirements and direct payment. In providing such support services, the UNDP CO shall ensure that the capacity of the Government-designated institution is strengthened to enable it to carry out such activities directly.

3. In addition, the UNDP CO may provide, at the request of the designated institution/Implementing Agent, the following support services for implementation activities:

(a) Identification and assistance with and/or recruitment of project personnel;
(b) Procurement of goods and services;
(c) Access to UNDP-managed global information systems, including rosters of consultants and providers of development services

4. The procurement of goods and services and the recruitment of project and programme personnel by the UNDP CO shall be in accordance with the UNDP regulations, rules, policies and procedures. If the requirements for support services by the CO change during the life of a programme or project, the annex to the project document is revised with the mutual agreement of the UNDP resident representative and the designated institution.

5. The relevant provisions of Article 1 of the SBAA between the Government of Papua New Guinea and UNDP signed on the 7th April 1981 (the "SBAA"), including the provisions on liability and privileges and immunities, shall apply to the provision of such support services. The

Government shall retain overall responsibility for the nationally executed project or programme through its designated institution/Implementing Agent.

6. Any claim or dispute arising under or in connection with the provision of support services by the UNDP CO in accordance with this letter shall be handled pursuant to the relevant provisions of the SBAA.

7. The manner and method of cost-recovery by the UNDP CO in providing the support services described in paragraph 3 above shall be in accordance with UNDP corporate rules and price lists as they apply.

8. The UNDP CO shall submit progress reports on the support services provided and shall report on the costs reimbursed in providing such services, as may be required.

9. Any modification of the present arrangements shall be effected by mutual written agreement of the parties hereto.

10. If you are in agreement with the provisions set forth above, please sign and return to this office two signed copies of this letter. Upon your signature, this letter shall constitute an agreement between your Government and UNDP on the terms and conditions for the provision of support services by the UNDP CO for this project.

Yours sincerely,

_____
Signed on behalf of UNDP
Roy Trivedy
Resident Representative

_____
For the Government of Papua New Guinea
Mr. Ruel Yamuna
A/Managing Director
Climate Change Development Authority

Attachment 1.

DESCRIPTION OF UNDP COUNTRY OFFICE SUPPORT SERVICES

1. Reference is made to consultations between Conservation and Environment Protection Authority, the institution designated by the Government of Papua New Guinea and officials of UNDP with respect to the provision of support services by the UNDP country office for the nationally implemented project "Facilitating Renewable Energy & Energy Efficiency Applications for Greenhouse Gas Emission Reduction (FREAGER)" (Atlas Award ID00094483), "the Project".

2. In accordance with the provisions of the letter of agreement signed on [*insert date of agreement*] and project document, the UNDP country office shall provide support services for the Project as described below.

3. Support services to be provided:

	Support services	**Schedule for the provision of the support services**	**Cost to UNDP of providing such support services (*)**	**Amount and method of reimbursement of UNDP (**)**
1.	Identification and recruitment of project personnel (International Technical Advisor, National Project Manager, Communications Officer, Project Administration, Finance and Procurement Assistant)	At the start of the project	US$ 7,530.53 per person (est. 4 staff)	US$ 30,122.12
2.	Procurement of goods and services (for project inception, evaluation and technical inputs)	During tenure of the project	US$ 469.28 per procurement case (est. 28 procurement cases, incl. national and international consultancies construction and goods)	US$ 13,139.84
3.	Direct payments / Financial support (i.e. vendor creation, voucher, issuance of checks, EFT process, F10 settlement, spot checks)	During tenure of the project	US$ 40.60 per payment process (est. 400 payments over project tenure) and US$44.14 per F10 settlement (est. 50 cases over project tenure)	US$ 18,447.00
4.	Admin. and support services (management of events, visa request, travel authorization, ticket request)	During tenure of the project	US$ 46.66 per support service (est. 50 cases over project tenure)	US$ 2,333.00
			TOTAL:	**US$ 64,041.96**

(*) Cost to UNDP of providing support service will be charged on transactional basis and based on effective UNDP Papua New Guinea Universal Price list at the time that transaction occurs.
(**) Amount will be charged at the end of each quarter based on transactions which occur during the quarter.

5. Description of functions and responsibilities of the parties involved is provided within the Attachment 2: Project Document “Facilitating Renewable Energy & Energy Efficiency Applications for Greenhouse Gas Emission Reduction (FREAGER)”, Atlas Award ID 00094483.

Attachment 2.

PROJECT DOCUMENT

“Facilitating Renewable Energy & Energy Efficiency Applications for Greenhouse Gas Emission Reduction (FREAGER)”, Atlas Award ID 00094483.

Annex 13. List of Organizations Consulted during Project Design

I. List of Organizations Participating in Project Stakeholder Logical Framework Analysis (LFA) Workshop – March 2016

1. Department of Petroleum and Energy (DPE, three representatives)
2. Independent Consumer and Competition Commission (ICCC, two representatives)
3. Civil Aviation Safety Authority (CASA, one representative)
4. PNG Power, Ltd. (PPL, one representative)
5. Department of Transport (two representatives)
6. Mineral Resources Authority (one representative)
7. Climate Change and Development Authority (CCDA, six representatives)
8. Eastern Highlands Provincial Administration (one representative)
9. UNDP Asia Regional Headquarters (one representative)
10. UNDP PNG Country Office (one representative)
11. Parnon Group (one representative)
12. Asian Development Bank (ADB, one representative)
13. World Bank (one representative)
14. New Zealand High Commission (one representative)
15. Civil society (an activist)
16. Solar Energy Solutions PNG (two representatives)
17. Aligned Energy (two representatives)
18. Astra Solar (one representative)
19. Thermotech Transpacific (one representative)

II. List of Organizations Having Individual Meetings with Project Team during Inception Mission – March 2016

1. Eastern Highlands Province
2. PNG Power, Ltd. (PPL)
3. ICCC
4. Aligned Energy
5. Bank of South Pacific
6 .Asian Development Bank
7. World Bank and IFC
8. Department of National Planning and Monitoring
9. UNDP Papua New Guinea – Head of Programme
10. UNDP PNG – Relevant Projects and Programs
11. UNDP PNG – Resident Representative
12. Climate Change Development Authority (CCDA)

III. List of Organizations Met with during Project Demo Design Mission – September 2016

Milne Bay Province
1. Milne Bay Province Provincial Administration (Provincial Administrator)
2. Milne Bay Province Provincial Works Unit
3. PPL Samarai Island
4. Samarai Island Local Level Government (LLG)

Enga Province
5. Enga Province Provincial Works Unit
6. Niung Village (full community meeting)
7. Prominent physician from Enga Province

Eastern Highlands Province
8. Eastern Highlands Provincial Administration (Vice Provincial Administrator responsible for projects)
9. Daulo District Administration
10. Upper Asaro LLG
11. Miruma Village of Miruma Ward, Upper Asaro, Daulo District (full community meeting)
12. Sirupa Village of Gotomi Ward, Lufa District (full community meeting)
13. Primary School Leadership, Gotomi Ward, Lufa District
14. Eastern Highlands Provincial Works Unit Leadership

Morobe Province
15. Evangelical Lutheran Church (ELC), Morobe Province
16. Morobe Provincial Administration (Vice Provincial Administrator)
17. Gatop Workshop (ELC) (responsible for mini-hydro station at Gatop)
18. Kabwum District Administrator
19. Proponent of proposed village mini-hydro station

East Sepik Province
20. Department of Planning, East Sepik Provincial Administration
21. PPL Wewak
22. South Sea Tuna
23. PPL Maprik

Annex 14. Stakeholder Engagement Plan

STAKEHOLDER GROUP	DESCRIPTION	ROLE IN PROJECT
Climate Change and Development Authority (CCDA)	CCDA is the lead government agency responsible for coordinating climate change initiatives in the country.	As lead implementing partner, leading implementation with responsibility for the achievement of overall project goals and objectives. Overall, management oversight during implementation of project activities will be undertaken by CCDA. Executive member of Project Board
Papua New Guinea Power Limited (PPL)	PNG Power Ltd (PPL) is a fully integrated power authority responsible for generation, transmission, distribution and retailing of electricity throughout Papua New Guinea and for servicing individual electricity consumers.	Providing technical engineering assistance, design, development, and supervision. Provision of co-financing in cash and in kind to support implementation of the project components, particularly the Samarai Island PV mini-grid project and Milne Bay Province replications and the East Sepik Township Energy Efficiency Programs. Member of Project Board.
Department of Petroleum and Energy (DPE)	DPE is the lead government agency responsible for the energy; sector and plays the key role in energy policy development and energy planning and regulations, including energy advice to PNG Government in the areas of fuel pricings, subsidies, and renewable energy resources.	Actively participating in project's policy related activities. Working with project-retailed consultants to develop and revise draft policies related to energy efficiency and renewable energy. Involvement in project's coordination mechanism for energy efficiency and renewable energy.
Independent Consumer Consumption Commission (ICCC)	ICCC is the principal economic regulator and consumer watchdog. Their primary role is to administer and implement the ICCC Act and other related legislation. ICCC performs a number of functions including: administration of price regulation, licensing, industry regulation and other matters outlined under the ICCC Act. In the power sector, ICCC is responsible for determining and regulating prices, as well as issuing licenses to those who produce power for sale.	Participating in project activities related to developing policies for the licensing and regulation of organizations who provide power via RE mini-grids. Revising, adopting, and enforcing such policies.
Department of Public Enterprise	The Department of Public Enterprises was created to provide policy oversight to remedy serious SOE (state-owned enterprise) performance weaknesses and provide stringent oversight to SOEs, so that they become profitable through policy level interventions. These interventions will include not only those for rehabilitating and investing in the existing SOE businesses, but also those for incubating new	Encouraging and providing guidance to PPL and ICCC in their participation in project activities and to PPL in the replication of project demos based on benefits to its bottom line. Participating in financing aspects of project.

	business opportunities and investments into one structure called the Kumul Consolidation Agenda.	
National Institute of Standards and Industrial Technologies (NISIT)	The National Institute of Standards and Industrial Technologies of Papua New Guinea (NISIT) is the government body established under the NISIT Act 1993 to evaluate, improve, and establish conformity assessment schemes and to address issues of productivity and technical barriers to trade.	Serving as key project partner in RE and EE standards and certification related activities.
Provincial Governments: Milne Bay Province, Eastern Highlands Province, East Sepik Province, and Morobe Province	Provincial governments in PNG are subject to the organic laws of PNG and are governed by the Provincial Executive Council (PEC). The main function of a provincial government is to implement the laws and policies made or adopted by the relevant provincial assembly as well as those laws made by the National Government, but applying to the provinces.	Participating actively in provincial-level project activities, including capacity building, demos, and provincial level RE and EE plans. Providing co-financing to project demos located in the respective province. Supporting replication of the project demos via use of PSIP. Provision of oversight and coordination at the provincial level during implementation of project activities.
District Administrations: Samarai Murua (Milne Bay), Daulo and Lufa (Eastern Highlands), Wewak and Maprik (East Sepik), Kabwum and Wasu (Morobe)	District administrations in PNG are also subject to the organic laws of PNG. They administer the affairs of the Local Level Governments (LLGs) inclusive of urban, rural, traditional and other forms approved by the National Executive Council (NEC). The district administration is responsible for all LLG matters and for making the appropriate recommendations to the Joint District Planning and Budget Priorities Committee (JDP&BPS) and PEC for district development matters.	Supporting the project demos as needed, including making specific recommendation to the PEC to support the project via co-financing and oversight functions. Providing liaison for coordination between CCDA, PPL, the provinces, and the communities.
Evangelical Lutheran Church PNG (ELC PNG)	The ELC PNG is a church organization established in 1886 in PNG. It is dominant in 17 districts nationwide with over 1.2 million members. The ELC PNG contributes significantly to ministerial services, education, health, and development services. It has significant land and properties and has three top officials that administer its operations: the Head Bishop, Assistant Head Bishop, and General Secretary.	Overseeing of the administration and management of the project initiatives in Wasu and Kabwum (Morobe Province). Participating in capacity building program in Morobe. Cooperation with the project in developing community RE mini-grid plan for the ELC. Replication of project demos.
Institute of Engineers	The Institute of Professional Engineers Papua New Guinea (IEPNG) is the professional body that represents professional engineers from all disciplines in Papua New Guinea. IEPNG provides services for about 1,400 members, who are classified into various membership classes according to their levels of education and extent of	Facilitating verification of engineering expertise in country. Participation in project technical capacity building program. Cooperation with project in promoting the development of a corps of "honest community mini-grid" engineers who develop projects at reasonable prices (without excessive profit taking) with good quality and

	experience in engineering practice. IEPNG is governed by an elected Board, chaired by the President and having eight other members. This Board sets strategy and employs the Chief Executive Officer, who manages the day to day operations of the Institute to provide services to members and to fund activities as defined by the Corporate Plan.	therefore to the benefit of the communities.
PNG Customs	PNG Customs was established in 1888 and draws its powers from the Customs Act of 1951 to control, supervise and authorize all forms of conveyances, persons, and cargo that move in and out of Papua New Guinea. PNG Customs also has jurisdiction under the Customs and Excise Tariff Acts to charge and collect duties and taxes. PNG Customs has an important responsibility to work collaboratively with a number of key partner agencies including both other Government agencies and industry. The Commissioner of Customs is the principle officer in the organization and is responsible to the Treasurer and Minister for Finance.	Providing support to the project in activities related to waiving the customs tax for RE and EE related equipment imports. Cooperating with the project in ensuring that sub-standard, low efficiency equipment that does not meet required standards is effectively barred from entering the country.
Incorporated Land Group (ILG) Division, Department of Lands and Physical Planning (DLPP)	The Incorporated Land Group (ILG) Division is under Customary Land Services within the Department of Lands and Physical Planning. The core function of the division is to register customary landowning units, giving them legal recognition under the ILG Act. The Act empowers customary groups for greater participation in the national economy. Following recommendations in March 2009 by the NEC on land reform of the customary land tenure system, the Land Groups Incorporation (Amendment) Act, 2009 was passed as a step towards land reform and become operational in March 2012 with the realignment of the division and operations with the new legislation.	Cooperating with the project in its work to develop policy and regulations for local people to set up ILGs for the purpose of developing and running community RE mini-grids.
Department of Works and Implementation (DOWI)	The Department of Works and Implementation (DOWI) is Papua New Guinea Government's implementing agency for infrastructure development in the country with offices in every province in the country all linked together through the wide area network. The DOWI provides government services in civil construction, architecture and building, geotechnical services, and research and materials. They also have a training institute.	Serving as a key provider to the project demos for low-cost, high quality technical services, particularly with regard to feasibility study and civil works. Participating in the project's technical capacity building on RE and EE.
Department of Environment and	The Department of Environment and Conservation (DEC)	Participating in or provision of guidance for development

Conservation (DEC)	was established in 1985. Its mission (approved by the National Executive Council on 22 August 1989) is to ensure natural and physical resources are managed to sustain environmental quality and human well-being. Efforts are currently underway to amalgamate three legislations (Environment Planning Act, Environment Contaminants Act, and Water Resource Act) to provide an effective and efficient environmental regulation process. The system is intended to provide for a one-stop-shop environmental approval.	of environment and social impact assessment recommended content for RE mini-grids, beginning with the project demos.
Indigenous Peoples and Local Communities	Indigenous peoples and local communities live in the areas in which the project demos will be implemented. Often, they live in small natural villages consisting of clan members and larger administrative villages consisting of multiple clans.	The project will actively involve indigenous peoples and local communities during project implementation. Already during the PPG phase, the project has carried out consultations with the indigenous communities in villages in which the two mini-hydro stations are envisioned to be located. Before implementation of the demos, further, more detailed consultations will be carried out via the FPIC process as part of the limited, site-specific environmental and social assessments. During project implementation, indigenous peoples and local communities will be actively involved in efforts to make productive use of renewable energy to raise incomes. This will occur at both the mini-hydro and the PV mini-grid demo sites. Outreach will insure that women and other marginalized groups have ample opportunity for involvement. Lastly, local communities in the two township EE demo locales will be involved in efforts to improved household EE via refrigerator and lighting replacement.

Annex 15. Gender Analysis

Gender remains a critical development issue in Papua New Guinea (PNG). According to the 2013 UNDP *Human Development Report*, gender inequality in Papua New Guinea has led to a 61.7 percent loss in potential human development. In the 2014 edition of the *Social Institutions and Gender Index* (SIGI)[34], Papua New Guinea reportedly has high levels of discrimination against women in social institutions.

During the project preparation phase, the following key gender issues that relate to gender and natural resource management, in particular, the energy sector in PNG were identified:

1) Although national legislation does guarantee equality to men and women in matters of inheritance, customary land is outside the scope of the law. Hence, customary rules of inheritance may lawfully operate in conflict with the legislation even if they discriminate against women. About 90 percent of land is under customary tenure[35]. Women have historically exercised very limited **rights over land** that is held under customary tenure. In systems of traditional tenure, differences between the rights of men and women might best be understood in relation to authority over land and fixed assets. Rights of control generally reside with men, regardless of whether the social system of descent and inheritance is matrilineal or patrilineal. Women are often culturally restricted from land tenure and have only user rights. Ownership is often biased by gender based on social and cultural norms, with mostly patrilineal systems, but in some regions matrilineal systems are predominant. This is complicated by the fact that the government legalizes both cultural and modern marriages. This inequality can render women vulnerable in the case when a woman married culturally is divorced. She has no legal right to land and is therefore often excluded from both her birth and marriage societies.

2) According to national legislation, women have equal rights regardless of their marital status to conclude contracts related to credit, real estate and other property (**non-land assets**), as well as commercial transactions. Women also have a right to administer property without interference or male consent, regardless of whether they acquire it during marriage, bring it into a marriage or are unmarried.[36] There is no legislative barrier to women in Papua New Guinea for **accessing financial services**, including opening bank accounts, accessing credit or bank loans. However, not having control or ownership of land or other substantial resources creates high barriers for women, as banks generally require collateral for loans.

   As a result of governmental efforts, women's participation in the micro-finance sector is high and they are more likely than men to translate their loans into benefits for their families. Recently the Government has set in place strategies that promote gender equality and equity programs in microfinance. Despite most efforts, the microfinance sector has seldom seen micro-business

[34] http://www.genderindex.org/country/papua-new-guinea The SIGI measures gender-based discrimination in social norms, practices and laws. It covers five dimensions of discriminatory social institutions, spanning major socio-economic areas that affect women's lives: (i) discriminatory family code; (ii) restricted physical integrity; (iii) son bias; (iv) restricted resources and assets; and (v) restricted civil liberties. The SIGI's variables quantify discriminatory social institutions such as unequal inheritance rights, early marriage, violence against women, and unequal land and property rights.

[35] Papua New Guinea Country Gender Assessment 2011-2012, available at http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/03/15/000356161_20130315143634/Rendered/PDF/755800REVISED0011020120Final0Report.pdf.

[36] CEDAW (2009), Papua New Guinea State Report (combined initial second and third) submitted to the CEDAW Committee May 2009 for consideration by the Committee at its 46th Session, available at http://www2.ohchr.org/english/bodies/cedaw/cedaws46.htm.

success stories on the part of women. One reason is that most women who are engaged in micro-businesses do so to meet the immediate household needs, such as school fees and family support.[37]

3) Women are underrepresented in PNG as **decision makers** and in **positions of power**. Women have generally had little say in the decision-making process as such. This disproportionate representation has several core causes, but at the root are cultural biases. In PNG cultural beliefs, customs and practices vary across provinces, clans, tribes and even families. In patriarchal societies, rigid notions of men's and women's roles in society and in the home remain. It is believed that men should occupy the role of breadwinner and head of the household, while women should confine themselves to domestic and care work within the home.

4) Like culture, **education** can also be a barrier to female participation, with percentage of female tertiary graduates averaging at 37 percent. There are fewer trained women for the formal sector and this is exacerbated when women are not promoted, paid, or trained on equal basis as men. Findings from the stakeholder interviews showed that women with some form of secondary and tertiary education were more vocal during community forums and meetings. On the other hand, participants believed that women that lacked formal education tended be shy and were less confident in expressing themselves.

5) Women drive the informal economy but are not adequately integrated into the cash economy. Women's actual financial significance and contributions to the real economy are egregiously undervalued by economic indicators derived from the formal cash economy as only about 5 percent of women are in the formal workforce. Women play a key role in the **actual labor** and activities of resource management in PNG such as collecting firewood, making gardens and even landownership in matrilineal societies. Many women, as producers of food, could be considered to have usage rights to land. Women produce over 80 percent of the country's food and account for doing 60-70 percent of the work related to food crop production.[38]

In PNG, gaining community support is not always easy, meaning that tailoring a project to meet the existing needs of a community is crucial, including consideration of specific gender roles and responsibilities of community members. The project activities have been designed to address some of these gender-related issues, as follows:

- The project will facilitate the employment, training and equipping of women across the project interventions, particularly within Outcome 2, Outcome 3, and Outcome 4. The project will ensure that the reach of project-funded education/ awareness-raising programmes, development support for productive applications, and skills training will include both male- and female-headed households from the targeted villages.

- The project will actively encourage the equitable use of women labor and supervisors from local rural villages in: the planning and implementation of demonstration projects (Outcome 2B); and replication projects.

[37] CEDAW (2010), Papua New Guinea Responses to the list of issues and questions with regard to the consideration of the combined initial, second and third periodic reports, Pre-Session Working Group 46th Session, available at http://www2.ohchr.org/english/bodies/cedaw/cedaws46.htm

[38] Japan International Cooperation Agency (2010), Country Gender Profile: Papua New Guinea, available at http://www.jica.go.jp/english/our_work/thematic_issues/gender/background/pdf/e10png.pdf.

- The project will ensure that women-owned and/or managed businesses participate equitably in the procurement of project-funded services, equipment, and infrastructure (all outcomes). In some instances, the project may adopt a preferential procurement approach to the provision of minor services and supplies (e.g. supply of rations, accommodation) from local women-owned businesses.

- The project will ensure that the interests of women and women-headed households are adequately represented in the project ESCO fund (Output 3.2) and SME loan fund (Output 3.3) and that women are actively involved in the planning of RE and EE interventions in the project planning domain.

- The project will ensure that the reach of project-funded community RE system support will equitably include both male- and female-headed households from the targeted villages (Output 2B.1 and 2B.2).

- The project will actively assist women-headed households living the project target areas to access: (i) grants for productive applications; and (ii) technical support for productive applications (Outcome 2B and Outcome 2A, respectively).

- The project will commit dedicated effort within its RE and EE awareness building work to ensure aspects are tailored to the needs of women (Outcome 4).

- The project will ensure that the approved national-level policies or regulations that promote RE and EE includes strategies, activities and financial incentives that will enable and finance the equitable involvement of women in the implementation of these policies and regulations (Output 1.2).

- The project will collaborate with the project-contracted businesses and international experts to continually develop and implement mechanisms which may further strengthen the capacities of local women and women-headed households across the project planning domain.

The project has targeted that at least 1,500 of the 7,550 households that will newly be receiving power via the project's community RE mini-grid demos will be households headed by women. It has further targeted that 4,500 of the 22,500 households that are to receive RE power by mini-grid projects that have already received permits or financing by end of project will be households run by women. It will target that 40 percent of participants in the project's capacity building workshops will be women and that at least 30 percent of international and national consultants retained by the project will be women. Lastly, it will aim for at least 20 of the 100 jobs created in EE and RE as a result of the project will be held by women.

Annex 16. Knowledge Management Strategy

The proposed project has knowledge management woven throughout its design. Its fourth component, which focuses on information and awareness, in particular, will develop a number of knowledge products. A key output of the fourth component will be a "one-stop-shop" website on RE and EE in PNG. This output will bring together the many knowledge products of the project (from all components) and put them in a convenient place accessible to persons in PNG who wish to develop RE and EE projects, as well as to others in the region and world, who may learn from the experience of PNG.

Among the knowledge products developed by the project and included on the one-stop-shop website will be, from Component 2 (technical and commercial viability), reports on the experience and lessons learned with the project demos in the areas of PV mini-grid, mini-hydro mini-grid, productive uses of RE, and township EE programs. Also from Component 2 will be information on lowest cost sourcing channels into PNG of quality RE and EE products, information of "honest," best costs of engineering, civil works, and construction aspects for mini-hydro and PV mini-gird projects in PNG, curriculum from technical training on micro/mini-hydro and PV mini-grid in PNG, and curriculum from technical training for EE in PNG (covering, in particular, refrigeration, AC, and industrial aspects).

From other outputs of Outcome 4, knowledge products of the project that will be included on the one-stop-shop website will be "how-to" guides on each of micro/mini-hydro and PV mini-grids tailored to the situation in PNG, briefings on the cost advantages of RE and EE as compared to diesel in PNG, educational curriculum on RE and EE (including tertiary level curriculum on community RE mini-grids and building energy audits and high school and primary school materials to be integrated into more general coursework), print and online media articles on RE and EE in PNG, RE pipeline projects looking for funding and partnerships, and data on RE resources in PNG. The last of these, data on RE resources will bring together information developed by the proposed project as well as information developed via other channels, such as wind resource data from the World Bank-GEF project.

From Component 1 (policy, plans, and institutions), all draft policies, roadmaps, standards, regulations, and plans, as well as their approval status, will be made available on the one-stop-shop website. Further, curriculum from various trainings for government officials will be made available on the website.

From Component 3 (financing RE and EE), items to be included on the one-stop-shop website will be curriculum from the financial sector capacity building workshops and materials on the ESCO fund and the community RE mini-grid loan fund. The fund materials will include information on how these funds work and how to apply to them, as well as case studies of experiences to date with projects that have been funded by them. Also from Component 3 to be included on the one-stop-shop website will be a guide on potential sources of funding for RE and EE, which will include "how-to" guidance on the highest potential sources, such as the Green Climate Fund.

Annex 17: Annual Targets

Strategy	Indicators	Year 0	Year 1	Year 2	Year 3	Year 4
Objective: Enabling of the application of feasible renewable energy and energy efficiency technologies for achieving greenhouse gas emission reduction in PNG	Cumulative tons of GHG emissions reduced from business as usual via adoption of community RE mini-grid projects and township EE programs in PNG (tons CO_2)[39]	0	0	4517.2	13,530	16,878.5
	Number of new households in rural areas and townships that have access to RE mini-grid generated electricity service or make use of established EE programs	0	855 (with at least 20% woman-headed households)	1,710 *(with at least 20% woman-headed households)*	5,000 *(with at least 20% woman-headed households)*	7,550 *(with at least 20% woman-headed households)*
	Total new reductions in or newly avoided amounts of annual diesel consumption achieved via installation of community RE mini-grid systems and total new reductions in annual diesel consumption from improved EE in industrial plants, commercial and institutional buildings, homes, and street lighting achieved via township EE programs (liters diesel per year)	0	0	2,308,319	2,308,319	8,839,034
Outcome 1: Rigorous implementation and enforcement of approved national and provincial energy policies, plans, and standards to promote the application of renewable energy and energy efficiency technologies	Government funding allocated for pipeline community RE mini-grid and township EE programs designated in national and provincial level RE and EE plans or roadmaps, including both equity and loan funding (USD million)	0	0	5	10	20
	Number of areas in which newly adopted policies and standards (since project launch) promote RE and EE.	0	0	4	6	9
Outcome 2A: Enhanced technical-commercial viability and capacity in the application of energy efficiency technologies and development of feasible RE-based energy systems in the country	No. of new jobs created (or no. of new entrants in the labor force) in the RE or EE sectors in areas such as project development, engineering design, costing and business aspects, and operations and maintenance.	0	0	30 *(of which, at least 20% are women)*	60 *(of which, at least 20% are women)*	100 *(of which, at least 20% are women)*
	Number of cases of high quality RE mini-grid systems achieved at low end international cost benchmarks	0	0	3	3	12
Outcome 2B: Increased installed capacity of RE	Total capacity of proposed community RE mini-grid systems that are financed (by banks) or	0	0	1,550	3,100	4,650

[39]Inclusive of direct and consequential greenhouse gas emission reductions that are attributable to the project.

based power systems and implementation of viable EE technology applications in PNG	approved by local government (for installation permit), kW					
	No. of homes and other buildings that are supplied with power from RE mini-grid projects that have received financing or permits	0	0	7,500 *(at least 20% are women-owned)*	15,000 *(at least 20% are women-owned)*	22,500 *(at least 20% are women-owned)*
	No. of proposed township EE programs that are financed by PPL and/or provincial governments	0	0	2	2	10
Outcome 3: Improved availability of, and access to, financing for renewable energy and energy efficiency initiatives in the energy generation and end-use sectors	Total committed new debt and equity financing of community RE mini-grid projects in PNG, including bank, private/commercial sector, or international funding but not including government funding (USD million)	0	0	15	30	75
	Total committed new debt and equity financing of township EE retrofits in PNG, including PPL, bank, private/commercial sector or other international funding, but not including government funding (USD million)	0	0	3	5	10
	No. of banks or other entities (aside from donors) that are providing debt financing for community RE mini-grids and EE technology application projects in PNG	0	0	1	2	3
Outcome 4: Improved awareness of, attitude towards, and information about renewable energy and energy efficiency applications in the energy generation and end-use sectors	Number of RE and/or EE project developers and investors, including engineering and construction firms, communities, building and industrial facility owners, etc., that have made use of project generated information found in its one-stop-shop information base or elsewhere to develop and implement RE and EE projects	0	0	5	15	40
	Number of relevant policy makers that support and endorse RE and EE initiatives in development plans	0	0	5	15	20
	Number of manufacturers in PNG profitably producing RE and/or EE related equipment	0	0	2	3	5