GEF-8 PROJECT IDENTIFICATION FORM (PIF)

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General Project Information

Project Title	
Global Program on Climate-Resilient Renewable Energy Systems in SIDS – National Project in the Independent State of Papua New Guinea	
Region Asia	GEF Project ID 12297
Country(ies) Papua New Guinea	Type of Project MSP
GEF Agency(ies): UNIDO	GEF Agency ID 250431
Executing Partner The final decision on the national executing entities will be taken by the Government during the PPG phase	Executing Partner Type Government
GEF Focal Area (s) Climate Change	Submission Date 3/3/2026
Project Sector (CCM Only) Climate Change Adaptation Sector	
Taxonomy Climate Change, Focal Areas, Sustainable Development Goals, Strengthen institutional capacity and decision-making, Influencing models, Transform policy and regulatory environments, Climate Change Adaptation, National Adaptation Programme of Action, National Adaptation Plan, Climate information, Small Island Developing States, Climate finance, Sea-level rise, Private sector, Community-based adaptation, Mainstreaming adaptation, Climate resilience, Adaptation Tech Transfer, Paris Agreement, United Nations Framework Convention on Climate Change, Nationally Determined Contribution, Local Communities, Stakeholders, Beneficiaries, Civil Society, Community Based Organization, Non-Governmental Organization, Indigenous Peoples, Type of Engagement, Partnership, Participation, Information Dissemination, Consultation, Private Sector, Individuals/Entrepreneurs, SMEs, Awareness Raising, Communications, Education, Public Campaigns, Behavior change, Gender Equality, Access and control over natural resources, Gender results areas, Knowledge Generation and Exchange, Capacity Development, Participation and leadership, Access to benefits and services, Gender Mainstreaming, Sex-disaggregated indicators, Gender-sensitive indicators, Women groups, Capacity, Knowledge and Research, Knowledge Generation, Learning, Knowledge Exchange, Peer-to-Peer, Field Visit, North-South, South-South, Conference, Innovation, Fragile and Conflict-Affected Situations, Conflict, Institutional and Social Fragility	
Type of Trust Fund SCCF	Project Duration (Months) 60
GEF Project Grant: (a) 2,639,726.00	GEF Project Non-Grant: (b) 0.00
Agency Fee(s) Grant: (c)	Agency Fee(s) Non-Grant (d)

250,774.00	0.00
Total GEF Financing: (a+b+c+d) 2,890,500.00	Total Co-financing 4,900,000.00
PPG Amount: (e) 100,000.00	PPG Agency Fee(s): (f) 9,500.00
PPG total amount: (e+f) 109,500.00	Total GEF Resources: (a+b+c+d+e+f) 3,000,000.00
Project Tags CBIT: No NGI: No SGP: No Innovation: No Competitive Window: No	

Project Summary

Provide a brief summary description of the project, including: (i) what is the problem and issues to be addressed? (ii) what are the project objectives, and if the project is intended to be transformative, how will this be achieved? iii), how will this be achieved (approach to deliver on objectives), and (iv) what are the GEBs and/or adaptation benefits, and other key expected results. The purpose of the summary is to provide a short, coherent summary for readers. The explanation and justification of the project should be in section B "project description".(max. 250 words, approximately 1/2 page)

Rural coastal communities in Papua New Guinea (PNG) face major deficits in essential services, with electrification below 15% and safe water access around 33%. Dependence on fossil fuels and vulnerable water sources heightens exposure to climate risks, including extreme heat, variable rainfall, stronger storms, and sea level rise. Increasing hot days (>35°C) and climate variability reduce crop yields and quality, while droughts strain water resources and floods damage crops, contaminate water, and disrupt infrastructure. Sea level rise and storm surges worsen coastal erosion, saline intrusion, and inundation, further degrading soils, water sources, and infrastructure. High energy costs for cooling, water pumping, and treatment exacerbate food insecurity and economic vulnerability.

The project strengthens the climate-adaptive capacity of rural communities, micro, small and medium-sized enterprises (MSMEs), and productive sectors by advancing sustainable, climate-resilient renewable energy and water utility models. It combines institutional reform with field-level demonstration to address technical, financial, and governance barriers through two pillars.

- At the national level, it establishes a support framework to operationalize climate risk assessments and resilience standards for renewable mini-grids tailored to PNG's climate profile. It supports the Off-Grid Regulation for Small Power Systems and creates a gender- and youth-responsive support desk for community utilities. A feasibility study will design a "Beyond the Grid Fund," introducing blended finance and resilience premiums to de-risk private investment in climate-hardened rural systems.
- At the community level, the project installs two climate-resilient solar PV mini-grids and integrated water systems engineered to withstand various climate change impacts. Using "diesel-off" technology with grid-forming inverters and battery energy storage, systems operate autonomously during extreme events while enabling climate-smart cold storage, agro-processing and other productive uses of MSMEs.

  The project strengthens 5,000 beneficiaries' adaptive capacity (CI 1; ≥50% women, 30% youth), manages 15 hectares (CI 2), adopts three national policies/plans (CI 3), trains 200 individuals (CI 4), and enables 30 MSMEs (CI 5) to use resilient renewable energy. It also targets 80,732 tCO_2e in direct and indirect emissions reductions over 20 years as co-benefit.

Indicative Project Overview

Project Objective

The project seeks to strengthen the climate-adaptive capacity of rural communities and key value chains - such as agriculture and fisheries - in Papua New Guinea by advancing sustainable, climate-resilient renewable energy and water utility models.

Project Components

1. National support framework for climate-resilient rural renewable energy and water systems

Component Type	Trust Fund
Technical Assistance	SCCF-A
GEF Project Financing ($)	Co-financing ($)
368,771.00	600,000.00

Outcome:

1.1 Gender- and youth-responsive national support framework for the sustainable operation and financing of climate-resilient RE and water systems for productive uses

Output:

1.1.1 Climate risk assessment and resilience standards for rural RE mini-grid systems (e.g. modules, inverters, battery, mounting) addressing the energy-water-food nexus

1.1.2 Gender- and youth responsive national framework and support desk for small-scale community utilities providing resilient RE and water services

1.1.3 Practical guidelines for the implementation of the new Off-grid Regulation for Small Power Systems and climate resilience aspects

2. Investments in climate-resilient rural renewable energy and water systems

Component Type	Trust Fund
Investment	SCCF-A
GEF Project Financing ($)	Co-financing ($)
1,671,539.00	3,000,000.00

Outcome:

2.1 Demonstrated feasibility and viability of rural climate-resilient RE mini-grid and water systems supporting key productive uses

Output:

2.1.1 Feasibility study and EPC tender for the installation of two (2) rural solar PV mini-grids and water systems resilient to climate impacts (e.g. category 5 cyclones, 1-in-100-year flooding, marine-grade corrosion)

2.1.2 Commissioned and operational solar PV mini-grid and water systems with continued supervision and technical support

2.1.3 Sustainable business, operational and maintenance (O&M) models for two (2) community RE and water utilities, incl. climate emergency plan for business continuity.

2.1.4 Gender- and youth-responsive technical and business training for the rural community utilities' staff

2. Investments in climate-resilient rural renewable energy and water systems

Component Type	Trust Fund
Technical Assistance	SCCF-A
GEF Project Financing ($)	Co-financing ($)
354,000.00	700,000.00

Outcome:

2.2 Proposed mechanisms to facilitate market uptake of climate-resilient RE systems for productive uses

Output:

2.2.1 Feasibility study on a gender- and youth-responsive "Beyond the Grid Fund" providing blended finance and resilience premiums to climate-resilient RE and water systems for productive uses

2.2.2 Disseminated results and lessons learned through the G-RES and GN-SEC network, including on gender and youth aspects

2.2.3 Training and certification scheme for climate-resilient RE technology and service providers

M&E

Component Type	Trust Fund
Technical Assistance	SCCF-A
GEF Project Financing ($)	Co-financing ($)
119,715.00	300,000.00

Outcome:

3.1 Effective and adaptive implementation and evidence-based learning

Output:

3.1.1: M&E reports (e.g. PIRs, data tracking framework, incl. gender and youth action plan reporting)

3.1.2 Mid-term and Terminal evaluation report

3.1.3 Sharing of M&E data and analytics with the G-RES program

Component Balances

Project Components	GEF Project Financing ($)	Co-financing ($)
1. National support framework for climate-resilient rural renewable energy and water systems	368,771.00	600,000.00
2. Investments in climate-resilient rural renewable energy and water systems	1,671,539.00	3,000,000.00
2. Investments in climate-resilient rural renewable energy and water systems	354,000.00	700,000.00
M&E	119,715.00	300,000.00
Subtotal	**2,514,025.00**	**4,600,000.00**
Project Management Cost	125,701.00	300,000.00
Total Project Cost ($)	**2,639,726.00**	**4,900,000.00**

Please provide justification

N/A

PROJECT OUTLINE

A. PROJECT RATIONALE

Briefly describe the current situation: the global environmental problems and/or climate vulnerabilities that the project will address, the key elements of the system, and underlying drivers of environmental change in the project context, such as population growth, economic development, climate change, sociocultural and political factors, including conflicts, or technological changes. Describe the objective of the project, and the justification for it. (Approximately 3-5 pages) see guidance here

1.1. Global Context and Environmental Imperative

Globally, Small Island Developing States (SIDS) are disproportionately exposed to the adverse impacts of climate change despite contributing less than 1% to global greenhouse gas emissions. The Intergovernmental Panel on Climate Change (IPCC) identifies SIDS as being at extreme risk from the impact of climate change due to their geographic isolation, limited economic diversification, and critical dependence on coastal infrastructure. The Pacific Island Countries (PICs) hold immense untapped renewable energy potential estimated by IRENA at over 10 GW, especially for solar power generation, yet remains heavily dependent on imported fossil fuels. This creates a double burden in PICs for urgently proofing energy infrastructure (and associated community services) against increasing immediate and long-term impacts of climate change, including intense tropical cyclones, storm surges, seal level rise and marine heatwaves, while simultaneously transitioning to much greater use of renewable energy. Compounding this vulnerability is the much higher cost for actions and limited economies inherent to SIDS and PICs, where the per-capita cost of resilient infrastructure and renewable energy installations are significantly higher than for continental nations.

1.2 Local Context: Papua New Guinea's Acute Vulnerabilities

Observed Climate Impacts and Systemic Failures

Papua New Guinea (PNG) is characterized by exceptional geomorphological diversity, including approximately 17,000 km of coastline, mountains up to 4,500 m, inland rivers extending 1,100 km, over 600 islands, and nearly 40,000 km of coral reefs. The country hosts diverse ecosystems, from rainforest lowlands and montane forests to alpine grasslands, savannahs, freshwater swamps, floodplains, and extensive coastal and marine environments (Government of PNG, 2020). These natural assets coexist with complex socio-economic vulnerabilities, heightening the country's exposure to climate change. Of PNG's 22 provinces, 15 are coastal or island provinces, where economic and social infrastructure is highly exposed to sea-level rise, storm surges, extreme winds, and coastal and inland flooding. The fragility of the electricity sector is a key multiplier of economic risk, as aging generation and distribution assets - many located in flood-prone zones, such as the Boram Diesel Power Plant in Wewak (~3 m above sea level) - are increasingly vulnerable. Failure of these assets can disrupt services, paralyze economic activity, and amplify cascading impacts across sectors.

Projected Climate Trends

PNG has experienced ~0.8–1.0°C warming since the late 19th century (CSIRO, 2021). Under a high-emissions scenario (SSP5-8.5/RCP8.5), warming could reach ~3.5–4.0°C by 2100, exceeding Paris Agreement thresholds. Mean annual rainfall is projected to increase modestly (≈3–6% by mid-century), with high confidence in increased intensity of extreme rainfall events, particularly in the Highlands and northern coast (World Bank, 2021). These changes elevate the risk of landslides, inland flooding, and infrastructure damage. Sea levels in the western Pacific are projected to rise 10–20 cm by 2030, increasing storm surge and coastal flooding risk, especially for settlements and energy infrastructure concentrated along the northern and island provinces. Salt spray and saline corrosion further threaten metal components, justifying the use of marine-grade, non-corrosive materials for renewable energy assets.

Drought, ENSO, and the Food-Energy-Water Nexus

Droughts are projected to become more severe when they occur, particularly during El Niño phases, leading to acute food shortages in the Highlands and other rain-fed agricultural zones. Household surveys indicate that drought is among the most significant livelihood shocks affecting rural communities (IFPRI, 2024). Conversely, La Niña phases bring excessive rainfall, increasing landslides, flooding, and sedimentation in reservoirs, which can damage hydro turbines, clog intakes, and disrupt transmission lines. This hydro-climatic volatility - extreme dry versus extreme wet - underscores the need for resilient decentralized energy systems, including grid-forming inverter-based mini-grids capable of autonomous islanding during grid instability or fuel supply disruptions. Heat and humidity are expected to increase under all scenarios, posing risks to human health and agricultural productivity.

Infrastructure Exposure and National Policy Alignment

PNG's infrastructure faces a resilience deficit. As of 2024, only 9.1% of national roads are considered in good condition (ADB, 2024), leaving rural communities isolated during climate shocks. Dry-season droughts and low water levels further jeopardize hydropower supply to the Port Moresby and Highlands grids. Coastal assets, such as the Boram Diesel Plant, are exposed to storm surges, flooding, and strong winds. This project aligns directly with the PNG National Adaptation Plan (2023–2030) and the National Energy Policy, which prioritize integrating disaster mitigation, hydro-risk management, and climate resilience into the energy sector to safeguard national development gains.

Electricity Sector Vulnerability and the Need for Resilient Renewable Energy Systems

The fragility of PNG's electricity sector amplifies national economic risk. Many generation and distribution

assets are aging and located in climate-exposed areas, including coastal zones and flood-prone regions. For example, the Boram Diesel Power Plant in Wewak, operated by PNG Power Limited (PPL), is situated less than 50 meters from the coastline and approximately 3 meters above sea level, making it highly vulnerable to storm surges, strong winds, coastal flooding, and tsunami inundation. Such exposure underscores the systemic risk of electricity failure, which can disrupt essential services and paralyze economic activity.

At the same time, the PNG energy sector is expanding renewable solutions to improve access, particularly for off-grid rural populations, aiming for a 70% electrification target by 2030 through mini solar farms and decentralized systems. However, these investments face significant physical risks, and without adaptation and resilience measures, their reliability is not guaranteed. The National Energy Roll-Out Plan has identified that many energy assets lack the capacity to withstand projected climate hazards, emphasizing the need for climate-resilient designs.

Integrating storage solutions, climate-resilient infrastructure, and grid-forming inverters into mini-grids is critical. These measures ensure reliable, decentralized electricity supply under extreme weather conditions, enhance energy autonomy for rural communities, and reduce the broader economic risks associated with electricity sector fragility.

1.3 Underlying Drivers of Environmental Change and Systemic Constraints

Papua New Guinea's urgent need for climate-resilient development is challenged by interlinked systemic barriers that exacerbate climate vulnerabilities and its inability to access significant amount of climate finance. These represent the 'soft limits to adaptation' the project aims to overcome using SCCF resources:

- Economic drivers: Despite being endowed with rich natural resources, biodiversity, and ecosystems, Papua New Guinea (PNG) faces challenges to reaching its goal of becoming a prosperous, upper-middle-income country by 2030. It is a significant global producer of gold, liquified natural gas, and agricultural products (e.g., coffee, cocoa, coconut) and has the third largest cover of tropical rain forest in the world, after the Amazon and the Congo Basin (WBG 2025), but its economic development relies on natural resources, leading to volatile economic growth, with a standard deviation of 5 percent from 1980 to 2021 (IMF 2024). PNG's domestic budget hinders climate change adaptation investment (PNG NDC 2). When population size is considered, PNG receives the least amount of climate finance in the Pacific. In 2021, Tuvalu and Nauru received $19,202 or $9,773 respectively per capita, while PNG received $166 per capita (Leng, 2023). In relation to the climate risk it faces, PNG was considered "extremely underfunded" to meet the costs of adaptation from 2015 - 2021, based on the 2024 Climate Adaptation Finance Index (CAFI) (Hirsch et al., 2024). The CAFI is a country specific indicator that calculates a global 'fair share' of adaptation finance based on per capita finance receive and the country's climate risk (using the INFORM Risk Index). In 2023 and 2024, PNG fell into the most underfunded category based on its population size and climate risk. In contrast, neighboring Pacific Island countries such as Palau, Nauru, Tuvalu, Tonga, the Marshall Islands, and Samoa were all categorized as adequately or well-funded on a per-capita basis (World Bank 2025).
- Climate & adaptation drivers: Vulnerability is driven by the increasing frequency of severe weather events, sea-level rise, and slow-onset temperature increases. These factors create a 'fragility cycle' in the power sector: extreme events cause physical destruction and outages, while rising temperatures increase peak demand, further destabilizing an already sensitive electricity system.
- Technological drivers: There is a pervasive resilience deficit in the built environment. Infrastructure is typically designed based on historical climate data, failing to account for multi-sectoral impacts like the energy-water nexus. The lack of context-specific, affordable adaptation technologies - such as Grid-Forming (GFM) inverters and hardened mounting systems—forces a reliance on standard 'off-the-shelf' solutions that frequently fail during extreme tropical weather events.

- Justice and inclusion drivers: Vulnerability is geographically and socially stratified. Outer island communities and subsistence farmers face an 'essential services gap,' where the failure of fragile transport and utility links leaves them isolated. These groups have the least capacity to self-finance adaptation, creating a cycle of poverty and vulnerability that the current market fails to address.
- Sociocultural and institutional drivers: The rapid pace of climate change is outpacing traditional community adaptation practices. Institutionally, an 'information void' exists due to a lack of granular population data and localized, real-time weather data. This prevents national and provincial agencies from implementing science-based, precise adaptation interventions or establishing early-warning protocols for utility maintenance.

Political and governance drivers: A persistent 'implementation gap' exists between high-level policy commitments (e.g., the NDC) and on-the-ground execution. Fragmented coordination between National and Provincial governments, combined with limited technical capacity within newly established bodies like the National Energy Authority (NEA), hinders the systematic rollout of resilient decentralized energy systems.

1.4 System Context: Electricity Sector

1.4.1 Overview of the Sector

PNG's electricity infrastructure is fragmented due to geography. The system comprises three primary grids—Port Moresby, Ramu, and Gazelle Peninsula—along with 19 independent stations and 26 smaller stations (PNG National Energy Policy 2017–2027). The Ramu system is the largest geographically, serving approximately 10 provincial towns, followed by the Port Moresby system, which serves the National Capital District and Central Province, and the Gazelle system serving East New Britain Province. All on-grid systems are operated by PNG Power Limited (PPL).

PPL manages 330 MW of the country's 797 MW installed generation capacity, covering the three main grids and 19 independent power systems. The remaining capacity (≈280 MW) is operated by industrial and private-sector entities. Frequent outages in PPL-managed grids negatively affect education, health, banking, and community security. Several private generators, provincial governments, churches, and mining companies supplement supply in off-grid areas. The National Energy Roll-Out Plan (NEROP) guides expansion, including mini-grid development.

As of early 2026, national electrification stands at 20–30%, with rural access below 15%. In off-grid communities, energy relies on biomass, small diesel generators, and pico-solar products, which provide basic lighting but insufficient capacity for productive uses such as water pumping, cold storage, or agro-processing. Approximately 60% of households own at least one off-grid solar product. System losses range from 21–29% due to technical and non-technical factors, and aging infrastructure contributes to frequent unplanned outages and voltage instability.

Grid generation relies primarily on oil, gas, and hydropower, with solar, wind, geothermal, and biomass resources remaining underutilized due to terrain and high costs. Hydropower potential is estimated at 15 GW, though detailed feasibility studies are limited.

1.4.2 Role of the Sector in National Development

PNG's electricity sector is a critical enabler of economic and social development. Under Vision 2050, the country aims for 100% renewable energy generation by mid-century, while the medium-term development plan targets 70% electricity access for all households by 2030, up from the current estimate of 14–20%. Achieving these goals requires a substantial increase in generation capacity, from ~787 MW to 2,000 MW by 2030.

Reliable electricity is essential for public services, private sector growth, and economic diversification. In urban centers, high tariffs (~US$0.30/kWh) and unreliable supply constrain energy-intensive industries, business investment, and productivity. In rural areas, limited access to modern energy services perpetuates structural inequalities, restricting opportunities for income generation, consistent healthcare, and education.

1.4.3 The Water-Energy Nexus

PNG's electricity sector is intrinsically linked to water security, forming a water-energy nexus that is highly sensitive to ENSO-driven rainfall variability. Hydropower facilities, including the Sirinumu Dam (Port Moresby) and Yonki Dam (Ramu), render the system vulnerable to hydrological fluctuations. During El Niño phases, drier conditions reduce reservoir levels, necessitating load shedding that disrupts electrically powered municipal water pumping and treatment. La Niña phases bring excessive rainfall, causing landslides, flooding, and reservoir sedimentation, which damage turbines and reduce storage capacity. Rural water access is limited, with safe water coverage at ~33% and electricity access below 15%. Limited power for groundwater abstraction and treatment forces reliance on unprotected surface water sources, which are vulnerable to contamination during flood events, threatening sanitation services. PNG is not on track to meet the government's target to meet 70% WASH access by 2030 (National WASH Policy 2015-2030).

1.4.4 The Food-Energy Nexus

Over 80% of PNG's population relies on subsistence agriculture, and climate change is projected to reduce crop yields. The food-energy nexus manifests through the absence of reliable electricity for cold chain infrastructure, agro-processing, and irrigation, constraining climate-resilient value chains and causing significant post-harvest losses. High electricity tariffs and unreliable supply limit deployment of energy-dependent technologies such as solar irrigation and refrigeration for fish and produce, restricting income diversification for rural smallholders and reinforcing climate vulnerability. Expanding resilient mini-grid access is critical for enabling climate-smart agriculture, local food processing, and improved nutrition outcomes.

1.4.5 Sector Challenges

PNG Power Limited, the vertically integrated national utility, operates under chronic financial stress, with reported losses reflecting several structural challenges include

- Infrastructure sensitivity: Transmission and distribution networks are vulnerable to landslides, floods, and saline corrosion (e.g., 2024 Enga landslide).
- Geographic barriers: Prohibitive capital costs for grid extension across mountainous terrain make decentralized renewable mini-grids more economically viable than grid extension for remote communities.
- Regulatory transition: The National Energy Authority (NEA), established under the NEA Act 2021, validated off-grid regulations for small power systems in late 2025. However, implementation remains at an early stage, and institutional capacity for the licensing and oversight of community-scale systems is currently limited.
- Dependence on expensive generation: High electricity costs are driven by a heavy reliance on expensive thermal generation using imported oil products. This is compounded by a small market, logistical hurdles, and historical inconsistencies in enforcing sector investment plans.
- Systemic reliability issues: Supply reliability is compromised by inadequate maintenance and a lack of refurbishment for transmission assets. Low bill collection rates further restrict PPL's cash flow, leading to reduced fuel purchases, limited generation capacity, and frequent load shedding.

- Planning and governance gaps: Inadequacies in planning, coordinating, and financing projects have resulted in weak enforcement of sector governance arrangements.

These constraints impede scalable rural electrification and slow renewable energy integration, highlighting the need for climate-resilient infrastructure, decentralized solutions, and strengthened institutional capacity.

2. Overall Objective and Rationale

The overall objective of this project is to strengthen the climate-adaptive capacity of rural communities, MSMEs and key productive value chains in Papua New Guinea. This will be achieved by transitioning decentralized renewable energy and water systems from chronic unreliability and climate vulnerability to autonomous, climate-resilient service delivery. Utilizing a 'proactive islanding' model, the project will integrate climate-resilient technology and hardened infrastructure supported by national institutional frameworks and replicable community-led utility models. By ensuring electricity and water access, the project secures essential services and protects communities from the damaging consequences of extreme weather events. The project explicitly addresses the energy-water-food Nexus by providing the technical and financial foundation for autonomous water purification and climate-smart cold storage, thereby preventing economic loss and damage and securing rural livelihoods.

3. Baseline Project Scenario

In the absence of targeted interventions, rural communities in Papua New Guinea will remain trapped in a cycle of climate-induced fragility and service deficits. With rural electrification below 15% and safe water access at 33%, the baseline is characterized by a 'Resilience Deficit' where existing systems are not designed for the intensifying hazards of the next three decades.

Water and food Security risks: Rural households face water source depletion during droughts and contamination during floods, while fossil fuel dependence and limited electricity constrain pumping, treatment, and storage capacity. This vulnerability compounds food insecurity as subsistence farmers suffers significant post-harvest losses without power for irrigation, refrigeration, or processing, alongside climate-induced yield variability and crop losses limiting income opportunities. In the baseline scenario, sporadic energy interventions - often utilizing 'grid-following' technology - lack the technical ability to operate autonomously during grid failures or fuel supply disruptions. Consequently, when climate shocks occur, these systems become 'stranded assets,' leaving clinics, schools, and water pumps without power at the exact moment they are needed for disaster response.

Climate-Compounded Nexus Risks: Under the baseline, the energy-water-food nexus is a single point of failure. Droughts deplete surface water sources, while floods contaminate them; without resilient, electrically-powered pumping and treatment, communities face immediate health crises. Simultaneously, subsistence farmers suffer significant post-harvest losses (estimated at 30-50% for perishables) because the baseline lacks the stable power required for cold storage or value-added processing, exacerbating food insecurity as yields become more variable.

Service delivery constraints: Baseline operations lack sustainable utility models. Infrastructure is often installed without professional training, quality and resilience standards, cost-recovery mechanisms, or community ownership. In the absence of this project, these informal arrangements will continue to collapse, wasting capital investment and reinforcing the 'build-neglect-replace' cycle.

Institutional constraints: National policy frameworks exist without operational support structures for rural service delivery. No dedicated coordination mechanisms or technical assistance units provide financing

guidance, regulatory support, or performance monitoring for decentralized systems. Rural initiatives therefore face high sustainability risks absent institutional backing, limiting alignment with national electrification and WaSH policy objectives for vulnerable populations.

Following initial stakeholder consultations, two remote island locations have been pre-selected - to be formally confirmed during the PPG phase: Buka in Northern Bougainville (5.4167° S, 154.6667° E) and Daru Island in the Western Province (9.0833° S, 143.2083° E). These remote island and coastal communities were identified due to their profound vulnerability to climate change and an acute lack of reliable energy access. Both areas face escalating threats from sea-level rise, severe storms, and saltwater intrusion, which frequently disrupt basic existing infrastructure. These specific locations will serve as critical testing grounds for adapting essential services in environments where traditional systems often fail. By deploying climate-resilient renewable energy and water solutions in these highly exposed areas, the project directly addresses the urgent needs of marginalized populations. Furthermore, anchoring this fieldwork with a central support hub in Port Moresby (9.4436° S, 147.1803° E) ensures that the practical lessons learned from these remote communities will be captured to inform national policies, fostering a scalable approach to climate adaptation that leaves no one behind.

4. Alternative Transformational Project Scenario

The proposed project shifts the trajectory of PNG's target communities from climate vulnerability caused by chronic service deficits toward resilient utilities operating in a community owned and professionally managed service model. By installing climate-resilient solar PV mini-grids and water systems and enabling cold storage systems, the project addresses the core barriers to sustainable development, climate change mitigation and climate adaptation.

Resilient infrastructure and integrated service delivery: Under the alternative scenario, communities gain access to climate-resilient solar mini-grids and water systems designed to 1-in-100-year flood and Category 5 wind standards. Unlike the baseline, these systems incorporate site-specific safeguards to withstand the climate hazards characteristic of PNG's rural landscape. The project replaces reliance on biomass and kerosene with reliable, renewable power capable of supporting productive uses of energy. Further, the communities will benefit from resilient water systems covering abstraction, filtration, and storage that enable reliable supply to safe water and eliminating dependence on contaminated surface sources during extreme weather events. Crucially, the project introduces Grid-Forming (GFM) technology, enabling these systems to provide 'synthetic inertia' and 'black-start' capabilities. Unlike the baseline, these hubs can 'island' and maintain 24/7 autonomous service delivery even when the national grid or fuel supply chains are severed by climate disasters.

Integrated Nexus Hubs for Economic Resilience: The project replaces the fragmented baseline with integrated service delivery. Resilient power is used to secure the water supply (abstraction, filtration, and storage) and enable productive uses. By providing reliable cold storage and solar-powered irrigation, the alternative scenario directly addresses post-harvest losses, stabilizing the food supply and creating the economic buffers (green jobs and increased household income) necessary to withstand climate shocks.

Professionalized 'Small-Utility' Business and Operational Models: The project establishes a paradigm shift from informal volunteer arrangements to sustainable small-utility business models. These community-based utilities operate with formal governance, cost-recovery mechanisms, and professionalized technical oversight. Local operators, including women- and youth-led, receive training to ensure system longevity, effectively ending the cycle where infrastructure is built and then abandoned due to neglect. By providing reliable electricity, the alternative scenario unlocks productive micro-businesses, including solar-powered cold storage and irrigation. This directly addresses the post-harvest losses currently suffered by subsistence farmers, stabilizing food security and building the economic buffers necessary for households to withstand climate-

induced yield declines.

Institutional coordination and scalability: At the national level, the project bridges the institutional vacuum by operationalizing the NEP 2017–2027 and WaSH Policy 2015–2030 through a dedicated National Support Unit. This unit provides the technical assistance, monitoring, and regulatory clarity required for decentralized systems to thrive. Inter-ministerial agreements are established to coordinate energy and water services as a single nexus, ensuring that investments are no longer implemented in silos. This institutional backing provides a clear pathway for scaling the model nationwide, ensuring rural communities are no longer excluded from PNG's 70% electrification target.

5. Justification for and value proposition of the project

GEF support will finance the incremental costs required to transition remote communities from vulnerable diesel generation to climate-hardened, renewable mini-grids. While national electrification efforts—such as the World Bank NEAT program—focus heavily on urban centers and main grids, they frequently bypass geographically isolated coastal and island provinces. This SCCF intervention specifically targets this 'last mile' gap, funding the critical 'resilience premium' needed to engineer off-grid systems capable of withstanding extreme weather conditions and recovering quickly from severe climate shocks.

Currently, these isolated communities depend on diesel fuel transported via unpredictable maritime and river routes. Climate-induced disruptions in this supply chain cause cascading failures across essential services, jeopardizing the water-energy-food nexus (e.g., safe drinking water, agricultural cold chains, and health services). By decentralizing the energy system and eliminating fossil fuel dependence, the project mitigates exposure to both global price escalations and local climate disasters. The project systematically addresses vulnerability reduction through two distinct but complementary pathways:

- **Increasing the adaptive capacity of infrastructure and institutions**: At the asset level, the integration of resilience-enhancing technologies (e.g., GFM inverters, cyclone-rated mounting) ensures off-grid energy and water systems can withstand extreme climate variability. At the governance level, the project builds the institutional framework needed to transition from ad-hoc, donor-dependent projects to a sustainable national strategy. By establishing a National Support Unit and inter-ministerial coordination, it ensures rural service delivery is backed by long-term technical oversight.
- **Reducing the sensitivity of local populations**: By ensuring the continuity of electricity and water supply during climate shocks, the project shields communities from compounding impacts. Reliable power secures water sanitation and enables agricultural cold storage, directly buffering the local food-water nexus. This uninterrupted service continuity preserves the foundational resources required for rapid community disaster response and recovery.

  The project delivers strong additionality by targeting financial, technical, and institutional gaps that international development aid and national budgets currently do not address:

- **Financial Additionality (The 'Resilience Premium'):** Baseline financing from the national budget and commercial sources primarily focuses on urban grid maintenance, leaving remote communities excluded. Furthermore, standard donor pilots often lack the specific funding required for severe climate adaptation. SCCF resources provide the 'resilience premium'—the incremental funding needed to bridge the gap between standard electrification and climate-hardened infrastructure (e.g., Category 5 wind-rated mounting, flood-proofed powerhouses). This upfront adaptation investment de-risks the environment, making small-utility models and local private sector involvement financially viable.

- **Technical Additionality:** Standard baseline investments typically utilize off-the-shelf renewable hardware that frequently fails in high-salinity and extreme weather environments. The project introduces specialized engineering, Grid-Forming (GFM) inverters, and climate-hardened battery storage to ensure assets survive the climate impacts they are meant to mitigate. This prevents renewable infrastructure from becoming 'stranded' during severe weather and facilitates a permanent displacement of climate-vulnerable fossil fuel supply chains.
- **Institutional Additionality:** Rural energy pilots in PNG are often implemented in silos and suffer high failure rates within a few years due to a lack of long-term operational support. This project establishes permanent national architecture by creating the National Support Unit at the National Energy Authority (NEA) and operationalizing National Resilience Standards. This transitions the sector from a fragmented 'reactive repair' approach to sustainable, risk-informed utility management.

6. Stakeholder and Systems Approach

Effective project implementation requires deep engagement and buy-in from key public, private, and civil society stakeholders throughout the project lifecycle. Consultation during the Project Preparation Grant (PPG) phase will formalize roles and secure co-financing. The project adopts a multi-stakeholder, co-creation model designed to ensure national ownership, technical complementarity, and long-term sustainability. The project's partnership architecture ensures vertical integration - from policy formulation to on-the ground adoption - and horizontal collaboration, maximizing impact and replication potential.

Oversight is provided by a Project Steering Committee (PSC) composed of key government entities. The inclusion of Department of National Planning and Monitoring would be important for mainstreaming climate resilience into national planning and budgetary frameworks (CI 13). Department of Provincial and Local Level Government for coordination support at the provincial level; National Energy Authority serve as important partner, supported by PPL as technical partner and UNIDO as the Implementing Agency, as well as coordinator of the G-RES and GN-SEC. In the moment, there is no final decision on the national execution partners by the Government. Therefore, this will be defined during the PPG phase.

7. Part of the Global Program on Climate Resilient Renewable Energy Systems (GRES)

The national project is part of the GEF and bilateral donor (e.g., Austria) funded Global Program on Climate-Resilient Renewable Energy Systems (G-RES), which is a multi-country program focused on accelerating a sustainable, climate-resilient energy transition across SIDS. The core objective of the overall program is to promote resilient renewable energy (RE) systems that reduce GHG emissions and dependence on fossil fuels, strengthen energy security and deliver productivity gains and climate adaptation co-benefits in key island value chains (water, agri-food, tourism, blue economy). The G-RES is underpinned by the principle that mitigation investments in SIDS are highly vulnerable and require adaptation financing (SCCF/LDCF) to be secure and sustainable. The program places a strong emphasis on empowering energy operators and MSMEs as the primary drivers of this transition.

The G-RES is structured as a framework comprising this global-regional project, which provides an umbrella for the national GEF-funded projects implemented in parallel with allocations from STAR, SCCF, or LDCF (in some cases). The global-regional project (GEF ID:12229) aims to accelerate national progress through regional and SIDS-SIDS cooperation, leveraging shared knowledge, harmonized standards, and blended financing to reduce barriers that prevent private sector, particularly MSMEs, to adopt or become suppliers of climate-resilient renewable energy and energy efficiency (R&EE) solutions. Due to the exposure of SIDS, the use of climate-proven technologies and methodologies (i.e., those features representing the incremental cost of adaptation) are a prerequisite for the sustainability of GEF CMM and mitigation investments. The SCCF component of G-RES (and this PNG project) specifically finances this resilience premium, ensuring that the

overall program's goal is climate-secure. G-RES contributes directly to the implementation of major multilateral commitments, including the Paris Agreement and the Antigua and Barbuda Agenda for SIDS (ABAS).

Figure 1: Global Program on Climate Resilient Renewable Energy Systems for SIDS

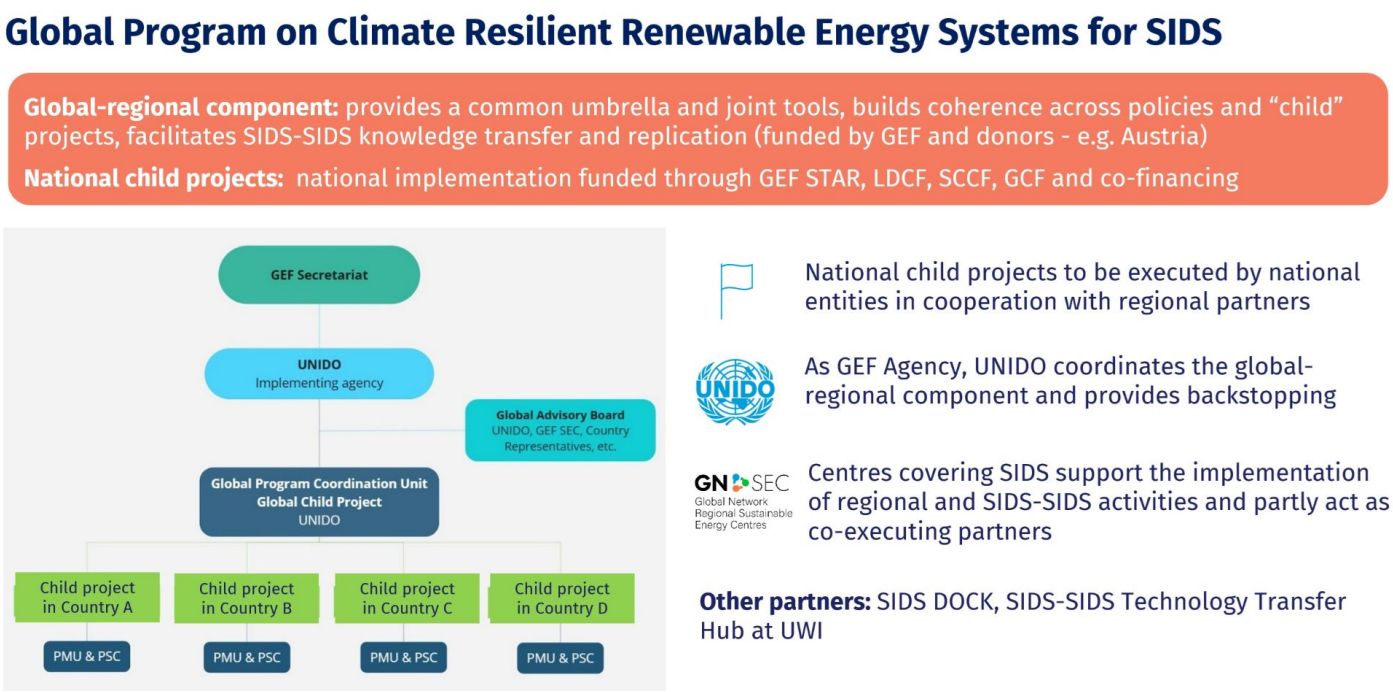


Figure 2: Objectives and scope of intervention of the G-RES Program for SIDS

B. PROJECT DESCRIPTION

Project description

This section asks for a theory of change as part of a joined-up description of the project as a whole. The project description is expected to cover the key elements of good project design in an integrated way. It is also expected to meet the GEF's policy requirements on gender, stakeholders, private sector, and knowledge management and learning (see section D). This section should be a narrative that reads like a joined-up story and not independent elements that answer the guiding questions contained in the PIF guidance document. (Approximately 3-5 pages) see guidance here

1. Overall Objective and Rationale

Overall Objective: The project seeks to strengthen the climate adaptive capacity of rural communities and key value chains—such as agriculture and fisheries—in Papua New Guinea by advancing sustainable, climate resilient renewable energy and water utility models. This objective is operationalized through a dual-track approach that establishes a robust national support framework while demonstrating the field-level viability of climate-hardened infrastructure.

Rationale: The project is structured to address systemic barriers to rural resilience by moving beyond simple infrastructure deployment toward a holistic ecosystem of technical standards, professionalized operations, and innovative financing:

- Component 1: National support framework for climate-resilient rural renewable energy and water systems. This component addresses the institutional vacuum that currently prevents the scale-up of durable rural services. By establishing a Gender- and youth-responsive national support framework, the project ensures that the National Energy Authority (NEA) can provide a dedicated support desk for community utilities. A critical rationale for this component is the development of Climate Risk Assessments and Resilience Standards (Output 1.1.1) specifically for the energy-water-food nexus. This ensures that technical dimensions for modules, inverters, battery sizing, and mounting are not 'off-the-shelf' but are engineered for PNG's specific climate profile. Furthermore, the project provides the practical guidelines necessary to operationalize the new Off-grid Regulation for Small Power Systems, bridging the gap between national law and rural implementation.

- Component 2: Investments in climate-resilient rural renewable energy and water systems. The rationale for this component is to provide a 'proof of concept' and lay the foundation for the replication of high-reliability utility models. Regarding Outcome 2.1, the project finances the installation of two solar PV mini-grids and water systems engineered for extreme resilience, specifically designed to withstand Category 5 cyclones, 1-in-100-year flooding, and marine-grade corrosion, which is paired with business continuity plans to ensure services remain operational during and after climate emergencies. Outcome 2.2, the project recognizes that GEF resources alone cannot close the access gap and addresses the financial barrier by conducting a feasibility study for a "Beyond the Grid Fund," a proposed mechanism that explores blended finance and resilience premiums to incentivize private sector participation in the nexus market. To ensure long-term technical quality and operational sustainability, the project establishes a Training and Certification Scheme for renewable energy technology and service providers, creating a professionalized local workforce – targeting 50% women and 30% youth participation - capable of maintaining these complex systems.

By integrating climate-resilient electricity and safe water access, the project provides a stable foundation for the agriculture and fisheries sectors. The transition to professionalized, community-led utilities—supported by a national help desk and innovative financing - replaces the failed 'build-neglect-replace' cycle with a sustainable, market-led model. This approach not only protects communities from immediate climate shocks but also builds the long-term institutional and technical capacity required to disseminate lessons through the

G-RES and GN-SEC networks, positioning PNG as a regional leader in climate-resilient service delivery.

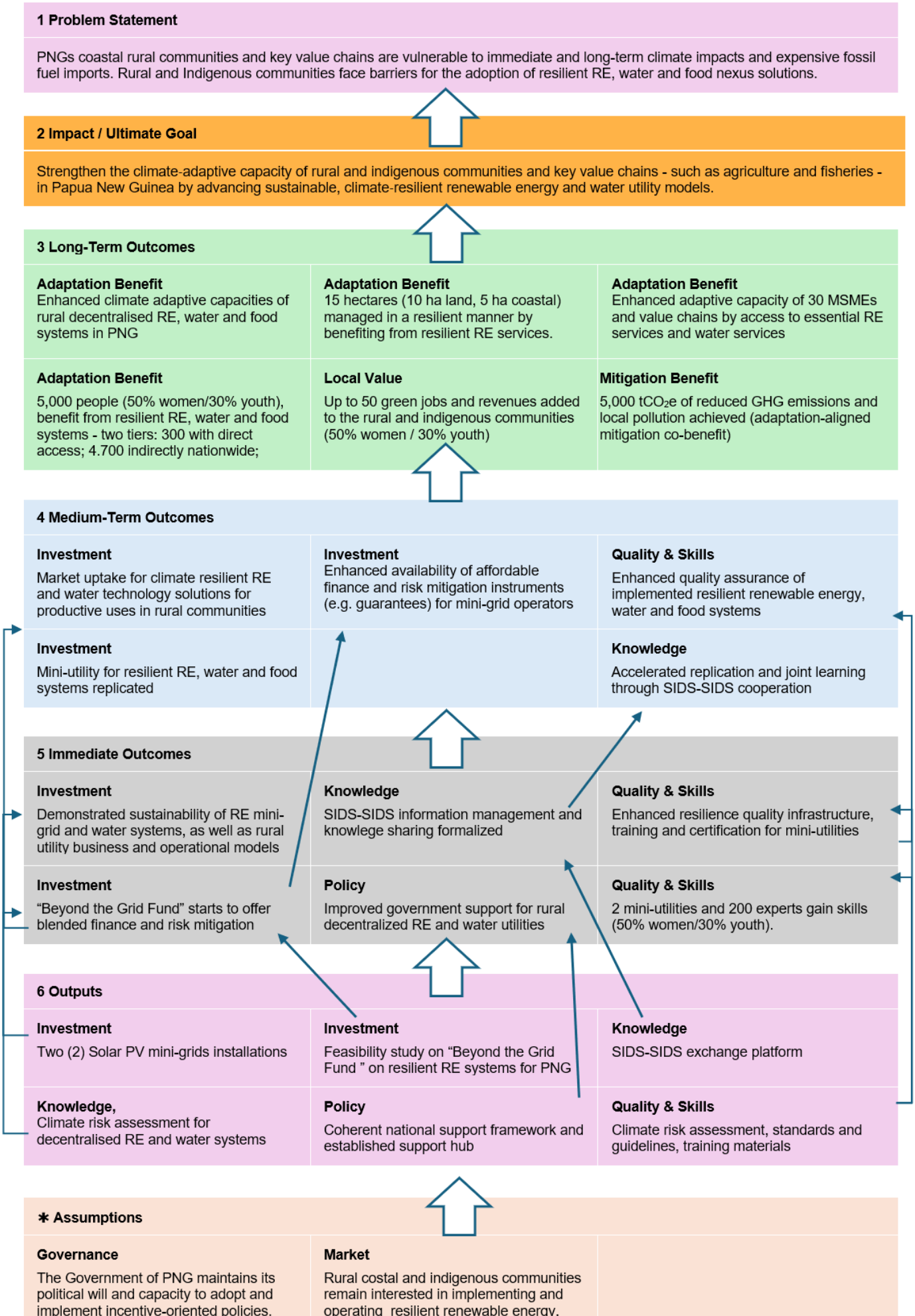
2. Theory of Change (ToC)

The project's Theory of Change centers on overcoming critical institutional, financial, and technical barriers - the 'soft limits' to adaptation - that currently prevent PNG's rural energy and water sectors from achieving climate resilience. By establishing rural and indigenous community small-utility models supported by a permanent national institutional framework, the intervention addresses systemic gaps hindering adaptation while enabling fossil fuel displacement. These key barriers are summarized below:

1. Historic lack of investment financing for rural electrification and clean water systems, and their financial viability under “normal” business models; absence of 'resilience premiums' or blended finance mechanisms to incentivize private sector entry into the rural market;
2. Historic difficulty (or lack of) adequate rural and indigenous community and landholder agreements for land and services of rural electrification and clean water systems and related governance for these systems.
3. Lack of business management and operational know-how to run micro- and small businesses for small utilities and green entrepreneurs.
4. Lack of general technical operations and maintenance know-how in rural and indigenous communities for rural electrification and clean water systems.
5. Inadequate mechanisms for major maintenance of equipment for rural electrification and clean water systems (that communities cannot do), and a supply chain for spare parts.
6. Lack of a national support mechanism to assist rural and indigenous communities with installation, operation, maintenance, and business models for rural electrification, clean water, and food storage systems.
7. Policy & Standards Gap: Lack of specific climate-resilience standards for decentralized systems, leading to 'off-the-shelf' hardware failures during Category 5 cyclones or 1-in-100-year floods.
8. Financial Barriers: Historic lack of investment financing and the absence of 'resilience premiums' or blended finance mechanisms to incentivize private sector entry into the rural nexus market.
9. Supply Chain Fragility: Inadequate mechanisms for major maintenance and a lack of reliable supply chains for specialized resilient spare parts (e.g., GFM inverters and BESS components).

The project adopts an integrated approach where process planning, finance, capacity building and knowledge management reinforce each other. This systemic approach is needed to ensure both short- and long-term outcomes that lead for enhanced adaptation to climate change of the national electricity system, while are the same time building the foundation for further adaptation and mitigation interventions beyond the support of this GEF project.

Figure 3: Theory of Change


1 Problem Statement
PNGs coastal rural communities and key value chains are vulnerable to immediate and long-term climate impacts and expensive fossil fuel imports. Rural and Indigenous communities face barriers for the adoption of resilient RE, water and food nexus solutions.
2 Impact / Ultimate Goal
Strengthen the climate-adaptive capacity of rural and indigenous communities and key value chains - such as agriculture and fisheries - in Papua New Guinea by advancing sustainable, climate-resilient renewable energy and water utility models.
3 Long-Term Outcomes
Adaptation Benefit
Enhanced climate adaptive capacities of rural decentralised RE, water and food systems in PNG
Adaptation Benefit
15 hectares (10 ha land, 5 ha coastal) managed in a resilient manner by benefiting from resilient RE services.
Adaptation Benefit
Enhanced adaptive capacity of 30 MSMEs and value chains by access to essential RE services and water services
Adaptation Benefit
5,000 people (50% women/30% youth), benefit from resilient RE, water and food systems - two tiers: 300 with direct access; 4.700 indirectly nationwide;
Local Value
Up to 50 green jobs and revenues added to the rural and indigenous communities (50% women / 30% youth)
Mitigation Benefit
5,000 tCO2e of reduced GHG emissions and local pollution achieved (adaptation-aligned mitigation co-benefit)
4 Medium-Term Outcomes
Investment
Market uptake for climate resilient RE and water technology solutions for productive uses in rural communities
Investment
Enhanced availability of affordable finance and risk mitigation instruments (e.g. guarantees) for mini-grid operators
Quality & Skills
Enhanced quality assurance of implemented resilient renewable energy, water and food systems
Investment
Mini-utility for resilient RE, water and food systems replicated
Knowledge
Accelerated replication and joint learning through SIDS-SIDS cooperation
5 Immediate Outcomes
Investment
Demonstrated sustainability of RE mini-grid and water systems, as well as rural utility business and operational models
Knowledge
SIDS-SIDS information management and knowlege sharing formalized
Quality & Skills
Enhanced resilience quality infrastructure, training and certification for mini-utilities
Investment
"Beyond the Grid Fund" starts to offer blended finance and risk mitigation
Policy
Improved government support for rural decentralized RE and water utilities
Quality & Skills
2 mini-utilities and 200 experts gain skills (50% women/30% youth).
6 Outputs
Investment
Two (2) Solar PV mini-grids installations
Investment
Feasibility study on "Beyond the Grid Fund " on resilient RE systems for PNG
Knowledge
SIDS-SIDS exchange platform
Knowledge,
Climate risk assessment for decentralised RE and water systems
Policy
Coherent national support framework and established support hub
Quality & Skills
Climate risk assessment, standards and guidelines, training materials
* Assumptions
Governance
The Government of PNG maintains its political will and capacity to adopt and implement incentive-oriented policies.
Market
Rural costal and indigenous communities remain interested in implementing and operating resilient renewable energy.

Causal Pathway Summary

Immediate Outcomes: The pathway begins with the delivery of tangible infrastructure and technical frameworks. This includes the installation of two (2) Solar PV mini-grids and the development of Climate Risk Assessments for decentralized renewable energy and water systems. Simultaneously, the project establishes a coherent national support framework and a physical support hub to help rural and indigenous communities and their mini-utilities address governance and operations. Technical quality is secured through the creation of resilience standards, guidelines, and training materials, while a feasibility study for the "Beyond the Grid Fund" and a SIDS-SIDS exchange platform provide the groundwork for financial and knowledge-based scaling.

Intermediate Outcomes: These outputs trigger a shift in market and institutional behavior. The demonstration of high-reliability utility models, governed by business continuity plans, validates the technical and financial viability of resilient RE and water solutions and utility models. The 'Beyond the Grid Fund' begins to offer blended finance and risk mitigation, leading to increased market uptake for climate-resilient technologies for rural and indigenous communities. The government support for rural utilities improves through the new policy framework, while the training and certification schemes result in 2 mini-utilities and 200 experts (50% women/30% youth) gaining high-level resilience skills. SIDS-SIDS information sharing is formalized, ensuring regional knowledge flows into PNG's rural sectors.

Long-term Outcomes: The causal chain culminates in the strengthening of the climate-adaptive capacity of rural communities and key value chains, specifically agriculture and fisheries. The long-term adaptation benefits are measured by 15 hectares (10 ha land, 5 ha coastal) managed in a resilient manner and 5,000 people (300 direct access; 4,700 indirect nationwide) benefiting from resilient systems. This impact includes the creation of 50 green jobs. This systemic shift from diesel reliance to decarbonized power generation will result in an estimated direct and indirect reduction of 80,732 tCO2e over the 20-year lifespan of the technology (5,046 directly through the mini-grid and 75,686 tCO2e through replication).

Ultimate Impact: PNG achieves a scalable, financially self-sustaining rural energy-water service delivery model that withstands climate extremes, including droughts, floods, and landslides and address the nature of the rural and indigenous communities. The energy-water-food nexus is strengthened through reliable services that enable climate-smart agriculture, significantly reduce post-harvest losses, and diversify rural livelihoods. The systematic inclusion of 'last mile' rural and indigenous communities in national electrification and WaSH trajectories creates transformative resilience for PNG's predominantly rural and indigenous population while contributing to long-term low-carbon development pathways. Critical energy services are decoupled from fossil fuel supply-chains highly vulnerable to climate change impacts.

Assumptions and Risks

Assumptions: The assumptions that underpin the ToC are that the Government of PNG maintains its political will and capacity to adopt and implement incentive-oriented policies and rural coastal communities remain interested in implementing and operating resilient renewable energy, water and food systems.

Risks: The major risks that can impede the ToC are a lack of continued support (technology transfer, capacity building and finance) to implement the needed adaptation and mitigation (i.e. renewable energy) interventions in the future and that macroeconomic circumstance or other shocks do not impede capital coming into PNG. There is also a minor risk of changes in government shifting future policy priorities.

3. Project Components and Activities

Component 1: National support framework for climate-resilient rural renewable energy and water systems

This component addresses the 'soft limits' of adaptation by creating the regulatory and institutional environment necessary for decentralized systems to survive PNG's extreme climate profile.

Outcome 1.1: Gender- and youth-responsive national support framework for the sustainable operation and financing of climate-resilient RE and water systems for productive uses.

- Output 1.1.1: Climate risk assessment and resilience standards for rural RE mini-grid systems. Description: This output moves beyond generic energy standards. It involves a national-level hazard mapping of 'hotspots' for cyclones, flooding, and sea-level rise addressing all future climate scenarios. Based on this, the project will codify engineering standards specifically for the nexus: defining marine-grade corrosion specs for coastal inverters, battery dimensioning, elevated mounting structures for flood zones, and wind-loading requirements for solar arrays in cyclone-prone provinces. It also includes battery dimensioning standards to ensure autonomy during prolonged cloud cover caused by climate shifts.

- Output 1.1.2: Gender- and youth-responsive national framework and support desk for small-scale community utilities. Description: Recognizing that rural and indigenous communities cannot manage complex repairs alone, this output establishes a National Support Desk that considers the unique circumstances of the indigenous communities. This is a centralized technical assistance unit, which will provide support to rural mini-grid and water utilities while all future climate scenarios.

- Output 1.1.3: Practical guidelines and procedures for the new Off-grid Regulation for Small Power Systems. Description: To bridge the gap between the 2025 regulations and local implementation, this output develops simplified 'how-to' manuals while considering the rural and indigenous nature of the communities.

Component 2: Investments in climate-resilient rural renewable energy and water systems

This component delivers the 'hard' adaptation increment and tests the financial mechanisms required to crowd in private sector participants. This component delivers the 'hard' adaptation increment and tests the financial mechanisms required to crowd in private sector participants. The rural renewable energy and water systems installed will contribute to food-energy-water nexus by: (1) Reducing electricity costs by switching from fossil fuels, that in turn increases affordability and uninterrupted electricity supply that is more resilient to the impacts of climate change. (2) The affordability and uninterrupted electricity supply is used for cold storage of food and food processing/preservation to allow for increase food security in the rural coastal communities. (3) The enhanced water systems will help prevent water loss, contamination and salination that are exacerbated due to the impacts of climate change. The water system will utilise the uninterrupted electricity supply to increase water storage and deliver water to the community, which will also allow for more water resources for food production. (4) The more affordable and uninterrupted electricity supply will also be used the new MSMEs for business that generation income for the community, increasing their economic resilience and ability to financial address impacts from climate change.

Outcome 2.1: Demonstrated feasibility and viability of rural climate-resilient RE mini-grid and water systems supporting key productive uses:

- Output 2.1.1: Feasibility study and EPC tender for the installation of two (2) rural solar PV mini-grids and water systems. Description: This involves technical designs and the launch of a competitive tender for Engineering, Procurement, and Construction (EPC). Unlike standard tenders, these specifications will mandate resilience-by-design: Category 5 wind-resistance for all arrays, waterproof battery enclosures, and water filtration systems capable of handling high turbidity during 1-in-100-year flood events as a means to address all future climate scenarios. While the feasibility study will also address the social and economic impacts on with the rural and indigenous communities.

- Output 2.1.2: Commissioned and operational solar PV mini-grid and water systems. Description: This is the physical deployment of the hardware and software. Beyond installation, this output includes a one-year supervised technical support period where the contractor provides on-the-job mentorship to rural and indigenous community operators, ensuring the system's smart-controllers and grid-forming capabilities are correctly calibrated to local load profiles.
- Output 2.1.3: Sustainable business, operational and maintenance (O&M) models and climate emergency plans. Description: This output establishes the 'Small Utility' entity at each site taking on to consideration the unique circumstances of the rural and indigenous communities. Crucially, it creates Climate Emergency Plans for Business Continuity, detailing protocols for securing hardware before a cyclone and procedures for prioritized power restoration to critical services (cold storage and water) immediately following a climate shock.
- Output 2.1.4: Gender- and youth-responsive technical and business training. Description: This goes beyond simple O&M. It trains rural and indigenous community members (50% women, 30% youth) in utility management, including digital billing, asset management, and the business case for productive uses such as refrigerated fish storage or mechanical crop processing.

Outcome 2.2: Proposed mechanisms to facilitate market uptake of climate-resilient RE systems for productive uses.

- Output 2.2.1: Feasibility study on a "Beyond the Grid Fund." * Description: This financial innovation explores how to bridge the 'Adaptation Increment' cost. The study will design a blended finance facility that provides grants and low-interest loans specifically to cover the extra cost of 'climate-hardening' hardware, as well as risk mitigation (e.g. guarantees), making resilient systems more attractive to private investors and reducing the high-risk barrier for the agriculture and fisheries sectors, especially in the rural and indigenous communities.
- Output 2.2.2: Disseminated results and lessons learned through G-RES and GN-SEC. * Description: This output ensures that PNG's results are not isolated. It formalizes knowledge sharing with other SIDS, using platforms like the Global Network of Regional Sustainable Energy Centers (GN-SEC) to export PNG's technical standards and financial models.<
- Output 2.2.3: Training and certification scheme for climate-resilient RE technology and service providers. Description: To prevent low-quality installations, the project creates a National Certification Scheme. This ensures that any private contractor bidding for rural work must be certified in PNG's specific resilience standards, thereby professionalizing the market and building consumer trust.

4. Transformational Impact and Global Benefits

The project's Theory of Change (ToC) centers on a systemic shift toward climate-resilient rural renewable energy and water utility models, positioning Papua New Guinea (PNG) as a regional leader in energy-water-food nexus solutions. By moving beyond traditional infrastructure cycles, the intervention addresses the structural barriers that currently prevent renewable energy from providing firm, reliable services during extreme climate events. As an SCCF-funded initiative, the primary rationale is the delivery of high-intensity Climate Change Adaptation (CCA) benefits through a combination of institutional de-risking and the application of climate-resilient technologies and standards.

Climate Change Adaptation (CCA) and Transformational Impact

At the national level, the project transforms the management of rural decentralized systems by integrating Climate Risk Assessments and Resilience Standards directly into the National Energy Authority (NEA) operational framework (Output 1.1.1). This technical intelligence allows the government to move from a fragmented donor-pilot approach to a proactive, standardized National Support Framework (Outcome 1.1). By establishing a permanent Support Desk (Output 1.1.2), the project protects the vital energy-water-food nexus,

ensuring that the water pumping stations, cold-storage facilities for fisheries, and agricultural processing hubs remain operational despite intensifying 1-in-100-year floods and Category 5 cyclones, while taking into consideration the special condition of the rural and indigenous communities. This institutional architecture ensures that the 15 hectares (CI 2) of managed land and coastal zones remain productive under a changing climate.

In the target 'last-mile' communities, the project delivers a transformational shift in asset durability. Through the Investment Component (Component 2), the project finances the installation of solar PV mini-grids and water systems engineered specifically for PNG's acute hazards - including marine-grade corrosion resistance and flood-proofed powerhouses (Output 2.1.1). By moving to a professionalized Small-Utility Model (Output 2.1.3), the project ensures that the 300 direct beneficiaries in the pilot sites, and 4,700 indirect beneficiaries nationwide, are supported by a system that includes Climate Emergency Plans for Business Continuity. This ensures that the energy-water lifeline is immune to external fuel supply chain disruptions, allowing for autonomous operation during climate disasters.

Contribution to SCCF Core Indicators

The project's transformational outcomes are mapped directly to the SCCF/GEF-8 Results Measurement Framework to ensure maximum accountability and impact:

- CI 1: 5,000 direct beneficiaries (50% women / 30% youth) gaining enhanced adaptive capacity through resilient energy and water services.
- CI 2: 15 hectares (10 ha land, 5 ha coastal) managed in a climate-resilient manner to support productive value chains.
- CI 3: 3 policy documents/plans adopted, including National Resilience Standards and Community Climate Emergency Plans.
- CI 4: 200 individuals (50% women / 30% youth) trained and certified in resilient RE and water utility operations.
- CI 5: 30 MSMEs (50% women / 30% youth-led) in key value chains (agriculture and fisheries) with increased adaptive capacity for productive uses.

Moreover, the project has other transformational impacts:

- **Addressing the 'Fragility Multiplier':** In rural PNG, decentralized energy is the foundational prerequisite for all other services. The project addresses the 'fragility multiplier'—where a single climate-induced power failure triggers the cascading collapse of water pumping, vaccine cold chains, and emergency communications. By hardening the energy source and enabling systems to operate autonomously ('islanded') when wider supply chains are severed, the project secures the entire essential service delivery chain.
- **Socio-Economic Sustainability:** The intervention unlocks productive uses of energy, such as agricultural processing, irrigation, and refrigeration. For PNG's predominantly subsistence-based rural population, this provides the technical means to reduce post-harvest losses and build the economic buffers necessary to withstand climate-induced yield variability, preventing localized weather events from evolving into protracted economic crises.
- **Financial Scalability:** Crucially, the design of the "Beyond the Grid Fund" establishes a replicable blended finance mechanism. By structuring a facility to specifically cover the upfront 'resilience premium,' the Fund will de-risk investments and incentivize private sector entry into the rural energy-water nexus.
- **Regional Replication:** As part of the G-RES program, the project will scale this model regionally. Combined with the dissemination of lessons learned through regional platforms like the Pacific Centre

for Renewable Energy and Energy Efficiency (PCREEE), this positions the intervention as a financially bankable and highly replicable adaptation blueprint for other Small Island Developing States.

5. Global Environment Benefits (GEBs)

The project delivers tangible GEBs by enhancing the resilience of human-managed ecosystems and reducing the carbon intensity of rural service delivery. As an SCCF-funded project, these benefits are categorized into Adaptation Benefits (primary) and Mitigation Co-benefits (secondary):

- Climate Change Adaptation (Primary GEB): The Core Indicators (C1 to CI5) are explained above.
- Climate Change Mitigation (Co-benefit): his systemic shift from diesel reliance to decarbonized power generation will result in an estimated direct and indirect reduction of 80,732 tCO2e over the 20-year lifespan of the technology (5,046 directly through the mini-grid and 75,686 tCO2e through replication). These mitigation co-benefits are formally tracked under GEF Core Indicator 6 (Greenhouse Gas Emissions Mitigated), successfully bridging PNGs's adaptation and mitigation commitments under the Paris Climate Agreement.

6. Private Sector Engagement

The project creates significant opportunities for private sector participation in PNG's rural energy-water sector by de-risking the market for climate-resilient infrastructure. Private sector entities, including renewable energy developers and engineering firms, will be engaged through competitive EPC procurement processes (Output 2.1.1) for the installation of solar mini-grids and water systems. By mandating adherence to new National Resilience Standards (Output 1.1.1), the project ensures that private contractors compete on quality and durability, establishing a high-value market for climate-hardened hardware.

Market facilitation is further enhanced through the “Beyond the Grid Fund” feasibility study (Output 2.2.1), which identifies blended finance mechanisms and 'resilience premiums' to attract private investment into 'last-mile' communities. Local entrepreneurs benefit directly from the professionalization of small-utility businesses (Output 2.1.3), while green entrepreneurs in the agriculture and fisheries value chains access specialized training for the operation of cold storage and food processing micro-businesses. Finally, the Training and Certification Scheme (Output 2.2.3) ensures that private service providers are technically qualified to maintain these complex systems, creating a sustainable local market for high-skilled technical services.

7. Gender Mainstreaming

Gender and youth considerations are structurally embedded into the project’s DNA through a 'Participation-to-Professionalization' pathway. The project's outcomes benefit rural energy-water service consumers equitably, with specific outputs designed for gender and social inclusion responsiveness, particularly targeting women, youth, and economically disadvantaged groups in PNG's subsistence communities.

Component 1: National Framework Integration Gender and youth responsiveness is institutionalized via the NEA Support Desk (Output 1.1.2), which provides technical and business advisory services tailored to female entrepreneurs. Furthermore, the integration of gender-disaggregated vulnerability data into the National Resilience Standards (Output 1.1.1) ensures that infrastructure siting and

governance protocols meet the safety and economic needs of women. Community engagement processes will specifically assess differential impacts of energy and water access gaps, prioritizing system designs that address gender-specific needs such as time savings from solar-powered water collection and safety through reliable lighting.

Component 2: Investment and Economic Leadership In the investment phase, the project moves beyond passive consumption to active economic leadership. It mandates the inclusion of women in Small-Utility governance (Output 2.1.3) and sets a rigorous target of 50% women and 30% youth for the technical training and Certification Scheme (Output 2.2.3). This effectively breaks gender barriers in the high-skilled energy sector by training 100 women and 60 youth as certified technicians and operators. Additionally, the 'Beyond the Grid Fund' (Output 2.2.1) will specifically explore financial windows to de-risk investments for women-led MSMEs in the agriculture and fisheries value chains, ensuring the 'Resilience Premium' enables women and youth to lead the transition to a climate-secure energy-water-food nexus.

Inclusive Governance and Implementation All vulnerable groups—including female-headed households, youth, the elderly, and persons with disabilities—will be engaged during feasibility studies to understand the differential impacts of climate change on their livelihoods. Their inputs will directly inform system siting, tariff structures, operating hours, and maintenance schedules through Community Governance Development (Output 1.1.3). Business training programs will prioritize women entrepreneurs for cold storage and agro-processing micro-businesses, directly addressing gender disparities in economic opportunities where women currently comprise the majority of subsistence agricultural labor.

8. Knowledge Management and Learning

Knowledge management is treated as a strategic asset to ensure that the 'Resilience-by-Design' approach is codified, sustained, and replicated across Papua New Guinea and the wider Pacific region.

Institutional Knowledge and Standards: Component 1 (Output 1.1.1) builds critical knowledge capacity among the National Energy Authority (NEA), PNG Power Limited (PPL), and provincial stakeholders by developing National Resilience Standards for energy-water nexus infrastructure. This codifies technical findings on hardware performance under extreme climate hazards (Category 5 winds, 1-in-100-year floods). Furthermore, Output 1.1.3 will capture and integrate indigenous local knowledge on climate hazards and community-level risks, ensuring that national policy is informed by the lived experience of rural populations.

National Support and Scalability: The National Support Unit (Output 1.1.2) acts as the central repository for project knowledge products, including the feasibility studies for the “Beyond the Grid Fund” (Output 2.2.1) and the validated utility business models. By coordinating technical findings and performance data from the pilot sites, the NSU ensures sustained access to scaling frameworks and O&M best practices beyond the project lifespan. This establishes a 'National Help Desk' capability that builds the institutional capacity required to attract future climate finance and de-risk private sector entry into the rural nexus market.

Professionalization and Regional Exchange: To ensure knowledge translates into high-level skills, the project establishes a Training and Certification Scheme (Output 2.2.3), transforming technical findings into a formal credentialing system for 200 local experts (50% women/30% youth). At the international level, the project utilizes the G-RES and GN-SEC networks (Output 2.2.2) – particularly the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE) - to facilitate SIDS-SIDS information management and knowledge sharing. This allows PNG to act as a 'lighthouse' for other

Pacific Island States, sharing its pioneering technical standards and financial models for climate-resilient rural utility delivery.

Moreover, the project will produce and disseminate lessons learnt on gender mainstreaming and integrating gender perspectives to ensure scaling up and replication. This could be done through leveraging the GN-SEC Gender and Youth Focal Point Network as well as the Gender Energy Compact Network and partners.

9. Stakeholder coordination and implementation structure

UNIDO, through the Sustainable and Just Energy Transition Unit (ECA/JET) and in coordination with the UNIDO-Barbados SIDS Hub in Bridgetown, will serve as the GEF Implementing Agency. UNIDO provides technical oversight and ensures the project's strategic alignment with the Global-RES program. Drawing on lessons learned from established SIDS initiatives, UNIDO will facilitate robust SIDS-SIDS cooperation and technical knowledge transfer through the Global Network of Regional Sustainable Energy Centres (GN-SEC).

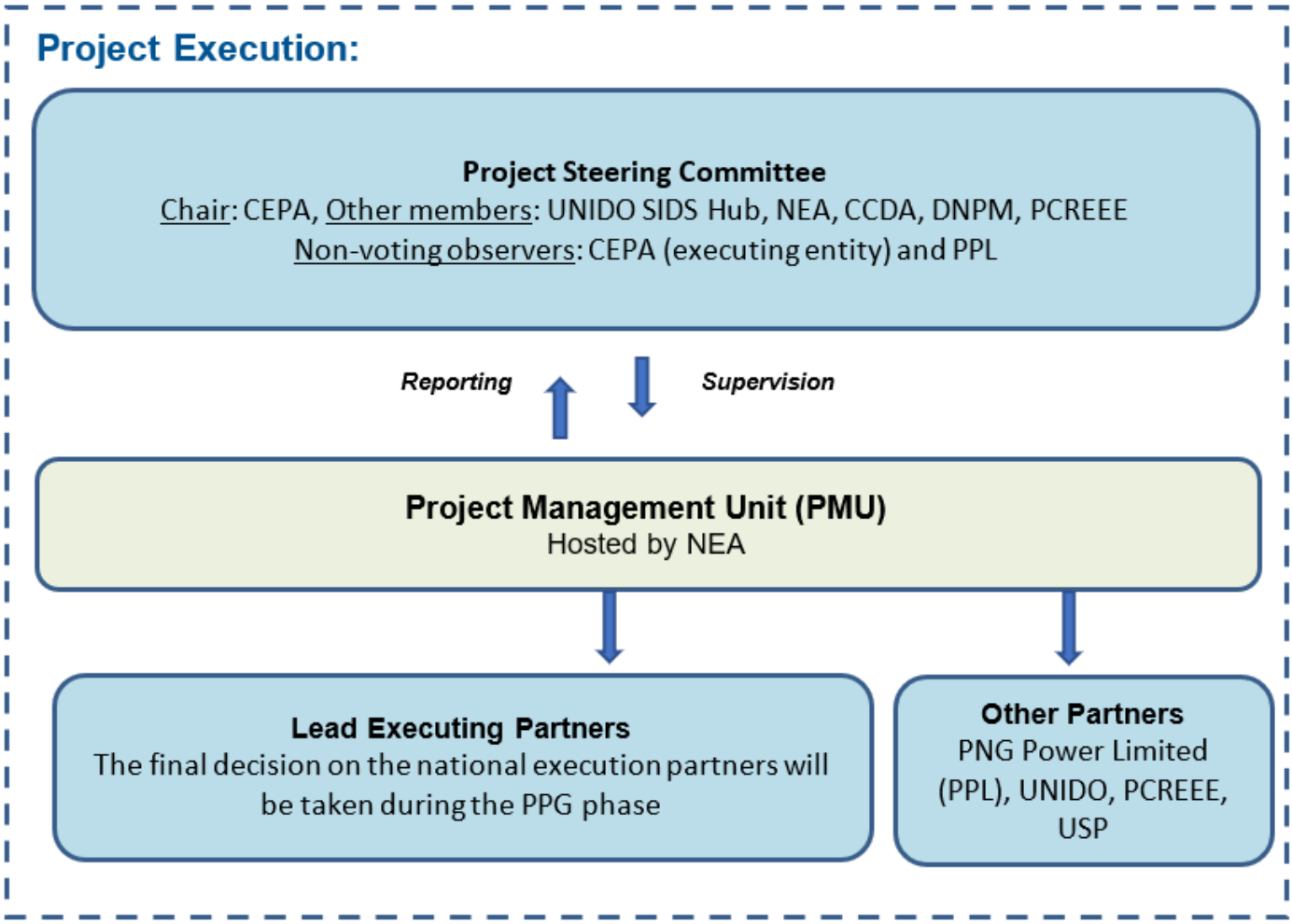
As the host of the GN-SEC platform, UNIDO ECA/JET facilitates South-South and triangular cooperation between the centers. In coordination with the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE)—and leveraging inter-regional exchange with the Caribbean Centre for Renewable Energy and Energy Efficiency (CCREEE) and other centers such as CEREEAC, SACREEE, SICREEE, and ECREEE—UNIDO will facilitate the transfer of climate-resilient engineering expertise, technical blueprints, and gender-mainstreaming models to other SIDS regions.

The institutional structure of this project and a summary of the stakeholder roles are given in the below figure and table.

Figure 4: Implementation Structure

Funding Partner: The Global Environment Facility (GEF)

Implementing Agency: UNIDO



The following tentative roles of the various stakeholders are foreseen. This will be further detailed/adjusted during the PPG phase. The current list, especially the executing entities is based on the current structure for policy and regulation in PNG, e.g. the existing roles of the entities. DNPM has an overall coordination role, where NEA is proposed (not decided) to act in the project management role. PPL provides more a support technical role based on their regulatory mandate to inspect electrical installations, while DPLGA provided a coordination role with the communities. The implementation structure will be finalized during the PPG phase. It is intended to work only with one main executing entity.

Type	Entity	Level of engagement	Contribution	Component
Governance	Conservation Environmental Protection Authority (CEPA).	CEPA is the ministry responsible for environment and is the GEF focal point for PNG. CEPA is a **steering**	**Operational guidance**: Guidance in matters of GEF supported projects and processes.	1 and 2

		committee member and chair.		
Governance & Execution	Department of National Planning and Monitoring	DNPM is responsible for formulation, coordination and alignment of plans, policies and strategies which support the uptake of renewable energy into national plans and budget. The national WASH policy implementation sits with DNPM. DNPM will most probably as an official **co-Executing Entity** (pending Government decision) and is a **steering committee** member (without voting right in case it is an executing partner).	**Resources mobilization**: Address coordination and alignment of renewable energy and WASH into government's national plans and budgets.	1 and 2
Governance & Execution	National Energy Authority	NEA is a state-owned entity performing secretariat functions to the National Energy Board, acts as an international contact point and represents PNG in overseas energy meetings. NEA will potential act (pending Government decision) as an official **co-Executing Entity** coordinating the project work, member of the Steering Committee (without voting right in case it is an executing partner) and hosts the **Project Management Unit (PMU).**	**Project management and coordination**: Addressing the GEF project management and coordination of activities (all Outputs), as well as coordination with other development partner projects in the electricity sector.	1 and 2
Execution	PNG Power Limited	PPL is the organization operating the national electricity system. PPL acts as another **Partner**	**Technical Support**: In-kind technical assistance to vendors supplying the services	1 and 2

		assisting with implementation and providing quality assurance on the technical aspects of the project.	under the outputs (all Outputs).	
Execution	Department of Provincial and Local Level Government (DPLGA)	DPLGA is a key administrative entity responsible for implementing national plans and policies at the District and Local Level Government managing provincial, social and economic functions.	**Project Implementation:** Facilitates access to local communities and coordinates relevant stakeholders at the provincial level.	
Governance & Technical	UNIDO ECA/JET in Coordination with the UNIDO SIDS Hub	UNIDO is the entity operating the global program for climate resilient renewable energy systmed (G-RES) for SIDS. UNIDO is the GEF Implementing Agency and supports the **Steering Committee** and M&E of the project.	**Knowledge Transfer**: Facilitates SIDS-SIDS and climate change adaptation and mitigation related technical knowledge transfer (Outputs 1.1.1 and 2.1.1).	1 and 2
Knowledge sharing	PCREEE	Regional GN-SEC center for the Pacific. Technical partner for regional scaling.	SIDS-SIDS Knowledge Transfer: Facilitating dissemination of technical blueprints (Output 2.2.2).	2
CSO / NGO / Academic	University of South Pacific (USP)	Premier regional university and key knowledge partner.	**Academic Exchange:** Facilitates South-South learning and research via PACE-SD.	
Governance & Policy	Climate Change Development Authority	CCDA is responsible for coordination of national climate change policy and planning. CCDA would be a **Steering Committee** member.	**Operational guidance**: Guidance in matters related to climate change policy and planning, and the integration with other national climate change project outcomes (all Outputs).	1
Other/ PPL	Private Sector	The private sector is another **Partner** who are commercial businesses (incl.	**Knowledge Transfer**: Facilitate knowledge on the changes to the electricity system and	1 and 2

		tourism) and households are significantly impacted by the availability of the electricity system.	its availability / reliability and how this impacts their members (Outputs 1.1.1 and 2.2.1).	

10. UNIDO Legal context

The present project is governed by the provisions of the Standard Basic Cooperation Agreement between the Papua New Guinea and UNIDO, signed on 2 February and 14 April 1989 and entered into force on 14 April 1989.

Coordination and Cooperation with Ongoing Initiatives and Project.

Does the GEF Agency expect to play an execution role on this project?

If so, please describe that role here. Also, please add a short explanation to describe cooperation with ongoing initiatives and projects, including potential for co-location and/or sharing of expertise/staffing

The execution structure will be defined during the PPG phase.

- **Alignment with other programs and projects**

This project functions as a strategic "resilience multiplier" within Papua New Guinea's (PNG) climate and development portfolio, bridging the gap between large-scale electrification goals and the localized physical risks of the energy-water-food nexus. It is designed to complement and enhance the impact of active GEF, GCF, and bilateral/multilateral initiatives by operationalizing climate resilience at community level, addressing gaps in decentralized systems, and strengthening adaptive capacity across sectors.

<u>GEF-Funded Alignment</u>

• The GEF project in PNG is part of the G-RES program, which comprises a global-regional component and a growing portfolio of national projects. The global-regional project (GEF ID: 12229) will accelerate national progress by strengthening coordination, ensuring policy coherence, facilitating SIDS–SIDS cooperation, and sharing best practices in climate risk assessments, energy policy development, and integrated resource and resilience planning—including gender responsive and socially inclusive approaches.
• GEF 8 Southeast Asia and the Pacific Forests Integrated Program (SEAP Forests IP) (GEF ID: 11116): As this program enters its second year of implementation (2025–2031), it focuses on forest governance and protection. The project provides the infrastructure backbone for forest-edge communities, establishing energy-water hubs that support sustainable non-timber forest product (NTFP) processing, directly reducing community reliance on biomass extraction.
• GEF 8 Blue and Green Islands Integrated Program (BGI IP) (GEF ID: 11252): Following its regional inception in late 2025, the BGI-IP is active in PNG's coastal and island provinces. The project operationalizes BGI IP's nature-positive goals by installing climate hardened cold storage for the sustainable fisheries the program promotes, protecting them from power outages that otherwise cause immediate post-harvest loss.
• Facilitating Renewable Energy and Energy Efficiency Project (FREAGER - GEF ID: 9273): This UNDP-implemented initiative laid the policy and regulatory groundwork for mini-grids in PNG. The project builds on these foundations by providing the 'Resilience Increment' (advanced GFM technology) that ensures mini-

grid hardware can survive the extreme weather events identified in national 2026 climate risk assessments.

GCF Funded Alignment

- GCF FP259: Adapting Tuna Dependent Pacific Island Communities (Approved Feb 2025): Currently in its first year of full implementation (2025–2031), this project targets fisheries resilience. The project operationalizes these gains by providing Proactive Islanding capability via Grid-Forming (GFM) technologies at coastal hubs, ensuring cold chains remain powered despite regional grid or fuel disruptions.
- GCF SAP054: SOURCE Pacific Drinking Water Project (Approved July 2025): As this project rolls out hydropanels across the Pacific, the project adds the battery resilience and power-hardening required to maintain water abstraction and treatment systems during 1 in 100 year climate shocks.
- GCF FP036: Pacific Islands Renewable Energy Investment Program: As FP036 approaches its September 2026 completion, the project serves as a 'technical successor' that addresses the reliability and 'diesel-off' challenges identified during FP036's implementation cycle.

Bilateral and Multilateral Energy & Climate Projects

- World Bank: National Energy Access Transformation (NEAT) (P172194) (2024–2030): This $204 million initiative is currently the primary electrification vehicle in PNG. The project serves as a "Resilience Lab" for NEAT, piloting climate hardened hubs in remote 'Window A' sites to inform national resilience standards for larger-scale rollout.
- ADB: Sustainable Energy Sector Development Program (Subprogram 1 & 2): With Subprogram 1 approved in late 2025, this initiative focuses on power sector reform. The project directly implements the NEA Small Power Systems Regulation (2024/25) at the community level, demonstrating that community-led utility models are operationally and financially viable.
- PacFresH2O – Protecting Freshwater Resources (IKI): Funded by the German International Climate Initiative (IKI), this program strengthens rural WASH systems. The project aligns with PacFresH2O by providing the climate-proofed power hubs needed for long-term water pumping and sanitation management in rural villages.
- Adaptation Fund Projects (ASSA, Climate FIRST): The project strengthens the 'Energy-Water' nexus components of the ASSA agricultural goals and utilizes the Climate FIRST initiative's (2024–2028) subnational planning data to ensure site selection is aligned with provincial priorities.
-

Core Indicators

Explain the methodological approach and underlying logic to justify target levels for Core and Sub-Indicators (max. 250 words, approximately 1/2 page)

META INFORMATION – SCCF

LDCF **false**	SCCF-B (Window B) on technology transfer **false**	SCCF-A (Window-A) on climate Change adaptation **true**
Is this project LDCF SCCF challenge program? **false**		
This Project involves at least one small island developing State(SIDS).		

true
This Project involves at least one fragile and conflict affected state.
true
This Project will provide direct adaptation benefits to the private sector.
true
This Project is explicitly related to the formulation and/or implementation of national adaptation plans (NAPs).
true
This project will collaborate with activities begin supported by other adaptation funds. If yes, please select below

Green Climate Fund **false**	Adaptation Fund **false**	Pilot Program for Climate Resilience (PPCR) **false**

This Project has an urban focus.
false
This project will directly engage local communities in project design and implementation
true
This project will support South-South knowledge exchange
true

This Project covers the following sector(s)[the total should be 100%]: *	
Agriculture	0.00%
Nature-based management	0.00%
Climate information services	10.00%
Coastal zone management	10.00%
Water resources management	30.00%
Disaster risk management	0.00%
Other infrastructure	40.00%
Tourism	0.00%
Health	0.00%
Other (Please specify comments) renewable energy	10.00%
Total	100.00%

This Project targets the following Climate change Exacerbated/introduced challenges:*

Sea level rise **true**	Change in mean temperature **true**	Increased climatic variability **true**	Natural hazards **true**
Land degradation **false**	Coastal and/or Coral reef degradation **false**	Groundwater quality/quantity **true**	

CORE INDICATORS – SCCF

	Total	Male	Female	% for Women

CORE INDICATOR 1 Total number of direct beneficiaries	5,000	2,500.00	2,500.00	50.00%
CORE INDICATOR 2 (a) Area of land managed for climate resilience (ha) (b) Coastal and marine area managed for climate resilience (ha)	10.00 5.00			
CORE INDICATOR 3 Number of policies/plans/ frameworks/institutions for to strengthen climate adaptation	3.00			
CORE INDICATOR 4 Number of people trained or with awareness raised	200	100.00	100.00	50.00%
CORE INDICATOR 5 Number of private sector enterprises engaged in climate change adaptation and resilience	30.00			

Key Risks

	Rating	Explanation of risk and mitigation measures
CONTEXT		
Climate	Moderate	Assessment: Typhoons, flooding, supply chain disruptions, or economic downturns could affect implementation, operations (assets), and project timelines. Moreover, there is the risk of climate-change induced supply-chain interruptions. Mitigation Measures: Integrate climate resilience and disaster preparedness modules into planning, procurement, and designs. Maintain flexible implementation timelines.
Environmental and Social	Moderate	Assessment: Environmental and social impacts can arise from the planning and implementation (of assets) under the project. As well as the future operations of these. Environmental risks are related to water extraction and adequate storage and potential hazardous waste from battery storage systems. As well as damage due to natural events of severe weather and earthquakes. While social impacts may related to access to services and land use / ownership of the communities (indigenous peoples). Mitigation Measures: Environmental and social aspects will be part of the planning, feasibility studies, and implementation of management plans of activities. Collaborate with CEPA, NEA, DPLGA and other divisions to ensure compliance with national environmental regulations. The planning, feasibly study, and community engagement will include activities during development and parts in the results for gender and social inclusion. Including indicators for engagement and

		monitoring future considerations. The standardization of equipment and national support unity will also help lower both environmental and social risks.
Political and Governance	Moderate	Assessment: The project is located in the less conflict prone areas of PNG. Bougainville Island has had past conflict in the mid-1990s and is currently peaceful and in the process of autonomous governance. Mitigation Measures: The project will evaluate the positioning of the installations during the PPG and initial implementation stages and shift to other communities if the security situation is deemed too risky for the project. Though it is noted the climate resilience is a driver in peace and security.
INNOVATION		
Institutional and Policy	Low	Assessment: There is a risk that continued investment in resilience and mitigation measures (as per the NDC and NAP) will be delayed due to lowered global input for climate finance support impacting the transitional impact beyond the project. National circumstances can also limit the level of operation and maintenance (O&M) of the enhanced assets under this project by reducing their positive impacts. Mitigation Measures: Ensure that there is a mechanism for Government divisions to coordinate information on support needs for the electricity, water and food sectors. Ensure that the community mini-utility micro-companies have planned for and streamlined O&M costs into the governance and planning by institutionalizing O&M into the business plan. As well that practice from the resilience and mitigation measures installed under the project are transferred to additional mini-grids, rural water systems and food storage outside of the project.
Technological	Moderate	Assessment: The technology to be deployed under the project is well proven globally, but implementation in rural communities is a challenge (i.e. similar systems have failed in the past). Mitigation Measures: The feasibility study will define what technology is operational optimal for rural coastal communities, and the owners' engineer supervision will ensure adequate installation of deployed technology and train is delivered by vendors. The development and training of the mini-utility companies in the communities and setting up a national support unit will help support the long-term operation of the systems installed.
Financial and Business Model	Moderate	Assessment: The technology to be deployed under the project is well proven globally, but implementation in rural communities is a challenge (i.e. similar systems have failed in the past). Mitigation Measures: The feasibility study will define what technology is operational optimal for rural coastal communities, and the owners' engineer supervision will ensure adequate installation of deployed technology and train is delivered by vendors. The development and training of the mini-utility companies in the communities and setting up a national support unit will help support the long-term operation of the systems installed. Assessment: There is a risk that the system stop working due to a lack of financial flow to repair and replace systems components (i.e. similar system have failed in the past). Mitigation Measures: The establishment of the business model for each mini-utility company in the

		communities is included in the project, and this includes preparing a tariff for services that cover the costs of general operation and maintenance. The national support unit may still need to help finance any major repairs, and this project will look at models to address this future investment financing.
EXECUTION		
Capacity	Moderate	Assessment: Collaborate with CEPA, NEA and other divisions do have limited human capacity. This leads to two potential risks: (1) That the in-kind human capacity that is needed for implementation support from CEPA, NEA and other divisions is limited or delayed, and (2) that these same entities may experience coordination delays due to overlapping mandates, competing institutional priorities, and limited project management capacity. Mitigation Measures: The Project Steering Committee (PSC) has the purpose to facilitate and communicate the human capacity needs and coordination of the project's activities. In addition, the PMU will have a professional working full time to ensure timely management of operational issues and daily coordination to achieve results, including managing the feedback loop for M&E between the executing entities and the PSC.
Fiduciary	Low	Assessment: Inaccurate, inconsistent, and/or delayed reporting of project spending in early phases of the project can delay or prevent spending in follow-on phases. Mitigation measures: The Government appointed the executing entity will handle the fiduciary elements of the project. This entity will work closely with the PMU on reporting the financing for the project. Assessment: The procurement of mini-grid electricity and water systems places some risk of corruption and incomplete installations (and related payments / stranded assests). Mitigation measures: UNIDO will holder oversight into the selection to vendors during the procurement phase to ensure there is no corruption, and UNIDO will work with the executing entities to selection only reputable vendors that have proven operational installations in PNG & Pacific. The procurement will include specific performance guarantees and security/bonds from vendors to ensure final working installations.
Stakeholder	Low	Assessment: The key stakeholders that directly impact the project outcomes have been only partially consulted during the development of this PIF but will be a part of the project peroration and steering committee (PSC). Stakeholder risks may arise outside of the above group during physical implementation due to land use rights, understanding economic impacts, and perceived lack of inclusion…etc. at the community level. Thus, buy in is critical. Mitigation Measures: Are to ensure adequately timed PSC meetings of at least every quarter, and monthly updates of project progress. Stakeholder consultations will be included in the processes of the project preparation, feasibility, and the implementation of project outputs. In addition, there is an extensive community engagement activities and mini-utility establishment process included in the project implementation to help appropriately manage this risk. These is where DPLGA and local CSOs are critically important to ensure buy-

		in from the start. If there is inadequate buy in the opportunity will be shifted to another appropriate community where there is sufficient buy in.
Other		N/A
Overall Risk Rating	Moderate	The overall moderate rating is devised based on total weighting of the 10 identified risks. Since 5 risks are low and 6 risks are Moderate, with the Moderate especially relating key categories that impact implementation. On the conservative side of caution a total Moderate risk is determined.

C. ALIGNMENT WITH GEF-8 PROGRAMMING STRATEGIES AND COUNTRY/REGIONAL PRIORITIES

Describe how the proposed interventions are aligned with GEF- 8 programming strategies and country and regional priorities, including how these country strategies and plans relate to the multilateral environmental agreements.

Confirm if any country policies that might contradict with intended outcomes of the project have been identified, and how the project will address this.

For projects aiming to generate biodiversity benefits (regardless of what the source of the resources is - i.e., BD, CC or LD), please identify which of the 23 targets of the Kunming-Montreal Global Biodiversity Framework the project contributes to and explain how. (max. 500 words, approximately 1 page)

Alignment with SCCF Adaptation Programming Objectives (GEF-8 Framework)

This project is strategically aligned with the goal of the GEF-8 SCCF Adaptation Programming to “strengthen climate resilience and reduce vulnerability to the adverse impacts of climate change in developing countries, specifically in sectors critical to SIDS economies.”

Strategic Alignment with GEF-8 SCCF Mandates

The project outcomes are strategically aligned with the Special Climate Change Fund (SCCF) Priority Area 1: Supporting the Adaptation Needs of SIDS. While Papua New Guinea is a large SIDS in the Pacific, it faces a unique 'adaptation gap' where 80% of the population resides in rural areas with limited access to essential services. This project addresses the SCCF mandate by leveraging energy and water access as core adaptation strategies, securing the resilience of decentralized infrastructure against the chronic and acute climate hazards—such as Category 5 cyclones and 1-in-100-year floods—that frequently disable rural services.

Alignment with SCCF Intervention Windows:

- SCCF Window A (Supporting the Adaptation Needs of SIDS): The project addresses the primary adaptation deficit in PNG’s rural coastal communities. It secures the essential Energy-Water-Food nexus by delivering climate-hardened infrastructure that directly benefits 5,000 people (CI 1) and ensures 15 hectares (CI 2) of productive value chains are managed in a resilient manner. It utilizes SCCF resources to pay for the 'Resilience Premium'—the incremental cost of engineering infrastructure to survive PNG’s extreme environmental conditions and protect life-sustaining services during climate shocks. The project facilitates the transfer of Grid-Forming (GFM) Inverter technology and advanced Battery Energy Storage Systems (BESS) (Output 2.1.2). This technology enables 'Proactive Islanding,' providing high-quality, autonomous power capable of supporting heavy-load productive uses (like mechanical food processing and water filtration) even during grid instability or fuel supply chain disruptions. Through the “Beyond the Grid Fund” (Output 2.2.1), the project creates an enabling environment for the private sector by providing a financial bridge to cover the

higher cost of climate-hardened hardware, transforming adaptation into a bankable business model for private developers.

Alignment with GEF-8 Adaptation Strategy Pillars (CCA)

- Pillar I – Building Climate Resilient Systems: This pillar addresses physical risks to PNG's infrastructure and economic systems.
  - Energy-Nexus Resilience: Solar PV mini-grids provide decentralized power resilient to fuel supply failures, powering cold storage and agro-processing to preserve the agriculture and fisheries value chains during extended dry seasons or following disasters.
  - Operational Resilience: The project moves PNG from fragmented donor pilots toward a Small-Utility Model (Output 2.1.3). This ensures that infrastructure is supported by local cost-recovery and technical ownership, coordinated by a permanent National Support Unit (Output 1.1.2).
  - Resource Resilience: Resilient water systems counter chronic rural water scarcity through filtration and elevated storage engineered for high-rainfall, landslide-prone terrains.

- Pillar II – Integrating Adaptation into Planning and Policy: This pillar ensures sustained, long-term national adaptive capacity.
  - NAP Operationalization: The project translates PNG's National Adaptation Plan (NAP) into action through Climate Risk Assessments (Output 1.1.1) and community vulnerability mapping that informs local rural interventions.
  - Policy and Standards: The project facilitates the formulation of National Resilience Standards and tariff frameworks, establishing the policy continuity required to integrate small-scale renewable energy and water systems into national development trajectories.
  - Monitoring for Resilience: Through the NEA Support Desk, the project institutionalizes a knowledge base that provides data-driven insights into the climate performance of rural assets, facilitating the systematic scaling of adaptation models across PNG's geography.

Contribution to Adaptation Core Indicators

The project's success is defined by its contribution to measurable adaptation outcomes tracked rigorously through SCCF Core Indicators and aligned with GEF-8 global indicators:

SCCF Project Core Indicators

SCCF Core Indicator	Male	Female (50%)	Youth (30%)	Total Target	Description / Rationale
CI 1: Number of direct beneficiaries	2,500	2,500	1,500	**5,000**	**Two tiers:** (i) ~300 residents/MSMEs in target sites with direct RE mini-grid access; (ii) 4,700 nationwide benefiting from the NEA Support Desk and new Resilience Standards.
CI 2: Land & Coastal Area (ha)	N/A	N/A	N/A	**15 ha**	**Nexus Management:** 10 ha of agricultural land and 5 ha of coastal fisheries zones managed via resilient energy/water services to prevent climate-induced degradation.

CI 3: Policies & Frameworks	N/A	N/A	N/A	**3**	**National Frameworks:** Includes (1) National Resilience Standards for Mini-grids; (2) Off-grid Regulation Guidelines; and (3) Community Climate Emergency Plans.
CI 4: Number of people trained	100	100	60	**200**	**Professionalization:** Technical training for NEA/PPL staff and community operators, leading to official **Certification** in GFM/BESS operations.
CI 5: Private enterprises (MSMEs)	15	15	9	**30**	**Value Chain Resilience:** Targeted support for MSMEs in agriculture and fisheries (cold storage/processing). *Asterisk denotes targets for women/youth-led businesses.*

Although this project is financed through the SCCF to address critical adaptation and technology transfer needs, it also delivers significant Climate Change Mitigation (CCM) co-benefits. The intervention aligns directly with GEF-8 CCM Strategy Entry Point 1.2: "Enable the transition to decarbonized power systems." By deploying resilient solar PV mini-grids and Grid-Forming (GFM) technologies in remote locations such as Buka and Daru Island, the project helps transition these isolated communities away from conventional generation toward autonomous, renewable-based energy models.

Alignment with GEF-8 Climate Change Mitigation (CCM) Strategy and Core Indicator 6 as Co-Benefit

While the primary driver for this transition is adaptation—specifically ensuring power and water continuity for essential services during severe weather and climate-induced supply chain disruptions—the operational reality inherently displaces imported diesel consumption. This systemic shift from diesel reliance to decarbonized power generation will result in an estimated direct and indirect reduction of 80,732 tCO2e over the 20-year lifespan of the technology (5,046 directly through the mini-grid and 75,686 tCO2e through replication). These mitigation co-benefits will be formally tracked under GEF Core Indicator 6 (Greenhouse Gas Emissions Mitigated), successfully bridging Papua New Guinea's adaptation and mitigation commitments under the Paris Agreement.

Alignment with Country and Regional Priorities

National Alignment

The proposed project is country-driven and firmly rooted in PNG's national policy framework and aligned with the country's international commitments. This creates a strong foundation for the project, which directly operationalizes the government's specific requests for implementation support in the energy sector related to climate adaptation and mitigation.

Climate & Adaptation Policies

- Climate Change Management Act (2021 Revised 2015): Supports the CCDA's mandate to regulate and promote climate-compatible development, ensuring rural infrastructure is 'climate-proofed' at the design phase.
- National Adaptation Plan (2022–2030): Aligned with Sectoral Priority Area no. 2 on climate-resilient infrastructure in energy, water, sanitation, and other rural sectors. The primary goal of the GEF project is to contribute to the climate adaptive capacities in the energy sector.
- Enhanced Nationally Determined Contributions (NDC): Directly implements PNG's Paris Agreement commitments, supporting a -50% GHG reduction target by 2030 (BAU) and carbon neutrality by 2050 in the "With Additional Measures" scenario. The project contributes to GHG emission reductions as a co-benefit.
- SDG 13 Climate Action Roadmap 2030: Builds local capacity for climate risk management and delivers decentralized, low-carbon solutions for at-risk rural populations.
- PNG National Disaster Risk Management Policy / Plan: Reinforces climate-resilient infrastructure, early warning, and disaster preparedness measures to reduce vulnerability to extreme events.
- PNG National Climate Finance Strategy / Green Growth Strategy: Supports leveraging climate finance for resilient energy, water, and food systems in rural communities.

Energy & Infrastructure Policies

- PNG Development Plan – Vision 2050 and Medium-Term Development Plan (MTDP 2023–2026): Contributes to financially and economically sustainable energy supply by displacing volatile fuel imports with renewable energy.
- National Energy Policy (2017–2027): Facilitates energy infrastructure development and a proactive approach to climate-risk mitigation through data-driven, community-led adaptation activities.
- National Energy Roll-Out Plan (NEROP) and MTDP IV (2023–2027): Validates the "Base Case" for rural areas and aligns with the 70% electrification target, adding a critical resilience layer.
- Renewable Energy Sub-Sector Policies 2025–2030: Includes the Solar Energy Policy 2030, supporting decentralized, community-scale renewable energy assets.
- NEA Regulation for Small Power Systems (Validated 2024/2025): Provides the first comprehensive legal framework for licensing, safety, and resilience standards for off-grid mini-grids under 1 MW.

Social / Cross-Cutting Policies

- National WASH Policy (2015–2030): Guides achievement of 70% access to safe water and sanitation; the project uses resilient energy as a prerequisite for secure water abstraction.
- National Gender Equality and Women's Empowerment (GEWE) Policy 2025–2035: Supports economic empowerment, climate action, and women's participation in decision-making and the green economy.

PNG Agriculture and Food Security Policy / Climate-Smart Agriculture Strategies: Aligns with the Energy-Water-Food nexus by enabling climate-smart irrigation, cold storage, and post-harvest processing.

Regional Alignment: Pacific Regional Policies

The barriers addressed by this project—technical grid instability, high fuel dependency, and infrastructure vulnerability—are common across the Pacific. Consequently, the project is aligned with several key regional frameworks coordinated by the Pacific Community (SPC) and the Pacific Islands Forum (PIFS):

- 2050 Strategy for the Blue Pacific Continent: The project supports the thematic areas of 'Climate Change and Disasters' and 'Technology and Connectivity,' promoting a resilient, future-ready Pacific through innovative energy solutions.
- Framework for Energy Security and Resilience in the Pacific (FESRIP) 2021–2030: Coordinated by SPC, this framework promotes a 'whole-of-sector' approach to energy security. This project specifically addresses FESRIP's goals regarding the deployment of technically proven, climate-resilient technological solutions (like GFM BESS) and the integration of gender and equity into energy planning.

- Framework for Resilient Development in the Pacific (FRDP) 2017–2030: The project operationalizes the FRDP's goals of integrated adaptation and low-carbon development. By hardening the Peleliu mini-grid, it provides a 'living lab' for the disaster preparedness and recovery principles championed by the Pacific Resilience Partnership (PRP).
- PCREEE Regional Business Plan: As a partner of the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE), the project contributes to the regional mandate to enhance the productivity of key industries (fisheries, tourism) through sustainable energy innovation.

By aligning with these SPC-led policies, the project ensures that the mini-grids are not just a national success but a scalable regional asset. The lessons learned will be systematically disseminated through the GN-SEC and PCREEE platforms, enabling fund-level learning and performance enhancements across all Pacific Island Countries. UNIDO and PCREEE are planning to launch the G-RES Program during the upcoming meeting of Pacific Energy and Transport Ministers in PNG in May 2026.

Alignment with the 2030 Agenda for Sustainable Development

The project delivers broad impacts across Agenda 2030, moving beyond energy to address the interlinked nature of resource security and sustainable growth in SIDS.

- SDG 13 (Climate Action): This is the primary goal, with a heavy emphasis on Adaptation. The project strengthens resilience and adaptive capacity to climate-related hazards (Target 13.1) and integrates climate change measures into national policies and planning (Target 13.2).
- SDG 7 (Affordable and Clean Energy): Framed as a resilience measure, the project ensures universal access to reliable and modern energy services for remote island populations (Target 7.1) and substantially increases the share of renewable energy in the national mix by resolving technical curtailment (Target 7.2).
- SDG 9 (Industry, Innovation, and Infrastructure): The project promotes resilient infrastructure and fosters innovation through the transfer of resilient technology. It also has a focus on MSMEs.
- SDG 6 (Clean Water and Sanitation): The project adopts a Water-Energy Nexus approach. In PNG, water security is entirely dependent on energy security, as water treatment, pumping, and desalination systems require a stable power supply. By hardening the Peleliu mini-grid and ensuring 24/7 autonomous RE power, the project secures the 'essential service nexus,' protecting the community's access to clean water during and after climate-induced disasters (Target 6.1 and 6.4).
- SDG 12 (Responsible Consumption and Production): The project promotes the sustainable management and efficient use of natural resources (Target 12.2) by reducing reliance on imported fossil fuels. Furthermore, the development of resilience guidelines for 30 MSMEs promotes sustainable practices in the tourism and fisheries sectors (Target 12.b), while the risk-informed asset management framework reduces systemic waste by shifting from reactive 'fail-and-fix' models to sustainable, predictive maintenance (Target 12.5).

Alignment with and Comparative Advantage of UNIDO

The United Nations Industrial Development Organization (UNIDO) brings a strong comparative advantage to the implementation of this project, rooted in its mandate to promote inclusive and sustainable industrial development (ISID) and its extensive experience in supporting low-carbon, resource-efficient, and climate-resilient transitions in developing countries and SIDS.

UNIDO's leadership in the industrial energy efficiency, renewable energy, and circular economy domains positions it uniquely to deliver integrated technical, policy, and financial solutions for energy utilities. In the Pacific, UNIDO has a long-standing presence through the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE) established with UNIDO support as part of the Global Network of Regional Sustainable Energy Centres (GN-SEC).

Moreover, this project for PNG is a country-level intervention developed under the framework of the GEF and bilateral donor (e.g., Austria) supported G-RES, coordinated by UNIDO. This global program, in partnership with the Global Network of Regional Sustainable Energy Centres (GN-SEC), seeks to accelerate the deployment of climate-resilient renewable energy and energy efficiency (RE&EE) and resource efficient technologies in SIDS.

D. POLICY REQUIREMENTS

Gender Equality and Women's Empowerment:

We confirm that gender dimensions relevant to the project have been addressed as per GEF Policy and are clearly articulated in the Project Description (Section B).

Yes

Stakeholder Engagement

We confirm that key stakeholders were consulted during PIF development as required per GEF policy, their relevant roles to project outcomes and plan to develop a Stakeholder Engagement Plan before CEO endorsement has been clearly articulated in the Project Description (Section B).

Yes

Were the following stakeholders consulted during project identification phase:

Indigenous Peoples and Local Communities:

Civil Society Organizations: Yes

Private Sector: Yes

Provide a brief summary and list of names and dates of consultations

The consultation took place between August and December 2025 and were conducted by the UNIDO Sustainable and Just Energy Transition Unit (ECA/JET) and a national UNIDO consultant in PNG. This included also consultations with CSOs (e.g. USP). This process included high-level discussions on electricity sector planning, grid stability, and the specific adaptation interventions mirrored in this PIF. While these broader consultations established the baseline and sectoral buy-in, detailed technical discussions focusing exclusively on the PIF's operational specifics will be a priority during the PPG phase. Initial consultation with communities, MSMEs and Indigenous People were undertaken during a mini-grid conference. However, due to limitations, specific stakeholder consultations with the two communities (e.g. MSME, Indigenous Peoples, and other vulnerable populations in the communities) will be done during the PPG phase where further safeguards assessment will be done.In summary, the following stakeholders were consulted so far:

Date(s)	Stakeholder Group	Participants / Key Entities Consulted	Means of Consultation	Key Topics & Outcomes
Dec 02, 2024	**UNIDO National Team**	**Raymond Unasi** (National Consultant, UNIDO)	Face-to-Face (Port Moresby)	Baseline validation, assessment of rural off-grid community needs, and localization of the project's

				technical approach to fit PNG's geographic constraints.
Dec 09, 2024	**National Government (Environment)**	**Alu Kaiye** and **Joseph Jure** (Conservation and Environment Protection Authority - CEPA)	Face-to-Face (CEPA HQ, Port Moresby)	Alignment with national environmental safeguards; integration of 'marine-grade' and flood-resilient hardware standards into the project design.
Aug – Dec 2024	**Co-Financing & Multilateral Partners**	**First discussions with ADB, World Bank, Austrian Development Agency (ADA)**, Pacific Centre for Renewable Energy and Energy Efficiency (**PCREEE**), Pacific Community (**SPC**), CCREEE	Virtual Meetings & Bilateral Emails	Discussion of potential synergies and co-funding; aligned ADA's global programmatic backing; mapped synergies with the ADB SESDP, WB NEAT, and GCF projects to avoid duplication.
Oct – Nov 2024	**Civil Society (CSOs) & Academia**	**University of the South Pacific (USP)**; **SIDS-SIDS UWI Hub (University of the West Indies)**; PNG Environment Alliance	Virtual Technical Webinars	First contact (ENSO impacts); established a cross-regional knowledge corridor between the Caribbean and Pacific.
Sept – Nov 2024	**Private Sector**	Local solar providers, agricultural MSMEs, Business Council of PNG	Virtual Roundtables & Sector Surveys	Assessed market capacity for Grid-Forming (GFM) tech; structured the 'Beyond the Grid Fund' de-risking mechanism to secure $600k in private equity.

(Please upload to the portal documents tab any stakeholder engagement plan or assessments that have been done during the PIF development phase.)

Private Sector

Will there be private sector engagement in the project?

Yes

And if so, has its role been described and justified in the section B project description?

Yes

Environmental and Social Safeguard (ESS) Risks

We confirm that we have provided indicative information regarding Environmental and Social risks associated with the proposed project or program and any measures to address such risks and impacts (this information should be presented in Annex D).

Yes

Overall Project/Program Risk Classification

PIF	CEO Endorsement/Approval	MTR	TE

Medium/Moderate

E. OTHER REQUIREMENTS

Knowledge management

We confirm that an approach to Knowledge Management and Learning has been clearly described in the Project Description (Section B)

Yes

ANNEX A: FINANCING TABLES

GEF Financing Table

Indicative Trust Fund Resources Requested by Agency(ies), Country(ies), Focal Area and the Programming of Funds

GEF Agency	Trust Fund	Country/ Regional/ Global	Focal Area	Programming of Funds	Grant / Non-Grant	GEF Project Grant($)	Agency Fee($)	Total GEF Financing ($)
UNIDO	SCCF-A	Papua New Guinea	Climate Change	SCCF-A Country allocation	Grant	2,639,726.00	250,774.00	2,890,500.00
Total GEF Resources ($)						**2,639,726.00**	**250,774.00**	**2,890,500.00**

Project Preparation Grant (PPG)

Is Project Preparation Grant requested?

true

PPG Amount ($)

100000

PPG Agency Fee ($)

9500

GEF Agency	Trust Fund	Country/ Regional/ Global	Focal Area	Programming of Funds	Grant / Non-Grant	PPG($)	Agency Fee($)	Total PPG Funding($)
UNIDO	SCCF-A	Papua New Guinea	Climate Change	SCCF-A Country allocation	Grant	100,000.00	9,500.00	109,500.00
Total PPG Amount ($)						**100,000.00**	**9,500.00**	**109,500.00**

Please provide justification

Sources of Funds for Country Star Allocation

GEF Agency	Trust Fund	Country/ Regional/ Global	Focal Area	Sources of Funds	Total($)
Total GEF Resources					**0.00**

Indicative Focal Area Elements

Programming Directions	Trust Fund	GEF Project Financing($)	Co-financing($)
CCA-2-1	SCCF-A	2,639,726.00	4900000
Total Project Cost		**2,639,726.00**	**4,900,000.00**

Indicative Co-financing

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Recipient Country Government	GoPNG / NEA and other entities	Grant	Investment mobilized	350000
Others	ADB (GCF funded PIREIP & SOURCE) / SESDP	Loans	Investment mobilized	2000000
Others	WB/NEAT	Loans	Investment mobilized	1000000
Others	Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE)	In-kind	Recurrent expenditures	300000
GEF Agency	UNIDO	Grant	Investment mobilized	80300
Donor Agency	Pacific Community (SPC) / GCF Project FP259	Grant	Investment mobilized	569700
Private Sector	MSMEs and local communities	Grant	Investment mobilized	600000
Total Co-financing				**4,900,000.00**

Describe how any "Investment Mobilized" was identified

The indicated investment particularly for the solar PV mini-grids were identified in discussions with local counterparts and relevant financial institutions. The co-funding arrangements will be detailed during the PPG phase.

ANNEX B: ENDORSEMENTS

GEF Agency(ies) Certification

GEF Agency Type	Name	Date	Project Contact Person	Phone	Email
GEF Agency Coordinator	UNIDO	2/13/2026	Ganna Onysko	+431260263647	G.ONYSKO@unido.org
Project Coordinator	UNIDO	2/13/2026	Martin Lugmayr	+431260263595	m.lugmayr@unido.org

Record of Endorsement of GEF Operational Focal Point (s) on Behalf of the Government(s):

Name	Position	Ministry	Date (MM/DD/YYYY)
Jude Tukuliya	Managing Director	Conservation and Environment Protection Authority	9/26/2025

ANNEX C: PROJECT LOCATION

Please provide geo-referenced information and map where the project interventions will take place

Please provide geo-referenced information and map where the project interventions will take place

Target Location	Province	Latitude / Longitude (Approx.)	
Buka / Northern Bougainville	Autonomous Region of Bougainville (ARB)	5.4167° S, 154.6667° E	
Daru Island	Western Province	9.0833° S, 143.2083° E	
NEA Support Desk	National (Port Moresby Hub)	9.4436° S, 147.1803° E	


Lorengau
Manus
Kavieng
Londolovit
Namatanai
Bismarck Archipelago
New Ireland
Pacific Ocean
Bismarck Sea
Rabaul
Jayapura
Vanimo
Wewak
New Guinea
Marienberg Mission
Watam
Bogia
Sepik
Kambot Mission
Karkar
Malala
Matukar
Madang
Oronga
Gagan
Hutjena
Sohano
Bougainville
Kimbe
Pomio
New Britain
Koripobi
Arawa
Kieta
Boku
Buin
Wabag
Usino
Mount Hagen
Goroka
Kundiawa
Kainantu
Kiunga
PAPUA NEW GUINEA
Lae
Wonenara
Wabo
Tefehui
Wau
Baimuru
Kamina
Fly
Ihu
Kerema
INDONESIA
Choiseul
New Georgia Group
SOLOMON ISLANDS
Solomon Sea
Komo
Ropondetta
Morehead
Daru
Port Moresby
Abau
D'entrecasteaux Islands
Samarai
Louisiade Archipelago
Papua New Guinea
International Boundary
Road
Minor Road
River
National Capital
City or Town
0 100 200 KM
0 100 200 MI
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ANNEX D: ENVIRONMENTAL AND SOCIAL SAFEGUARDS SCREEN AND RATING

(PIF level) Attach agency safeguard screen form including rating of risk types and overall risk rating.

Title
GHG calculation sheet_PNG mini-grids
ES_Screening_250431_PNG_Climate_Resilient_RES_rev_signed

ANNEX E: RIO MARKERS

Climate Change Mitigation	Climate Change Adaptation	Biodiversity	Land Degradation
Principal Objective 2	Significant Objective 1	No Contribution 0	No Contribution 0

ANNEX F: TAXONOMY WORKSHEET

Project Component	Taxonomy: Influencing Models & Stakeholders	Climate Mitigation (UNFCCC)	Climate Adaptation (UNFCCC)	Justification / Rationale
1. National support framework for resilient energy/water systems	**Influencing Model:** Strengthening institutional capacity and policy frameworks; De-risking investment.	Significant Objective (1)	**Principal Objective (2)**	**Institutional Resilience:** Addresses the 'soft limits' of adaptation by operationalizing national resilience standards and the 'Beyond the Grid Fund.' Aligns with the **Antigua and Barbuda Agenda for SIDS (ABAS)** by building national self-reliance.
2. Resilient renewable energy and water systems in rural communities	**Influencing Model:** Demonstrating systemic innovation; Transforming policy and regulatory environments.	Significant Objective (1)	**Principal Objective (2)**	**Technological Transfer:** Directly finances the 'Resilience Premium' for GFM-enabled infrastructure. Provides high-intensity adaptation by securing the energy-water-food nexus against Category-5 shocks and 1-in-100-year floods.
2. (Sub-element) Professionalized Small-Utility Models & MSMEs	**Stakeholders:** Private Sector; SMEs; Local Communities; Beneficiaries (Women/Youth).	Significant Objective (1)	Significant Objective (1)	**Socio-Economic Resilience:** Ensures the longevity of RE assets through certified O&M. Reduces the sensitivity of local populations (CI 5)

				by providing refrigeration and irrigation, effectively creating an economic buffer against climate-induced yield loss.