



PROJECT IDENTIFICATION FORM (PIF)

PROJECT TYPE: MEDIUM-SIZED PROJECT

TYPE OF TRUST FUND: GEF TRUST FUND

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PART I: PROJECT INFORMATION

Project Title:	Promoting Sustainable Mini-grids in Mauritanian provinces through hybrid technologies		
Country(ies):	Mauritania	GEF Project ID: ¹	5769
GEF Agency(ies):	UNDP	GEF Agency Project ID:	5357
Other Executing Partner(s):	Ministry of Environment, APAUS, SOMELEC	Submission Date:	12 March 2014
		Re-submission Date:	28 April 2014
		Re-submission Date:	19 May 2014
GEF Focal Area (s):	Climate Change	Project Duration (Months)	48 months
Name of parent program (if applicable):	N/a	Agency Fee (\$):	120,663
• For SFM/REDD+ <input type="checkbox"/>			
• For SGP <input type="checkbox"/>			

A. INDICATIVE FOCAL AREA STRATEGY FRAMEWORK²:

Focal Area Objectives	Trust Fund	Indicative Grant Amount (\$)	Indicative Co-financing (\$)
CCM-3 - Promote Investment in Renewable Energy Technologies	GEFTF	1,270,142	7,700,000
Total Project Cost		1,270,142	7,700,000

B. INDICATIVE PROJECT FRAMEWORK

Project Objective: To optimize existing mini grids in Mauritania by increasing the share of Renewable Energy (RE) and developing an appropriate business model for the sustainability of the hybrid system						
Project Component	Grant Type ³	Expected Outcomes	Expected Outputs	Trust Fund	Indicative Grant Amount (\$)	Indicative Cofinancing (\$)
1. Policy, regulatory, legislative and financial de-risking instruments for hybrid based mini-grids (diesel/RE) development	TA	Enabling policy and institutional framework for hybrid-based mini-grids set up	1.1 Policy and legislative package for hybrid-based electrification adopted 1.2 Cornerstone policy instrument defined, adopted and enforced, e.g. reduction of upfront investment costs, financially viable tariff, subsidies, harmonized national electricity code, concession regimes, licensing rules, PPAs and PPPs for hybrid-based mini-grids	GEFTF	185,000	600,000
	INV	Financial viability of hybrid mini-grid ensured	1.3 Output-based Aid (OBA) Scheme, long term concessions, and other appropriate tariff for hybrid-mini grid designed and set-up for long term viability	GEFTF	350,000	1,000,000
2. Capacity Building for hybrid mini-grid system management	TA	Capacity for delivering turnkey solutions and quality O&M&M	2.1 Published Guidebook on hybrid diesel/RE based mini grids development 2.2 On-the-job capacity building program for hybrid plant manufacturers delivered,	GEFTF	185,142	800,000

¹ Project ID number will be assigned by GEFSEC.

² Refer to the reference attached on the [Focal Area Results Framework](#) when completing Table A.

³ TA includes capacity building, and research and development.

		services for hybrid diesel/RE plants	including on materials, plant design, combination, construction, O&M			
			2.3 Business and technical advisory services to the power utility and other hybrid mini grid plant developers			
			2.4 Tailored capacity building program delivered to relevant national agencies			
3. Showcasing a viable hybrid mini-grid business model	INV	A functioning business model is demonstrated for the technical and financial viability of diesel/RE hybrid-based mini-grids Sustainable O&M&M models are demonstrated	3.1 Pilot sites for mini-grids identified and assessed, and institutional/investment model defined 3.2 Public private partnerships are established for the exploitation of hybrid mini-grids 3.3 1 MW of Wind power generation capacity is installed and managed sustainably in a hybrid power plant <i>covering 4 coastal communities</i> 3.4 Public Relation and investment promotion campaign conducted 3.5 The business model concept replicated	GEFTF	450,000	5,000,000
Subtotal					1,170,142	7,400,000
Project Management Cost (PMC) ⁴				GEFTF	100,000	300,000
Total Project Cost					1,270,142	7,700,000

C. INDICATIVE CO-FINANCING FOR THE PROJECT BY SOURCE AND BY NAME IF AVAILABLE, (\$)

Sources of Cofinancing	Name of Cofinancier	Type of Cofinancing	Amount (\$)
National Government	MEDD, APAUS, SOMELEC	In-kind	2,000,000
GEF Agency	UNDP	Grant / Cash	200,000
Bilateral agencies	IRENA/ADFD	Loan	5,000,000
Private Sector	Technology suppliers / IPPs	Equity / Cash	500,000
Total Co-financing			7,700,000

D. INDICATIVE TRUST FUND RESOURCES (\$) REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY¹

N/A

E. PROJECT PREPARATION GRANT (PPG)⁵

Please check on the appropriate box for PPG as needed for the project according to the GEF Project Grant:

- (upto)\$100k for projects up to & including \$3 million

<u>Amount</u> <u>Requested (\$)</u>	<u>Agency Fee</u> <u>for PPG (\$)⁶</u>
___68,000___	___6,460___

⁴ To be calculated as percent of subtotal.

⁵ On an exceptional basis, PPG amount may differ upon detailed discussion and justification with the GEFSEC.

⁶ PPG fee percentage follows the percentage of the GEF Project Grant amount requested.

PART II: PROJECT JUSTIFICATION⁷

A. Project Overview

A.1. Project Description

1) Global environmental problems, root causes and barriers that need to be addressed

Mauritania is a sub-Saharan country located in West Africa, covering 1,030,700 sq. km, and is sparsely populated with only 3.3 million inhabitants (2012). It is estimated that approximately 20% of the population live on less than \$1.25 per day. 70% of the surface area is desert and only a small part of the country has rainfall that is greater than 300 mm per year. Imported fossil fuel is the principal energy resource used for electricity generation. About 59% of the primary energy supply in the country is from biomass. The shares of other renewable energy resources like wind and solar are negligible. The country has a low electrification rate of only 60% mainly in urban areas. Electricity demand is growing at approximately 12% per annum and the country faces frequent power shortages, as demand already exceeds supply. Mauritania seems to have important oil reserves, but the exact quantity is still unknown. The country is largely unexplored. Offshore oil was discovered in Mauritania in 2001 but is barely commercially exploited.

In rural areas, the electrification rate is below 5%. And mainly, this electrification is limited to provincial capitals, with mini-grid systems. The Electrification grid is not interconnected in Mauritania, but it is constituted by several independent mini-grids. Even the second town Nouadhibou, is not connected to the main grid covering the capital Nouakchott. The cost of grid extension in Mauritania is estimated to be more than 25,000 USD per Km⁸. The main grid, as well as most mini-grids, is managed by SOMELEC, the national power utility. The total installed capacity of the country in 2013 is estimated at 220 MW. The Second National Communication to the UNFCCC (2008) highlighted that the Energy sector is one of the major sources of national GHG emissions.

Fossil fuels constitutes the main source of electricity generation in Mauritania at up to 75%. Petroleum and natural gas are the main fossil fuels used. All the fossil fuel used for electricity generation is imported, as there is no refinery industry in the country. Which means all the oil exploited is exported. The natural gas potential is about to be exploited. The Government created SPEG, a company dedicated to manage natural gas based plants. SPEG is owned by a consortium composed of SOMELEC (40%), SNIM (34%) and Kinross, a world leading mining company (26%). The first power plant managed by SPEG will be exploiting the Banda offshore natural gas reserves, near Nouakchott. The Banda gas reserves are estimated to power 700 MW over 20 years. The first phase of the plant, which is under construction, will deliver 180 MW. The plant is expected to be operational by 2015. A second phase is planned, starting 2016, and will double the capacity to 360 MW. Within the second phase, Mauritania will be exporting electricity to neighboring countries such as Senegal and Mali. Other natural gas reserves are under exploration.

To date, hydropower is the second source of electricity generation, covering up to 15%.

In the recent years, the country has understood its large potential in renewables. Several initiatives are ongoing, but still in a nascent stage: 15 MW Solar PV power generation in Nouakchott with Masdar⁹, 4.5 MW Wind in Nouadhibou with SNIM¹⁰, 30 MW Wind farm near Nouakchott with AFESD¹¹, etc. However, in the provinces, most of the isolated mini-grids use generators running on diesel to produce electricity.

⁷ Part II should not be longer than 5 pages.

⁸ Source: Reducing the Cost of Grid Extension for Rural Electrification, ESMAP (2000)

⁹ MASDAR is an international RE company based in UAE

¹⁰ SNIM is the national mining company

¹¹ AFESD (FADES in French) is the Arab Fund for Economic and Social Development, usually called the Arab Fund.

Summary of the potential of RE in Mauritania

Hydropower	Solar PV	Wind
Average flow rate in the south of the country along the Senegal River: 732 m ³ /s/year. Potential electricity produced per year: 4,000 GWh	Solar irradiation: 5 to 8 kWh/m ² /day Potential electricity produced per year: 200 billion GWh	Average annual wind speed: 3 to 9 m/s Potential electricity produced per year: 500,000 GWh

Especially in the provinces, harnessing abundant RE potential via hybrid mini-grid systems with diesel and either solar PV or wind power, can provide an economically viable, environmentally sustainable and climate-friendly power supply alternative.

The sector however faces numerous problems and barriers, which cumulatively prevent the reduction of the diesel usage and increase the share of RE, making hybrid-based mini grids, much higher in cost and less attractive than conventional power generation project. These barriers are enumerated below.

Legal, regulatory and institutional framework: Renewable energy development in Mauritania is not well organized. Several programmes and projects are initiated, without any proper coordination, nor prioritization. Although there is a clear willingness to develop renewable energies, Mauritania has no renewable energy policy, roadmap or specific plan of action yet. A proper institutional framework should be put in place to regulate the market. Especially in the provinces and rural areas, there are no specific provisions enabling IPPs to implement and operate RE or hybrid-based mini-grids and no preferential financial incentives are given. SOMELEC holds the quasi monopoly of electricity generation, except for some mining companies and some delegated service operators. The current legislation does not prevent the national power utility to develop hybrid systems in provinces, but the legislation can be improved to include more incentives and promotions.

Institutional and human capacities at all levels (sub-regional, national and local) are also insufficient to support rural electrification based on hybrid power plants.

Technical barriers: The combination of power generation sources, using both a fossil fuel and RE for a hybrid system, will require qualified people to manage the system. SOMELEC is not used to manage hybrid system in isolated areas, and therefore will need more technical and engineering capacities to ensure optimal system design, installation and maintenance. The low quality and quantity of skilled and competent workers in the power sector increases the cost of RE operation due to the need to rely on expensive imported services even for basic repair and maintenance. The overall management of the technical system will have a real influence on the lifetime of the system and its affordability to end-users.

Sustainable O&M&M model: The lack of experience with and demonstration of sustainable operation, maintenance and management (O&M&M) of hybrid diesel/RE-based mini grids poses a significant barrier. Before any large-scale replication can take place, such model has to be designed and tested in order to minimize the substantial transaction costs and prove economic and technical viability of solar PV and wind power operations in second cities of Mauritania. The key missing aspects of a sustainable O&M&M model, that have to be put in place are : (i) technical oversight over plant operations and responsibility for repairing faulty equipment such as cracked Solar panels; (ii) an efficient and effective tariff structure which adequately covers both start-up and O&M&M costs; (iii) a robust and effective financial management, billing and payment collection system; and (iv) community mobilization, customer relations and conflict resolution procedures (such as in case of illegal connections or theft), engagement of productive end-users, etc.

Financial and economic viability: The financial barrier is related to first, the upfront investment to shift from a diesel based to a hybrid based mini grids. The power utility already has consumers that afford to pay the generated

electricity from diesel generators. So willingness and capacity to pay is not a major problem in the provinces. However, if the hybrid system results in higher electricity tariffs, this will raise concern and prevent new consumers from acceding to electricity services. This will constitute a barrier to the growth of the demand. The market size is critical to have a financially viable system. So financial modalities should be developed to enable the power utility or an independent power producer to cover the upfront cost of a hybrid system. The second financial barrier is the billing and pricing. The electricity tariffs are heavily subsidized¹².

2) Baseline scenario and associated baseline projects

The Government of Mauritania has undertaken in recent years several actions towards increasing modern energy access and promotion of clean energies. This includes the enactment of several legal acts, among them: (i) an electrical code (and introducing liberalization of the electricity sector), (ii) a law establishing a regulatory Authority, (iii) a law establishing the Agency for Promotion of Universal access to modern energy services (APAUS) (iv) a decree creating in October 2010 the National Agency for the development of renewable energy and energy efficiency (ANADER)¹³ (v) a policy letter for the rural electrification, in agreement with the Economic Development of Rural Electrification (ADER). The Government also created in 2009, a climate change coordinating unit (CCPNCC) which role is to coordinate and address nationwide climate change issues.

The overall mandate of APAUS is the reduction of social poverty by improving the living conditions, especially in areas with low attractiveness to private operators. The agency ensures the provision of basic services like water, electricity and telecommunication to rural and peri-urban areas. The core business model it operates under is one of public ownership of the assets with delegation of the operations to the private sector. APAUS manages the FAUS, a national fund for universal access to services. On the other hand, the mission of ADER is specific to the coordination and facilitation of decentralized rural electrification process. ADER is a private agency, but recognized by the Government as providing public services. ADER usually is a prime contractor for executing rural electrification programmes.

To better manage the isolated mini-grids in the provinces, the Government authorized the creation of hybrid mini-grids. This will help the Government to reduce its heavy subsidy towards the power utility company. In already existing mini grids fully operating with diesel generators, the average commercial cost ranges from 90 to 160 UM/kWh (0.31 to 0.55 USD/kWh)¹⁴. But this is subsidized. Without any subsidy, the real cost is estimated to be on average 0.54 USD/kWh. On average at world level, the production cost of hybrid RE (solar PV or wind) / diesel-based mini-grids is estimated to be 0.4 USD/kWh, without any subsidy¹⁵.

Several initiatives on promoting renewable energies are initiated in Mauritania. Among them, a readiness assessment campaign and several hybrid energy generations that are subsumed as baseline for this GEF funded project.

Renewable Readiness Assessment (RRA):

In 2011, the International Renewable Energy Agency (IRENA) developed the Renewables Readiness Assessment (RRA) as “a comprehensive tool for assessing key conditions for renewable energy technology development and deployment in a country, and the actions necessary to further improve these conditions”. Unlike other assessments, the RRA is a country-initiated, country-led process that identifies short- to medium-term actions for rapid deployment of renewables. There are four main phases in this assessment: (i) initiation and demonstration of intent; (ii) detailed country assessment and action plan; (iii) RRA validation and finalization; and (iv) follow up.

¹² According to IMF, the subsidy towards the energy sector represents almost 2% of the GDP in Mauritania. This was even more (3.4% of the GDP) before the energy reform in 2011

¹³ But ANADER was dissolved a few months after its creation, due to overlap mandates with other existing institutes such as APAUS and ADER.

¹⁴ Source: SOMELEC data in 2012

¹⁵ Hybrid Mini-Grids for Rural Electrification: Lessons Learned, Alliance for Rural Electrification (ARE), (2011). And Hybrid power systems, IRENA, (2013)

Mauritania initiated this exercise last year, and the first phase is just completed. It helped to provide an overview of RE potentials, and a list of current national RE initiatives up to date in the country. Government officials, key stakeholders and actors were informed of the process during a workshop held in November 2013 where they were invited to identify and detail potential actions needed to enhance renewable energy deployment in the country.

The enabling environment created by the GEF funded project will facilitate the completion of the remaining phases of the renewable readiness assessment exercise. As well, the GEF funded project will benefit from this assessment.

Hybrid Wind Energy Project for 4 coastal Communities:

The project aims to improve access to electricity in four zones along the coastal area, towards the north of the country (near Nouadhibou). The four target localities are Lemcid, Lemhaijrat, Bellewakh, and Loubeir. They are located in isolated areas far from any electrical grid. Wind energy was chosen due to the high potential on the Mauritanian coast, particularly in the targeted zones. The wind speed in that area is about 9 m/s.

The localities chosen are fishing villages, with important activities on fish conservation. Energy is needed for cooling and ice production. But energy is also needed for the production of drinking and potable water, through seawater desalination. Water is scarce in the targeted villages, located in the Sahara desert, and the only way to access potable water is by treating the seawater.

In each locality, the project intends to install wind turbines with a combined capacity of 270kW. These are small turbines, with mast heights of 11 to 15 meters. The total capacity to be installed in the 4 localities is about 1 MW of wind energy. This will be hybridized with the already existing 1 MW capacity generated from diesel generators. In addition to the power plant, the project will build transmission and distribution lines, constituting a mini-grid. The energy will be utilized mainly for lighting, cooling (fish) and seawater desalination.

The project was prepared by APAUS and submitted for financing to the Abu Dhabi Fund for Development (ADFD) and was just pre-approved in January 2014. The ADFD will provide 5 million USD as loan to the project. The final approval and availability of the loan will occur once some criteria are met. Among them, (i) cofinancing (the ADFD covers only 50% of the project cost, the rest needs to be co-financed); (ii) demonstration that the project will be well implemented, under an adequate legal environment; (iii) demonstration of potential replications.

The GEF funded project will help to secure this financing by (i) putting in place an enabling environment for the development of hybrid diesel/RE based mini-grids, (ii) developing a suitable business model and financial instruments of these hybrid mini-grids for viability and replication, (iii) and building partnerships for the cofinancing. The GEF proposed project will also use the above diesel/wind power mini-grids as a showcase of a new business model that allows confidence, sustainability and replication.

Hybrid diesel/solar PV plant in Kiffa:

The project aims to improve access to electricity in Kiffa (third city of Mauritania in terms of population, 600 km south from Nouakchott), meet the needs of populations and economic activities, through the construction of a hybrid solar PV / thermal power plant.

The total capacity of the plant will be 6.1 MW: 1.3 MW from Solar PV and 4.8 MW from diesel generators. The actual electricity demand in that region is 2.1 MW, entirely produced from thermal sources. But that demand is expected to increase by 4.8 MW in 2017 and 6.7 MW in 2022.

The total budget of the project is 30 million USD, in which 19 million USD is dedicated to the construction of the hybrid plant. The remaining budget will be for the extension of the mini grid around the Kiffa region and a capacity building program to SOMELEC, the power utility, for a better management of the plant.

The budget is provided by AFD (French Development Agency) through a 25 million USD of concessional loan, and 5 million USD as grant, through the EU Energy Facility program.

The construction of the plant started in 2013, and is expected to be completed by 2017.

Other hybrid plants¹⁶:

Besides the Kiffa project, there are many other smaller initiatives for hybrid diesel/RE (mainly solar PV) plants in provinces in Mauritania. But all of them at this point, face lack of secured funding, and are at the stage of either idea or feasibility study.

Projects	Main stakeholder	Description
Néma and Adel Bagrou (East)	APAUS	Capacity: at NEMA: 6 MW (4MW thermal / 2 MW Solar PV); at Abel Bagrou: 3 MW (2MW thermal / 1 MW Solar PV) Budget: 68 million USD (to be secured) This projects aims to hybridize and increase the existing thermal plant to 9 MW, with an extension of the mini grid. The produced electricity is targeted mainly for households and water pumping.
Atar (North)	SOMELEC	Capacity: 4 MW (2MW thermal / 2 MW Solar PV) Budget: 22 million USD (to be secured) This projects aims to hybridize and increase the existing thermal plant to 4 MW.
Tidjikja (Centre)	SOMELEC	Capacity: 2 MW (1MW thermal / 1 MW Solar PV) Budget: 22 million USD (to be secured) This projects aims to hybridize and increase the existing thermal plant to 2 MW.
Aleg (South)	SOMELEC	Capacity: 4 MW (2MW thermal / 2 MW Solar PV) Budget: 22 million USD (to be secured) This projects aims to hybridize and increase the existing thermal plant to 4 MW.

Atar, Tidjikja and Nema are part of the “Spider centres” (*centres araignées*). The concept of spider centres was created to limit the unaffordable extension cost of the main grid. A spider centre supplies several localities that are linked to the center by a 33 kV Medium Voltage line. Electricity generation is made from diesel generators installed in the centre. Centres are managed either by SOMELEC or APAUS.

The above hybrid projects are promising, but most of the funding is not secured yet. The business model of these projects is not optimized, as it is either managed by the power utility, SOMELEC, at a highly subsidised cost, or managed by APAUS, through small delegated service operators (private sector) with high electricity pricing. The proposed GEF funded project will help to sustain the hybrid mini grid concept, by introducing a better business model (public private partnerships) and favoring the replication. The project will enable large-scale replication by removing underlying policy, technical and financial barriers to investment and management of hybrid based mini-grids.

Beside the above listed hybrid projects focussing on provinces and second cities, there are other hybrid projects focussing on rural and remote areas, such as PERLE (Rural electrification program through renewable energy on a large scale). PERLE is a program that aims to improve access to rural electrification and its productive use through an optimum use of renewable energy in Mauritania. Among the objective of PERLE, is to establish 15 hybrid power plants, running with diesel and either Solar PV or Wind energy. However, the GEF proposed project would focus

¹⁶ In addition to the listed hybrid diesel/RE projects, there are others that are entirely RE source production (not hybrid), such as the 15MW solar PV plant in Nouakchott with Masdar, the 3 MW solar PV plant in Zouerate with SNIM, the 15 MW wind power plant in Nouakchott, the 2.5 MW solar PV plant in Aftout with IBD. Etc... But these projects are not hybrid and do not have the same objective compared to the RE based hybrid projects in the provinces.

more on provinces or areas with tangible income generating activities where the innovative business model will be developed and demonstrated. Once the business model is fully functioning, it can in a second phase, be adapted for the rural areas, where the capacity and willingness to pay is lower.

3) Proposed alternative scenario: brief description of expected outcomes and components of the project

The Project objective is to optimize existing mini grids in Mauritania by providing an adaptive business model and maintaining a sustainable hybrid system (diesel/RE), and to reduce direct GHG emissions by 41,300 tCO₂.

The Program consists of the following three components:

- Policy, regulatory, legislative and financial instruments for hybrid based mini-grids (diesel/RE) development
- Capacity Building for hybrid mini-grid system management
- Showcasing a viable hybrid mini-grid business model

Component 1: Policy, regulatory, legislative and financial instruments for hybrid based mini-grids development

This component will enable the development of hybrid mini-grids, by facilitating the increased share of renewable energies in the already existing and future planned mini-grids. The power utility SOMELEC, APAUS, and other private and independent power producers, will benefit from this legislation. A new business model will be promoted in the management of these hybrid mini grids. The power utility business model will be the basis of the business model, but with broader partnerships such as public and private partnerships, to enable the private sector to be involved while reducing the investment load of the power utility.

Basically, the policy framework will promote a “hybrid” business model, combining the utility business model and the private sector business model. Each of these business models has its advantages and disadvantages, so combining the two will be more relevant and sustainable.

According to the World Bank, utilities are the most common driver for rural electrification in developing countries. The principal advantage of the utility model is that the primary responsibility lies with an experienced party with the financial resources and technical capabilities to implement and manage the project. Utilities have a privileged position and can easily have better access to financial mechanisms. Some experts consider that this model is more likely to be successful because of economies of scope and scale that utilities can generate, but also in the light of their access to financing¹⁷. However, utilities can have a top down approach that is not suitable to local circumstances and may lose ownership and willingness to pay from local communities. Utilities are also usually driven by political agendas, and may follow a demonstration approach, by doing an upfront investment in rural areas, without proper maintenance. This usually leads to a quick failure of the mini-grid.

The private sector based model is the ideal option. But investing in rural areas presents a high risk that most of the private companies cannot afford. The capacity of payment in the provinces are low. But if well established, the private sector model has the advantage to be sustainable, as driven by profit. But this model leads usually to higher electricity pricing, that customers cannot afford.

The hybrid model¹⁸, what is proposed in this project, will be a combination of the utility and private sector models. This will be done mainly through public private partnerships. For example, the utility can invest in the mini-grids

¹⁷ Hybrid Mini-Grids for Rural Electrification: Lessons Learned, Alliance for Rural Electrification (ARE), (2011)

¹⁸ Hybrid usually refers to the energy source of the mini grids. But here particularly, when associated with business model, it refers to the combination of 2 traditional business models: the power utility business model and the private sector business model.

installations, while a local private company is responsible for the overall daily management, maintenance and operating. This kind of arrangement will certainly lower the O&M&M costs. APAUS has already experienced some kind of cooperation with delegated service operators that can be compared to a small-scale public private partnership. The lessons learned from these cooperations will feed the development of the new business model. The PPG phase will help to better define the proposed business model.

This component will help to design policy instruments for long term viable hybrid mini grids, while developing some financial instruments (Output-based aid (OBA) scheme, long term concessions, appropriate tariff for hybrid-mini grid) to have the involvement of the private sector. The output based aid and the long-term concessions for example, will help to attract the private sector.

Component 2: Capacity Building for hybrid mini-grid system management

This component will address technical barriers to the implementation of hybrid mini-grids. The aim is to help the power utility SOMELEC, APAUS and potential service providers upgrade their capacity for delivering turnkey solutions for hybrid systems. Technical assistance will be provided to a number of competitively selected local SMEs through an open Tender or Call for Expression of Interest for the provision of solar and wind power equipments. An international technology transfer partner (an experienced renewable energy company) will be sub-contracted to deliver such assistance. In addition, the project will provide training courses to system designers and end-users, develop and publish guides on design, installation and maintenance of hybrid systems. Confidence and capacity building of private sector investors will be conducted. Also, community organizations in pilot locations (local NGOs and SMEs/productive users) will be provided with assistance and advice on the relevant aspects of wind and solar PV operations, such as identification of potential sites, pre-feasibility assessment and business planning. Key stakeholders in the governments, relevant civil servants, and selected national agencies will also benefit from the capacity building.

Component 3: Showcasing a viable hybrid mini-grid business model

The expected outcome from this component is the improved confidence of communities, developers, the power utility and potential investors in the technical and economic viability of hybrid-based mini-grid plants.

The showcase will consist of supporting the hybrid diesel/wind power plant project in 4 costal zones, by putting in place a suitable business model that allows confidence, sustainability and replication. If successful, the project will favor similar initiatives and induce other hybrid plants to secure funding and partners. The showcase will result to the effective installation of 1 MW wind power.

The showcase will be implemented in conjunction with financial instruments and OBA scheme to be designed under Component 1. The showcase (entire Component 3) will demonstrate the financial viability of the proposed business model. Financial viability of hybrid mini-grids will be addressed by introducing a cost-recovery tariff system (Output 1.2) supplemented by output-based aid (OBA) scheme (Output 1.3)

- Cost-reflective tariffs: Permitting cost recovery and cost-based tariffs is essential to enabling the power utility and private sector entities to operate hybrid mini-grid systems. These developers have no ability to cross-subsidize electricity rates and must demonstrate financial viability to obtain financing. The key challenge and task here is to set the mini-grid tariffs at the right level that balance profitability of investment, on one side, with affordability of service for consumers, on the other side.
- OBA scheme: While cost-recovery tariff structure is essential to ensure commercial viability of the service providers for hybrid mini-grid systems, in practice, it is usually unrealistic to expect full cost-recovery tariff, given the low ability to pay in provinces. Worldwide, almost all rural electrification programs, in developing and developed countries alike, involve some form of

public subsidies. Therefore, OBA scheme is proposed as additional financial incentive to service providers in the situations when application of financially viable tariff is not feasible.

All in all, the combination of two instruments, market tariffs and OBA scheme is seen as the most suitable choice of instruments to effectively address the underlying barrier, i.e. financial and economic viability of hybrid mini-grids in Mauritania. The size of the OBA scheme is an initial estimate that needs further definition. In part the current proposed amount is informed by the availability of funding. At PPG stage, the cost for the incentive will be clearly quantified.

Through the implementation of the pilot investment project, the appropriateness of proposed policy and financing instruments will be demonstrated. The demonstrations will also be used as a testing ground for developing a domestic technology supply chain. Furthermore, these demos/pilots are expected to generate valuable information on the suitability of, and the practical implementation of the operation & maintenance & management (O&M&M) models that will be developed. The project will seek to test a few alternative models, i.e. in addition to the utility and private sector models, involving community-based organizations (e.g. equipments owned by association of energy users).

4) Incremental cost reasoning and expected contributions from the baseline, the GEFTF and co-financing

The GEF funds will be used for incremental activities designed to remove the identified barriers. In particular, the GEF funds will be used for those incremental activities that expand the scope of, or supplement, the baseline activities in leading to or enhancing global environmental benefits. GEF funds will help mini-grids to move from diesel-based system to a hybrid system. Without this GEF funded project, the development of mini grids in Mauritania will continue using generators running on diesel to provide electricity, with a high level of subsidy. The private sector even willing to invest in rural areas on hybrid systems, will not likely do so, as investing in that area alone seems to be not profit making. The table below summarizes Project Activities and Incremental Reasoning:

Baseline practices	Alternative to be put in place by the project	Expected Global Benefits
Component 1: Policy, regulatory, legislative and financial instruments for hybrid based mini-grids development		
The renewable energy development in Mauritania is not well organized. Several programmes and projects are initiated, without any proper coordination, nor prioritization. Although there is a clear willingness to develop renewable energies, Mauritania has no renewable energy policy, roadmap or specific plan of action yet. Especially in the provinces and rural areas, there are no specific provisions enabling IPPs to implement and operate hybrid-based mini-grids and preferential financial incentives are not sufficient. The current legislation does not prevent the national power utility to develop hybrid systems in provinces, but does not	The policy framework will promote a new business model for the management of hybrid diesel/RE mini grids. The power utility business model will be the basis of the business model, but with broader partnerships such as public and private partnerships, to enable the private sector to be involved while reducing the investment load of the power utility. This will favor PPP (public private partnerships). The project will also conduct a comprehensive assessment and prepare a proposal for tariff setting methodologies, which would balance the requirements for minimizing public subsidies, ensuring adequate rates of return for investors and respecting the social electrification objectives set by the government. Along with appropriate tariff structure, other incentives and de-risking instruments will be considered such as Output Based Aid (OBA) schemes. GEF resources will be used to develop financial instruments such OBA scheme and long-term concessions to reduce the operational, delivery and market-related risks. The enabling environment created by the GEF	The electricity generated from hybrid diesel / wind power based mini-grids facilitated by the project will result in a reduction of 41,300 t CO ₂ over technology 20 years lifetime. The establishment of this framework will also apply to all future investments in hybrid mini-grids and thus can be estimated to indirectly contribute to additional emission reductions post-project (this will be defined at the PPG phase)

include sufficient incentives. There is no financial instruments that allow hybrid mini-grids to be managed sustainably.	funded project will also facilitate the completion of the remaining phases of the renewable readiness assessment exercise.	
Baseline practices	Alternative to be put in place by the project	Expected Global Benefits
Component 2: Capacity Building for hybrid mini-grid system management		
Institutional and human capacities at all levels (sub-regional, national and local) are insufficient to support electrification based on hybrid power plants. There is also a lack of experience with and demonstration of sustainable operation, maintenance and management (O&M&M) of hybrid mini-grids.	The GEF funded project will help the power utility SOMELEC, APAUS and potential service providers upgrade their capacity for delivering turnkey solutions for hybrid systems. An international technology transfer partner (an experienced renewable energy company) will be sub-contracted to deliver technical assistance. In addition, the project will provide training courses to system designers and end-users; develop and publish guides on design; and installation and maintenance of hybrid systems. Confidence and capacity building of private sector investors will be conducted. In addition, community organizations in pilot locations (local NGOs and SMEs/productive users) will be provided with assistance and advice on the relevant aspects of Solar PV and wind power operations, such as identification of potential sites, pre-feasibility assessment and business planning. Key stakeholders in the governments, relevant civil servants, and selected national agencies will also benefit from the capacity building.	The electricity generated from hybrid diesel / wind power based mini-grids facilitated by the project will result in a reduction of 41,300 t CO ₂ over technology 20 years lifetime. All future hybrid projects will benefit from enhanced domestic technological capacities and O&M services and thus can be estimated to indirectly contribute to additional emission reductions post-project (this will be defined at the PPG phase)
Baseline practices	Alternative to be put in place by the project	Expected Global Benefits
Component 3: Showcasing a viable hybrid diesel and wind power based mini-grids business model		
Several hybrid projects exist but there is still no experience of proper hybridization in the country. Beside the Kiffa project, there are many other smaller initiatives for hybrid diesel/solar PV plants in provinces in Mauritania. But at this point, they face lack of secured funding, and are at the stage of either idea or feasibility study.	The project will aim at improving confidence of communities, developers, the power utility and potential investors in the technical and economic viability of hybrid-based mini-grid plants. The project will ensure proper design, quality standards, business model and financial instrument of a viable hybrid mini-grid. The showcase will consist of supporting the hybrid diesel/wind power plant project in 4 costal zones, by putting in place a suitable business model that allows confidence, sustainability and replication. If successful, the project will favor similar initiatives and induce other hybrid plants to secure funding and partners. The showcase will result to the effective installation of 1 MW wind power.	The electricity generated from hybrid diesel / wind power based mini-grids facilitated by the project will result in a reduction of 41,300 t CO ₂ over technology 20 years lifetime.

5) Global environmental benefits

A very preliminary and conservative estimate indicates that the total direct project CO₂ emissions reduction from the 1 MW share of Wind power in the coastal zones with hybrid systems installation is **41,300 tons**¹⁹. Considering the US\$ 1,270,142 from the GEF as support for this project, the unit abatement cost is about 1,270,142 / 41,300 = **US\$ 30.6** per ton of CO₂ reduced.

6) *Innovativeness, sustainability and potential for scaling up*

Innovativeness: The project has several distinctive features, which makes it highly innovative. First, the project will promote hybrid electricity generation systems. The combination of diesel and renewable energy into one power plant will improve the sustainability of the mini-grid. Second, the project will not just promote a utility business model or a private sector business model, but both, through a hybrid business model (PPP) combining the advantages of both models. In addition, Mauritania does not have any renewable energy policy, and this project will fill this gap.

Sustainability: From technical and economic points of view, the sustainability of hybrid-based power generation has been proven in the international market, both in the context of developed and developing countries. By addressing the underlying policy and financing barriers that impede the development of hybrid systems in Mauritania, the creation of a sustainable niche for Solar PV and wind power systems will be realized. Financial sustainability of hybrid system will be ensured via the introduction of financially viable business models, which in its pilot stage will be supported with output-based aid scheme and long-term concession. In addition, the project will address the capacity needs of all actors across the entire rural electrification system value chain. This capacity building will have long term impact on both sustainability and scaling up.

Potential for scaling-up: The project will enable large-scale replication by removing underlying policy, technical and financial barriers to investment in diesel/RE hybrid-based mini-grids. There are at least 5 hybrid mini grid projects that can serve as replication. This number is expected to increase gradually in the future. This constitutes a big potential for replication and scaling up of the proposed GEF funded project, as an operational business model will be defined and adopted for hybrid mini-grid systems.

A.2. Stakeholders. Identify key stakeholders (including civil society organizations, indigenous people, gender groups, and others as relevant) and describe how they will be engaged in project preparation:

Stakeholders	Expected role
Ministry of Environment (CCPNCC)	<ul style="list-style-type: none"> • Coordination of the overall project preparation activities • Gather key stakeholders during project preparation • Help in the co-financing letter commitment
Agency for Promotion of Universal access to modern energy services (APAUS)	<ul style="list-style-type: none"> • Resources assessment for pilot projects • Integration of proposed hybrid policy framework in the national strategies and plans for rural electrification • Facilitating investment promotion, support for Solar PV/Wind power, and issuance of co-financing letters
SOMELEC and Private sector: mini-grid operators and SME/manufacturers of	<ul style="list-style-type: none"> • Identification/confirmation of pilot sites • Provide investment to pilot projects • Technology needs assessment for Solar PV/Wind power supply chain and hybrid systems

¹⁹ Assumptions: (1) Wind power system capacity factor = 30%; (2) Useful life of wind power systems = 20 years; (3) Average emission factor from diesel generators = 0.786 ton CO₂/MWh

Calculations:

Total installed capacity = 1 MW

Annual power generation (wind power systems) = 1 x 0.3 x 8760 = 2,628 MWh

Annual CO₂ emission reduction = 0.786 x 2,628 = 2,065 tons/year

Lifetime CO₂ emission reduction = 2,065 x 20 = 41,300 tons

Stakeholders	Expected role
Solar PV plant systems	<ul style="list-style-type: none"> • Design of O&M&M models
Ministry of Energy	<ul style="list-style-type: none"> • Ensure consistency of the project and ensure the integration of proposed RE-related policies in the national policy and institutional framework for power sector reform • Identification of pilot sites • Plan activities related to transfer and development of domestic Solar PV and Wind power supply chain and O&M&M models
Ministries of Finance and Economic Affairs and of Development	<ul style="list-style-type: none"> • Lead and provide guidance on the design of appropriate financial mechanisms and output-based aid incentive scheme • Assist in the establishment of financial mechanisms and incentives
Multilateral donors: ADFD, IRENA, IDB, EU, AFD, KfW, etc.	<ul style="list-style-type: none"> • Commitments for co-funding and share of experience
Local communities organization	<ul style="list-style-type: none"> • Organization and conduct of awareness raising campaigns • Ensure good buy-in from direct beneficiaries of the project
Women groups and gender	<ul style="list-style-type: none"> • Organization and conduct of awareness raising campaigns • Participate in the design of income-generating activities
Indigenous people (Imraguen)	<ul style="list-style-type: none"> • Organization and conduct of awareness raising campaigns • Participate in the design of the local governance model
Civil society organizations and NGOs	<ul style="list-style-type: none"> • Organization and conduct of awareness raising campaigns • Knowledge sharing
Local and international finance institutions	<ul style="list-style-type: none"> • Providing loan financing models for pilot projects

A.3 Risk. Indicate risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, propose measures that address these risks to be further developed during the project design (table format acceptable):

Risk	Level of Risk	Mitigation Action
Political risk: Project implementation is a risk, as the country faced project cancellations in the past due to political instability. In addition, Mauritania is located in the very unstable part of the unsecured Sahara.	Moderate	The current political situation in the country is stable. However, this risk exists due to recent legislative election contests. To mitigate this risk, the project will build a wide coalition of partners and stakeholders whose interest in hybrid mini-grids promotion will likely to sustain, even in case of regime change. They include local businesses and communities, NGOs and international development agencies.
Policy risk The success of this project will be determined to a large degree by adoption and effective enforcement of the proposed policies. Lack of political support may jeopardize the achievement of immediate results and over-all impact.	Low	Initial consultations with the Government of Mauritania have indicated an interest and a willingness to establish a Renewable Energy Support Unit and an Investment Grant Mechanism for Renewable Energy projects. The political will to support this project is strong.
Technology risk The crack of Solar panels or wind turbines is quite common and could result to systems breaking down. Insufficient quality of locally produced equipment	Moderate	The project intends to utilize proven feasible and affordable technologies and replicate solutions that have been successfully introduced in several countries in the region. In this respect, the project will build partnership with material producers established in the country.

Risk	Level of Risk	Mitigation Action
leading to early breakdown of the systems and dwindling consumer confidence in the technology.		
Financial risk Widespread poverty and lack of sustainable source of income resulting in low ability to pay for energy supply services. There is also a lack of ability to finance projects for SMEs.	Moderate	The project voluntarily decided to work with already existing mini-grids. In these areas, there is already a capacity and willingness to pay from end-users. On the other hand, the combination of the power utility business model and private sector business model through PPP (public private partnerships) will reduce the financial risk from both side (utility side and private sector side).
Market risk In Mauritania, hybrid systems will have to compete with subsidized and locally available diesel alternatives, such as Multifunctional platforms (MFP) running on diesel. Without additional incentives, hybrid plants will likely to remain uncompetitive.	High	Introduction of financial viable tariff for hybrid diesel/RE-based mini-grids will be a cornerstone instrument of the proposed policy package and business model, aimed specifically at addressing this market risk by leveling the playing field for RE against other available alternatives. Financial commitments will be secured to sustain the policy package and business model operation beyond the GEF proposed project duration from the Government and other donors.
Climate risk Climate change is predicted to cause changes and increase variability of Mauritanian solar and wind patterns. Higher temperatures may cause overheat of solar panels and reduce the productivity of these panels. And stronger wind may cause destruction and broken of panels.	Moderate	In the case of extreme climate change, regular maintenance and inspection will help to cool the solar panels and prevent their overheat or destruction. Some actions will be adopted in that case, such as attaching a substrate on the glass layer of the solar panels using thermal conductive cement/backsheets, or elevating the solar panels a few inches from the roof to allow cool air to circulate in between. Both of these actions are important to protect from overheating.
Overall Risk Rating	Moderate	

A.4. Coordination: Outline the coordination with other relevant GEF financed and other initiatives:

During the PPG phase, in-depth consultations will be undertaken to establish partnerships and practical modalities for linking and collaborating with several ongoing and planned modern energy access related projects/programs in Mauritania. This is not only to avoid unnecessary duplication but also to ensure that GEF resources build on the progress and achievements made to date through such initiatives. A strategy and plan for collaboration with relevant ongoing and planned initiatives such as those stated below will be prepared during the preparatory phase, including defining the roles and responsibilities of critical stakeholders.

The proposed project is one of a series of similar UNDP-GEF initiatives aimed at promoting renewable energy based mini-grids in Africa (such as Small hydro based mini-grids in Congo-Brazzaville and DR Congo). These projects share the same market transformation approach and model for RE-based rural electrification. The portfolio will be coordinated by UNDP-GEF Regional Coordination in Africa, including analysis and presentation of lessons learnt, organization of regular face-to-face and virtual networking, knowledge sharing and outreach activities and events.

B. Description of the consistency of the project with

B.1 National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. NAPAS, NAPs, NBSAPs, national communications, TNAs, NCSAs, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.:

The proposed project is in line with the following national strategies and plans:

- The Government of Mauritania has undertaken in the past recent years several actions towards modern energy access and promotion of clean energies. This includes the enactment of several legal acts, among them: (i) an electrical code (and introducing liberalization of the electricity sector), (ii) a law establishing a regulatory Authority, (iii) a law establishing the Agency for Promotion of Universal access to modern energy services (APAUS), and (iv) a policy letter for the rural electrification, in agreement with the Economic Development of Rural Electrification (ADER). The Government also created in 2009, a climate change coordinating unit (CCPNCC) whose role is to coordinate and address nationwide climate change issues.
- In the Poverty Reduction Strategy Paper III (PRSP 2011-2015), Mauritania will promote the use of renewable energies, and intends to increase the share of renewable energies in the national electricity generation from less than 1% nowadays to 15% by 2015 and 20% by 2020. This will be mainly from solar, wind and hydro sources.
- The Second National Communication to the UNFCCC (2008) of Mauritania highlighted that the Energy sector is a significant contributor to GHG emissions representing some 14% of total GHG emissions for the country. The Second National Communication, as well as early results of the third national communication, identified renewable energy technologies as being able to play an important role in helping to reduce GHG emissions.
- National Portfolio Formulation Exercise (NPFE): This project is among the priority GEF-5 CCM projects stated in the National Project Formulation Document (NPDF) for GEF 5. The NPDF specifically states UNDP as the GEF Agency for this project.

B.2. GEF focal area and/or fund(s) strategies, eligibility criteria and priorities:

This project is consistent with the GEF-5 strategy to address climate change, especially the Objective 3 (Renewable Energy: Promote investment in renewable energy technologies) because its main objective is to facilitate investment in hybrid wind power and solar PV-based mini-grid systems in Mauritania.

B.3. The GEF Agency's comparative advantage for implementing this project:


UNDP has implemented over 230 GEF clean energy projects in close to 100 developing countries, and has acquired a unique base of institutional knowledge on transforming renewable energy markets in developing countries. One of UNDP-GEF's three signature climate mitigation programs – Clean Energy – specifically promotes access to clean and affordable energy supply. Two recent UNDP publications on de-risking renewable energy investment environments ('Transforming Renewable On-Grid Energy Markets' and 'De-Risking Renewable Energy Investment') summarize UNDP's empirically- and theoretically-robust 'theory of change' for catalyzing private-sector renewable energy investment. A former UNDP publication on Solar PV in Africa ("Solar Photovoltaics in Africa") gathered the lessons learning from various experiences with financing and delivery models in Africa. With specialized staff devoted to energy, finance, NAMAs and carbon mechanisms, UNDP is one of very few international organizations with the understanding of national conditions and priorities (backed by its global network of 129 Country Offices), renewable energy sectoral expertise to be able to design and implement such a program.

PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S): (Please attach the [Operational Focal Point endorsement letter\(s\)](#) with this template. For SGP, use this [OFP endorsement letter](#)).

NAME	POSITION	MINISTRY	DATE (MM/dd/yyyy)
Mr. Mohamed-Yahya O. LAFDAL	Director of DPCIE / GEF Operational Focal Point	Ministry of environment and sustainable development	12/12/2013

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF/NPIF policies and procedures and meets the GEF/LDCF/SCCF/NPIF criteria for project identification and preparation.					
Agency Coordinator, Agency name	Signature	DATE (MM/dd/yyyy)	Project Contact Person	Telephone	Email Address
Adriana Dinu UNDP – GEF Executive Coordinator and Director a.i.		May 19, 2014	Saliou Toure Regional Technical Advisor EITT	+221 33 869 07 89	Saliou.toure@undp.org