Seychelles Energy Commission

Technical Specifications for Grid-Connected Photovoltaic Power Systems

Developed under the GOS-UNDP-GEF Project on Grid Connected PV Rooftop Systems

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February 2014

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1.0 BACKGROUND

UNDP/GEF is supporting the implementation of the project –'Grid-Connected PV Rooftop systems' by the Ministry of Environment and Energy of the Government of Seychelles. The GOS-UNDP-GEF project envisages increasing the use of grid-connected photovoltaic (PV) systems as a sustainable means of generating electricity in selected main islands and smaller islands of the Seychelles, with a focus on small-scale producers who are already connected to the national electricity grid of the Public Utilities Corporation (PUC).

These Technical Specifications developed by the project and promulgated by the Seychelles Energy Commission (SEC) are intended to ensure import and installation of PV systems that offer superior and safe technical performance, optimal utilisation of solar resource, and compliment the electricity network in Seychelles.

It is envisaged that the energy generated by the PV array after appropriate power conditioning is intended to be used to replace whole or part of the energy requirement of total connected load of the facility where the systems are installed. A grid connected PV Power plant with export and import of energy to the grid is envisaged. The system will comprise of PV array, Power Conditioning System and switchgear.

2.0 PHOTOVOLTAIC ARRAY

2.1 Crystalline silicon Photovoltaic Module type certified according to IEC 61215 or Thin-film Photovoltaic Module type certified according to IEC 61646. A copy of test certification and Quality Management System (QMS) certification of the production facilities is mandatory, from Seychelles Bureau of Standards (SBS) or internationally approved testing authority recognised by SBS before authorisation of import/supply.

2.2 A minimum warranty of 20 years with degradation of power generated not exceeding 10% over the entire 20-year period is required for all PV Modules supplied.

2.3 It is envisaged that the sizing of the array will be based on the past energy consumption of the electricity consumer. The average annual energy production of the PV array should be equal to or less than the average annual energy consumption of the consumer. The physical size of the array and consequently the energy production may be limited by the amount of shade free area available on the rooftop of the consumer.

3.0 ARRAY SUPPORT STRUCTURE

3.1 The PV array and the support structures should be mounted on the roof of the consumer. The PV array support structure should be fixed at a tilt angle of 15° facing the North/Equator. The support structure shall be designed to ensure the modules are mounted to reduce the effect of shading. It should be ensured that the entire space requirement of the array is met within the shade free space limits available over the roof of the facility. In facilities where there are shade free rooftop area constraints, the size of the PV array should be reduced to fit the available shade free area[1].

3.2 PV modules should be mounted on non-corrosive support structures be made of stainless steel, aluminium or galvanised iron (protective layer of 30 μm). Support structure design and foundation or fixation mounting arrangements should be able to withstand minimum horizontal wind force of 150 km per hour and should be able to resist at least 25 year life of outdoor exposure in hot, humid and saline conditions prevalent in Seychelles without suffering significant damage or corrosion.

4.0 INVERTER

4.1 The inverters should be certified according to IEC 61727 and IEC 62109. A copy of test certification and QMS certification of the production facilities is mandatory, from SBS or internationally approved testing authority recognised by SBS before authorisation of import/supply. The inverter should have the capability on a utility interactive mode. Rated output voltage shall be AC 230V±10% over the full range of PV array operating voltages. That is, when the input DC voltage varies from 80% to 120%, the output AC voltage must be within 10% of the rated voltage;

4.2 The inverter output frequency should 50Hz and the variation should not be over 1%. The inverter output waveform should be pure sine wave and the output waveform total harmonic distortion should be no more than 5%.

[1] Area on the rooftop which is not shaded by nearby buildings, structures or vegetation during any part of the day.

4.3 The inverter shall be capable of operating continuously for 10 hours at its rated power under ambient temperatures of 40° Centigrade.

4.4 Inverter circuits must include protection against over-current when working current is greater than 150% of the rated current, short circuit of input and output terminals, reverse polarity on DC input terminals and lightning induced transients.

4.5 The maximum quiescent current draw of the inverter circuit must not exceed 3% of the rated input current of the inverter. The noise produced by the inverter unit should be no more than 65dB at a distance of 3 meters from the inverter.

4.6 The power factor shall be within the range of 0.95 leading to unity relative to the PUC's Electricity supply.[2]

4.7 Inverters with a rating of more than 100 kVA must provide on-site or remote control of output and must provide a communications platform to PUC.

5.0 WIRING AND PROTECTION

5.1 The supplier of the grid connected PV system will be responsible for wiring and protection on the DC side and on the AC side up to the interface with the existing electrical system of PUC.

5.2 Good quality copper conductor may be used for interior wiring as per the applicable SBS standards viz. UL4703 or TUV 2 Pfg 1169 08.2007. Conductors must be supported using purpose-made saddles or supports and PVC conduits should be used. Drooping or unsupported runs are not allowed.

5.3 The voltage drop in the cables between the PV array and the inverter shall normally not exceed 3% of the nominal voltage, at maximum rated array current. The minimum cross sectional area of the copper cables to be used on the DC side should be calculated according to the following formula

$$\mathbf{S = 0.3 \times L \times I_m / \Delta V}$$

Where

S is the cross-sectional area of the cable in mm^2

L is the cable length in meters

$\mathbf{I_m}$ is the maximum current in Amperes

And **ΔV** is the maximum allowable voltage drop in % which should be set as 3%.

5.4 The ampacity[3] for any given wire cross-section shall not be exceeded. In the case of interior wiring, the ratings at 40°C shall apply. For external wiring in the vicinity of the PV array, or other exposed locations liable to high temperatures, the ratings at 60°C shall apply. All exterior exposed cabling or conduits shall be fully UV-resistant and rated for the application;

[2] Leading power factor is VARs absorbed by the inverter.
[3] Rated current carrying capacity

5.5 Holes through roofing materials should be avoided wherever possible. Cables through roofing shall be contained in purpose-made roof entry boxes, or proper glands, which shall form a weather-proof seal to prevent leakages. All holes in roofing shall be thoroughly sealed and made waterproof with UV-resistant silicone sealant or an equivalent method.

5.6 The maximum current of a PV array (or sub-array) shall be regarded as 130% of the nominal short-circuit current of the array (or sub-array) rated under Standard Test Conditions;

5.7 In the two-conductor DC wiring system on the PV array side, the negative conductor should be grounded, by direct connection to a good earth contact. The connection to earth shall not contain any fuses or switches. The conductor connecting the grounded conductor to earth must not be less than the largest conductor in the circuit. Hence all switches, fuses and interrupts must be installed in the ungrounded positive conductor. The recommended point of connection between the grounded conductor and the earth is at, or near, the negative terminal of the battery

5.8 The following conventions shall be followed for two-conductor DC wiring the PV power systems - Positive - Red and Negative- Black. Separate earth conductors, if present, should be green or bare.

5.9 Fuses and circuit-breakers shall be rated for DC service, have voltage ratings greater than the maximum circuit voltage and have current ratings between 125% and 150% of the maximum design current for the circuit;

5.10 Special DC switches are preferred and they shall be rated for the current and voltage of the circuit they disconnect. Minimum disconnection requirements are a switch or circuit-breaker for disconnecting the PV array.

5.11 The casing of the inverter should provide adequate protection for the electronic components housed inside and should be UV resistant and water-proof. Charge regulator boxes should display good workmanship and should provide protection according to the standard IEC 60529. For indoor installations the reference under IEC 60529 will be IP 32 and for outdoor installations it will be IP 54. For inverters installed on the external wall of the facility, the casing should be able to resist at least 25 year life of outdoor exposure in hot, humid and saline conditions prevalent in Seychelles without suffering significant damage or corrosion.

6.0 INSTALLATION

6.1 The roof-top, grid-connected PV power system to be installed only by a technician who has been approved by the SEC in accordance with the qualifications and accreditation requirements specified by Seychelles Institute of Technology (SIT) and Seychelles Qualification Authority (SQA).

6.2 A unique identification number will be given to the technician by SEC and/or SQA/ SIT.

7.0 USER TRAINING AND DOCUMENTATION

7.1 Adequate training should be provided by the company to the user[4] to enable them to safely operate the system and to carry out basic upkeep and maintenance.

7.2 A user manual with illustrations and easy to understand narration in English and/or French and/or Creole language should be provided to the user. The should essentially cover the basic principles of PV, illustration and description of the grid-connected PV system and components; regular maintenance and operation procedures, 'Do's and Don'ts', name of the Supplier in Seychelles, model or type number of the grid-connected PV system, serial number of the system indicating the year of manufacture, serial number of the technician carrying out the installation and the address and telephone number of the supplier.

7.3 A permanent name plate should be mounted or laminated in the inverter containing name of the Supplier in Seychelles, model or type number of the grid-connected PV system, serial number of the system indicating the year of manufacture, serial number of the technician carrying out the installation and the address and telephone number of the supplier

8.0 BATTERY

8.1 It is not recommended to use a lead-acid battery for energy storage along with the grid-connected PV system as the PUC electrical grid acts as the storage. Use of batteries for energy storage is not likely to be economically feasible for the users and will not be supported through government financial incentives.

8.2 If batteries are used they should be certified according to IEC 61427. A copy of test certification and QMS certification of the production facilities is mandatory, from SBS or internationally approved testing authority recognised by SBS before authorisation of import/ supply. The battery will be of flooded lead-acid type with positive tubular plate.

8.3 If batteries are used the inverter should be upgraded to a power conditioning unit which also includes a battery charge regulator. The charge regulator must protect the battery from over-charging, but at the same time allow the battery to reach a full state of charge efficiently. The upper voltage threshold/s of the charge regulator must be suitable for tubular plate batteries and the expected range of battery operating temperatures based on the battery manufacturers' data. Temperature compensation should be provided for over-charge protection and override facilities to permit equalisation charges should be built in.

8.4 The charge regulator discharge control must ensure that the tubular plate battery is not discharged below a suitable level by providing deep-discharge protection. The maximum depth of discharge should be selected to ensure that discharges down to this level will not cause premature damage to the battery[5]. Current and temperature compensation may be required on the load-shed voltage, for adequate battery protection.

8.5 The PV system supplier will be responsible for collection and safe disposal of used lead-acid batteries after the useful lifetime. The supplier should provide details of arrangements for collection and disposal of lead acid batteries.

[4] Appropriate member of the household in the case of domestic installations and an electrical technician or an equivalent in the case of commercial installations.
[5] As established from battery manufacturer's data

United Nations Development Programme
Country: Seychelles
PROJECT DOCUMENT

Project Title: Grid-Connected Rooftop Photovoltaic Systems

UNDAF Outcome(s): Given the limited number of UN resident agencies in Seychelles (only the World Health Organization), the country is not required to prepare a UNDAF.

UNDP Strategic Plan Environment and Sustainable Development Primary Outcome:
Mainstreaming environment and energy: Strengthened national capacities to mainstream environment and energy concerns into national development plans and implementation systems
UNDP Strategic Plan Secondary Outcome: N/A
Expected CP Outcome(s): UN Country Programme 2012-2016 – Country Programme Outcome #2: By 2016, the governance systems, use of technologies and practices and financing mechanisms that promote environmental, energy and climate-change adaptation have been mainstreamed into national development plans.
Expected CPAP Output (s) Seychelles does not have a CPAP.
Executing Entity/Implementing Partner: Seychelles Energy Commission
Implementing Entity/Responsible Partners: United Nations Development Programme

Brief Description

Currently, the Seychelles is almost 100% dependent on imported oil to meet its energy needs, including electricity production. The objective of the proposed project is to increase the use of grid-connected photovoltaic (PV) systems as a sustainable means of generating electricity in selected main islands and smaller islands of the Seychelles, with a focus on small-scale producers who are already connected to the national electricity grid. The project will revise the legal, regulatory and policy framework to better support the adoption of renewable energy technologies, and grid-connected PV systems in particular; design and implement financial mechanisms that will make the purchase and installation of solar PV systems more attractive to the private sector; establish the first market supply chain for solar PV systems in the country; provide training to establish local capacity for the installation and maintenance of PV systems; and demonstrate for the first time in the Seychelles the viability and practicality of grid-connected PV systems through demonstration PV systems. Together, these actions are designed to play a critical role in "jump-starting" the adoption of solar PV technology in the Seychelles, and in setting the stage for broad-scale replication by reducing the costs of PV technology through a market-based approach that will establish financial incentive mechanisms for PV systems and reduce transaction costs (by creating a reliable supply chain and establishing local capacity for installation and maintenance). In this way, the project is designed to transform an energy sector that today is almost 100% dependent on imported fossil fuels into one where solar PV and other RETs provide a significant percentage of national energy production going forward.

Atlas Award ID:	00065515
Project ID:	00081971
PIMS #	4331
Start date:	April 2012
End Date	April 2016
Management Arrangements	NEX
PAC Meeting Date	TBD

Total resources required	7,287,138
Total allocated resources:	**7,287,138**
• **Regular (GEF)**	**1,160,000**
• **Other:**	**6,127,138**
○ Government	1,224,697
○ Multi-Lateral	237,480
○ Private Sector	3,159,223
○ Parastatal	1,405,738

Agreed by (Government):

Date/Month/Year

Agreed by (Executing Entity/Implementing Partner):

Date/Month/Year

Agreed by (UNDP):

Date/Month/Year

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List of Acronyms

ADFD	Abu Dhabi Fund for Development
APR	Annual Performance Report
AWP	Annual Work Plan
CESD	Climate and Environmental Services Division
CO_2	Carbon dioxide
COI	Indian Ocean Commission
DBS	Development Bank of Seychelles
GEF	Global Environment Facility
GDP	Gross Domestic Product
GHG	Greenhouse gases
GOS	Government of Seychelles
IAEA	International Atomic Energy Agency
IDC	Islands Development Company
IFC	International Finance Corporation
IPP	Independent Power Producer
M&E	Monitoring and Evaluation
MHAETE	Ministry of Home Affairs, Environment, Transport and Energy
MoF	Ministry of Finance
MND	Ministry of National Development
NCCC	National Climate Change Committee
NGO	Non-governmental Organization
PIR	Project Implementation Review
PPG	Project Preparation Grant
PUC	Public Utilities Corporation
PV	Photovoltaic
QPR	Quarterly Progress Report
RCU	UNDP/GEF Regional Coordinating Unit in Pretoria
RET	Renewable Energy Technology
SC	Steering Committee
SEC	Seychelles Energy Commission
SEYPEC	Seychelles Petroleum Company
SIDS	Small Island Developing States
SIF	Seychelles Islands Foundation
SIT	Seychelles Institute of Technology
SNCCS	Seychelles National Climate Change Strategy
ToR	Terms of reference
TPR	Tripartite Review
TTR	Terminal Tripartite Review
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNDP-CO	United Nations Development Programme Country Office
UNFCCC	United Nations Framework Convention on Climate Change
UniSey	University of Seychelles

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1. SITUATION ANALYSIS

1.1 Context and global significance: Environmental, Policy and Institutional

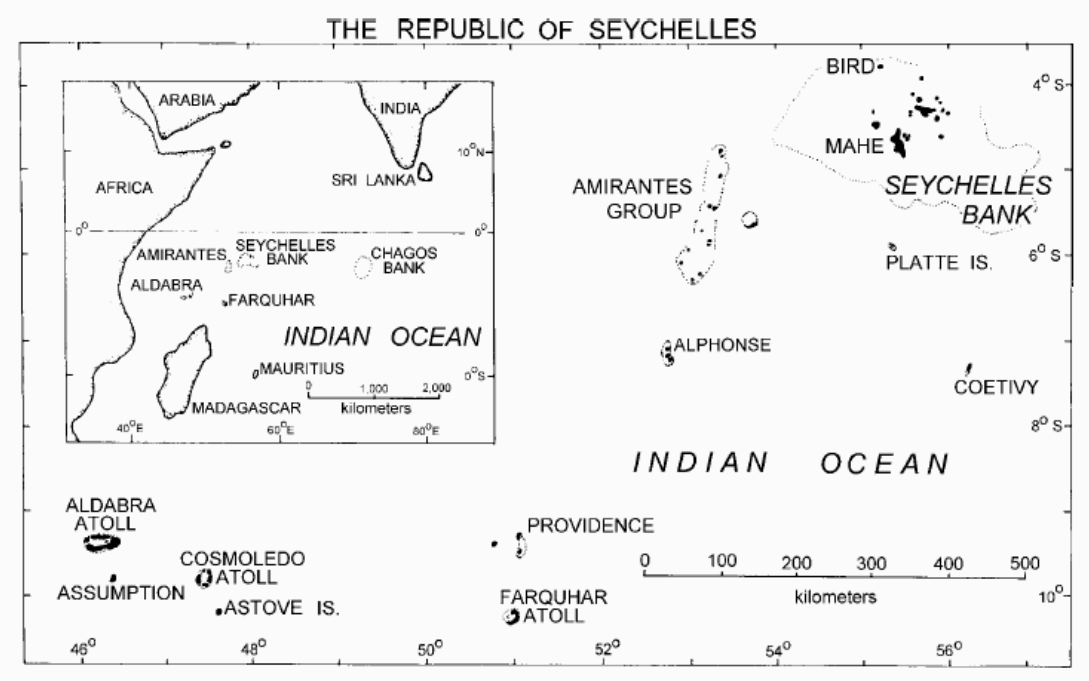
Problem statement

1. Currently, the Seychelles is almost 100% dependent on imported oil to meet its energy needs, including electricity production. As with most Small Island Developing States (SIDS), this dependence on fuel imports has a significant economic and budgetary cost to the country, with the balance of payments and State budget deficits made worse by the financing of electricity and other energy infrastructure (in 2009, fuel imports as a whole accounted for 22.5% of all imports, while imports of fuel for electricity generation alone accounted for 4.5% of all imports and was equivalent to 12% of the total government budget: data from Seychelles Energy Commission). Imported fossil fuels are also the single largest contributor of greenhouse gases in the Seychelles (based on emissions during the shipping process and in the burning of fuel to produce electricity), and the country's overwhelming dependence on imported fuel poses real energy security concerns, both in terms of access to supplies and pricing. Shipping of oil to the country poses a threat to globally significant biodiversity (e.g. to the Aldabra UNESCO World Heritage Site, a remote atoll located close to a major petroleum shipping route) and to important national economic resources (coral reefs and other coastal habitat are critically important for both the tourism and fisheries sectors, by far the two largest sectors in the national economy). Data from the past 10 years shows that, without any intervention, the impact of imported fuel on the national economy and environment will only grow in the coming years. In 2000, total primary energy consumption (PEC) was 109,548 TOE (ton of oil equivalent), whereas by 2007 it had increased to 158,629 TOE (for an average annual growth rate of 4.2%). A 2007 study found that local consumption of imported petroleum fuels increased by an average of 5.4% per year between 1996 and 2007, and in the 3-year period 2005-2007 the average rate of increase was 9.7% per year (the increase in local consumption was greater than total primary energy consumption because the latter figure includes international aviation fuel consumption, which accounts for approx. 30-40% of PEC and grew more slowly than local consumption in the past 10 years). Demand is likely to continue to increase as a result of continued expansion of the electricity distribution system, rising standards of living, and the deployment of projects created by a recent influx of foreign investment. In addition, at present the Seychelles receives approximately 160,000 visitors annually, and this number is expected to rise significantly in the coming decade. Thus, in order to improve its economic performance, secure its energy supply, and conserve its environment, the Seychelles needs to find new ways to reduce its dependency on imported fossil fuels.

Country Information

2. The Seychelles is an island nation in the Western Indian Ocean located approximately 1,000 kilometres east of mainland Africa. The country has a total landmass of 455 square kilometres, spread among 115 islands, of which 42 are granitic and the remainder are coralline. The main granitic islands, also known as the inner islands, in descending order of size, are Mahé, Praslin, Silhouette and La Digue, and together these islands support approximately 95% of the population of 86,525 (as of 2010). Map 1 shows the physical location of the Seychelles archipelago in the Indian Ocean. The population of Seychelles is growing at an estimated rate of 2 to 3% per year.

Map 1: Location of the Seychelles Archipelago



3. The climate of the Seychelles is equatorial with an average rainfall of 2,200 mm. Humidity is uniformly high, and mean temperatures at sea level range from 24°C to 30°C. The prevailing winds bring the wet northwest monsoon from December to March and the drier southeast monsoon from May to October. Climatic conditions, however, vary dramatically between islands, mainly in relation to their altitudes and positions; the mean annual rainfall in the country diminishes on a trajectory from the northeastern to the southwestern islands. Rainfall can be as high as 5,000 mm per year on the top of Morne Seychellois (900 m.) on Mahé and as low as 867 mm on the coralline island of Assumption. The main granitic islands lie to the north of the West Indian Ocean cyclone belt, but they can suffer storm surges from cyclonic activity to the south.

4. After many years of extensive foreign borrowing, the Seychelles underwent a debt crisis in mid-2008 when it missed payments on its private foreign debt and it credit rating was downgraded to "Selective Default". At this time, the Government of Seychelles asked the International Monetary Fund for support to undertake a public debt restructuring. A set of fiscal reforms have since been enacted, including significant cuts in Government staffing and various tax reforms including introduction of a broader business tax and a personal income tax, as well as the planned introduction of a value-added tax in 2012. As a result of these measures, the worst of the economic downturn appears to be over; although real GDP declined by 7.5% during 2009, it increased by 4% in 2010 and a growth rate of 5% was projected in 2011. Inflation, which rose to 29.26% in 2008 and 22.31% in 2009, dropped to 0.42% in 2010 and was projected to be approximately 2.5-3.0% in 2011. The exchange rate for the Seychelles Rupee (SR) seems to have settled at about SR 12 to USD 1 after having fluctuated from between SR 5.5 and SR 18 over the past decade. Per capita income in 2009 was approximately $8,335, putting Seychelles into the category of "upper middle income" countries.

Policy, Institutional & Legal Framework

5. The Seychelles has taken several steps in the past few years to consolidate its national energy laws, policies and programs, and to establish the development of renewable energy technologies in the country as a national priority. Among the recent steps in this direction have been: 1) the establishment in 2010 of a Seychelles Energy Commission; 2) the lifting of tariffs on all renewable energy technology imports; 3) and various measures to promote energy conservation and renewable energy, including the removal of taxes on solar water heaters and other energy saving devices, and a new policy to remove all conventional vehicles from the island of La Digue and allow only electric or hybrid vehicles.

Policies & Priorities

6. The overarching policy document for the energy sector in the Seychelles is the Seychelles Energy Policy 2010-2030, which was developed with UNDP support during 2010 and formally approved by Cabinet and adopted as official government policy in 2010. The Energy Policy includes significant analyses of historical, existing and projected energy demand and supply, and proposes key changes to the institutional and regulatory framework for energy in the country, including strengthening the Seychelles Energy Commission, creation of an independent Energy Regulator, and clearly defined IPP regulations to promote renewable energy development. The Energy Policy also represents the first formal recognition by the Government of Seychelles of the important of renewable energy production, and in this regard is an important step forward. The Seychelles Energy Policy sets a national target of 15% of energy demand met by renewable energy by 2030. On the other hand, the Energy Policy is not a traditional policy or planning document and does not provide detailed targets, methods, or timeframes for instituting changes to energy management in the country.

7. In addition to the Seychelles Energy Policy, several other policy documents have some relevance to the energy sector and to the promotion of renewable energy. The National Climate Change Strategy (SNCCS), formulated in 2009, is intended to mainstream climate change into sustainable development through a cross-sectoral approach addressing matters of policy, institutions, capacity building and civil society involvement. The SNCCS identifies five strategic objectives: (i) advance understanding of climate change, its impacts and appropriate responses; (ii) put in place measures to adapt, build resilience and minimize vulnerability to the impacts of climate change; (iii) achieve sustainable energy security through reduction of greenhouse gas emissions; (iv) mainstream climate change considerations into national policies, strategies and plans; (v) and build capacity and social empowerment at all levels to adequately respond to climate change. The Seychelles Sustainable Development Strategy 2011-2020, which is the framework document for all environment-related programs and policies in the country, identifies the "promotion of renewable and alternative energy at the national level" as one of 5 strategic objectives for the energy sector in the country.

8. Seychelles is also a signatory to the SIDS DOCK Support Programme, a joint initiative of UNDP and the World Bank funded by the Government of Denmark that was developed in close consultation with the Alliance of Small Island States (AOSIS). As one of the countries to have formally signed on to the SIDS DOCK Seychelles has committed to several critical goals in order to move toward sustainable development planning by 2033:

    - Increase energy efficiency by a minimum of 25% (relative to a 2005 baseline)
    - Generate a minimum of 50% of electric power from renewable energy sources
    - Decrease by 20% – 30% the use of liquid petroleum fuels in transportation

Laws & Regulations

9. The most important existing legislation in the Seychelles for the management of the energy sector, electricity production, and the adoption of renewable energy technologies, are the Public Utilities Corporation Act (1985) as amended (the "PUC Act") and the Seychelles Energy Commission Act (2010) ("SEC Act"). The PUC Act, including its subsidiary legislation, authorizes the operations of the Public Utilities Corporation (PUC), and provides detailed financial and technical regulations to direct its operations. The PUC Act also authorizes the PUC to be the sole supplier for electricity, water and sewerage in the country (Part II Section 5 (1) of the Act), thereby providing the fundamental legal basis for regulating energy production and supply in the country. The SEC Act authorizes the establishment of the Seychelles Energy Commission (SEC) and provides the broad parameters of its mandate, which is directed towards the liberalization of the Seychelles energy markets by ensuring the provision of adequate, reliable, cost effective and affordable energy while protecting the environment. The SEC Act introduces and promotes the use of renewable energy in Seychelles.

10. In addition to these laws governing the actions of the energy sector, recent amendments to existing tax legislation have had a direct and beneficial impact on renewable energy in the country. Currently, imports of technologies for non-renewable energy production, such as diesel generators, are subject to a 15% tax rate under the Goods and Services Tax Act. However, Amendment 3 to the 2010 regulations of the Goods and Services Tax Act of 2001 (Regulation 163F) state that "Goods imported to be used in the process of conservation, generation or production of renewable or environment friendly energy sources, as endorsed by the Seychelles Energy Commission are exempt from Goods and Services Tax". A similar exemption for renewable energy technologies is offered in the 2010 "Promotion of Environment Friendly Energy Regulations" under the Trades Tax Act. A new Value Added Tax (VAT) is scheduled to go into effect in 2012, and this legislation as well will support solar energy by providing credits (covering the 15% VAT rate for imported RETs for registered importers. Additional relevant legislation is listed in Table 1.

Table 1: Legislation relevant to the Energy Sector in Seychelles

Legal Instrument	Date of Enactment
Public Utilities Corporation Act	1985
Occupational Safety and Health Decree	1991
Public Health Act	1991
Road Transport Act	1991
State Land and River Reserves Act	1991
Town and Country Planning Act	1991
Environment Protection Act	1994
Environment Protection (Standards) Regulations	1995
Noise Pollution Standards SBS	1998
Seychelles Energy Commission Act	2010

11. Despite these existing legal instruments, it is widely agreed that key components of the legislation regarding the energy sector in the Seychelles are vaguely worded and incomplete. For example, while existing Electricity Regulations give the PUC the power to grant permits to auto-producers or independent power producers (IPPs), this only applies in cases where it is not practical for the applicant to be supplied by PUC; the regulations do not address the issue of electricity from auto-producers or IPPs (exist customers) being fed back into the grid and it remains unclear to Government and PUC officials whether it is legal for PUC to buy electricity from independent power producers, even at negotiated tariffs. In addition, none of the existing legislation authorizes the establishment of an independent regulator for the energy sector.

12. For this reason, the 2010 Seychelles Energy Policy calls for a strengthening and revision of the existing legal framework for energy in the country, and the Government of Seychelles (with support from the European Union) is currently undertaking a review of existing legislation and the drafting of new legislation. One expected result of this process will be a new, comprehensive Energy Act in 2012, which is expected among other things to liberalize and deregulate the existing Seychelles energy market by: 1) fostering renewable energy systems; and 2) authorizing all parties to provide renewable electricity to the grid. The Energy Act also will authorize the establishment of a regulatory body (possibly as part of the Fair Trade Office) to regulate quality and price of electricity service, and to call upon the Energy Commission and private consultants for analyses and advice when needed. Another expected result will be new subsidiary legislation under the Energy Act to address the following: 1) repeal the existing PUC Act; 2) clearly define the division of responsibilities between the PUC (production, transmission and distribution) and auto-producers or independent power producers (production); 3) define a tariff methodology; 4) develop rules for auto-producers and IPP's (i.e. a Grid Code); 5) improve the regulation and licensing of electricity services, including the generation, transmission, and distribution of electricity (licensing powers to be exercised by the independent energy regulator); and 6) obligate the PUC to submit to public an bi-annual integrated Resource Plan.

Institutional Framework

13. The institutional structure of the Government of Seychelles has undergone significant change in the past 3 years, due in large part to a significant downsizing of the government as part of an IMF austerity package. A new framework for the management of the energy sector is now in place, although some roles and responsibilities remain to be more clearly defined (see barriers section). The key institutions, and their roles and responsibilities, are listed in Table 2.

Table 2: Institutions with Oversight of the Energy Sector in Seychelles

Functions related to Energy Sector	**Institution**
Approve energy policies and strategies	Cabinet
Prepare background documents for energy policy decisions on request or by own initiative	SEC / PUC / SEYPEC
Import and domestic sale of oil	SEYPEC
Transmission and distribution of electricity	PUC
Production of electricity	PUC
Update information and statistics on energy imports, energy production and energy consumption	SEC / PUC / SEYPEC / NSB
Update knowledge relevant to energy research, information and training programs; liaise with international agencies	SEC / PUC / SEYPEC
Provide guidance / strategies for energy efficiency and renewable energy programs, including incentives	SEC / PUC / NGOs
Define methodology and framework for energy pricing and tariffs, including auto-producers and IPPs	Cabinet
Oversee the management of public companies in the energy sector, including evaluating of performance indicators	Cabinet
Approve prices and tariffs	Cabinet
Propose and monitor overall health and safety regulations in energy sector	PUC / SEYPEC

14. Seychelles Energy Commission (SEC): The most important change in the institutional framework was the establishment in 2009 of the SEC, a new agency formed under the Ministry of Home Affairs, Environment, Transport and Energy (MHAETE) and reporting directly to its Minister. The Commission, which has 5 full-time staff, is tasked with ensuring "the provision of an adequate, reliable, cost effective and affordable energy supply while protecting and conserving the environment." The primary functions of the SEC are: 1) to coordinate the development and implementation of national energy policy and strategy; 2) to formulate a national energy plan; 3) to advise the Minister on all matters relating to energy, including renewable energy; 4) implement and enforce the energy supply laws, to review other laws relating to energy, and to make recommendations for new legislation to the Minister; 5) to promote energy efficiency and conservation and the use of renewable energy; 6) to promote research into, and the development and the use of, new techniques relating to extraction, production, transmission, distribution, supply and use of energy; 7) to encourage the development of the energy industry including the related capacity building; 8) to collect and maintain energy data, produce national energy statistics and fulfill any requirements for reporting of energy and emissions data, as appropriate; and 9) to perform such other functions as the Minister in writing may assign. At present, the SEC has no jurisdiction over the operation and construction of power plants and other large-scale construction projects in the country, nor has it been officially designated as an independent regulator of the electricity sector. It is expected, however, that a new Energy Act will designate the SEC as the independent regulator for the electricity sector, and will reorient the SEC away from its policy function to focus more on outreach and awareness to the public and private sector, data collection and management, and energy planning and resource assessment.

15. Public Utilities Corporation (PUC): Another key institution is the PUC, a government-owned corporate body responsible for providing Mahé and the other inner islands of Seychelles with electricity, water and sewerage service. Established under the PUC Act, PUC is a parastatal body currently under the aegis of the Ministry of National Development, and is the sole producer and distributor of public electricity. PUC is a public institution that delivers services for the government, but it does not set the policies required to carry out its functions, which are instead determined by the Ministry. PUC's assets are the general property of the state and its employees are public sector employees. The Electricity Division of the PUC is made up of two sections: the Generation Section and the Electricity Transmission & Distribution Section. The Generation Section is responsible for the production of electricity from the three generating stations it manages, comprised of diesel and HFO-based generators situated on the islands of Mahé and Praslin. The Electricity Transmission & Distribution Section is responsible for transmission and distribution of electricity on the principal inner islands, and includes an inspectorate service to ensure that high operations and equipment standards are maintained in all installations. In 2009, the Government of Seychelles signed a two-year contract for management of the PUC with the French company Suez Energy, designed to help the PUC improve its service and reduce production costs. This contract ended in July 2011, and PUC is once again under local management.

16. Seychelles Petroleum Company (SEYPEC): Another key institutional player is SEYPEC, a fully integrated parastatal oil company with activities in the upstream, downstream and shipping sectors. Among other activities, SEPEC manages procurement, supply, marketing and distribution of refined products (motor-gasoline, diesel, fuel oil, Jet A-1, Avgas, lubricants and liquid petroleum gas) for consumption in Seychelles, as well as marine bunkering, aviation refuelling, bulk storage, trans-shipment and transportation of petroleum products by the company's own fleet of five tankers. In terms of oversight, the Ministry of National Development (MND) has portfolio responsibility for the PUC, while the MENRT has responsibility for the SEC, as well as other energy-related responsibilities such as 1) pollution prevention, inspections and appraisal of ad-hoc environmental

impact assessment; and 2) providing recommendations to the Planning Authority on siting for infrastructure development.

17. Independent Energy Regulator: An independent regulator responsible for the energy sector does not yet exist in the Seychelles. Pursuant to the Energy Policy and the new Energy Act, the independent ER would be a regulatory body, with the following responsibilities:

Table 3: Responsibilities of Independent Energy Regulator

Thematic Areas	Primary Tasks
Policy	• Implement the policy of Government relating to applicable utility/electricity service;
Licensing	• Grant, vary and revoke licences in respect of a utility service
Tariffs	• Develop methodology for the calculations of electricity sales tariffs for full cost recovery. To be approved by Minister of Finance • Regulate tariffs and other charges levied by a licensee in accordance with any rules specified in the proposed Electricity Act;
Oversight / Mediation	• Mediate or arbitrate disputes between a consumer and a licensee, or between 2 or more licensees • Determine whether a licensee has an obligation to extend a utility/electricity service to consumers; • Establish an appropriate procedure for receiving and enquiring into complaints by consumers in relation to a utility service/electricity *[could be partly done by Fair Trading Commission Act, 2009]*; • Establish and implement adequate systems for monitoring the compliance by licensees with standards and applicable regulations, and make such information publicly available
Quality of Service	• Develop key performance indicators (KPI's)
Auto-Producer & IPP Access	• Memorandum on Auto-producer and IPP access and Installation Agreements • Solicited Auto-Producers & IPPs. Based on needs described in IRP plan. Open tender. • Unsolicited Auto-Producers & IPPs. If qualified Renewable: Feed in tariff when developed. All other: Right to export to PUC at avoided costs – based on negotiated contract. Contract approved by Regulator

18. National Climate Change Committee (NCCC): The NCCC was set up in August 1992 to provide overall coordination of national climate change activities. Members of the NCCC include representatives from most government departments, the private sector and non-governmental organizations.

19. The Climate and Environmental Services Division (CESD): The CESD, which is part of the MHAETE, was established in 2008 in response to an increase in extreme weather events that prompted government to strengthen its national meteorological services and establish a fully-fledged institution for disaster prevention and response. The CESD incorporates the National Meteorological Services (NMS), an Environment Engineering Section (EES) and a Programme Management Section (PMS) to enable focus on climate change issues.

Baseline information on Seychelles Energy Sector and the Electricity System

20. Seychelles depends on imported petroleum fuel to meet all of its energy needs. In 2009, its primary energy consumption was 158,629 TOE (tonne of oil equivalent), out of which 59,572 TOE was used for electricity generation. In addition, the country imports double this amount to supply marine bunkers and international aviation. Although Seychelles has undertaken oil exploration in its offshore waters, it has not found any commercially viable reserves of fossil fuels such as oil, natural gas, coal

etc. The country does not have any significant renewable energy (RE) production at this time, although potential exists for solar, biomass, wind and micro-hydropower. National energy demand is increasing every year, primarily due to population growth and increased economic activity. This growth in demand for imported fuels has resulted in a significant impact on government finances, and makes the country highly vulnerable to fuel price hikes. In 2008, when oil prices peaked at US$145 per barrel, Seychelles' annual cost for fuel import represented a substantial fraction of GDP.

Energy Demand

21. Total Final Consumption (TFC) of energy in Seychelles is expected to grow at an average rate of 4.1% per year through 2030 (UNDP Policy Report). Total Final Consumption of energy is divided into electricity consumption and fuels; electricity consumption includes own production and production by independent power producers. Electricity consumption has increased on average by 5.5% per year over the past decade, and is forecast to double between 2007 and 2030. The most important sector for energy demand is Land Transport, followed by Industrial (Seychelles has two processing factories and one canning factory for fisheries) and Residential (electricity is the main energy source and nearly all houses are connected to the grid, and LPG is widely used for cooking). Other important sectors include Air and Sea Transport (primarily fuel for inter-island travel and trade); Manufacturing and Construction (primarily electricity but also gas oil for plant operations and heat production); Commercial and Institutional (primarily electricity, although LPG is used for cooking in all hotels, guest houses and restaurants); and Fisheries (primarily fuel for this industry, which is the 2nd largest, after tourism, in the country).

Energy Supply

22. Seychelles Petroleum Company (SEPEC) is the sole importer and distributor of petroleum products in Seychelles (primarily imported from the Gulf Region). International marine and aviation bunker fuels accounted for 72% of total fuel imports. The main types of fuel imported were: Fuel Oil, Gas Oil, Gasoline, Aviation Fuel, Jet Kerosene, LPG and Kerosene.

Electricity System

23. Electricity consumption in Seychelles is primarily used in the following sectors: Commerce and Industry (42%), Domestic (33%), Government (13%) and export oriented activities (11%). PUC operates two power stations on Mahé and one on Praslin. The distribution systems on Mahé feed some of the other inner islands via submarine cable, and the system on Praslin also feeds the island of La Digue via submarine cable. The transmission and distribution grid has a total of 330 Km of high and medium voltage lines, and 1,500 Km of low voltage lines. Electricity is generated using internal combustion engines running on fuel and gas oil; the grid emissions factor is 0.688 tCO_2/MWh (see Annex 6, Section 2.3). In 2009, PUC used 51,028 TOE of Heavy Fuel Oil and 10,227 TOE of Light Fuel Oil, as well as 272 TOE of Lubricating Oil. In addition to the power capacity at the PUC power stations, there is some power production capacity in private ownership. On the inner islands, there is approximately 10-15 MW of total capacity. In addition, the supply of electricity on the outer islands is from small gas oil operating engines and is the responsibility of each island's owner. The Island Development Company (IDC) and private hotels are the main producers and consumers of electricity on these islands. PUC's installed capacity is 85.3 MW, of which 76.5 MW is on Mahé, and 12.9 MW is on Praslin (see Table 3 below). Data on the overall installed capacity on the other islands is not readily available.

Table 4: Electricity Production Capacity in Seychelles[1]

Power Station	*# of Units*	*Biggest Unit (MW)*	*Year(s) of Installation*	*Total Capacity (MW)**	*Max. Load (MW) – 2008***
Victoria A	*1*	*4*	*?*	*4.00*	*0*
Victoria B	*7*	*6.5*	*1971-1998*	*28.75*	*14.80*
Victoria C	*7*	*6.5*	*2000*	*43.75*	*33.80*
Mahe Total	*15*			*76.50*	*38.00*
Praslin	*9*	*3.0*	*1981-2003*	*12.78*	*6.10*
Total (excl. Victoria A)	*23*			*85.3*	

* Total capacity is all installed capacity, including almost 40-year old generator sets that can only be expected to be used as reserve capacity for few hours, or have not been in operation for several years.

** Max. load in both Praslin and Mahe in 2008 was about 50% of total installed capacity. However, due to security of supply reasons this figure might be misleading. Especially in Island systems, it is necessary to have substantial backup capacity (reserves) in order to avoid disruptions of the electricity supply. Thus, the Seychelles' 2nd National Communication on Climate Change reports total production capacity as approximately 60MW.

PUC Finances and Electricity Pricing

24. Prior to 2007, electricity prices had remained unchanged for 11 years in the Seychelles, supported by Government subsidies to PUC. Since 2007, prices of electricity in the country have increased dramatically, due to a rise in global oil prices and the need for the Government of Seychelles to reduce subsidies for electricity consumption. After earning a modest profit in 2004, the Electricity Division of the PUC operated at a loss in each year from 2005-2008, as electricity tariffs over the period were inadequate to cover expenses. As noted in the UNDP Energy Policy Report "The average electricity tariff level should have been somewhere in the range of 13% to 17% (say 15%) higher in 2008".

25. Looking forward, it seems clear that electricity tariffs will have to rise further in the short and medium term due to several factors. For one, current tariffs are only sufficient to cover the operating and maintenance costs for PUC, but not its capital costs. To date, PUC's total net assets (approximately SR 630 million, for both the water and electricity systems) have been totally funded by the Government (including SR 319 million in capital contributions and a Government loan of SCR 749 million that is interest-free and has no fixed repayment period). In addition, the value of PUC's net fixed assets declined in every year between 2004 and 2008, meaning that the total sum of plant retirements and depreciation expense exceeded capital investment. Taken together, this means that PUC has under-invested in its capital base during the past decade and those investments that were made came through government subsidies and were not reflected in electricity tariffs. Given the government's commitments under the IMF austerity package, including a commitment to address the poor financial positions of many parastatal organizations such as PUC so they do not continue to act as a drain on Government finances, it is inevitable that PUC will have to raise its own capital investment through borrowings and internally generated funds, and that tariff levels will need to be established that consider these factors. Finally, it is important to note that electricity delivery costs may vary widely in different locations in the country (due to cost factors such as transport of fuel, transmission, operations and maintenance, etc.), but the PUC only has cost data for the points of production.

[1] Significant additional electricity production capacity is coming online to the Seychelles electricity grid in 2011-2012. In early 2011, the United Arab Emirates (UAE) provided the Government of Seychelles two generators (which run using heavy fuel oil) of 8 MW capacity each; these generators were a gift with a combined value of 8.95 million Euros and became operational in July 2011. In addition, the UAE is also providing a gift to the Seychelles of a 6 MW wind farm, expected to be operational in 2012.

Renewable Energy Uses & Potential in Seychelles

26. To date, renewable energy has played a minor role in the Seychelles. The most widespread use is that of solar water heaters, which have been installed at a significant number of households in the past ten years. The use of wood resources for charcoal production, and for heating in the food drying process, is another example, although the vast majority of cooking is done with liquid petroleum gas. With regard to solar power, the few solar PV systems in operation in the Seychelles are mostly off-grid systems for remote communications and small installations on outlying islands without the presence of a public grid. The only active grid-connected PV in the entire country are three very small systems: a 1kWp PV system installed by the Public Utilities Corporation (PUC), commissioned to enable PUC to gather data on the potential for solar PV systems, and two systems at private residences (one of 10kWp and one of 0.6 kWp). The PUC system is rated 1.0 kWp and produces approximately 92 kWh of electricity per month.2 A few solar photovoltaic systems are in use at few private homes (less than ten) as well, although none of these systems are grid-connected. Looking forward, there is one significant alternative energy system under development, namely a wind farm with a capacity of 6 MW. This project, with funding from the Abu Dhabi Development Fund, will potentially be operational in the second half of 2012 (additional details in Section 1.4 below).

27. The potential for Solar PV systems in the Seychelles is strong. Pilot data from the PUC indicate that solar radiation values for Seychelles are good; average annual Full Load Hours (FLH) are estimated at 1,300 (3.56 per day). Average daily insolation recorded over three years on the main island of Mahe is 5762 Wh/m². However, the high mountains on Mahe create a microclimate with increased cloudiness and rainfall; locations farther from Mahe will have significantly higher insolation. Existing utility scale photovoltaic systems have efficiencies of approximately 13%. Given the insulation values on Mahe, this gives an average area of approximately 8,000 m² per MWp installed. From the pilot plant data available and after compensating for inverter to PV panel mismatch, the estimated electrical energy yield from a 250 kWp plant is 0.33 GWh per year on Mahe (see Annex 8 for further details).

28. In addition to solar power, Seychelles has some potential for other forms of renewable energy production. As noted above, a wind power project is currently in the planning stages, although data on the wind power potential is not yet available. A 2008 assessment estimated the total potential for hydropower at 1,800 kWp, distributed at 25 installations with sizes ranging from 30 kWp to almost 200 kWp (Inventaire des potentialités hydrauliques de l'île de MAHE; July 2008). Hydropower production would be seasonable (approximately 9 months/year). A 2009 analysis of the landfill in Mahe, which receives 30,000–35,000 tons of waste annually, estimated possible methane recovery could provide electrical production of approximately 294 kW (the energy content or calorific value of landfill gas is 350 to 600 Btu/ft3 or 3.6 to 6.2 kWh/m3. Assuming an average production of 200 m3/hour of landfill gas, the input power is 200 m3/hour x 4.9 kWh/m3 = 980 kW and the expected output power (electrical) is approximately only 0.30 x 980 kW = 294 kW, with 0.30 being the efficiency of the combustion engine).

29. In addition to interest on the part of government decision-makers, some individuals and private companies in the Seychelles are becoming increasingly interested in solar PV systems. The Island Development Corporation, which manages most of the 100+ outer islands in the Seychelles archipelago, is investigating opportunities for alternatives to oil-generated electricity, as are the

[2] In the log frame, the energy production assumptions for the new systems to be installed with support from the project are based on 650,000 kWh per year for 500kwp, based on FLH of 1,300. This is equivalent to 108.33 kWh per kWp per month, rather than the 92 kWh noted above. The PUC modules are quite old and the conversion efficiency of the system is much lower than was expected; hence the lower output.

management institutions for some of the islands (e.g. the Seychelles Islands Foundation). On the main islands (Mahé, Praslin and La Digue) where an electrical grid is in operation, PUC has encountered repeated difficulties in securing financing for new power generation and transmission facilities, and as a result not all demand for electricity in can be supplied from PUC. A number of hotels have had to establish their own power production facilities, particularly those with high energy demands (primarily for air conditioning, water heating, refrigeration/freezing, and desalination) and located in areas where the electrical transmission lines are operating near or at capacity. For example, the Banyan Tree Hotel, which has approximately 60 villas and consumes approximately 6 million kWh/year, produces approx. 40% of its needs using its own gas oil generators (three 1 MW units). The interest and experience of these private companies and other organizations represents an opportunity for partnerships in the demonstration of PV systems in the country.

Comparison of Solar PV with other RETs and with Current Energy Production in Seychelles

30. The use of renewable energy such as solar power has several distinct advantages as compared to fossil fuel usage for a small island country such as the Seychelles. As noted earlier, dependence on fossil fuel imports has a significant economic and budgetary cost to the country; and poses concerns for energy security (both in terms of access to supplies and price volatility). The cost of energy in SIDS is, on average, among the highest in the world, primarily as a result of the very high cost of transportation associated with the relatively small quantities of fuel delivered to the various countries. The UNDP Asia-Pacific Oil Price Vulnerability Index (OPVI), which was constructed to measure the vulnerability of countries to increasing oil prices, has shown that SIDS such as the Seychelles are extremely vulnerable to global energy prices. Out of 24 Asia-Pacific SIDS studied, the rising cost of fuel imports translates to between 12% to 30% of import costs and from 12-21% of total GDP. The Seychelles is a highly indebted country, and in 2008 and 2009 imports of fossil fuels accounted for 4.5% of the country's total imports. Furthermore, because the Seychelles is not classified as a Least Developing Country (LDC), it has limited access to concessionary international financing to help reduce its foreign debt burden or to alleviate the impact of fuel purchases on its economy. Alternatively, increased availability of foreign exchange from avoided fossil fuel imports would allow the government to reduce borrowing, thereby freeing up financial resources to support investments by the private sector. In addition, the volume of GDP and foreign exchange resources that the country currently spends to pay for energy imports could otherwise be directed to alleviating poverty, adapting to climate change and rise in sea level, and other interventions necessary for sustainable development.

31. Reducing its reliance on fossil fuels would have additional benefits for the Seychelles. Imported fossil fuels act as the country's single largest contributor of greenhouse gases (and therefore contribute to global climate change impacts, which present a significant threat to the country) and pose an on-going threat to its environmental and economic wellbeing (coastal and marine habitats critical to both tourism and fisheries). In addition, the burning of heavy fuel oil and diesel has negative effects on human health (through airborne contaminants as well as noise pollution, a source of on-going controversy at the PUC power plant on the island of Praslin). On the other hand, renewable energy sources such as solar energy provide a financial hedge against fuel price increases; will greatly reduce greenhouse gas emissions; and has more limited impacts on the environment or human health. In addition, technologies such as solar power provide energy to coincide with peak demand; are likely to create more jobs; and use a proven and easily replicable technology that can provide energy for both grid-connected and off-grid sites, an important consideration in a country of 115 islands. As the Seychelles National Energy Policy 2010 states: "The main challenge for the supply sector is to reduce the dependency of petroleum products, to maintain a high level of security of supply and to reduce environmental impacts including emissions of CO2… Increased energy efficiency and renewable energy seem to be the only viable ways to meet these challenges."

32. Of the various renewable energy technology (RET) options currently on the market, the Seychelles Energy Policy 2010 identified four RETs that may be appropriate in the country (solar PV; wind power; micro-hydro; and biomass / municipal solid waste). Solar photovoltaic energy systems have been identified by the Government of Seychelles as a high priority, and the best option for a GEF-funded project, for a number of reasons. On its own terms, solar PV is seen as desirable because: 1) it is a simple, proven technology that is easy to install and maintain, which is highly important in a small, remote island nation with limited technical expertise or access to replacement parts; 2) it can be developed as a distributed system of small-sized systems, which can spread benefits widely and has the potential for widespread replication; 3) it can improve grid stability because of a highly predictable supply and because a distributed system increases the flexibility of grid management; 4) there is significant private sector interest and potential in developing solar PV systems (government policy is that the renewable energy sector should be led by the private sector); and 5) it is economically competitive compared with other options and the government expects it to become more so in the near to mid-term. Apart from its own merits, solar PV is considered the best option for this project because of the potential state of development of other RETs in the country. Wind power is estimated to be the most expensive RET option for the country; in any case, the Government is moving ahead with a 6 MW wind power project with grant funding from the government of Abu Dhabi. Biomass / Municipal Solid Waste-to-energy projects also have attractive costing and might provide up to 6MW in production capacity; but again the Government is already moving ahead with a project at the main landfill. Micro-hydro is attractive on a cost basis, but its size potential is very limited (1-2 MW for the entire country). Table 4 below provides a summary of the strengths and weaknesses of the various RETs in comparison to one another, and to the existing fossil fuel based energy production system.

Table 5: Comparison of PV with other energy production options

Factors	Solar PV	Fossil Fuels	Wind	Micro-hydro	Municipal Solid Waste / Biomass
Stakeholder Interest (leadership and/or investment) – Government	High (MOF, PUC, SEC and DOE all support)	Not applicable	High (planned Masdar project)	Medium	High (tender process underway)
Stakeholder Interest Private Sector & General Public	High	Not applicable	Low	Low	High (5 companies, 3 foreign, 2 local, have participated in tender)
Cost Overall Cost per Unit of Electricity	Medium (but costs are steadily decreasing)	Medium (with risk of significant cost increases)	High	Low	Low
Cost Up-Front Capital Costs	High	Medium	High	High	High
Cost Availability of Financing	Low	Medium (Govt. subsidies to end)	High (UAE grant)	Low	High (financing in place)
Technical Feasibility Complexity of Technology	High (simple, proven technology)	High (already exists)	Medium (complex, new to country)	High	Low
Technical Feasibility Grid Compatibility	High (PUC has confirmed)	Very high (already exists)	Medium	???	???
Technical Feasibility Site Suitability	High (many sites can be used)	Very high (already exists)	Low (few sites possible)	Low (very few sites)	High (existing landfill)
Technical Feasibility Reliability of Supply	High	High (although risk exists of supply disruptions)	Low (winds are highly seasonal)	Low (rainfall is highly seasonal)	High
Social Benefits Job Creation	High (could employ many in installation	Medium (employs fair amount of persons)	Low	???	???

Factors	Solar PV	Fossil Fuels	Wind	Micro-hydro	Municipal Solid Waste / Biomass
	and maintenance)				
Social Benefits Human Health (air quality)	High	Low	High	High	Medium
Social Benefits National Energy Security	High (if there is widespread adoption)	Low (vulnerable to price fluctuations; supply disruptions)	High	Low (total potential is 1.8 MW)	Low (total energy potential is 6 MW)
GEF Criteria Replication Potential	High (potentially many public / private buildings)	Not applicable	Low (limited # of suitable sites)	Very low (limited # of sites)	Low (only 1 other, small landfill)
GEF Criteria Innovation	High (essentially no grid-connected PV in the country)	Low	Low (Masdar project already in planning)	High (none exists in country)	High (none exists in country)

33. With regard to the financial costs of Solar PV and other RETs as compared to the existing fossil fuel based energy production in the Seychelles, analyses were carried out during the PPG phase as regards the costs of all of these options. Based on the figures in Table 5 below (further details on these cost estimates are available in Annex 8), solar PV systems are currently a competitive option for energy production in the Seychelles. When compared to energy production from fossil fuels based on current (2011) prices and actual revenues from production (electricity sold), the cost of solar PV systems (SR3.42 per kWh) is actually less than current PUC costs on Mahe (SR4.25 per kWh) and Praslin (SR4.69 per kWh). Furthermore, PUC has reported that it expects that beginning in 2012 the Government of Seychelles will no longer subsidize its capital costs, and PUC will have to cover all capital costs from its own resources. As for other renewable energy technologies, while Hydropower and Biomass / Municipal Solid Waste show lower average LCOE production costs than Solar PV, the amount of energy that can be produced from either of these technologies is highly limited in the Seychelles. The last option, wind power, is significantly more expensive than solar (SR5.94 per kWh).

Table 6: Summary costs of production of electricity in the Seychelles (in U.S. Dollars)

					2009 Fuel Prices				2011 Fuel Prices			
	PV	**Wind**	**Hydro**	**Bio / MSW**	PUC Mahe (Elec. Prod.)	PUC Praslin (Elec. Prod.)	PUC Mahe (Elec. Sold)	PUC Praslin (Elec. Sold)	PUC Mahe (Elec. Prod.)	PUC Praslin (Elec. Prod.)	PUC Mahe (Elec. Sold)	PUC Praslin (Elec. Sold)
Fuel costs (USD/kWh)	0.00	0.00	0.00	0.00	0.14	0.15	0.16	0.18	0.28	0.30	0.32	0.35
CapEx cost USD/kWh	0.24	0.47	0.19	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OpEx USD/kWh	0.04	0.02	0.01	0.04	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.03
Total Cost USD/kWh	**0.28**	**0.49**	**0.20**	**0.25**	**0.16**	**0.18**	**0.19**	**0.21**	**0.30**	**0.33**	**0.35**	**0.38**

1.2 Threats posed by climate change

34. An archipelago of 115 islands, the Seychelles is characterized by widely spread islands of small size where the vast majority of human habitation and infrastructure is situated on low-lying coastal plains. As a result, the Seychelles is highly vulnerable to the adverse effects of climate change, including climate variability and severe weather events, and the expected negative impacts of climate change on the economy, environment, and wellbeing of the population of the Seychelles are projected to be significant. According to the Seychelles' 1st National Communication on Climate Change, the archipelago is expected to suffer from increased flooding and erosion from climate-change related sea level rise and increased intensity of tropical storms. Rising sea surface temperature and changes in ocean chemistry will negatively impact on the health of coral reef systems (which have already

undergone several coral bleaching episodes in the past 15 years), which serve as a natural protective barrier for the coastal plateau, as a major tourism attraction, and as essential habitat to support biodiversity and fisheries. Preliminary findings indicate that climate change will impact agricultural production by altering the availability of water and changing the risk of plant disease propagation. In addition, four global circulation models indicate that water shortages, which are already a significant problem on the main islands of the Seychelles, will grow more acute through the following mechanisms: i) decreases in rainfall during the dry southeast monsoon which will reduce stream flow, groundwater recharge and therefore water supply; ii) increases in surface-air temperatures which will increase rates of evapo-transpiration and consequently reduce stream flow, ground water recharge and further exacerbate the water supply problem; and iii) increases in rainfall intensity which will result in greater surface runoff and reduced water capture in existing storage facilities. These same models also project wetter northwest monsoons, which will elevate the risk of climate sensitive diseases such as Malaria, Chikungunya, Leptospirosis and Dengue. Detailed projections of the entire range of economic, social and environmental impacts from climate change in the Seychelles have yet to be carried out. However, the Intergovernmental Panel on Climate Change 4th Assessment Report (Working Group II) on small islands placed a 'very high confidence' level on the probability of negative impacts imposed by climate change and sea-level rise on water resources, vital infrastructure, settlements and facilities that support the livelihood of island communities; a 'high confidence' level on the negative impacts climate change on biodiversity, tourism, agriculture, coral reefs, fisheries and other marine-based resources; and a 'medium' confidence level on the negative impacts on human health.

1.3 Long-term solution and barriers to achieving the solution

35. The full potential of renewable energy to produce electricity has been only minimally exploited in the Seychelles. Previous efforts to promote and adopt renewable energy technologies in the country, including PV systems, wind, and biomass gasification projects, have largely failed. In some cases, the proposed technology was not technologically feasible in the context of a Small Island Developing State. More often, however, these efforts have failed because of legal, regulatory, and policy constraints that have subsidized fossil-fuel based energies at the expense of RETs and a lack of understanding and political will among policy makers on the need to change the country's energy production strategy. The political will now exists to support renewable energy, and to reduce the country's dependence on imported fossil fuels, due in part to the advances made in renewable energy technologies and price reductions in the past several years, and to no small degree to concerns about energy security and prices brought on by the 2008 spike in global oil prices and the current IMF-sponsored economic restructuring in the country. However, understanding and political support have yet to translate into concrete changes on the ground, and significant barriers remain to the widespread adoption of RETs, including solar power. These barriers can be broken down into three categories:

36. Financing and Market Barriers: Neither the Government of Seychelles, which is currently participating in an IMF-sponsored economic reform process, nor the Public Utilities Corporation, which can no longer rely on government subsidies for capital expenditures (as of 2012), is in a position to provide sufficient financial incentives to spur the widespread adoption of solar PV systems. At the same time, the private sector faces financial and market constraints to adopting PV technology due to the unwillingness of private lenders to provide financing for RETs and the lack of a functioning supply chain and technical support system that would ensure broad availability of PV systems, competitive prices through supply chain efficiencies, or adequate maintenance support for end-users. Although the Government has expressed its willingness to support financial mechanisms to spur investment in renewable energy, it has no experience with such mechanisms and little technical expertise in assessing RETs or selecting the most appropriate financial incentive platform. Thus in the baseline scenario, opportunities for potential PV adopters to secure financing and to find

reliable suppliers and servicers for PV systems will be severely limited. For this reason, the project is designed to establish a financing scheme for PV systems that combines the resources of the GEF, the Ministry of Finance, the European Investment Bank, and the International Finance Corporation, so that potential adopters of PV technology are motivated to make investments in PV systems. Furthermore, significant capacity building activities will be designed and carried out to spur the growth of PV market players in the country, including suppliers and service companies. Training will be provided to government and private financial institutions on assessing and making loans to various RET projects.

37. Institutional and Regulatory Barriers: Currently, there is no legal / regulatory framework or administrative mechanism in place that allows for independent power producers or auto-producers to access and feed power into the grid. Moreover, neither financial incentives nor a feed-in tariff system are in place to support independent power producers, and the current tax code and energy-related legislation do not provide authorization for such programs. On the institutional side, despite the recent creation of a Seychelles Energy Commission (SEC) institutional responsibilities for a well-function energy sector remain incomplete and unclear, most notably in the lack of regulatory and/or enforcement powers for the SEC and the absence of any independent regulator of the electricity sector in the country. Thus, in the baseline scenario, development of grid-connected PV systems will remain impossible under the law, and institutional support and guidance for renewable energy technologies will remain weak. For this reason, targeted activities will be carried out to revise the legal and policy frameworks to authorize grid-connected solar PV systems and to prioritize the development of RETs in the country, as well as establish an independent regulator.

38. Technical and Knowledge Barriers: Existing technical and institutional capacity and experience with PV systems in the Seychelles is extremely limited, and there are no technical standards or certification requirements for labor associated with renewable energy systems. The almost complete absence of operating solar PV systems in the country, the limited access to information on the opportunities and advantages of this technology, and the absence of technical information such as solar irradiation levels and grid compatibility requirements, constrains investment in solar PV systems. At the same time, the absence of any detailed assessments of national energy resources, including projected electricity demand and supply, have limited awareness among policy makers on the need to prioritize the development of renewable energy technologies. Thus, in the baseline scenario, the potential benefits of solar PV and other RETs will remain poorly understood in the Seychelles while technical capacity to install and operate PV systems, and to connect such systems to the electricity grid, will continue to be severely limited. For this reason, significant programs on technical training and certification processes for solar PV and other RETs; targeted studies of national energy resources and electricity grid requirements; and information sharing and awareness raising on the technical, financial and socio-economic aspects of renewable energy opportunities in the country, will be designed and conducted. A summary of the various barriers and the strategy for addressing them are presented below:

Summary of barriers and mitigation strategies

Barrier	Present Situation	Strategy for addressing barrier
Financial / Market	• Insufficient financial resources available to spur the widespread adoption of solar PV systems. • Unwillingness of private lenders to provide financing for RETs • Lack of a functioning supply chain and technical support systems that would	Component 1 • Selection and implementation of financial incentive scheme Component 2 • Training and technical support for private financial institutions on assessing RET

	ensure broad availability of PV systems, lower prices through supply chain efficiencies, or adequate service support for end-users • Lack of experience with financial mechanisms; little technical expertise in assessing RETs or selecting from among various financial incentive models	projects • Capacity building of private sector players to establish RET supply chain • Training of staff from government agencies, development banks, and private banks in assessing / developing financial incentives and RET projects
Institutional / Regulatory	• No legal / regulatory framework or administrative mechanism in place that allows for independent power producers to access and feed power into the grid • No financial incentives or feed-in tariff system in place to support independent power producers, and current tax code and energy-related legislation do not provide authorization for such programs • Institutional responsibilities remain incomplete and unclear for RE sector	Component 1 • Detailed regulations and secondary legislation in support of a new Energy Act • Revised PUC Act • Selection and implementation of financial incentive scheme • Established and Operational Independent Electricity Regulator (IER)
Technical / Knowledge	• Existing technical and institutional capacity and experience with PV systems in the Seychelles is extremely limited • No technical standards or certification requirements for labor associated with renewable energy systems. • Almost complete absence of operating solar PV systems in the country, very limited access to information on the opportunities and advantages of this technology • Absence of any detailed assessments of national energy resources, including projected electricity demand and supply	Component 1 • Completed National Energy Master Plan and Energy Resource Assessment Component 2 • Training on policy and economic issues related to RETs • Training on installation, operation and maintenance of PV systems • Certification program for private businesses / individuals as PV technicians Component 3 • Technical Report on Grid Capacity and Requirements • Test Demonstration PV System with PUC • Installed Demonstration PV systems

1.4 Stakeholder Analysis

Stakeholder Information

39. In general, public awareness about renewable energy technologies and solar photovoltaic systems in particular, is low in the Seychelles. A survey on renewable energy conducted with 50 randomly selected persons in the Seychelles in late 2010 found that the typical Seychellois has very limited knowledge about renewable energy and little understanding that RETs can produce positive economic gains or independent power producers might have the possibility of selling energy back to the national electrical grid. Although a majority of respondents viewed the adoption of solar water heaters at the household level as a positive development, few were aware that Solar PV systems can also be installed at the household level. This limited understanding of renewable energy options is likely explained in part by the lack of developers, suppliers, financiers or owners of renewable technologies in the country, as well as the lack of professionals involved in the design, engineering, manufacturing, or installation of equipment related to RETs.

40. Key institutional stakeholders are described in Section 1.1. In addition to these government institutions the most important stakeholders for developing a solar PV industry in the Seychelles are

potential end-users, primarily private sector businesses. At present, a variety of private businesses have expressed interest in installing and managing solar PV systems. One such group are hotels, many of which are located in remote areas on the main islands and have several reasons for installing solar PV systems, including: the need for back-up electricity generation capacity (most hotels currently have fuel oil or diesel powered backup generators, which are much more costly than grid-supplied electricity); the desire to reduce overall usage of grid-supplied electricity (in particular to avoid "demand charge" rates for high monthly levels of use); and the desire to "green" operations as part of sustainability initiatives and marketing to clientele. Another group of potential end-users are small island managers (including the Island Development Corporation, which manages a large number of small islands), who are interested in reducing their dependence on very expensive fuel oil or diesel generators. Additionally, several retail operations (grocery stores, car dealerships), office complexes, and manufacturing facilities have expressed interest in installing solar PV systems. Apart from end users, another important group of stakeholders are local environmental NGOs. Several NGOs, including Sustainability for Seychelles and the Sea Level Rise Foundation, have undertaken numerous public education and awareness campaigns on climate change issues and could play a vital role in raising awareness about renewable energy technology options in the Seychelles. Additional details on key governmental, non-governmental and private stakeholders in the energy sector in the Seychelles, in particular those with interest and/or expertise in renewable energy technologies and their expected participation in the project are provided in Section 5.3.

2. STRATEGY

2.1 Project rationale and policy conformity

Project Rationale

41. The project proposed will support the adoption of solar PV systems in the Seychelles by implementing demonstration projects for grid-connected systems on commercial buildings on the main islands of the Seychelles, as well as one stand-alone PV system on one of the country's 100+ smaller outer islands. The potential for PV systems in the Seychelles is excellent given the high levels of solar radiation at its location 4 degrees south of the Equator, as well as the high cost of generating electricity due to the archipelago's isolated location and its reliance on imported fossil fuels. Solar PV presents an excellent opportunity given that other renewable energy technologies are either already under development (e.g. wind power) or have fairly limited potential and applicability according to previous studies in the country (e.g. micro-hydro, biogas, and wave power). On the main islands, where the Public Utilities Corporation (PUC) is the supplier of almost all electricity, there is a well-established grid system that can support the feeding of PV generated electricity into the grid. **Most importantly, the PUC is willing, for the first time, to support the sale of power back to the grid (due to new national policies that prioritize renewable energy, and to the country's desire for WTO accession, which requires it to "open up" its energy market).** Moreover while there are only a handful of PV systems currently installed in the country, rising fuel costs have sparked interest among energy users, particularly those managing small or outer islands.

Consistency of the Project with GEF Strategies and Strategic Programs

42. In accordance with the "Focal Area Strategies and Strategic Programming for GEF-4", dated July 25, 2007, the project is in compliance with the GEF's Strategic Programme #3 "Promoting Market Approaches for Renewable Energy". The project will contribute to the stated Expected Outcome of Strategic Program #3, namely "Growth in markets for renewable power in participating program countries" and to each of the three program indicators, namely: 1) tons CO2eq avoided; 2) adoption

of policy frameworks, allowing renewable generators equitable access to the grid; and 3) kWh generated from renewable sources. Furthermore, the project emphasis on revised legal, regulatory and policy frameworks to support RETs supports the emphasis of Strategic Program #3 on "developing policies and regulatory frameworks that provide limited incremental support to strategically important investments… and ensuring that all countries have adopted regulations leveling the playing field for on-grid renewable energy", while the financial mechanisms and demonstration activities under the project support the emphasis on "initial investments to jump-start the market for a specific renewable technology".

43. The proposed project also supports Seychelles efforts to achieve its Millennium Development Goals. One of the "Set Goals" listed in the Seychelles Millennium Development Goals (MD Goal + 7: Improve the quality of life factors for comprehensive environmental health of the population and to reduce national environmental impacts of socioeconomic activities) is "to increase proportion of primary commercial renewable energy". More generally, energy is central to sustainable development and poverty reduction efforts, as it affects all aspects of development – social, economic, and environmental – including livelihoods, access to water, agricultural productivity, health and hygiene, population levels, and education. In this sense, achievement of any of the Millennium Development Goals in the Seychelles is dependent on significant improvements in the quality, quantity and sustainability of its energy services.

2.2 Country ownership: country eligibility and country drivenness

Country Eligibility

44. According to the Instrument for the Establishment of the Restructured Global Environment Facility, Seychelles qualifies for GEF financing on the following grounds:

- It has ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 22 September 1992 and signed the Kyoto Protocol on the 20 March 1998; and
- It receives development assistance from UNDP's core resources.

Fit with National Priorities & Programs

45. Adoption of renewable energy technologies is a clear priority for the Government of Seychelles, as expressed in various policy documents and on-going and planned projects. In his State of the Nation address in February 2008, President James Michel stated: "The issue of energy is one that is critical for us, and for our future. The amount of petroleum products our country is consuming now is not sustainable in the long term. Government is presently drafting an energy policy that will look at radical solutions that we will have to adopt. Government will remove all taxes, including GST [Goods and Services Tax], on certain solar energy products such as solar panels." Also in 2008, the Government established an Energy Security Steering Committee to study options for moving the country away from its dependence on imported oil. A report from this committee, with a list of policy recommendations ranging from short- to long-term, identified the need to promote other viable technologies, including grid-connected PV, as part of the national energy mix. Recommendations for the medium-term measures were aimed at changing the energy mix to make it more sustainable and reduce the country's vulnerability.

46. The 2010 Seychelles Energy Policy calls for the establishment of an independent Energy Regulator, for clearly defined IPP regulations in order to facilitate the creation of IPPs using renewable energy, and it sets a national target of 15% of energy demand met by renewable energy by 2030. The National Climate Change Strategy (SNCCS), formulated in 2009, includes among its priority

objectives "to achieve sustainable energy security and reduce greenhouse gas emissions" and "to mainstream climate change considerations into national policies, strategies and plans". One of the "Set Goals" in the Seychelles Millennium Development Goals (MD Goal + 7: Improve the quality of life factors for comprehensive environmental health of the population and to reduce national environmental impacts of socioeconomic activities) is "to increase proportion of primary commercial renewable energy". Another indicator of the country's interest in renewable energy is its decision in 2011 to join SIDS-Dock (see Pg. 9) and the International Renewable Energy Agency. Beyond the policy realm, the GOS is also devoting significant resources to the development of various RETs, including a 6 MW wind power installation (expected to be operational in late 2011) and a proposed municipal solid waste / biomass energy production installation (construction bids are currently being reviewed).

47. In addition to support for RETs in general, the Government of Seychelles also has a specific interest in the adoption of Solar PV energy production. The National Greenhouse Gas Mitigation Options report, produced for the Second National Communication to the United Nations Framework Convention on Climate Change, recommends increased efforts to promote RET to reduce CO2 emissions, and specifically recommends that the government "encourage wide use of Photovoltaic cells, through demonstration projects such as the installation of PV panels on rooftops of public buildings to generate electricity". A 2008 report by the Public Utilities Corporation specifically "recommends installation of one medium size PV plant on the island of Mahe and another plant on the island of Praslin… This will help Seychelles gain valuable operations and maintenance experiences with high penetration grid connected PV installations. But more importantly, the PV plants will act as fuel savers for the country."

Fit with Regional Priorities & Programs

48. To date, regional approaches to renewable energy in the Indian Ocean have been limited. However, the Seychelles has been a participant in the development (on-going) of the joint European Union – Indian Ocean Commission "Regional Program on Renewable Energy and Energy Efficiency", which is intended to support renewable energy development and energy efficiency improvements in IOC member countries, including detailed energy resource analyses. With a planned overall (regional) budget of 10 million euros, this program will work to remove barriers to the development of renewable energy and energy efficiency technologies, focusing on interventions that will benefit most from a regional approach. Among these interventions are: 1) sharing of experience in policy development and in energy sector restructuring, including integration of renewable energy in electric power systems; 2) exchange of experience regarding the development of decentralized electricity systems (based on hydro, solar, wind or biomass) and their consistency with grid extension in the medium and long term; 3) enhancing the role of private enterprises and the emergence of regional markets; 4) shared regional-level research and development costs, such as assessments of the resource potential for wind or geothermal energy; and 5) coordinated approaches to international finance institutions and donor organizations. The program will not provide funds to meet equipment and infrastructure requirements.

2.3 Design principles and strategic considerations (1/2 page)

Value-Added of GEF Involvement in the Project Demonstrated through Incremental Reasoning (What would happen if the GEF did not support the project)

49. The full potential of renewable energy to produce electricity has been only minimally exploited in the Seychelles, primarily because of legal, regulatory, and policy constraints that have promoted fossil-fuel based energies and restrained the adoption of RETs; a lack of understanding and political will

among policy makers of the need to change the country's energy production strategy; and the resulting unwillingness among government agencies, the private sector, and other sectors of the society to investigate and pilot alternative energy production systems. Political will now exists to support renewable energy, and to reduce the country's dependence on imported fossil fuels. However, understanding and political support have yet to translate into concrete changes on the ground, and significant barriers remain to the widespread adoption of RETs, including solar power (additional details on barriers are provided in Section 1.3). In the absence of the proposed project, it is highly probable that these barriers would prevent or delay by years the introduction and spread of solar photovoltaic systems (as well as other renewable energy technologies) in the Seychelles. In this business as usual scenario, the Seychelles would continue to rely almost exclusively on imported fossil fuel for electricity production, resulting in continued greenhouse gas emissions, risks to the environment, and lack of energy security for the country. For this reason, GEF funds will be used to specifically remove these barriers by supporting incremental activities necessary to facilitate the deployment, diffusion and transfer of solar PV power generation systems in Seychelles. These barrier removal activities will contribute to the realization of global environmental benefits by facilitating the reduction of GHG emissions from the country's electricity generation sector, and by spurring the development of other available RE resources of the country, based on the lessons learned and experienced gained from this project.

2.4 Project objective, Components and outputs/activities

Objective, Components and Outputs

The objective of the project is to increase the use of grid-connected photovoltaic (PV) systems as a sustainable means of generating electricity in selected main islands and smaller islands of the Seychelles, with a focus on small-scale producers who are already connected to the national electricity grid. The project will pursue this objective by, *inter alia*: revising the legal, regulatory and policy framework to better support the adoption of renewable energy technologies, and grid-connected PV systems in particular; designing and implementing financial mechanisms that will make the purchase and installation of solar PV systems more attractive to Independent Power Producers; establishing the first market supply chain for solar PV systems in the country; providing training to establish the first technicians to support the installation and maintenance of PV systems; and demonstrating for the first time in the Seychelles the viability and practicality of grid-connected PV systems through pilot systems installed with various partners.

Component 1 of the project, which addresses policy, institutional, legal/regulatory and financial frameworks, will cover Renewable Energy Technologies (RETs) in general; Component 2, which addresses technology support and delivery systems, will address RETs but emphasize Solar PV systems; and Component 3, which addresses demonstration systems for energy production, will be focused specifically on Solar PV systems. Activities under Components 1 and 2 will be concentrated in the initial stages of the project, as they will set the stage for the establishment of PV demonstration systems under Component 3 during the latter stages of the project (details on the proposed timing of the project outputs listed below are provided in Annex 5). Together, these actions are designed to play a critical role in "jump-starting" the adoption of solar PV technology in the Seychelles, and in setting the stage for broad-scale replication by reducing the costs of PV technology through a market-based approach that will establish financial incentive mechanisms for PV systems and reduce transaction costs (by creating a reliable supply chain and establishing local capacity for installation and maintenance). In this way the project is designed to transform an energy sector that today is almost 100% dependent on imported fossil fuels into one where solar PV and other RETs provide a significant percentage of national energy production.

Component 1: Improved policy, institutional, legal/regulatory and financial framework for Renewable Energy Technologies

In the current baseline situation, there is no legal / regulatory framework or administrative mechanism in place that allows for independent power producers to access and feed power into the grid. Moreover, neither financial incentives nor a feed-in tariff system are in place to support independent power producers, and the current tax code and energy-related legislation do not provide authorization for such programs. On the institutional side, despite the recent creation of a Seychelles Energy Commission (SEC), institutional responsibilities remain incomplete and unclear, most notably in the lack of regulatory and/or enforcement powers for the SEC and the absence of any independent regulator of the electricity sector in the country. Thus, in the baseline scenario, development of grid-connected PV systems will remain impossible under the law, and institutional support and guidance for renewable energy technologies will remain weak.

For this reason, the project will undertake targeted activities to revise the legal and policy frameworks to authorize grid-connected solar PV systems and to prioritize the development of RETs in the country; and to establish an independent regulator and clarify other institutional responsibilities for oversight and technical support of RETs. In order to establish and sustain a thriving market for grid-connected solar PV systems in the Seychelles, fundamental changes must be made to existing energy production policies and legislation, including creating the first detailed assessments of existing and potential energy production and use (including renewable energy), and incorporating that information into policy; establishing the authority for third party generation of energy and for sale of such energy to the electricity grid; and consolidating institutional authorities for the energy sector, including establishment of an independent regulator for the electricity sector. Of equal importance, financial mechanisms and incentives must be developed and implemented that will allow for the adoption and widespread replication of installed PV systems by various parties, including private sector companies and eventually households. To generate understanding of and support for these policy, legal, institutional and financial changes, information and raising awareness on the potential and advantages of solar PV systems will be carried out targeting government decision-makers, investors, local businesses, island managers, NGOs and community organizations. The project proponent, the Seychelles Energy Commission, will take a lead role in all of these activities, and in so doing strengthen its technical capacity and its ability to function as the key agency for energy policy and planning in the country.

Output 1.1 – Completed National Energy Master Plan and Energy Resource Assessment: To deliver this output, a National Energy Database will be created, and training on methods and techniques for collecting energy data, and on maintaining and updating the database will be carried out. A detailed assessment of national energy resources will be carried out, including projected electricity demand and supply for each of the main islands and at the sectoral level, using Energy Demand Modelling and Forecasting techniques such as Long-range Energy Alternatives Planning (LEAP) software. In addition, training will be conducted for the Seychelles Energy Commission (SEC) and other staff on techniques for technical and economic evaluation of electricity generation technologies, including comparison of unit costs, technical advantages and disadvantages, and system optimization decisions for combined electricity generation technologies (e.g. diesel generator, wind turbine, PV, cogeneration, combined cycles, etc.). A national Energy Resource Assessment, which will include analysis of the potential total installed capacity for various RETs, and the possible timing of significant new RET installations, will be conducted. Moreover, capacity building on Energy Planning for the SEC and PUC and the preparation of an Energy Master Plan for Seychelles for the period 2014-2030 will also be done, with co-financing support from the International Atomic Energy Agency (IAEA). Building on previous analyses of RETs in the country, such as those in the 2010 UNDP-sponsored Seychelles Energy Policy study, and 2009-2010 studies on potential of wind power (carried out by Masdar) and waste-to-energy (managed by DOE), this assessment will allow the Government of Seychelles for the first time to develop a long-term strategy for energy

resource production and conservation that incorporates RETs and is based on expected supply and market conditions, and will allow both the PUC and auto-producers to better gauge the opportunities for new RET investments.

Output 1.2 - National Solar Irradiation Map: At present, there is very limited data in the Seychelles on solar irradiation, and there are no operating solar radiation metering stations in the country. This lack of data on solar irradiation levels in different areas of the country creates additional risk and uncertainty for potential solar PV investors, particularly given the high level of variation in solar radiation between islands and in different locales on the same island due to topography and variable cloud cover. In order to create a comprehensive and accurate solar map of the Seychelles to clearly define these variations and improve site selection methodology, complete radiation data will need to be collected at various sites on various islands. For this reason, pyranometers will be purchased and installed / monitored by the SEC in collaboration with the Meteorological Service of the Ministry of Home Affairs, Environment, Transport and Energy (MHAETE). These devices will provide accurate, site-specific data that will form the basis of the national solar irradiation map. This work will be co-financed by the Seychelles Energy Commission.

Output 1.3 – Approved National Energy Policy: The existing 2010 National Energy Policy will be updated to take advantage of new information resources and a new legal and regulatory framework. The updated policy will use the results of the National Energy Planning and Resource Assessment (see Output 1.1), as well as the targets established in the new Energy Act (see Output 1.4), to identify and prioritize specific national priorities and targets for energy resource management. The new policy will include targets for energy efficiency strategies and renewable energy technologies; the promotion of market-oriented energy production, including clear targets for renewable energy generation as a percentage of overall electricity generated in the Seychelles at various dates in the near, mid and long term future; and formal recognition of a range of renewable energy technologies (solar, wind, biomass, waste-to-energy) as priorities for future energy development in the country. The formulation and drafting of the new energy policy will be carried out by the MHAETE under the guidance of the Principal Secretary (PS) for Energy, and in consultation with key stakeholders from government, the private sector and civil society. The PS for Energy and the Minister of MHAETE will be responsible for ensuring that the policy is presented to and approved by Cabinet.

Output 1.4 – Approved and enforced detailed regulations and secondary legislation in support of a new Energy Act: The Government of Seychelles, with support from the EU - Seychelles Climate Change Support Programme (SCCSP), is in the process of approving a new Energy Act, whose scope will include provisions for the entire energy sector, identifying principles for the formulation of policies and institutional authority, as well as rules on energy efficiency and renewable energies. Overall, the Energy Act will reflect a revised institutional framework suitable for the implementation of energy policy goals, where institutions, including authorities and market operators, are clearly identified, along with their roles, powers and functions. The Energy Act also will extend the powers of the SEC, will modify some rules related to its governance, and will set the necessary provisions to permit the SEC to become the authority responsible for energy efficiency, renewable energy and electricity regulation (see Output 1.6). The proposed GEF project, with additional co-financing from the SCCSP, will ensure the effective implementation of the Energy Act by hiring local and international legal consultants to jointly develop detailed regulations and subsidiary legislation to the Act. The legal consultants will work directly with the PS of Energy and the SEC, and in consultation with other stakeholders such as the PUC and independent power producers and/or end-users, in drafting the provisions, and the PS of Energy will be responsible for getting their approval at the Ministerial level (regulations and subsidiary legislation do not require approval by the National Assembly). Key elements of the new regulations and subsidiary legislation will include: 1) definition and legal recognition of Independent Power Producers and of third-party energy generation, and of entry and sale of this energy to the grid; 2) a national grid code, grid connection authorization for auto-producers and IPPs, and identification of the institutional authority for

grid access and use; 3) legal authorization of a new independent electricity regulator (the SEC); 4) detailed regulations and guidelines for all issues pertaining to electricity production (by both the PUC and auto-producers and IPPs), as well as issues pertaining to electricity transmission and distribution (by PUC); 5) rules on electricity market entry and conditions, obligations, rights, roles and powers of authorities/consumers/ market players; and 6) regulations for Installation Agreements between auto-producers and/or IPPs and the PUC, including authority to approve PPAs (likely to rest with the SEC); conditions for grid connections; details on the price to be paid to auto-producers and IPPs for electricity produced (to be set by the independent regulator); and limits (if any) on the size of individual auto-producers and IPPs and/or on the overall size of all auto-producers and IPPs).

Output 1.5 – Approved and enforced revised PUC Act: The existing PUC Act (1985) identifies the PUC as the sole provider of electricity in the Seychelles. This Act will be amended to authorize third party energy generation by auto-producers and IPPs, and the entry and sale of the energy produced to the national electricity grid. The Act also will be streamlined so that many of the detailed provisions (many of which are out-dated) are eliminated and/or contained in subsidiary regulations. Many of the necessary changes to the PUC Act have been outlined in the draft Energy Act, including proposals for the repeal of specific regulations and proposals for new and revised Regulations, Codes and other secondary legislation. The work to revise the PUC Act will be carried out by the same team of legal consultants identified under Output 1.4, and with the same approach to consultation and collaboration, all of which will be funded jointly with GEF funds and co-financing from the SCCSP.

Output 1.6 – Established and Operational Independent Electricity Regulator (IER): The draft Energy Act proposes that the Seychelles Energy Commission will be the new Independent Regulator for the electricity sector, which will be politically independent and financially self-sufficient (through fees on the electricity sector). Under the Energy Act, the SEC shall be granted powers to define: 1) tariffs for electricity supplied to be paid by consumers to PUC; 2) tariffs of electricity produced to be paid by PUC to IPPs and auto-generators (from renewable energy sources); and 3) tariffs to be paid for the use of the network by third parties buying and selling electricity independently. To help enable the SEC to take on its new role as Independent Regulator, a variety of training programs for SEC staff will be designed and implemented. The legal consultants drafting new regulations and subsidiary legislation under Output 1.4 will provide training on the monitoring of new regulations and guidelines, on development and oversight of Installation Agreements and potential future Power Purchase Agreements, on development of future regulations and secondary legislation, and on the establishment of decision-making & transparency conditions for the SEC as an independent regulator, including requirements for the publication of decisions, reporting and information sharing (including a web site), and public hearings and consultation documents. In addition, the SEC will develop guidelines and protocols for its role as an IER. Finally, a joint training strategy on technical issues with the project "Removal of Barriers to Solar PV Power Generation in Mauritius, Rodrigues and the Outer Islands", which is also working to help establish an IER, will be developed. Together, the two projects will seek training from established IERs in other countries of the Indian Ocean sub-region (as well as technical experts) in areas such as: setting electricity prices / tariffs; monitoring energy supply (meters) and other functions; providing oversight of PUC and auto-producers and IPPs; ensuring health and safety regulations; managing dispute settlement; monitoring quality of service, technical standards, and compliance; promoting energy efficiency and renewable energy, will be designed and implemented.

Output 1.7 – Developed, Approved and Implemented Financial Mechanisms to support Purchase/Operation of Solar PV Systems: Working with a variety of partners, including the Ministry of Finance, the Development Bank of Seychelles, the European Investment Bank, and the International Finance Corporation, the different options for providing financial incentives to support the purchase and operation of solar PV systems (as well as other renewable energy technologies) by independent power producers will be explored. Among the possible financial mechanisms, of which more than one may be

implemented, are: a purchase rebate scheme for solar PV equipment; a Feed-In Tariff system; various tax and tariff measures; concessionary loan programs; etc.

During year one of the project, an international consultant (economist) will be hired to work together with the economist on the SEC staff to assess the various mechanisms and provide recommendations on which mechanisms should be employed, including details on capitalization levels, eligibility, and other conditions (additional details on the process for selecting financial mechanisms are provided in Annex 9). In addition, this team will investigate the desirability of implementing various risk management mechanisms, such as PV electricity production guarantees (in case power production targets are not met by developers) and insurance programs to safeguard auto-producers in case of non-payment for electricity already supplied to the grid, based on an analysis of potential risks, discussions among relevant institutions, and identification of suitable co-financing sources for such programs. Later in the project, other options will also be studied for potential implementation over the long-term, including: 1) financing schemes for replication of solar PV systems post-project, based on careful analysis of factors such as the economic capacity of consumers to afford more expensive electricity and the likely availability of public funds and/or other financing sources to reduce or eliminate the need for increased tariffs; and 2) the desirability of authorizing solar PV developers in the Seychelles who can provide up-front financing for commercial and residential customers who wish to install PV systems (one of the main hurdles to expanding PV systems more widely) in exchange for the revenue streams generated by those systems.

Output 1.8 – Completed education and awareness campaigns promoting the benefits of RETs: Education and awareness campaigns targeting three groups -- key decision-makers, potential adopters of PV technology, and the general public will be developed and implemented. Increasing the awareness of decision-makers on the economic, social and environmental benefits of RETs will be an important step in securing the support necessary to strengthen legislative, policy and financial frameworks to support the adoption of such technologies. Providing information and raising awareness about PV systems among investors, local businesses and developers will encourage support from the private sector and help to generate suitable partnerships for PV projects. Increasing awareness among the general public, NGOs and community organizations about RETs, and the PV pilot projects in particular, will generate interest in replication the use of PV and other RETs throughout the country. To address these needs, the SEC will organize a series of workshops for decision-makers and electricity sector participants on the benefits of RETs and on the details and implications of the new Energy Act and associated regulations, including the functions of the new Independent Electricity Regulator. Local civil society groups, including several environmental NGOs with extensive experience in public awareness raising on climate change, renewable energy and energy conservation issues, are likely to be contracted to implement outreach and education to both private sector players and the general public on the potential benefits, mechanisms and opportunities of RETs in the country. Finally, evaluations will be carried out to measure knowledge of and support for RETs at the onset of the project and again at project end.

Component 2: Strengthening of the technology support and delivery system for Renewable Energy Technologies

In the current baseline situation, technical and institutional capacity and experience with PV systems in the Seychelles is extremely limited, and there are no technical standards or certification requirements for labor associated with renewable energy systems. Knowledge of renewable energy technologies (RETs), including Solar PV systems, is very limited in the Seychelles, and direct experience with any RETs is limited to a handful of private individuals who have installed (non-grid-connected) Solar PV systems at their households and a single PV test system at the PUC plant on Mahe. The almost complete absence of operating solar PV systems in the country, the very limited access to information on the opportunities and advantages of this technology, and the absence of technical information, such as solar irradiation levels and grid compatibility requirements, continue to constrain investment in solar PV systems. At the same

time, the absence of any detailed assessments of national energy resources, including projected electricity demand and supply, have limited awareness and therefore support among policy makers on the need to prioritize the development of renewable energy technologies. Thus, in the baseline scenario, the potential benefits of, and opportunities for, adoption of solar PV and other RETs will remain poorly understood in the Seychelles. In addition, technical capacity to install and operate PV systems, and to connect such systems to the electricity grid, will continue to be severely limited.

For this reason, significant capacity building to enable the first demonstrations of grid-connected PV systems, as well as their adoption on a wider scale, and the development of a viable private sector market in Solar PV (and other RETs) in the country will be performed. Capacity building will by necessity be wide-ranging in its scope, ranging from technical issues related to the electricity grid and RETs, to enabling key players to understand the economic rationale for renewable energy, to developing and implementing financial mechanisms and market structures, to training government and private financial institutions on assessing and making loans to various RET projects. In addition, platforms for information sharing will be required to ensure the spread of best practices and to reduce transaction costs and eliminate critical gaps in market information. Capacity building and training programs will be carried out (as far as possible) through partners such as the Seychelles Institute of Technology (SIT) and the University of Seychelles (UniSey), who themselves will receive capacity building support to strengthen their expertise on renewable energy technologies.

Output 2.1 – Completed Capacity Needs Assessment and Developed Capacity Building Strategy: Comprehensive capacity needs assessment on the key capacity issues relevant to establishing a viable Solar PV technology market in the Seychelles will be carried out. The assessment will determine the required technical and financing/market capacities and resources for the installation and operation of grid-connected PV systems, and assess to what degree those capacities and resources exist in the Seychelles, including among the key project partner institutions and private sector partners who will install PV systems (at present, there is extremely limited technical capacity and experience with Solar PV and other RETs in the country, particularly in the private sector). The results of the Capacity Needs Assessment will be used to refine the proposed capacity building and information sharing activities described in Outputs 2.2 – 2.6.

Output 2.2 – Completed Outreach on Policy/Economic Issues: Training will be provided to the staff of the Seychelles Energy Commission and the Public Utilities Corporation on the policy and economic issues surrounding RETs; on how to carry out economic analyses and comparison of different RETs; and on strategies and mechanisms for the implementation, monitoring and evaluation of RET projects. This training will be provided either directly by staff of the IAEA, or by experts contracted by IAEA, using co-financing funds from the SEC and IAEA. It is expected that initial training will take place at the onset of the project, and that follow-up assessment and additional training will be provided in year 3 of the project. In turn, SEC and PUC staff will provide guidance on how to measure the benefits and costs of RETs to national policymakers and potential regional / international partners, so as to establish increased understanding and hopefully support for RETs from these parties.

Output 2.3 – Completed Training Program on Technical Issues: Training will be provided on a variety of technical issues related to Renewable Energy Technologies to a variety of different stakeholders. A small PV system, as well as safety equipment, will be purchased for use in training of PUC staff and various private sector players (e.g. electricians, technology sales companies, and end-users such as hotels and managers of outer island infrastructure) on the installation, operation, maintenance and repair of PV systems and their connection to the electricity grid. Additional training will be designed and conducted for SEC and/or PUC staff to enhance their capacity to collect and assess solar radiation data, to establish technical guidelines and standards for grid-appropriate PV systems, and for the oversight and monitoring of PV systems and of grid absorption capacity (PUC currently only has a few staff with any experience

with RETs). It is expected that this training will be provided by staff from the Seychelles Institute of Technology, two of whom will be sent by the project to Mauritius for a 4-6 week training course prior to providing initial training and follow-up courses. The SEC will be responsible for monitoring and assessing the effectiveness and uptake of this training over the course of the project. In addition, two staff from PUC will be sent by the project to Mauritius for training on the certification of solar PV system technicians, so that the PUC can establish and operate a certification program in the Seychelles for private businesses / individuals as PV technicians. The project also will support PUC in taking the steps necessary to get international accreditation for the certification program.

Output 2.4 – Completed Training Program on Financial Issues: Capacity building will be carried out to enable the SEC to evaluate the financial viability of grid-connected PV systems and to formulate incentives and find financing partners over the long-term to attract private sector investors to PV and other RETs. The SEC staff economist will participate in a short-term overseas course in RE financing, which will allow the SEC to better understand how and to what degree the country should integrate RETs into its energy production portfolio, and will be an important tool for the Government to determine the economic and financial viability of individual projects that it will be called upon to approve, especially as project developers will surely solicit the Government for various forms of financial incentives. If the Government opts to establish a feed-in tariff system, the SEC will be responsible for developing a standard financial evaluation methodology for calculating feed-in tariffs. In addition, the European Investment Bank has indicated its intention to provide training and tools on RE financing for various government (MoF, DBS) and private sector finance experts, for example to local banks and/or other financial institutions so that they can appraise PV projects for potential loans or lines of credit. The SEC will work with the DBS and MoF to ensure the effectiveness and uptake of these training efforts, for example by evaluating the number of persons working on financing and incentive schemes for PV systems and the number of banks / financial institutions that are providing financial assistance to grid-connected PV system projects, and adapting the training program as required.

Output 2.5 – Completed Training Program to support Market Development: A study of market demand (who are potential customers and what are their needs for PV capacity, financing, etc.) and market structure (financing; supply; etc.) will be conducted. Based on this study, develop a capacity building program in the first year of the project. It is anticipated that training for private sector partners (e.g. electricians, technology sales companies, end-users such as hotels and managers of outer island infrastructure) will focus on business planning, life cycle costing, quality assurance, procurement, and marketing of PV and other RETs, so as to encourage private businesses to provide the full range of services needed for delivery, installation, commissioning, and after sales services of these technologies. Business development and management experts from the Seychelles Institute of Technology and the University of Seychelles are likely to play a key role in this training, while the SEC will monitor ongoing effectiveness and uptake. In addition, the capacity of the SEC and PUC to offer support services to RE market players in ownership and management models, project identification and development, business development advice and services, market and technology assessments, and quality assurance of RE equipment also will be addressed through participation in targeted courses with instructors from SIT and/or other organizations.

Output 2.6 – Established Partnership and Information Sharing Platforms: The Seychelles is somewhat late in developing renewable energy production, and as a result it can benefit greatly from data and lessons learned from other countries in the region or with similar opportunities and constraints (e.g. other SIDS). Joint training workshops/courses and other information sharing mechanisms will be coordinated with the UNDP-GEF project "Removal of Barriers to Renewable Energy in Mauritius, Rodrigues and the Outer Islands", with a particular focus on ownership and management models, financial mechanisms and supportive policy instruments, and funds have been allocated for key stakeholders to travel to Mauritius for some of the workshops/courses, and for hiring relevant experts / trainers. The project also will work

with the SEC to establish and assist a business association for local RET owners, suppliers, servicers, etc., with the goal of facilitating information sharing on market opportunities and technical solution, as well as creating a coordinated and strong voice in the country in support of RETs. The SEC will provide policy and regulatory guidance to the RET business association to facilitate the establishment of joint ventures and/or licensing agreements between foreign PV manufacturers and local PV companies, in particular with RET companies in the region (Mauritius, Reunion, South Africa) and elsewhere in the developing world (e.g. large PV players such as China and India). Finally, a RET-focused public web portal for the country will be designed, established, operated and maintained. It will contain frequently updated information on energy consumption data, energy production data, solar irradiation, net metering, solar pricing, regulatory changes, etc., and will be managed by SEC technical staff. This web portal also will be used to disseminate training materials and best practices and lessons learned developed through the project.

Component 3: Solar Photovoltaic demonstration projects

In the current baseline situation, neither the Government of Seychelles, which is currently participating in an IMF-sponsored economic reform process, nor the Public Utilities Corporation, which can no longer rely on government subsidies for capital expenditures (as of 2012), is in a position to provide sufficient financing to spur the widespread adoption of solar PV systems. At the same time, the private sector also faces financial and market constraints to adopting PV technology, due to the unwillingness of private lenders to provide financing for RETs, and the lack of a functioning supply chain and technical support system that would ensure broad availability of PV systems, lower prices through supply chain efficiencies, or adequate service support for end-users. And although the Government has expressed its willingness to support financial mechanisms for renewable energy, it has no experience with such mechanisms, as well as little technical expertise in assessing RETs or selecting from among various financial incentive models. Thus, in the baseline scenario, opportunities for potential PV adopters to secure financing and to find reliable suppliers and servicers for PV systems will be severely limited.

For this reason, the proper and close coordination of the implementation of demonstration grid-connected PV systems on the main islands of the Seychelles, as well as at least one small, stand-alone system on one of the outer islands that will be installed, with funding from a financing scheme for PV systems that combines the resources of the GEF, the Ministry of Finance, and the European Investment Bank, has to be done so that potential adopters of PV technology are motivated and ready to make investments in PV systems. The focus will be on small-scale producers who are already connected to the national electricity grid (the vast majority of businesses and households in the Seychelles are connected to the electrical power grid). The proposed systems would together have a total capacity of 1,305 kWp, using individual panels of 100 Wp. Based on an average of 1,300 Full Load Hours (FLH) for PV Systems in the Seychelles, these systems are expected to produce around 1,696,419 kWh of electricity per year. The PV systems to be installed are demonstration systems, intended to demonstrate the feasibility of installing and operating PV systems that can be connected to the national grid; to develop the management and technical capacity in the country to install and maintain PV systems; and to show to potential buyers and the broader general public the advantages of solar PV technology. The PV demonstrations will provide clear evidence on the technical feasibility and cost effectiveness of PV systems in the Seychelles, both for small-scale systems on the smaller islands and for commercial buildings on the main islands. In this regard, they will be the initial step in scaling up PV production in the country and reducing its dependence on fossil fuel imports.

Output 3.1 - Technical Report on Grid Capacity and Requirements: The PUC will develop clear guidelines on the technical requirements to ensure safety and enable feed-in for grid-connected PV systems, as well as an analysis of the grid's capacity to absorb intermittent electricity production from PV systems and other RETs (and the level at which grid-connected RET production would necessitate

investments in increased storage capacity and grid reinforcement). In addition to setting the groundwork to allow for grid-connected PV systems, this work also will help to define the technical information required to establish the new national grid code (which will be subsidiary legislation of the new Energy Act). If relevant, an analysis of any results produced from a grid simulation study of the effect of the proposed Masdar wind power project (expected to be carried out in 2012) will be performed.

Output 3.2 – Completed Grid Upgrade, Expansion and Refurbishments: The Government of Seychelles has contracted Masdar to carry out extensive grid upgrade, expansion and refurbishment work from 2012 through 2014. Among the stated objectives of this program is to strengthen the electricity grid in order to allow electricity from auto-producers and IPPs to feed into the grid (and as such a percentage of this grid strengthening program equal to the projected % of grid electricity coming from grid-connected solar PV systems has been counted as co-financing.

Output 3.3 – Test Demonstration PV System with PUC: Approximately 5 kWp of PV systems will be installed at facilities managed by the Public Utilities Corporation, which will produce approximately producing 6,500 kWh of electricity annually. Potential sites for any systems are the roof of Power Station C at Roche Caiman (Mahe) and the PUC facilities on La Digue (which was designated as an "eco-island" in Seychelles Vision 2020). These test systems are intended to allow PUC to develop more precise data on PV production capacity in the country; to test the advantages and disadvantages of various PV technologies (e.g. amorphous and polycrystalline modules); and to develop practical capacity and experience in managing the interaction between PV systems and the electrical grid. In addition, experience in managing these systems will be of significant assistance to the PUC if it is selected to manage the 5 MW solar PV installations currently being considered by the Government of Seychelles and the Abu Dhabi Fund for Development.

Output 3.4 –Purchase Strategy for PV Systems: Building on work carried out during the PPG phase (see Annex 7), different options for the purchase of Solar PV systems will be analysed. The analysis will look at factors such as: 1) determination of grid-suitable and optimal PV technology; 2) identification of competitive and reliable suppliers, and 3) assessment of optimal payment, delivery and warranty schemes. The model developed during the PPG phase of the full life cycle costs for the pilot PV systems will be expanded using examples from other countries as well as the most up to date international guidelines. Based on the analyses done, a purchase strategy for PV systems will be developed and documented. This work will be carried out jointly by the project team and a locally hired technical consultant (e.g. electrical engineer). Such a strategy, along with other relevant information on the cost of PV systems will be useful to any parties in the Seychelles interested in purchasing PV Systems to minimize their purchase and operating costs and to avoid purchasing unsuitable or unreliable technology.

Output 3.5 – Selected Project Demonstration Partners: Criteria and procedures will be developed and implemented for a transparent public tender process to select and award demonstration projects for grid-connected PV systems with private sector partners on the three main islands of the Seychelles (Mahe, Praslin and La Digue). The project team and SEC staff will lead this work, with support from the legal consultants hired under Outputs 1.4 - 1.5. Demonstration project partners on the main islands are expected to be primarily private (and possibly para-statal) commercial enterprises, as this sector is widely seen to be the most likely to adopt PV systems in the near to medium term, but private residences are also eligible. The vast majority of the 1,280 kWp to be purchased through the public tender process will be grid-connected systems installed on the main islands of the country. However, for the remaining smaller islands in the country, a separate public tender process will take place to select demonstration projects for small micro-grid PV systems, based on the results of any feasibility studies and the capacities and resources of the potential partners. At least one partner, the Seychelles Island Foundation, has already been confirmed for one of the small outer islands. SIF manages two World Heritage Sites in the Seychelles, the remote island of Aldabra and the Vallee du Mai site on the island of Praslin. Aldabra will

be the location of a demonstration stand-alone PV system; the Vallee du Mai will be a grid-connected PV system. SIF will purchase, install and operate its own PV systems (totalling 25 kWp) and will coordinate with the project team in collecting information on PV system operations and other lessons learned for both grid connected and remote island operations. Additional details on the Tender process are provided in Annex 9.

Output 3.6 – Completed Feasibility Analyses for Project Demonstrations: Using the data on solar irradiation collected under Output 1.2, selected project partners will propose specific sites for demonstration PV systems. For each demonstration, a feasibility analysis will be carried out, collecting data on shadow profiles, grid accessibility, available and suitable space (rooftop or ground), and the structural design of buildings to ensure sufficient load capacity to support PV panels and systems, and other factors. In addition, a general feasibility study for mini-grid PV systems will be conducted for the Outer Islands (co-financed by the Islands Development Company).

Output 3.7 – Signed Installation and Financing Agreements with Demonstration Partners: Each selected partner will sign a formal agreement with the Government of Seychelles covering the obligations and rights of the partners regarding installation, operation and maintenance of project pilot PV systems, including providing data on system costs, electricity production, reliability, etc. to the Seychelles Energy Commission. In addition, project partners will sign financing agreements with any institutions providing financial incentives through the project. At present, this will most likely be the Development Bank of Seychelles (DBS), which is expected to act as the fiduciary agency responsible for all of the financial incentives implemented by the project. These incentives include a purchase rebate scheme, whereby auto-producers will receive a reimbursement of 35% of the purchase price of the PV system capital equipment (these items are already exempted from import duties in the Seychelles). Participating partners will only be eligible to receive the purchase rebate once their PV systems is installed and operational, as verified by the Seychelles Energy Commission or its designated representative. Funds to enable this purchase rebate scheme will come from the Seychelles Ministry of Finance and the GEF (see Annex 9 for details). In addition, the European Investment Bank will make a low-interest loan facility of up to 3 million Euros available to the DBS so that it can establish a renewable energy and energy efficiency projects loan mechanism; this DBS loan mechanism is expected to be of sufficient size to provide low-interest loans for all of the PV system purchase costs (after the purchase rebates) anticipated in this project.

Output 3.8 - Installed Demonstration PV systems with Private Partners: Based on projections of PV system costs and available financing for the purchase rebate, a minimum target of 1,305 kWp of PV systems in the Seychelles will be installed by private companies and organizations in the Seychelles. Collectively, these installations will produce 1,696,419 kWh of electricity annually. The vast majority of installed PV capacity will be at various sites on the main islands of Mahe, Praslin and La Digue, most likely on the rooftops of hotels and commercial buildings. Each PV system will be installed with all of the necessary protection, control and instrumentation equipment. Conversion from DC to AC will be through a bank of grid inverters and stepped up through a transformer, all of which will be reviewed and approved by the PUC to fit grid specifications. In addition, a number of micro-grid systems are expected to be installed on some of the smaller islands, in order to provide a model for replication on others of the 115 islands in the country. Limits on the size of PV systems installed at any given site will be determined during the first year of the project, based in part on the requirements of the grid code. It is expected that installation of the PV systems will begin in year 2 of the project (early-mid 2013) and continue for three years, with 50% of the total capacity installed in that year 2, 30% in the year 3, and 20% in year 4 (the final year of the project).

Output 3.9 – Reports on the Operational Performance of Demonstration PV Systems: The Seychelles Energy Commission will be responsible for on-going monitoring of system performance for all PV

systems installed through the project. This will include confirmation that PV systems are installed and maintained correctly and as required in the installation agreements. In addition, SEC will perform periodic monitoring of electricity produced by the PV systems; of levels of electricity going into and out of the grid; and of technical problems with various kinds of equipment. Data collected will be made publicly available on the SEC website. In addition, the SEC will raise awareness and build capacity among the project partners to carry out data monitoring both during and after the project, including long-term partnerships with SEC to provide data to the public through the SEC website.

Global, National and Local Benefits

50. The project will create provide measurable global benefits through the installation of 1,305 kWp of grid-connected Solar PV systems in the Seychelles. This installed capacity is expected to produce approximately 1,696,419 kWh of electricity annually, replacing an equal amount of fossil fuel based electricity production; this will reduce annual consumption of fuel oil by 390.18 metric tons, and directly reduce CO2 emissions by approximately 1,167.14 metric tons per year. For the lifetime of the system (20 years), there will be a total reduction of 23,343 metric tons CO2. In addition to these direct benefits, the project will facilitate additional installed capacity of grid-connected PV systems both during and after the project. Using the GEF bottom-up approach for indirect emissions reductions and a replication factor of 3 (for a demonstration project with capacity building), it is estimated that total emissions reductions would be 70,028 metric tons of CO2. Alternatively, using the GEF top-down approach for indirect emissions reductions, and based on the assumption that the government's target of 5% of total national electricity production from Solar PV will be met within 10 years of the end of the project and a GEF causality factor of 80% (where the "GEF contribution is dominant, but some of this reduction can be attributed to changes in the baseline"), the total emissions reductions would be 243,504 metric tons of CO2. A more detailed description of GHG emissions calculations is provided in Annex 6.

51. Development of the renewable energy sector by the project also will have national benefits for the Seychelles. By increasing the use of renewable energy in the overall energy mix of the country, the project will help to diversify energy production, improve energy security and decrease dependency on imported fuels required to meet current and future additional power demand. The cost of energy production from solar PV systems, which is currently estimated to be almost the same as existing fossil-fuel based production in the Seychelles (see Annex 8), is likely to continue to decline due to lower PV equipment costs, thereby creating economic savings for the government (in terms of reduced financial subsidies to the PUC) and for electricity end-users. It is generally accepted that Solar PV systems produce more employment (through labor required for marketing, installing and maintaining the systems) than the existing fossil fuel production, thereby creating national benefits in terms of job creation, and contribute to technology transfer and the development of local technical capacities. Finally, solar PV systems and other RETs that replace fossil fuel power generation at large power plants will reduce air and noise pollution and thereby benefit human health and well-being.

2.5 Key indicators, risks and assumptions (1/2 page)

Key Indicators

52. Key indicators of the project's success include:

- Direct reduction of GHG emissions by 2,685 tons[3] of CO_2eq by end of project, and 20,664 tons of CO_{2eq} post-project, assuming a 20-year equipment projected life and no replication factor
- Estimated indirect reduction of GHG emissions of at least 70,028, on the basis of a replication factor of 3 and a 20-year projected life for equipment
- Independent Electricity Regulator established and fully operational by project end
- Strengthened legal framework to enable grid-connected renewable energy production (new Energy Regulatory Act; revised PUC Act; new Independent Regulator Act; new Electricity Act)
- Construction of 1,305 kWp of grid-connected PV systems completed by end of the project, generating 1,696,419 kWh of electricity per year

Detailed indicators are provided in the Project Results Framework in Section 3.

Risks

53. The main identified risks include:

- The domestic market is too small to make imports and services for PV systems economically competitive, or to enable the establishment of committed local PV dealers and technicians
- Government financial support for RETs does not extend beyond the end of the project
- Enactment of new and revised energy legislation and regulations is delayed
- Lack of inter-institutional ownership and cooperation in implementing the project activities
- PV system operators do not participate as promised due to concerns about government commitment, appropriate pricing or changes in IRR hurdle rate assumptions, and/or technical challenges
- Human resources are slow in being hired and/or insufficiently trained to successfully implement the project

Further details on these risks, together with related mitigation measures, are presented in the "Offline Risk Log" in Annex 1.

Assumptions

54. The assumptions are outlined in the Project Results Framework in Section 3.

2.6 Financial modality

Justify the type of financing support provided with the GEF resources

55. The GEF is being asked to provide a grant for the funding of activities that will result in the establishment of the first significant Solar PV systems in the Seychelles, which will substantially contribute to reductions in GHG emissions. The GEF funds will be used for developing and implementing legal and policy frameworks; for carrying out capacity building activities necessary to enable the adoption and replication of grid-connected PV systems and the development of a Solar PV market in the country; and for installing and operating demonstration PV systems in partnership with private organizations and companies at various sites around the country. The proposed project is

[3] Total installed capacity target for project is 1,305 kWp, which would reduce GHG emissions by 1,167 tons of CO_2eq per year. However, the PV demonstration systems will be installed over final three years of the project. Accordingly, the "direct reduction" target assumes the following rate of installation during the project: average installed capacity is 25% during year 2 of project; 65% during year 3 of project; and 90% during year 4 of project

requesting grant money from the GEF for both technical assistance and investment; ***approximately 70% of GEF funds will go directly towards investment in solar PV production capacity, where they will be pooled with government funds to establish a financial incentive mechanism to support selected participants in in purchasing and operating grid-connected PV systems.*** No loan or revolving fund mechanisms are considered appropriate for this purpose, and, therefore, grant-type funding is considered as the most adequate to enable successful delivery of the project Components. The transfer of GEF funds through the financial mechanism to selected participants will be conditional on the installation and active operation of the PV systems, so that GEF funding will be triggered by direct reductions in GHG emissions. As such, GEF funds will support activities that are incremental to the existing baseline, in which most investments in renewable energy are limited to policy and legal exercises.

2.7 Cost-effectiveness

56. The proposed project activities to promote the installation of solar PV systems in the Seychelles represent the most cost-effective opportunity for the country to significantly increase its renewable energy production. As detailed in Annex 8, while both Hydropower and Biomass / Municipal Solid Waste show lower energy production costs than Solar PV, the amount of energy that can be produced from either of these technologies is highly limited in the Seychelles (294 kw for biomass/MSW and 1,800 kw for hydropower), and programs are already underway to develop biomass / municipal solid waste production. Wind power, which has significantly greater overall production potential (as evidenced by the 6 MW wind power system currently being installed by Masdar), is significantly more expensive than solar PV production. When compared to existing fossil fuel based production in the Seychelles, the cost of energy production from solar PV systems is currently lower. Furthermore, it is likely that solar PV production will be even more competitive as compared to fossil fuels in the future, as solar PV equipment costs continue their steady decline, fossil fuels continue to increase in price, and the Government of Seychelles ends its current subsidization of capital costs for fossil-fuel based power plants.

57. The project will create installed capacity of 1,305 kWp of Solar PV systems, which are expected to produce approximately 1,696,419 kWh of electricity annually. Electricity produced from these systems will be connected to the grid, and will therefore replace existing fossil fuel based electricity production, which has an emission factor of 0.688 tCO2/MWh. Solar PV production will reduce annual consumption of fuel oil by 390.18 metric tons (station efficiency of 0.23kg/kWh), and CO2 emissions by approximately 1,167.14 metric tons per year. For the lifetime of the system (20 years), there will be a total reduction of 23,343 metric tons CO2. Therefore, the unit abatement cost (GEF$/ton CO2) of the direct CO2 emissions reduction from the solar PV demonstrations is US$49.70 / ton CO2.

58. In addition to these direct benefits, the project is expected to "jumpstart" the market for grid-connected PV systems in the Seychelles by removing key barriers to PV and other RETS through capacity building, development of market structures and participants, policy and legal/regulatory changes, and financing mechanisms. These changes should facilitate additional installed capacity of grid-connected PV systems in the country both during and after the project, and therefore imply the potential for significant increases in avoided GHG emissions and improved cost effectiveness (for example, the UAE-based energy company Masdar is assessing the possibility of a 5 MW solar photovoltaic installation in the Seychelles; this project is much more like to go forward if barriers to grid-connected PV systems are removed by the proposed GEF project). Using the GEF bottom-up approach for indirect emissions reductions and a replication factor of 3 (for a demonstration project with capacity building), it is estimated that total emissions reductions would be 70,028 metric tons of CO2, and the unit abatement cost would reduce to US$23.01 / ton CO2. Alternatively, using the GEF

top-down approach for indirect emissions reductions, potential reductions and associated cost effectiveness are even more advantageous. The Government of Seychelles has established a target of 5% of total national electricity production from Solar PV; assuming that this target is met within 10 years of the end of the project and a GEF causality factor of 80% (where the "GEF contribution is dominant, but some of this reduction can be attributed to changes in the baseline") then the total emissions reductions would be 243,504 metric tons of CO2, and the unit abatement cost would reduce to US$4.76/mtCO2. The Table below provides summary information on these estimates; in addition, a detailed description of GHG emissions calculations is provided in Annex 6.

Table 7: Project GHG emission reduction impacts

Particulars	Direct: Project (20-year equipment life)	Direct: Post-Project	Indirect – Bottom Up: Post-project with replication (GEF Replication Factor of 3)	Indirect – Top Down: (GEF Causality Factor of 80%)
Installed PV (MW)	1.305	TBD	3.915	1.3 – 17.01
Total CO_2 emissions reduced (tons)	23,343	TBD	70,028	243,504
CO_2 emissions reduced (tons) per GEF $ (GEF Budget of $1,160,000)	$49.69	TBD	$16.56	$4.76

2.8 Coordination with Other GEF Agencies, Organizations and Stakeholders

59. Several projects related to strengthening and reorienting the energy sector in the Seychelles are on-going or expected to get underway in the next few years. At present, the Government of Seychelles is implementing the EU-funded "Seychelles Climate Change Support Programme", a Euro 2 million project whose objective is to support implementation of the priorities identified in the Seychelles National Climate Change Strategy. As baseline activities to complement the proposed GEF project, the EU project, which runs from 2010-2014, will mainstream climate change into national development policies and in key sector strategies and action plans, build the capacity of key stakeholders, and establish effective steering & monitoring mechanisms. In addition, the EU project will support changes to the legal framework for the energy sector to enable wide participation and investment in renewable energies, innovation and access to transfer of technology, and improved energy efficiency. During the preparation phase of the proposed GEF project, there has been close coordination with the EU project on the scope of legal and regulatory work that needs to take place in order to effectively support renewable energy, and particularly grid-connected PV systems, in the Seychelles. The EU project has targeted the finalization of a new Energy Act in early 2012, and in the following years additional funding from both the EU project and this GEF project will jointly support development of specific regulations under the new Act; the EU contribution will constitute co-financing for the GEF project (as described in Section 2.4, Outputs 1.4 and 1.5).

60. Another relevant project is the EU-COI - Regional Program on Renewable Energy and Energy Efficiency, which is expected to provide Euro 15 million to four countries in the Indian Ocean region (Comoros, Madagascar, Mauritius and Seychelles) for renewable energy development and energy efficiency improvements. This program, which is proposed to start in 2012, will focus on 1) human resource development and institution building for the energy sector; 2) promotional campaigns and advocacy plans for renewable energy and energy efficiency; 3) improved regulatory and business environments for renewable energy based grid-connected electricity generation; 4) strengthened capabilities among government agencies and private investors to design, engineer, construct and operate decentralised electric power / energy systems based on renewable energy; and 5) development

and implementation of energy efficiency standards and labels for buildings and household appliances and equipment. The exact activities to be carried out in each country, and the division of activities and resources between regional and national approaches, have not yet been finalized.

61. Another potential baseline project is an IFC-funded "High Risk Capital Loan Program", which is intended to establish a financing mechanism to support loans for high risk capital expenditures, possibly including renewable energy technologies. This program, which would be implemented in collaboration with the Development Bank of Seychelles (DBS) and Nouvobanq (a commercial bank owned by the Government of Seychelles), is still under development, although the IFC did sign an agreement with the Government of Seychelles in November 2011, which indicated that the program would include financing for "renewable energy and energy-saving projects through the private sector", and would most likely focus on the household sector in its initial stages.

62. With regard to installed capacity of renewable energy technologies, a number of projects are planned or underway in the country. The Abu Dhabi Development Fund, in partnership with the government of the Seychelles, is considering US$28 million in funding for a 6 MW wind power installation on the main island of Mahe. This project, which is being led by the energy services company Masdar, is expected to install the wind turbines in 2012. The Seychelles Energy Commission will have a staff member assigned to the project support team, and will have responsibility for all media communication and information and awareness raising for the project.

63. Several other, smaller RET projects are in the discussion and exploration phase. Two private German companies, Sea & Sun Technology and Faktor X New Energy, are working with the SEC to seek funding support from the German Energy Agency (DENA) to install a 10kWp rooftop grid-connected PV system in the Seychelles as a way of stimulating future private sector investment in the country. In addition, the Ministry of Home Affairs, Environment, Transport and Energy is currently reviewing bids for waste to energy systems to be installed during 2012 at the landfill sites on at least two of the main islands.

2.9 Sustainability

64. In the near to medium term, the widespread adoption of solar PV systems in the Seychelles (as in most countries) will depend on the availability of financial incentives and mechanisms to reduce system costs, in particular the costs of capital equipment. In recognition of this, significant efforts were carried out during the PPG phase to secure long-term financing partners and funds for renewable energy technologies (including solar PV) in the Seychelles. In this regard, the European Investment Bank (EIB) is working to establish a concessionary loan program for renewable energy and energy efficiency technologies, in partnership with the Ministry of Finance and the Development Ban of Seychelles. This program is expected to become operational in 2012 and to continue beyond the end of the proposed GEF project in 2016 with an open-ended timeframe. The EIB also has indicated that funding levels for this program can easily be sustained to meet any potential level of demand in the Seychelles. In addition, the International Finance Corporation is also working with the Seychelles Ministry of Finance to develop a High Risk Capital Loan Program, which if implemented also will provide long-term funding for renewable energy projects, including the purchase of Solar PV systems. Thus, it is expected that these two financial incentive schemes, which will support one or more of the potential financing mechanisms (e.g. purchase rebates; a feed-in tariff; concessionary loans; etc.) will be of sufficient duration and size to ensure the financial sustainability of solar PV and other RETs in the Seychelles over the long-term.

65. The proposed financial mechanisms are intended to reduce the upfront capital costs for PV system end-users, and to help reduce the financing, technical and regulatory risks associated with a new

market, all of which are acknowledged as primary barriers to successful solar PV commercialization. The exit strategy is envisaged as follows: Once the US$1.5 million that is available for the financing mechanisms for PV systems capital costs are disbursed (by the end of the project), these mechanisms will no longer exist (unless the Government wants to continue to capitalize and operate them). However, the EIB (and possibly IFC) concessionary loan programs are expected to continue indefinitely after the project ends, providing an ongoing financial incentive to potential PV system end-users. In addition, in 2012 the market for solar PV systems in the Seychelles does not yet exist. With the injection of US$1.5 million in financial incentives as well as its other activities, the project will "jump-start" the solar PV market in the country so that by the end of the project there will be a "growth market" for this industry, characterized by increased use of solar PV systems, functioning supply chains and market services, and large sales volumes. In such a market, prices for PV systems will likely have dropped significantly compared to the current situation, and financial incentives will not be required for many potential investors.

66. The market-based approach taken by the project also will contribute to financial, and institutional, sustainability. By promoting the development of a market value chain (suppliers, service companies, technicians, financers), the project is designed to help establish self-sustaining mechanisms for adoption and operation of solar PV systems, which will create their own on-going financial and institutional resources through revenue derived in the marketplace. Additionally, by removing technical barriers to grid-connected PV, and establishing clear and transparent criteria and mechanisms for participation in solar PV projects, the project will establish institutional processes and capacities that do not require on-going and repeated resource allocations. Together, the financial and institutional sustainability approaches integrated into the project design will greatly increase the likelihood that long-term and sustained GHG emissions reductions will be realized in the country.

2.10 Replicability

67. The potential to replicate installed capacity of solar PV systems throughout the Seychelles is high. In terms of available sites / capacity, there is significant potential for additional grid-connected PV systems on the main islands, in part because the current amount of installed PV capacity is close to zero. Substantial investments have been made in the Seychelles in the past 30 years in land reclamation, so that there are several large reclaimed islands in close proximity to the capital city and port area with ample space for solar PV installations. Numerous commercial buildings and enterprises also have available land and rooftop sites, as do the many single-family homes in the country. On the smaller islands, currently there are approximately 15 smaller islands with permanent populations, ranging in size from a few dozen to several hundred persons. All of these islands, most of which have tourism facilities, incur significant costs for electricity production from small diesel generators, and therefore also constitute areas of high potential for replication. In terms of financial / economic conditions for replication, the financial incentive mechanisms to be established in partnership with the EIB and IFC (see Sustainability section above) are expected to be sufficiently large to cover any potential levels of demand for solar PV systems (and other RETs) at least through the near to medium term. Thus, if the project can succeed in establishing market conditions and structures to support the adoption of solar PV; in removing legal/regulatory barriers to grid-connected PV; in creating reliable and transparent mechanisms for the selection of projects and the awarding of financial incentives; in removing technical and information barriers for grid-connected PV, and most importantly, in clearly demonstrating the viability of a private sector led model for grid-connected solar PV systems, it is expected that other private sector (commercial and household) end-users will invest in solar PV systems. Thus, it is anticipated that neither site limitations nor funding constraints will present significant limits to replicating the adoption of solar PV systems. In this scenario, the primary limiting factor will be potential impacts of solar PV on grid stability.

3. PROJECT RESULTS FRAMEWORK

This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD: UN Country Programme Document 2012-2016 – Country Programme Outcome #2: By 2016, the governance systems, use of technologies and practices and financing mechanisms that promote environmental, energy and climate change adaptation have been mainstreamed into national development plans.					
Country Programme Outcome Indicators: Outcome Indicator 2 – **"**Area of terrestrial and marine ecosystems under improved management or heightened conservation status increased by 50 per cent by end of 2016"					
Primary applicable Key Environment and Sustainable Development Key Result Area (same as that on the cover page, circle one): 1. Mainstreaming environment and energy OR 2. Catalyzing environmental finance OR 3. Promote climate change adaptation OR 4. Expanding access to environmental and energy services for the poor					
Applicable GEF Strategic Objective and Program: To promote on-grid electricity from renewable sources – CC4-SP3-RE					
Applicable GEF Expected Outcomes: Total avoided GHG emissions from on-grid PV electricity generation.					
Applicable GEF Outcome Indicators: Avoided GHG emissions from on-grid PV electricity generation (tons CO_2/MWh); and \$/t CO_2.					
Strategy	**Indicator**	**Baseline**	**Targets**	**Source of Verification**	**Assumptions**
Project Objective: Increase the use of grid-connected photovoltaic (PV) systems as a sustainable means of generating electricity in selected main islands and smaller islands of the Seychelles	• Amount of reduced CO_2 emissions from the power sector (compared to the project baseline) by EOP, tons $CO2_{eq}$ • Cumulative installed capacity of grid-connected PV systems (kWp) • Cumulative total electricity generation from installed grid-connected PV systems (kWh)	• 0[4] • 0 • 0	• 1,512[5] • 1,305 • 1,696,419	Project's annual reports, GHG monitoring and verification reports Project final evaluation report Post project market monitoring and evaluations	Continued commitment of project partners, including Government agencies and investors / developers
Outcome 1: Comprehensive and strengthened policy and legal frameworks adopted to promote RETs and enable grid-connected renewable energy production	• No. of grid-connected RE production projects approved and facilitated by the IER by EOP • No. of grid-connected RE production projects that benefitted from the enforcement of the strengthened legal frameworks by EOP • Volume of funding mobilized or granted) from the incentives scheme by EOP, US\$	• 0[6] • 0 • 0	• At least 30[7] • At least 30[8] • 1,473,707[9]	Published documents. Government decrees/laws.	Commitment of the various Government institutions, private sector actors and project stakeholders
Output 1.1 – Completed National Energy Master	• Government-approved National Energy Master Plan (NEMP) by Year 1	• None	• NEMP by end of 2013	Published NEMP document	Unchanged commitment of

[4] GHG emissions from electricity generation scheduled to increase from 189,968 tons / year (2009) to 299,957 tons / year by 2020

[5] Total installed capacity target for project is 1,305 kWp, which would reduce GHG emissions by 840 tons of CO_2eq per year. However, the PV demonstration systems will be installed through the project. Accordingly, the "direct reduction" target assumes the following rate of installation during the project: average installed capacity is 25% during year 2 of project; 65% during year 3 of project; and 90% during year 4 of

Plan and Energy Resource Assessment	• Completed and published Energy Resource Assessment Report by Year 2	• None[10]	• By end of 2014		relevant Government institutions
Output 1.2 - National Solar Irradiation Map	• Completed and published solar map by Year 2 • % of regions covered with comprehensive solar radiation data by Year 2	• 0[11] • General solar insolation data only	• 15 months from project start • 80%[12]	Published National Solar Map	Unchanged commitment of relevant Government institutions
Output 1.3 – Approved National Energy Policy	• Government-approved National Energy Policy (NEP) by Year 2 • No. of approved policies on RET promotion that are strictly enforced by EOP	• 0[13] • No policies on RET	• End of first year • At least 3	Published policy document	Continued interest of policymakers to expand the use of RETs in the country
Output 1.4 – Approved and enforced detailed regulations and secondary legislation in support of a new Energy Act	• No. of formulated and recommended implementing rules and regulations (IRRs) on the NEP by end of 2013 • No. of approved and enforced secondary legislations in support of the NEP by end of 2013	• 0 • 0	• At least 2[14] • At least 2[13]	Approved and published regulations	Unchanged commitment of relevant Government institutions
Output 1.5 – Approved and enforced revised PUC Act	• Approved and enforced subsidiary legislation under the PUC Act, Business Tax Act, and Fair Trade Commission Act by end of first year	• Existing PUC Act	• By end of first year	Published Acts	Unchanged Commitment of relevant Government institutions
Output 1.6 – Established and Operational Independent Electricity Regulator (IER)	• No. of grid-connected RE production projects approved and facilitated by the Independent Electricity Regulator (IER) by EOP	• 0[15]	• 10	IER official documents	IER will be authorized by law
Output 1.7 – Developed, Approved and Implemented Financial Mechanisms to support Purchase / Operation of Solar PV Systems	• No. of financing schemes developed, established and operational by end Year 2 • Volume of funding mobilized or granted from the established financing scheme by EOP, US$	• 0[16] • 0	• At least 1 • At least US$1,473,706	Official financial incentive scheme reports	Effective coordination of various partners to establish incentive scheme
Output 1.8 – Completed education and awareness	• No. of designed and completed education and awareness campaigns targeting key decision-makers,	• 0	• At least 2	Workshop reports and communication materials	Participation by decision-makers

[10] Only existing out-of-date energy resource assessment
[11] Presently available solar radiation data insufficient to accurately design on-grid PV systems
[12] Target coverage to be finalized with SEC
[13] SEC has no regulatory and/or enforcement powers
[14] Target to be finalized based on findings and recommendations from the EU - Seychelles Climate Change Support Programme (SCCSP) which is supporting the GoS in the process of approving a new Energy Act, as well as provisions for the entire energy sector and formulation of policies and institutional authority under the Act
[15] No IER in place
[16] Presently no funding exists for financial incentive schemes in support of RET systems.

campaigns promoting the benefits of RETs	potential users of PV technology, and the general public by EOP • No. of customers enquiring for information about PV systems from the SEC and PV dealers EOP .	• 0	• 50[17]	Surveys of SEC and dealers	Market actors are willing to cooperate in providing this information
Outcome 2: Enhanced national capacity for the development, operation, and financing of RET systems	• No. of entities in the country gainfully engaged in the various supply chain activities of the PV and RET markets by EOP • No. of personnel of the MOF, local banks and FIs that are actively working on the formulation and implementation of incentive schemes and on the evaluation of the economic/financial viability of grid-connected PV system projects by end Year 1 • No. of local banks/FIs that are providing financial assistance to grid-connected PV system projects by EOP. • No. of joint ventures and/or licensing agreements between foreign PV manufacturers and local PV and RET companies facilitated by the business association by EOP	• 0 • 0 • 0 • 0	• At least 10[18] • 4 • 3 • 3	Training modules/number of staff trained. Assessment reports & published documents. Website.	Cooperation of concerned entities.
Output 2.1 – Completed Capacity Needs Assessment and Developed Capacity Building Strategy	• Finalized capacity needs assessment (CNA) finalized by Year 1 • No. of capacity building programs based on the CAN report designed and implemented by Year 2	• 0[19] • 0	• 6 months of project start • 2	Published documents	Continuous active participation of stakeholders in strategy development
Output 2.2 – Completed Outreach on Policy/Economic Issues	• No. of personnel of the MOF, SEC, and financial institutions actively working on the formulation and implementation of incentive schemes and on the evaluation of the economic / financial viability of grid-connected PV system projects by Year 1	• 0	• 4[20]	Assessment report by Seychelles Energy Commission	Continuous active Participation of government and private sector partners
Output 2.3 – Completed Training Program on Technical Issues	• No. of training courses on solar PV system installation, operation and maintenance designed, organized and conducted by EOP • Number of individuals trained by EOP	• 0 • 0	• 5 • At least 50	Assessment report by Seychelles Energy Commission	Constant active participation of private sector partners

[17] 20 customers enquiring for information about PV systems from the SEC and PV dealers by Year 2 and 50 by EOP
[18] To be confirmed or adjusted during the project inception phase
[19] Very limited information on capacities in Seychelles to develop RETs
[20] The results of the Capacity Needs Assessment will be used to refine the proposed capacity building and information sharing activities and targets described in Outputs 2.2 – 2.6.

	• % of trainees still involved in PV system projects by EOP, % • No. of private sector actors certified as solar PV technicians by EOP	• 0 • 0	• 80% • 5		
Output 2.4 – Completed Training Program on Financial Issues	• No. of training courses on financing grid-connected solar PV system projects designed, organized and conducted by EOP • Number of individuals trained by EOP • No. of local banks / financial institutions that are providing financial assistance to grid-connected PV system projects by EOP	• 0 • 0 • 0	• 5 • At least 50 • At least 3	Project report	Constant active participation of private sector partners
Output 2.5 – Completed Training Program to support Market Development	• No. of training courses on supply chain business operations for solar PV and other RET systems designed, organized and conducted by Year 4 • Number of individuals trained by Year 4 • % of trainees still involved in the supply chain businesses for PV systems and other RET systems by EOP, % • No. of fully certified and operational entities in the country engaged in the various supply chain activities of the PV and RET markets by EOP	• 0 • 0 • 0 • 0	• 5 • At least 50 • 80 • 6	Market assessment by Seychelles Energy Commission	Availability of persons in the country with sufficient technical education and capacity
Output 2.6 – Established Partnership and Information Sharing Platforms	• Average no. of meetings held each year of the business association starting Year 2 • No. of joint ventures and/or licensing agreements between foreign PV manufacturers and local PV and RET companies facilitated by the business association by EOP	• 0 • 0	• 4 • 2	Project final report and web portal	Complete cooperation of all energy sector players and project partners in data collection
Outcome 3: Increased electricity production from RET systems (e.g., PV systems) and interest among energy	• Cumulative amount of reduced CO2 emissions compared to the project baseline from the demo projects by EOP, tons $CO2_{eq}$ • Cumulative total electricity generation from grid-	• 0[21] • Minimal	• 1,512[22] • 1,696,419[23]	Project's annual reports, GHG monitoring and verification reports SEC reports	Continued commitment of project partners, GOS agencies and investors / developers

[21] Expected CO2 emissions from power sector was 189,968 tons/year (2009) and 299,957 tons/ year by 2020

[22] Total installed capacity target for project is 1,305 kWp, which would reduce GHG emissions by 840 tons of CO_2eq per year. However, the PV demonstration systems will be installed through the project. Accordingly, the "direct reduction" target assumes the following rate of installation during the project: average installed capacity is 25% during year 2 of project; 65% during year 3 of project; and 90% during year 4 of project

sector investors and operators.	connected PV systems by EOP, kWh • No. of replication projects implemented that are based on or influenced by the success of the PV system demonstrations by EOP	 • 0	 • 3		EIB and/or other partners continue financial incentive programs after project end
Output 3.1 - Technical Report on Grid Capacity and Requirements	• Completed report on grid capacity requirements by Year 1	• None[24]	• 6 months after project start	PUC technical report	Active participation of PUC in drafting guidelines and standards
Output 3.2 – Completed Grid Upgrade, Expansion and Refurbishments	• Total installed capacity of grid-connected RE-based power systems in the Seychelles by EOP, MW	• Minimal	• At least 8[25]	PUC technical reports	PUC carries out grid upgrade work according to schedule
Output 3.3 – Test Demonstration PV System with PUC	• Total installed capacity of grid-connected demo PV systems by Year 3, kWp • Total power generation from the demo PV systems by EOP, kWh	• 1 • Minimal	• 5 • 6,500 kWh/year	PUC documentation	PUC is actively involved in testing PV systems and training technicians
Output 3.4 –Purchase Strategy for PV Systems	• Completed purchase strategy report on reliable and cost-effective options for purchase and installation of solar PV systems in the Seychelles • No. of solar PV system project developers that considered the information in the purchase strategy report useful in their projects by Year 1	• None exists • 0	• End Year 1 • 50	Project report	Renewable energy technologies available for purchase / delivery to Seychelles at competitive prices
Output 3.5 – Selected Project Demonstration Partners	• No. of interested entities that have applied for hosting demo PV system projects by Year 4 • No. of planned and approved grid-connected demo PV system projects by Year 2	• 0 • 0	• 30 • At least 10[26]	Project report	Sufficient interest among potential partners
Output 3.6 – Completed Feasibility Analyses for Project Demonstrations	• No. of completed technical and economic feasibility analyses of potential demo sites projects by Year 4	• 0	• At least 10	Project reports	Sufficient trained technical personnel are available
Output 3.7 – Signed Installation and Financing Agreements with Demonstration Partners	• No. of signed installation agreements for grid-connected PV demo projects by Year 4	• 0	• At least 10	Signed Installation Agreements	Project financing scheme is in place in a timely manner
Output 3.8 - Installed Demonstration PV systems with Private	• Cumulative installed capacity of grid-connected PV demo projects (kWp) by EOP	• 0 kWp	• 1,305[27]	Project final evaluation report	Sustained participation by demonstration partners

[23] Estimated to be produced annually when all systems are operational at EOP; cumulative targets will be calculated and pro-rated based on assumptions as to when systems will come online
[24] No technical guidelines exist for grid-connected RETs
[25] Target to be confirmed or adjusted based on the results of grid work and assessment of grid stability in Year 1.
[26] Limits on the size of PV systems installed at any given site will be determined during the first year of the project, based in part on the requirements of the grid code
[27] This includes SIF purchase, installation and operation of its own PV systems – totaling 25 kWp – on remote islands

Partners					
Output 3.9 – Reports on the Operational Performance of Demonstration PV Systems	• No. of demo project profiles prepared and disseminated by EOP • No. of replication projects planned by EOP	• 0 • 0	• At least 15[28] • At least 15[29]	Project final evaluation report SEC website	Sustained participation by demonstration partners and

[28] As linked to related targets for Output 3.8
[29] As linked to related targets for Outputs 3.3, 3.5 and 3.8

4. TOTAL BUDGET AND WORK PLAN

Award ID:	00065515	Project ID(s):	00081971
Award Title:	GEF PIMS 4331 EITT FSP Seychelles – Technology Transfer		
Business Unit:	MUS10		
Project Title:	Seychelles - Grid-Connected Rooftop Photovoltaic Systems		
PIMS no.	4331		
Implementing Partner (Executing Agency)	Seychelles Energy Commission		

GEF Outcome / Atlas Activity	Responsible Party / Implementing Agent	Fund ID	Donor Name	Atlas Budget Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	Budget Note
Component 1: Strengthened policy, institutional, legal / regulatory and financial framework for Renewable Energy Technologies	**NIM**	**62000**	**GEF**	71200	International Consultants	17,250	0	0	0	17,250	1
				71300	Local Consultants	2,700	5,400	2,700	2,700	13,500	2
				71400	Contractual Services - Individuals	5,458	5,458	5,458	5,458	21,833	3
				71600	Travel	15,292	2,017	2,017	0	19,325	4
				72100	Contractual Services - Companies	5,250	5,250	2,250	2,250	15,000	5
				74200	Audio Visual & Print Prod Costs	3,000	5,250	4,500	2,250	15,000	6
					Total Component 1	**48,950**	**23,375**	**16,925**	**12,658**	**101,908**	
Component 2: Strengthening of the technology support and delivery system for Renewable Energy Technologies	**NIM**	**62000**	**GEF**	71200	International Consultants	12,000	0	0	0	12,000	7
				71300	Local Consultants	11,200	600	600	600	13,000	8
				71400	Contractual Services - Individuals	5,458	5,458	5,458	5,458	21,833	3
				71600	Travel	10,042	9,017	2,017	0	21,075	9
				72100	Contractual Services - Companies	27,000	41,000	7,000	3,000	78,000	10
				72200	Equipment and Furniture	3,000	1,000	1,000	0	5,000	11
				72800	Information Technology Equip.	0	2,400	800	800	4,000	12
				74200	Audio Visual & Print Prod Costs	1,050	1,050	450	450	3,000	13
				74500	Miscellaneous	10,000	5,000	0	0	15,000	14
					Total Component 2	**79,750**	**65,525**	**17,325**	**10,308**	**172,908**	
Component 3: PV demonstration projects	**NIM**	**62000**	**GEF**	71200	International Consultants	10,000	0	0	0	10,000	15
				71300	Local Consultants	4,200	0	0	0	4,200	16
				71400	Contractual Services - Individuals	5,458	5,458	5,458	5,458	21,833	3
				71600	Travel	4,792	2,017	2,017	0	8,825	17
				72100	Contractual Services - Companies	0	12,500	0	0	12,500	18
				72200	Equipment and Furniture	16,450	0	0	0	16,450	19
				72800	Information Technology Equip.	7,000	0	0	0	7,000	20
				74500	Miscellaneous	0	428,211	195,198	109,556	732,966	21
					Total Component 3	**47,900**	**448,186**	**202,673**	**115,014**	**813,773**	
Project Management	**NIM**	**62000**	**GEF**	71200	International Consultants	0	17,000	0	23,000	40,000	22
				71400	Contractual Services - Individuals	5,852	5,852	5,852	5,852	23,410	23
				72100	Contractual Services - Companies	3,500	1,500	1,500	1,500	8,000	24
					Total Project Management	**9,352**	**24,352**	**7,352**	**30,352**	**71,410**	
					PROJECT TOTAL	**185,952**	**561,439**	**244,276**	**168,333**	**1,160,000**	

Budget notes:

	Budget Notes
1	International consultant to work on national energy policy under Output 1.3 (10 days at $600/day); International consultant (economist) to work on financial mechanisms under Output 1.7 (15 days work at $750/day)
2	1 technical (local engineer) consultant to work with the Seychelles Energy Commission on technical issues related to its role as the country's Independent Electricity Regulator under Output 1.6 (about 10 days in year 1, 15 days in year 2, 10 days each in years 3 & 4; total of 45 days at $300 / day = 13,500)
3	Contractual Services – Individuals will cover GEF contributions to the payment of 3 persons: • Solar PV Technical Expert: This expert will provide technical guidance to the project on a periodic basis throughout the first 3 years of the project. It is estimated that this person will work as follows: 7 weeks in year 1; and 4 weeks each in years 2 and 3. This expert will be paid at a rate of $2,500 per week, and in total, the expert will incur costs to the project of $37,500 in wages, all of which will be paid with GEF funds. These costs are distributed evenly over the three project Components ($12,500 to each Component) • PCU Chief Technical Advisor: A centralised Programme Coordination Unit (PCU) has been established by the UNDP and the Government of Seychelles to oversee, support, administer and coordinate the implementation of all UNDP-GEF environmental projects in the Seychelles. The PCU is comprised of a National Programme Coordinator, an International Chief Technical Advisor (currently being recruited), and administrative and accounts support staff. The current UNDP-GEF portfolio in the Seychelles consists of 5 projects totaling approximately US$10 million; the proposed project therefore constitutes approximately 10% of the overall portfolio. Although the PCU Chief Technical Advisor will provide technical oversight and support to this project, it is expected that this will not be at the same level as this person provides to other projects in the portfolio (since the advisor is expected to be someone with a biodiversity / natural resources background). For this reason, only 5% of the costs of the CTA will be paid by this project; these costs are approximately $140,000/year, which means $7,000/year and $28,000 in total for this project. These costs are distributed evenly over the three project Components ($9,333 to each Component)
4	Travel costs for 1) International consultant to work on national energy policy under Output 1.3 (DSA of $325/day for 10 days, plus travel at $2,000); 2) International consultant (economist) to work on financial mechanisms under Output 1.7 (DSA for 10 days at $325/day, plus travel at $2,000); and 3) Solar PV Technical Expert noted in #3 -- it is estimated that this person will spend 5 weeks in the Seychelles (on 2 trips) in year 1, and 2 weeks in the Seychelles in each of years 2 and 3 (1 trip each year). The costs for these trips will be $325/day for DSA and $1,500/trip for travel costs. In total, the expert will incur costs to the project of $26,475 in travel and DSA, all of which will be paid with GEF funds. These costs are distributed evenly over the three project Components ($8,825 to each Component)
5	Funds designated to hire local companies or NGOs to carry out education and awareness campaigns on RETs and new energy laws and policies under Output 1.8
6	Funds for the production of audio-visual and printed materials as part of the education and awareness campaigns on RETs and new energy laws and policies under Output 1.8
7	Study of market demand (who are potential customers and what are their needs for PV capacity, financing, etc.) and market structure (financing; supply; etc.) under Output 2.5 carried out by an intl. consultant (20 days at $600/day)
8	Local consultant to carry out a capacity needs assessment on national capacities for RETs under Output 2.1 (30 days at $300/day); local consultant to create website and operate on a daily basis (for example information on net metering, energy consumption data, energy production data, solar irradiation, etc.) under Output 2.6 ($4,000)
9	Travel costs for: 1) international consultant carrying out study of market demand and market structure under Output 2.5 (DSA for 10 days at $325/day, plus travel at $2,000); 2) SEC and PUC staff and others in Seychelles to travel to Mauritius for training in information systems and other exchange of lessons learned under Output 2.6 ($7,000); and 3) Solar PV Technical Expert travel costs ($8,825; details explained in note #4)
10	3 workshops at $1,000 per workshop for capacity assessment and strategy development under Output 2.1; various activities to support training on RET technical issues under Output 2.3, including sending 2 persons from the Seychelles Institute of Technology to go to Mauritius for a 4-6 week course on Solar PV technology; about $15,000 total; then paying these trainers to provide training in Seychelles ($7,000); and also sending 2 persons from PUC to

	Budget Notes
	Mauritius for training on certifying PV installations (1 week course; $4,000 total); funding for the staff economist at the SEC to undergo intl. training in RET financing under Output 2.4 (approx. $25,000); contracting of local partners / institutions to provide training on market development under Output 2.5 (approx.. $11,000); and joint training workshops with solar power project in Mauritius on information sharing strategies and lessons learned throughout project implementation under Output 2.6 (approx.. $13,000)
11	Purchase of PV equipment (incl. small PV system, safety equipment, etc.) to use as training equipment under Output 2.3 (approx. $3,000); miscellaneous equipment to assist in training on market development under Output 2.5 (approx. $2,000)
12	Costs for ongoing web hosting ($4,000) for information sharing platforms under Output 2.6
13	Audio-visual equipment to assist in training on market development under Output 2.5 (approx. $3,000)
14	International accreditation process for certification program for PV installers/operators under Output 2.3 (approx. $5,000); creation and on-going support to local association of solar PV system owners and businesses under Output 2.6 (approx. $10,000)
15	International consultant to process data (remotely) collected on grid capacity and functioning (approx. $10,000)
16	Hire local electrical engineer to assist in technical analysis required to develop purchase strategy for demonstration PV systems under Output 3.4 (12 days at US$350/day)
17	Travel costs for Solar PV Technical Expert travel costs ($8,825; details explained in note #4)
18	Services of local IT company to train SEC staff on how to use and maintain software and equipment for operational monitoring of PV systems under Output 3.9 ($12,500)
19	Purchase and operation of a 3 kWp test system (at US$5,620 per kWp) to be installed as a test system at PUC facilities under Output 3.3
20	Software and equipment to send data on PV production and feed in and out of the grid to SEC website under output 3.9 ($7,000)
21	GEF contribution to financial mechanisms for the purchase of solar PV systems by private partners under Output 3.8 ($732,966)
22	International Consultants for External Evaluations of Project: $17,000 for mid-term evaluation; $23,000 for final evaluation
23	GEF contribution to the payment of the Project Manager (total of $7,689; see point # 3 above for more details). In addition, also noted under point #3 above, a centralised Programme Coordination Unit (PCU) coordinates the implementation of all UNDP-GEF environmental projects in the Seychelles. Since the Project Manager for this project will be based at the PCU, and benefit from its oversight, administrative and accounting services, the project will pay for approx. 10% of the PCU staff costs (with the exception of the Intl. CTA, covered under point #3). These staff members are: a National Programme Coordinator, a Finance Manager, a Programme Assistant, and a Driver, whose total expense to this project over 4 years will be $23,410.
24	Funds for the project inception workshop ($2,000) and for annual external audits ($6,000)

Summary of Funds:

	Year 1	Year 2	Year 3	Year 4	Total
Global Environment Facility	$185,952	$553,939	$244,276	$168,333	**$1,160,000**
Seychelles Energy Commission	$272,515	$68,515	$41,463	$41,463	**$423,956**
Public Utilities Corporation	$351,435	$351,435	$351,435	$351,435	**$1,405,738**
Ministry of Finance	$0	$592,593	$148,148	$0	**$740,741**
Dept. of Environment	$15,000	$15,000	$15,000	$15,000	**$60,000**
PV System End-Users	$0	$2,527,379	$631,845	$0	**$3,159,223**
Seychelles Islands Foundation	$50,000	$50,000	$0	$0	**$100,000**
International Atomic Energy Agency	$85,640	$26,840	$0	$0	**$112,480**
European Investment Bank	$65,000	$0	$0	$0	**$65,000**
United Nation Development Programme (UNDP)	$15,000	$15,000	$15,000	$15,000	**$60,000**
Total	**$1,040,542**	**$4,200,699**	**$1,447,166**	**$591,231**	**$7,287,138**

5. MANAGEMENT ARRANGEMENTS

5.1 *Collaborative arrangements with related projects*

68. At present, there are no other ongoing or planned GEF-funded renewable energy projects Seychelles. However, the project will coordinate closely with the UNDP-GEF project "Remo Barriers to Solar PV Power Generation in Mauritius, Rodrigues and the Outer Islands", as projects will be overseen by, and receive technical support and guidance from, the environmer of UNDP Mauritius (details on this coordination are provided in Section 2.8). Apart from funded projects, several projects supported by other donors provide the opportunity for collabo during project implementation. Among the most important are the Danida / World Bank funded *DOCK Support Program*, designed to support Small Island Developing States (SIDS) to transit low carbon economies through development and deployment of renewable energy resource promotion of greater energy efficiency; the EU funded *Seychelles Climate Change Su Programme,* which is undertaking significant revisions of the energy-related legislation i Seychelles; the EU-IOC funded *Regional Program on Renewable Energy and Energy Effic* which is supporting renewable energy development and energy efficiency improvements ir member countries; and the IAEA funded "Building Capacity on Energy Planning and the Prepa of an Energy Master Plan for the period 2014-2030 to improve energy security", designed to su the Seychelles Energy Commission in developing a comprehensive long-term energy plan co the period 2014 to 2030, and to strengthen energy planning capacity among the staff of the SE PUC. Additional details on coordination with these projects are provided in Section 2.8.

5.2 Roles and responsibilities of the parties involved in managing the project

69. The project will be implemented over a period of four years. The project will be implemented Seychelles Energy Commission under overall responsibility of the Department of Enviro (DOE) in the Ministry of Home Affairs, Environment, Transport and Energy (MHAETE). project will be nationally implemented (NIM) by the Department of Environment (DOE) Ministry of Home Affairs, Environment and Transport (MHAET), in line with the Standard Assistance Agreement (SBAA, 1977) between the UNDP and the Government of Seychelles. day-to-day oversight of the project will be the responsibility of the Seychelles Energy Commissi

70. The UNDP will monitor the project's implementation and achievement of the project output ensure the proper use of UNDP/GEF funds. The UNDP Country Office (CO) will be responsib (i) providing financial and audit services to the project; (ii) recruitment and contracting of p staff; (iii) overseeing financial expenditures against project budgets; (iv) appointment of indepe financial auditors and evaluators; and (v) ensuring that all activities, including procuremer financial services, are carried out in strict compliance with UNDP/GEF procedures.

71. A centralised Programme Coordination Unit (PCU) has been established by the UNDP ar Government of Seychelles to oversee, support, administer and coordinate the implementation UNDP-GEF environmental projects[30] in the Seychelles. The PCU is comprised of a Na Programme Coordinator, an International Chief Technical Advisor (currently being recruited administrative and accounts support staff.

[30] Mainstreaming biodiversity conservation objectives in production activities in the Seychelles terrestrial and environments; Mainstreaming prevention and control of introduction and spread of invasive alien species; Capacity devel for sustainable land management in Seychelles; and Capacity development for improved national and international enviro management in Seychelles (CB2).

72. Day-to-day management of the project will be carried out by a Project Manager (PM), whose Terms of Reference are presented in Section IV, Part IV of this document. The PM will work under the overall guidance of the Project Steering Committee (PSC), and will report to the PSC and the GEF National Programme Coordinator. The PM will be selected jointly by DOE, SEC and UNDP, in consultation with the UNDP/GEF Regional Technical Adviser from the UNDP/GEF Regional Co-ordination Unit in Pretoria. The PM's prime responsibility is to ensure that the project produces the results specified in the project document, to the required standard of quality and within the specified constraints of time and cost. The PM will be supported by an international Solar PV Technical Expert (on a part-time basis), as well by national and international experts taking the lead in the implementation of the specific technical assistance components of the project. These services, either of individual consultants or under sub-contacts with consulting companies, will be procured in accordance with applicable UNDP/GEF guidelines. Contacts with experts and institutions in other countries that have already gained more experience in implementing solar PV projects are also to be established.

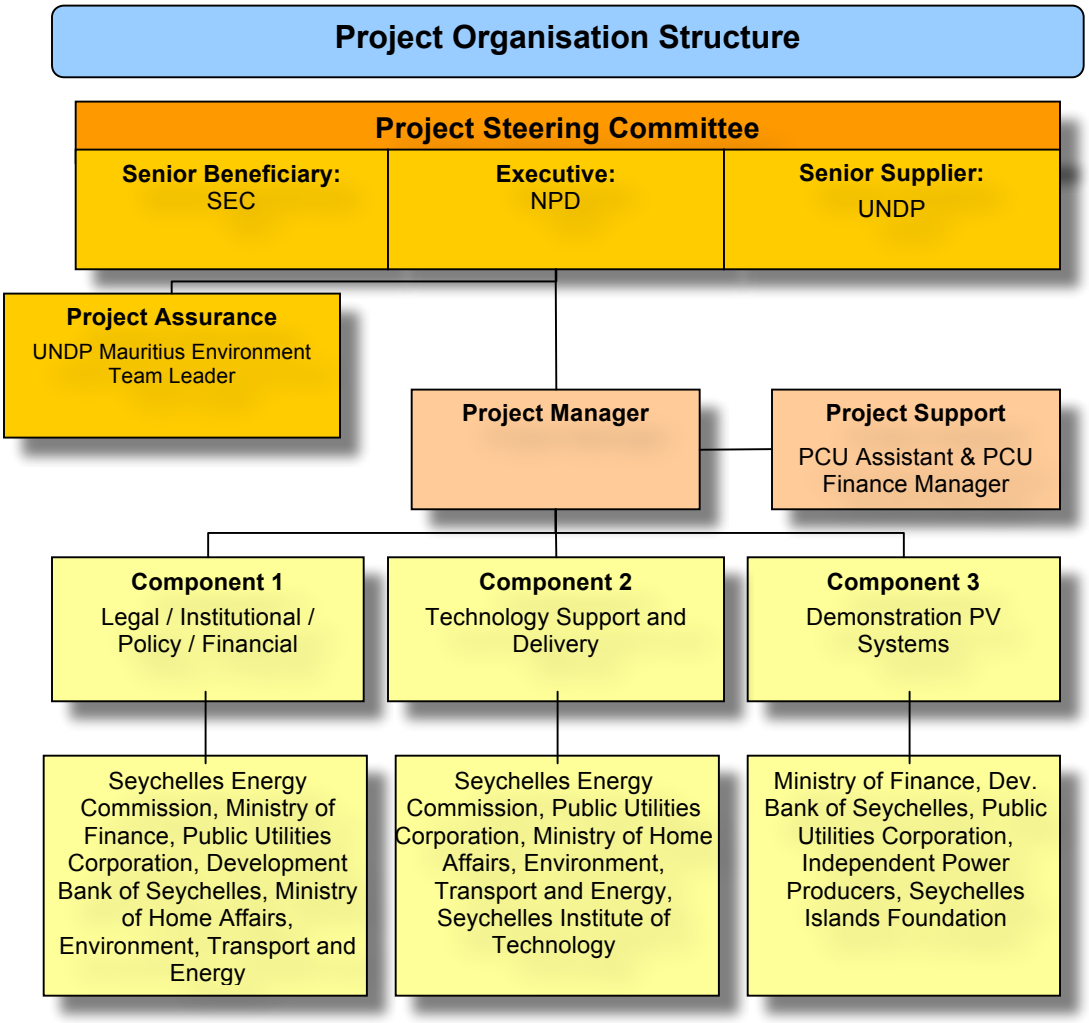
73. Responsibility for implementation of the project will be shared by two sub-agencies of the MHAET, the DOE and the Seychelles Energy Commission (SEC). DOE will have oversight responsibility for the project and will designate a high level official to act as the National Project Director (NPD) who will provide strategic oversight and guidance to project implementation. The NPD will not be paid from the project funds, but will represent a Government in-kind contribution to the Project. The NPD will sign and approve the project financial reports, the financial requests for advances, and any contracts issued under NIM. The SEC, on the other hand, will have direct day-to-day participation in the implementation of the project, acting as the key partner on technical issues such as laws/regulations, policies, RE technologies, management of the energy sector, etc.

74. A Project Steering Committee (PSC) will be constituted to serve as the project's coordination and decision-making body. The PSC will ensure that the project remains on course to deliver the desired outcomes of the required quality. The PSC will be chaired by the NPD (the "Executive"). The PSC will include representation from: Seychelles Energy Commission (SEC); Ministry of Home Affairs, Environment, Transport and Energy (MHAETE); Ministry of Finance (MoF); Public Utilities Corporation (PUC); Development Bank of Seychelles (DBS); Seychelles Islands Foundation (SIF); and the United Nations Development Programme (UNDP). Representatives of other stakeholder groups may also be included in the PSC, as considered appropriate and necessary. The PSC will meet at least twice per annum to review project progress, approve project work plans and approve major project deliverables. UNDP will function as the "Senior Supplier", representing the interests of the project funding agencies and providing guidance regarding the technical feasibility of the project. The UNDP Mauritius Environment Team Leader will function in the role of "Project Assurance", supporting the Steering Committee by carrying out objective and independent project oversight and monitoring functions. The final list of the PSC membership will be completed at the outset of project implementation and presented in the Inception Report, and will include selection of individuals or groups of individuals to act as "Senior Beneficiary", representing the interests of those who will ultimately benefit from the project to ensure the realization of project results from their perspective of project beneficiaries. The project manager will participate as a non-voting member in the PSC meetings and will also be responsible for compiling a summary report of the discussions and conclusions of each meeting.

75. The PSC will establish a formal reporting relationship with the Environmental Management Plan Seychelles (EMPS) Steering Committee to ensure ongoing alignment of the project with national strategies, plans and programmes.

76. UNDP Mauritius / Seychelles will maintain the oversight and management of the overall project budget. It will be responsible for monitoring project implementation, timely reporting of the progress to the UNDP Regional Coordination Unit and GEF, as well as organizing mandatory and possible complementary reviews and evaluations on an as-needed basis. It will also support the Department of Environment and the Seychelles Energy Commission in the procurement of the required expert services and other project inputs and administer the required contracts. Furthermore, it will support the co-ordination and networking with other related initiatives and institutions in the country.

77. An overview of the project organisation structure is shown below.



Financial and other procedures

78. The financial arrangements and procedures for the project are governed by the UNDP rules and regulations for National Implementation Modality (NIM). Financial transactions will be based on direct requests for advances – based on the quarterly work plans and financial reports - submitted by the DOE to UNDP. The arrangements for the financial reporting, request for transfer of funds, and the

advance and disbursement of funds to the implementing partners will, in turn, be detailed in the MOU between DOE and the implementing partners.

79. All procurement and financial transactions will be governed by national rules and regulations, and must be compatible with the UNDP rules and regulations as specified in the Aide Memoire signed between UNDP and Department of Environment on the modus operandi of the PCU.

Results of capacity assessment of implementing partner/s

80. A preliminary capacity assessment of each implementing partner (NS, MCSS, SIF and GIF) is appended in Annexure III. A more comprehensive capacity assessment of the DOE, and each of the implementing partners, will be undertaken at project inception (this will comprise the capacity 'baseline' for each project partner).

Audit Clause

81. The Government will provide the Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds according to the established procedures set out in the Programming and Finance manuals. The Audit will be conducted by the legally recognized auditor of the Government, or by a commercial auditor engaged by the Government.

Use of intellectual property rights

82. In order to accord proper acknowledgement to GEF for providing funding, a GEF logo should appear on all relevant GEF project publications, including among others, project hardware and vehicles purchased with GEF funds. Any citation on publications regarding projects funded by GEF should also accord proper acknowledgment to GEF.

5.3 Project Coordination Structure

83. The project will be implemented by the Seychelles Energy Commission under overall responsibility of the Department of Environment (DOE) in the Ministry of Home Affairs, Environment, Transport and Energy (MHAETE). However, in order to successfully implement the various components of the project, the SEC will need the support and cooperation of various government ministries and departments, as well as partners outside of government, to create a market-oriented environment that can successfully promote private sector participation in grid-connected PV systems. The table below provides a summary of organizations that have an interest in renewable energy in general, and PV systems in particular, in the Seychelles, and describes their expected role in the implementation of the proposed project.

Table 8: Key Energy Sector Stakeholders and their role in project implementation

Organization	***Activities***
Seychelles Energy Commission (SEC)	Established in 2009 as part of the MENRT; the role of the SEC is to promote the use of viable alternative energy production technologies, especially RETs. The SEC will be the project Executing Agency. In addition, the SEC will take the lead role in revising policies and laws/regulations related to renewable energy and PV systems in particular; in developing a long-term national energy strategy; and in working with and coordinating RET entrepreneurs and technicians, financial institutions, government agencies, and PV system end-users in the installation, operation and financing of PV systems

Ministry of Home Affairs, Environment, Transport and Energy (MHAETE)	The MHAETE oversees energy policy and implements energy conservation projects (such as waste to energy) in the country. Within the Ministry, the Principal Secretary for Energy will take a lead role in national energy policy and planning, as well as oversight of the SEC. The Climate and Environmental Services Division (CESD), which incorporates the National Meteorological Services (NMS), an Environment Engineering Section (EES) and a Programme Management Section (PMS), will provide technical expertise and data on climate and energy related issues
Public Utilities Corporation (PUC)	PUC is currently the sole producer and distributor of electricity in the Seychelles. PUC has stated its interest in diversifying its energy production mix, including the use of PV systems, and intends to support the project by installing demonstration PV systems at its own power plants on Mahe and Praslin. PUC also will take an important role in developing national capacities for the installation, operation, maintenance and repair of PV systems and their connection to the electricity grid, as well as for oversight and monitoring of PV systems.
Ministry of Finance (MoF)	The MoF will provide financial incentives for PV system operators, and also will play a key role in working with government to determine the economic and financial viability of proposed RET projects and with development institutions and banks to enhance their capacity to appraise PV projects for potential loans or lines of credit
Seychelles Institute of Technology (SIT) & University of Seychelles (UniSey)	SIT is responsible for much of the technical training that takes place in the country, in a wide variety of fields. Lecturers from SIT have undertaken international training courses on RETs, and the institution has expressed interest in offering courses related to RETs in conjunction with the project. UniSey was founded in 2010, and includes programs in finance and environmental management. Both SIT and UniSey may be able to play a key role in providing expertise (either through their own faculty or in helping the project to identify outside experts) in financing and in market development capacity building, including business planning and business development advice and services, market and technology assessments, life cycle costing, quality assurance, procurement, and marketing of PV systems
MASDAR	This Dubai-based company is active in renewable energy development in the Seychelles. MASDAR is currently in the final planning stages for the development of a 7MW wind power facility on Mahe, and in addition, is currently assessing the feasibility of a solar PV project in the country. Masdar is expected to share baseline data as well as technical knowledge on management of RET systems with the project partners.
Private Sector Partners (PV System Operators)	The project will work closely with a number of private sector businesses and organizations who will install and manage grid-connected PV systems as part of the project demonstration activities. The operators will have ultimate responsibility for the installation and operation of the demonstration PV systems, and will play an important role in providing feedback to the project team on the lessons learned and best practices from the demonstration systems. At present, a variety of private businesses have expressed interest in installing and managing solar PV systems. One such group are hotels, many of which are located in remote areas on the main islands and have several reasons for installing solar PV systems, including: the need for back-up electricity generation capacity (most hotels currently have fuel oil or diesel powered backup generators, which are much more costly than grid-supplied electricity); the desire to reduce overall usage of grid-supplied electricity (in particular to avoid "demand charge" rates for high monthly levels of use); and the desire to "green" operations as part of sustainability initiatives and marketing to clientele. Another group of potential end-users are small island managers (including the Island Development Corporation, which manages a large number of small islands), who are interested in reducing their dependence on very expensive fuel oil or diesel generators. Additionally, several retail operations (grocery stores, car dealerships), office complexes, and manufacturing facilities have expressed interest in installing solar PV systems."
Seychelles Islands Foundation (SIF)	SIF manages two World Heritage Sites in the Seychelles, the remote island of Aldabra and the Vallee du Mai site on the island of Praslin. Aldabra will be the location of a demonstration stand-alone PV system; the Vallee du Mai will be a grid-connected PV system. SIF will purchase, install and operate its own PV systems, and will coordinate

	with the project team in collecting information on PV system operations and other lessons learned for both grid connected and remote island operations.
Environmental NGO Community	The Seychelles has a strong community of environmental NGOs, several of which have been active in public awareness campaigns and educational activities on climate change and energy efficiency and conservation. In this project, it is expected that one or more of these NGOs will play a key role in education and awareness raising on RETs and Solar PV systems in particular, and may provide technical advice for potential project partners on how to install PV systems.

6. MONITORING FRAMEWORK AND EVALUATION

The project will be monitored through the following M&E activities. The M& E budget is provided in the table below.

Project start: A Project Inception Workshop will be held within the first 2 months of project start with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and programme advisors as well as other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

The Inception Workshop should address a number of key issues including:

a) Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis-à-vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.
b) Based on the project results framework and the relevant GEF Tracking Tool if appropriate, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.
c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
d) Discuss financial reporting procedures and obligations, and arrangements for annual audit.
e) Plan and schedule Project Board meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 12 months following the inception workshop.

An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly:

- Progress made shall be monitored in the UNDP Enhanced Results Based Managment Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).
- Based on the information recorded in Atlas, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.

- Other ATLAS logs can be used to monitor issues, lessons learned etc... The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annually:

- Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements.

  The APR/PIR includes, but is not limited to, reporting on the following:
  - Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
  - Project outputs delivered per project outcome (annual).
  - Lesson learned/good practice.
  - AWP and other expenditure reports
  - Risk and adaptive management
  - ATLAS QPR
  - Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

Periodic Monitoring through site visits:
UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of project cycle:
The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation (insert date). The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC).

The relevant GEF Focal Area Tracking Tools will also be completed during the mid-term evaluation cycle.

End of Project:
An independent Final Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental

benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

The Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response, which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC).

The relevant GEF Focal Area Tracking Tools will also be completed during the final evaluation.

During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Learning and knowledge sharing:
Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.

The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.

Finally, there will be a two-way flow of information between this project and other projects of a similar focus.

M&E Work Plan and Budget

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
Inception Workshop	▪ Project Manager ▪ Seychelles Energy Commission ▪ UNDP CO, UNDP GEF	2,000	Within first two months of project start up
Inception Report	▪ Project Manager	None	Immediately following IW
Measurement of Means of Verification of Project Results	▪ Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members.	To be finalized in Inception Phase and Workshop	Start, mid and end of project
Measurement of Means of Verification for Project Progress on *output and implementation*	▪ Oversight by Project Manager ▪ Project team	To be determined as part of the Annual Work Plan's preparation	Annually prior to ARR/PIR and to the definition of annual work plans
ARR/PIR	▪ Project manager and team ▪ UNDP CO ▪ UNDP RTA ▪ UNDP EEG	None	Annually
Periodic status/	▪ Project manager and team	None	Quarterly

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
progress reports			
Technical reports, as per project activities	▪ Project Team ▪ Consultants, as needed	Cost to be covered by consultancy budget	To be determined by Project Team and UNDP CO
Mid-term Evaluation	▪ External Consultants (evaluation team) ▪ Project manager and team ▪ UNDP CO ▪ UNDP RCU	17,000	At the mid-point of project implementation
Final Evaluation	▪ External Consultants (evaluation team) ▪ Project manager and team ▪ UNDP CO ▪ UNDP RCU	23,000	At least three months before the end of project implementation
Project Terminal Report	▪ Project manager and team ▪ UNDP CO ▪ Seychelles Energy Commission	None	At least three months before the end of the project
Audit	▪ External Auditor ▪ UNDP CO ▪ Project manager and team	6,000 (1,500 per year)	Yearly
Visits to field sites (UNDP staff travel costs to be charged to IA fees)	▪ UNDP CO ▪ UNDP RCU (as appropriate) ▪ Government representatives	For GEF supported projects, paid from IA fees and operational budget	Yearly
TOTAL Indicative COST Excluding project team staff time and UNDP staff and travel expenses		US$ 48,000	

7. LEGAL CONTEXT

This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the SBAA [or other appropriate governing agreement] and all CPAP provisions apply to this document.

Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

The implementing partner shall:

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

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

Audit Clause: The Audit will be conducted in accordance with UNDP Financial Regulations and Rules and applicable audit policies on UNDP projects.

Annex 1: Risk Analysis

OFFLINE RISK LOG

Project Title: Grid-Connected Rooftop Photovoltaic Systems	**Award ID:** 4331	**Date:**

#	Description	Date Identified	Type	Impact & Probability 1 (low); 5 (high)	Countermeasures / Management Response	Owner	Submitted, Updated by	Last Update	Status
1	Domestic market is too small to make imports and services for PV systems economically competitive, or to enable the establishment of committed local PV dealers and technicians	During PIF formulation	Financial & Strategic	Domestic market services for PV systems fail to materialize and growth of PV sector stagnates post-project I = 3 P = 2	The project will work with the Ministry of Finance and the Development Bank of Seychelles to ensure long-term (post-project) financial incentive programs for PV system operators, so as to promote rapid and significant market growth (to help meet the national policy goal of 15% of all energy production from RETs by 2030). The project also will undertake significant efforts to reduce and/or eliminate technical capacity barriers, which currently constrain investment in PV systems, by establishing a reliable and viable supply chain for PV systems in the Seychelles, including training to private sector partners (e.g. electricians, technology sales companies, end-users such as hotels and managers of outer island infrastructure) in business planning, life cycle costing, quality assurance, procurement, and marketing of PV and other RETs, so as to encourage private businesses to provide the full range of services needed for delivery, installation, commissioning, and after sales services of these technologies. In addition, the project will coordinate closely in sharing lessons learned with the UNDP-GEF technology transfer project "Removal of Barriers to Renewable Energy in Mauritius, Rodrigues and the Outer Islands", and will explore the possibility of relying (at least in part) on supply chain operators in Mauritius to service the Seychelles market and/or on developing opportunities for Seychelles companies to supply the Mauritius market.	Project Steering Committee + Seychelles Energy Commission		N/A	N/A
2	Financial support for RETs does not extend beyond the end of the project	During PIF Formulation	Financial	Replication of project demonstration PV systems will be limited in the absence of	During the PPG phase, the project team has carried out consultations with two international finance institutions that are in the process of developing new financing mechanisms that can support the purchase of solar PV systems over the long-term. The European Investment Bank (EIB) is working with the Development Bank of Seychelles to establish a renewable energy	Project Steering Committee + Seychelles Energy Commission		N/A	N/A

#	Description	Date Identified	Type	Impact & Probability 1 (low); 5 (high)	Countermeasures / Management Response	Owner	Submitted, Updated by	Last Update	Status
				financial incentives I = 4 P = 1	and energy efficiency projects loan mechanism. The EIB has explicitly stated that it has a "long-term interest is to provide finance for a range of renewable energy technologies and projects, as well as energy efficiency investments in Seychelles", and that after the initial renewable energy line of credit is established, "it will be a relatively simple matter to approve and implement further lines of credit in the future… for RE/EE investments to a range of financial intermediaries". In a separate initiative, the International Finance Corporation has signed a Memorandum of Understanding with the Seychelles Ministry of Finance, the Development Bank of Seychelles (DBS) and Nouvobanq (a commercial bank owned by the Government of Seychelles), to develop a High Risk Capital Loan Program, which if implemented also will provide financing for "renewable energy and energy-saving projects through the private sector", and would most likely focus on the household sector in its initial stages. In addition, during the project implementation period, the project team will work with the Seychelles Energy Commission to explore possible options for a tariff surcharge or other funding to enable a long-term financial incentive scheme. It is worth noting as well that the proposed project is designed to jump-start the solar PV industry in the Seychelles, which should bring down costs through better supply chains; increased competition; and the existence of trained local personnel for operations and maintenance. Project activities also will help to increase revenues (or savings) through developing information on the best technologies / systems for local conditions, and providing data on site-specific solar irradiation levels.				
3	Enactment of new and revised energy legislation and regulations is delayed	During PIF Formulation	Regulatory	Operations of grid-connected auto-producers and signing of PPAs postponed I = 4 P = 2	Working in partnership with the EU-funded Seychelles Climate Change Support Partnership, the project preparation team has ensured that a new draft Energy Act (which will authorize grid-connected auto-producers and PPAs; establish the SEC as an independent electricity regulator; and authorize a new grid code to enable grid-connected RETs) will be submitted to the National Assembly before this project even commences. In addition, these two projects will maintain momentum with key government	Project Steering Committee + Seychelles Energy Commission		N/A	N/A

#	Description	Date Identified	Type	Impact & Probability 1 (low); 5 (high)	Countermeasures / Management Response	Owner	Submitted, Updated by	Last Update	Status
					agencies (Seychelles Energy Commission; Ministry of Finance; Ministry of Home Affairs, Environment, Transport, and Energy) to champion new energy regulation.				
4	Lack of inter-institutional ownership and cooperation in implementing the project activities	During Project Formulation	Political & Organizational	Institutional opposition delays/limits new legislation, policies and demonstration PV systems I = 2 P = 2	Establishment of a viable model for grid-connected independent power production may be perceived as a threat by the existing power production monopoly (PUC). The project will continue to work with PUC leadership to make clear the potential benefits to PUC of grid-connected RETs (including their own installation of RETs, as well as opportunities to become the major player in installing, operating, and servicing RETs owned by auto-producers), and with key government policymakers to ensure that legislation and policies mandate on-going cooperation between PUC and auto-producers	Project Steering Committee		N/A	N/A
5	PV system operators do not participate as promised due to concerns about Government commitment, pricing, and/or technical challenges	During Project Formulation	Organizational	Demonstration PV systems do not meet targets for total installed capacity I = 2 P = 2	The project anticipates that regulations authorizing grid-connected auto-producers and the formulation of Installation Agreements will take place during the first year of the project, which together with Ministry of Finance commitments to financial incentives, will reassure PV system operators that their systems will be integrated into the electricity grid and that pricing will be competitive and transparent. In addition, the project team will work with PUC to sort out all technical issues related to grid-connection in the early months of the project, and to encourage PUC to assist with installations and/or to train 3rd party technicians to carry out installations	Project Steering Committee + Seychelles Energy Commission		N/A	N/A
6	Human resources are slow in being hired and/or insufficiently trained to successfully implement the project	During Project Formulation	Operational	Project is implemented too slowly and / or without meeting key objectives I = 4 P = 2	The project will seek qualified technical personnel from throughout the Indian Ocean region, and if necessary, will recruit internationally for a Solar PV Technical Expert. In addition, as part of the UNDP-GEF Programme Coordination Unit in the Seychelles, the project will benefit from well-established and efficient recruitment processes. The project also will establish partnerships with recognized international entities and/or individual experts with proven track records of successfully supporting similar actions in other countries.	Project Steering Committee		N/A	N/A
7	Public Utilities Corporation may limit the amount of	During Project Formulation	Regulatory	Project cannot install as much capacity as projected	The project will work closely with PUC to resolve any technical concerns regarding grid-connected PV and overall grid stability so that PUC fully understands the compatibility of PV systems with electricity grids as demonstrated throughout the world, and so that	Seychelles Energy Commission		N/A	

#	Description	Date Identified	Type	Impact & Probability 1 (low); 5 (high)	Countermeasures / Management Response	Owner	Submitted, Updated by	Last Update	Status
	grid-connected PV to 2% of grid-connected electricity production (i.e. 880 kWp of the 44 mWp capacity)			(approx. 1.3 mWp), and replication (grid-connected) is not possible I = 2 P = 2	PUC can abide by stated government policy to greatly increase grid-connected RETs in the country				

Annex 2: Agreements

Signed Letters of Co-Financing (separate documents)

1. Seychelles Energy Commission (SEC)
2. Public Utilities Corporation (PUC)
3. Seychelles Department of Environment
4. Seychelles Ministry of Finance
5. International Atomic Energy Agency
6. European Investment Bank (EIB)
7. Indian Ocean Tuna Company (potential auto-producer)
8. VetiverTech (Mr. Josepth Tirant – potential auto-producer)
9. Seychelles Islands Foundation (SIF)
10. United Nations Development Programme – Mauritius and Seychelles
11. Independent Schools Ltd (potential auto-producer)

Annex 3: Terms of Reference

1. Project Manager

I. Summary Information	
Post title:	Project Manager
Office:	UNDP-GEF Programme Coordination Unit
Duration of Employment:	One year with possibility of extension (up to four years)

II. Overview

The project manager will be selected jointly by the executing agency and UNDP, in consultation with the UNDP/GEF Regional Technical Adviser from the UNDP/GEF Regional Co-ordination Unit in Pretoria, through an open and competitive process. The Project Manager's prime responsibility is to ensure that the project produces the results specified in the project document, to the required standard of quality and within the specified constraints of time and cost. As such, the PM will be responsible for the overall management of the project, including the mobilization of all project inputs; supervision over project staff, consultants and sub-contractors; and acting as a liaison with the Government, UNDP, private sector partners and other stakeholders, and maintaining close collaboration with any donor agencies providing co-financing. The PM will report to the Project Steering Committee (PSC) on overall progress of project activities. For on-going administrative and reporting functions, the PM will be responsible to the CEO of the Seychelles Energy Commission and to the National Programme Coordinator of the UNDP-GEF Programme Coordination Unit (PCU). The Project will be based at the offices of the PCU in Victoria, Seychelles, and the PM will benefit from the services of the Administrative Assistant and the Finance Manager based at the PCU offices. The project manager also will be supported by an international Technical Adviser, as well by national and international experts taking the lead in the implementation of the specific technical assistance components of the project. These services, either of individual consultants or under sub-contacts with consulting companies, will be procured in accordance with applicable UNDP/GEF guidelines.

II. Duties & Responsibilities

- Supervise and coordinate the production of project outputs, as per the project document;
- Mobilize all project inputs in accordance with procedures for nationally implemented projects;
- Lead the preparation of consultants' and sub-contractors' terms of reference, identification and selection of national and international sub-contractors/consultants, cost estimation, time scheduling, contracting, and reporting on project activities and budget, and supervise and coordinate the work of all consultants and sub-contractors;
- In close liaison with the implementing partners, prepare and revise project work and financial plans;
- Liaise with relevant government agencies, private partners, and all other partners for effective coordination of all project activities;
- Oversee and ensure timely submission of the Inception Report, Combined Project Implementation Review/Annual Project Report (PIR/APR), technical reports, quarterly financial reports, and other reports as may be required by UNDP, GEF, and other oversight agencies;
- Disseminate project reports and respond to queries from stakeholders;
- Report progress of project to the PSC, and ensure the fulfilment of PSC directives.
- Oversee the exchange and sharing of experiences and lessons learned with relevant projects nationally and internationally;
- Ensure the timely and effective implementation of all components of the project;
- Assist relevant government agencies and implementing partners with development of essential skills through training workshops and on the job training, thereby upgrading their institutional capabilities;
- Carry out regular, announced and unannounced inspections of all sites and activities.
- Undertake other management duties that contribute to the effective implementation of the project.

III. Qualifications and Experience

Education:	• Master's degree or equivalent in engineering, economics, international development, social sciences, public administration or other relevant field.
Experience:	• Minimum of 5 years of experience in the utility/energy field. • Experience in project management • Proven ability to draft, edit and produce written proposals and results-focussed reports. • Strong presentation and reporting skills; • Ability to administer budgets, train and work effectively with counterpart staff at all levels and with all groups involved in the project; • Proven experience working with Government, private sector, civil society, international organizations or donors in combination with the knowledge of economic and financial analysis, institutional, regulatory and policy frameworks. • Good knowledge of climate change and renewable energy issues • Prior knowledge and experience of the political, social and environmental factors and issues related to energy development and climate change mitigation in island countries; • Knowledge of and experience with operational modalities and procedures of UNDP and/or GEF • Experience in the use of computers and office software packages (MS Word, Excel, etc.)
Language Requirements:	• Excellent English, both written and oral

2. Solar PV Technical Expert

I. Summary Information	
Post title: Office: Organisation: Duration of Employment:	Solar Photovoltaic Technical Expert Home Independent 15 weeks over 3 years (7 in year 1; 4 each in years 2 and 3) (TBC pending additional discussions with SEC)
II. Overview	
The Solar Photovoltaic Technical Expert (SPTE) will be internationally recruited, based on an open competitive process. The SPTE will report to the Project Manager and to the CEO of the Seychelles Energy Commission. The SPTE will work from his/her home country, and at the offices of the SEC when in the Seychelles (5 weeks in year 1; 2 weeks each in years 2 and 3). The SPTE will be responsible for overseeing data collection, data analysis, and development and use of modelling software related to national energy planning and national energy resource assessment (Output 1.1), and the national solar irradiation map (Output 1.2).	
II. Duties & Responsibilities	
TBD pending discussions with SEC	
III. Qualifications and Experience	
Education:	TBD
Experience:	TBD
Language Requirements:	• Excellent English, both written and oral

Annex 4: GEF Climate Change Mitigation Tracking Tool

See separate document

Annex 5: Project Implementation Schedule

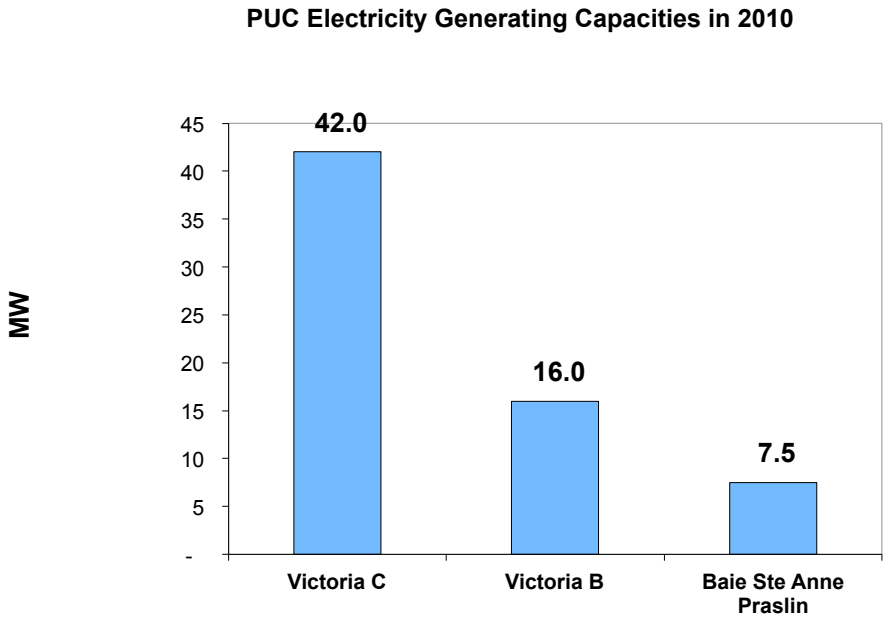
Outputs	2012			2013				2014				2015				2016	Lead Responsibility for Implementation
	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	
Component 1: Improved policy, institutional, legal/regulatory and financial framework for Renewable Energy Technologies																	
1.1 – National Energy Planning and Energy Resource Assessment																	Intl Tech. Consultant & Local Consultants (oversight) with SEC (data collection)
1.2 – National Solar Irradiation Map																	Intl. Tech. Consultant + SEC
1.3 – National Energy Policy																	Intl. Consultant and Dept. of Energy
1.4 – Regulations and secondary legislation in support of a new Energy Act																	Intl. & Local consultants
1.5 – Revised PUC Act																	Intl. & Local consultants
1.6 – Establishment and Operation of Independent Electricity Regulator																	National Consultant & SEC
1.7 – Financial Mechanisms to support Purchase/Operation of Solar PV Systems																	Intl. Consultants (Lawyer and Economist)
1.8 – Education and awareness campaigns promoting the benefits of RETs																	SEC; NGOs, private companies
Component 2: Strengthening of the technology support and delivery system for Renewable Energy Technologies																	
2.1 – Capacity Needs Assessment & Strategy																	Local Consultant
2.2 – Outreach on Policy/Economic Issues																	SEC
2.3 – Training Program on Technical Issues																	SIT and/or Intl. Contractor
2.4 – Training Program on Financial Issues																	SEC
2.5 – Training Program to support Market Development																	Intl. Consultant and/or local business associations
2.6 – Partnership and Information Sharing Platforms																	SEC, Project Manager

Outputs	2012			2013				2014				2015				2016	Lead Responsibility for Implementation
	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	
Component 3: Solar Photovoltaic demonstration projects																	
3.1 – Technical Report on Grid Capacity and Requirements																	PUC + Intl. Consultant
3.2 – Grid Strengthening																	Project Manager
3.3 – Install Test PV System with PUC																	PUC
3.4 – Purchase Strategy for PV Systems																	Project Manager + Local Consultant
3.5 – Selection of Project Demonstration Partners																	Project Manager + SEC
3.6 – Feasibility Analyses for Project Demonstration Sites																	Intl. Tech. Consultant + SEC
3.7 – Installation & Financing Agreements with Demonstration Site Partners																	SEC
3.8 - Install Demonstration PV systems																	PUC, Private Partners
3.9 - Operational Monitoring of PV Systems																	SEC

Annex 6: Analysis of Greenhouse Gas Emission Reductions

1. Generation and Distribution of Electricity

The Public Utilities Corporation (PUC) is the sole producer and distributor of public electricity in Seychelles, operating two power stations on Mahe and one on Praslin. The total generating capacity of PUC is 66 MW. The figure below shows the capacities of the three power stations, Victoria C, Victoria B and Baie Sainte Anne Praslin.



2. Emissions of carbon dioxide (CO_2) from Public Electricity Generation in the Seychelles

CO_2 emissions from electricity generation are related to the amount of fuel consumed in power stations. Emissions are estimated using the IPCC method. The Carbon Emission Factor will be determined using the formula below for different type of fuel (HFO, LFO) and lubricating oil (Lub oil) consumed in power stations

2.1 Establishing the Carbon Emission Factor (EF) for CO_2 (tCO2/TJ)

$$EF = CEF \times (1 - FCS) \times FCO \times 44/12$$

Where

EF (t CO2/TJ)	: Carbon Emission Factor of fuel used
FCS	: Percentage of carbon stored for fuel used (0%)
FCO	: Fraction of Carbon Oxidised (99%)
44/12	: Ratio of molecular weight of Carbon Dioxide (CO_2) and Carbon(C)

The data presented in the table below have been used to calculate the Carbon Dioxide Emission Factor for the consumption of HFO, LFO and LubOil:

	Unit	HFO	LFO	LubOil

Fraction of Carbon Stored (FCS)	-	0	0	0.5
Fraction of Carbon Oxidised (FCO)	-	0.99	0.99	0.99
Carbon Emission Factor (CEF)	t C/TJ	21.1	20.2	20.0
Carbon Dioxide Emission Factor (EF)	t_{CO2}/TJ	76.593	73.326	36.30

Source: National Greenhouse Gas Mitigation Report, 2nd National Communication on Climate Change (2008)

- Carbon Dioxide Emission Factor for HFO = 21.1 x (1-0) x 0.99 x 44/12 = 76.593
- Carbon Dioxide Emission Factor for LFO = 20.2 x (1-0) x 0.99 x 44/12 = 73.326
- Carbon Dioxide Emission Factor for Lub Oil = 20.0 x (1-0.5) x 0.99 x 44/12 = 36.30

2.2 Overall Carbon Dioxide Emissions in Seychelles

Using the above Carbon Dioxide Emission factors, actual Carbon Dioxide emissions are then calculated using the formula below for each type fuel and lubricating oil consumed in power stations:

CO_2 Emissions = M x NCV x CEF

Where

CO_2 emissions (t) : Amount of Carbon dioxide emitted in metric tonne
M (t) : Amount of fuel consumed in metric tonne
NCV (TJ/1000 t) : Net Calorific Value of fuel in TeraJoule/ kilotonne of fuel
CEF (t CO_2/TJ) : Carbon Emission Factor for CO_2 in tonne of CO_2 per TetraJoule

The Net Calorific Values are given below:

Source: National Greenhouse Gas Mitigation Report, 2nd National Communication on Climate Change (2008)

Thus, for example, total CO_2 Emissions from public electricity generation in the Seychelles in 2009 can be calculated as:

- CO_2 Emissions for HFO = 51,028 x 40.19 x 76.593 = 157,078 t
- CO_2 Emissions for LFO =10,227 x 43.33 x 73.326 = 32,493 t
- CO_2 Emissions for Lub Oil = 272 x 40.19 x 36.30 = 397 t
- **Total CO_2 Emissions for all fuels = 189,968 t**

	Unit	HFO	LFO	LubOil
Net Calorific Value (NCV)	TJ/1000 t	40.19	43.33	40.19

The Table below shows a detailed accounting of carbon dioxide emissions from the PUC power stations on Mahe and Praslin from 2000 to 2009 based on the company's electricity generation statistics and the formula shown above for CO_2 Emissions:

	Fuel and Lub Consumption in MT			CO_2 Emissions in tonnes			
Year	**HFO**	**LFO**	**Lub Oil**	**CO_{2HFO}**	**CO_{2LFO}**	**$CO_{2LubeOil}$**	**Total CO_2**
2000	27,467	15,279	221	84,552	48,546	321	133,419
2001	37,299	6,572	132	114,816	20,882	191	135,889
2002	39,555	7,961	203	121,763	25,292	294	147,349
2003	38,602	10,779	187	118,829	34,246	272	153,347
2004	40,554	9,827	220	124,837	31,222	319	156,378

2005	37,406	14,409	268	115,145	45,782	390	161,316
2006	46,735	10,120	182	143,862	32,152	265	176,280
2007	49,463	10,875	214	152,259	34,552	312	187,123
2008	49,236	9,636	249	151,562	30,616	363	182,541
2009	51,028	10,227	272	157,078	32,493	397	189,968

2.3 Carbon Dioxide Emissions per MWh in the Seychelles

Carbon Dioxide Emissions per kWh generated by PUC power stations can be calculated using the formula below:

Carbon Dioxide Emissions (tCO_2/MWh) = Total CO2 Emissions (t) / Total Electricity Generated (MWh)

For example, in 2009:
Carbon Dioxide Emissions (tCO_2/MWh) = 189,968 / 275,707.803 = **0. 689 tCO_2/MWh**

The table below shows the Carbon Dioxide Emissions per kWh for PUC power stations for the period 2000-2009:

Estimation of Carbon Dioxide Emissions from PUC power stations from 2000 to 2009

Year	Total CO_2Emission	Total Electricity Generated	Carbon Dioxide Emission
	t	MWh	t CO_2/MWh
2000	133,419	189,457.725	0.704
2001	135,889	201,169.178	0.675
2002	147,349	218,785.281	0.673
2003	153,347	223,783.829	0.685
2004	156,378	225,986.864	0.692
2005	161,316	232,985.210	0.692
2006	176,280	251,938.337	0.699
2007	187,123	270,583.843	0.691
2008	182,541	267,744.088	0.682
2009	189,968	275,707.803	0.689

Thus, by taking the overall emissions from 2000-2009, and the overall electricity generated during that same period, the Average Carbon Dioxide Emission for PUC for the period from 2000 to 2009 can be calculated as 0.688 tCO_2/MWh. (Note: The Greenhouse Gas Mitigation Report in the Seychelles 2nd National Communication on Climate Change shows a figure is figure of 0.698 tCO_2/kWh for the years 2000-2007; however this is inaccurate (presumably due to a mathematical error) as it uses the same data as the table above; the accurate number for that period is 0.689 tCO_2/kWh, slightly higher than the current figure due to the figures for 2008 and 2009.

3. Quantification of Direct Benefits: Comparing the emissions of the current energy supply with that of PV

3.1 Project Parameters

The Yearly Energy Production of a PV system is FLH x kWp.

The Installed Capacity (kWp) of the PV demonstration systems in the project is estimated at 1,305 kWp.

The Theoretical Annual Full Load Hours (FLH) for PV system in Seychelles is 1754 (kWh) (source: UNDP Energy Policy report 2010). However, based on measurements done at the test facility at PUC in 2008-2009, an average of 1300 full load hours could be expected under reasonably favourable local conditions with minimum shade (this is the average efficiency assumption we used for the project)

Therefore the yearly energy production of the project PV systems is 1,305 kWp X 1,300 = 1,696 MWh

3.2 Calculation of the Annual Amount of CO2 avoided

If the amount of electrical energy produced by the PV were to be produced by the existing PUC electricity generation system, the CO_2 emissions generated would be calculated using the formula below:

Average Carbon Dioxide Emissions: tCO_2MWh x FLH x KWp /1000 = Amount tCO_2/yr

For the proposed PV systems, using average emissions from 2000-2009, the following results are realized:

Annual CO2 Emission Reduction = (0.688x1300x1305) / 1000 = **1,167.14 tCO_2/yr**

3.3 Direct Project Emission Reductions

The GEF guidelines for calculating the lifetime CO2 emission savings of technology / measures implemented during the project period (as direct action of the GEF project) are as follows:

CO2 direct = $e * l * c$

Where

- e = annual energy savings in the last year of the project period [in t / MWh]
- l = average useful lifetime of equipment in years
- c = CO_2 intensity of the marginal technology [in t CO2/ t fuel or MWh]

Using this calculation, and assuming an expected lifetime of 20 years for the PV systems, the total direct CO2 Emission reduction will be 1,696 x 20 X 0.688 = **23,343 tCo2**

3.4 Direct Post-project Emission Reductions

N/A

4. Quantification of Indirect benefits: Estimate medium to long-term replication of PV systems installed by project

Indirect benefits in terms of emissions reductions can be estimated using both a top down and a bottom up approach.

4.1 Bottom-Up Approach

The GEF guidelines for calculating GHG emissions saved with investments after the project period, using the bottom-up approach, are as follows:

$CO_{2\ indirect\ BU} = CO_{2\ direct} * RF$

Where

- $CO_{2\ direct}$ = estimate for direct & direct post-project emission reductions
- RF = replication factor, i.e., how often the project's investments are repeated during the 10 years after project implementation

Using the bottom up approach, and assuming a replication factor of 3 (project type: demonstration with capacity building), the additional total indirect CO2 emissions reduced (with investments after the project period) as a result of the project can be estimated at: 23,343 x 3= **70,028 tCO2**

4.2 Top-Down Approach

The GEF guidelines for calculating maximum achievable indirect GHG emissions as assessed by the top-down methodology are as follows:

$CO_{2\ indirect}\ TD = P10 * CF$

Where

- P10 = Technical and economic potential GHG savings with the respective application within 10 years after the project
- CF = GEF causality factor

The Government of Seychelles has discussed a target of 5% of national energy production from PV systems. One of the main expected outcomes of this project is to support an energy policy that sets specific targets for renewable energy as a percentage of national energy production, and to promote the introduction of PV systems as the best technology option to meet such targets.

Reaching this target of 5% of national energy production from Solar PV systems is likely to take a number of years, although it will be facilitated by project activities in capacity building, alleviation of market barriers, changing of policies, establishing standards, and financing mechanisms.

The table below, based on an overall electricity production of 275,708,000 KWh in 2009, and using estimates of an annual growth of 3% of the production of electricity, with a displacement by Solar PV systems increasing by 0.5% / year over 10 years, calculates the expected total CO2 emission reduction using the formula: Annual CO2 emission reduction = Energy production (MWh/yr) x Average Carbon Dioxide Emission (tCO2 / MWh)

Year	**Annual Electricity Production MWh** (Annual growth 3%)	**% of production from PV Systems** (Annual growth 0.5%)	**Production from PV Systems (MWh)**	**Avg. CO2 Emission (tCO2 / MWh)**	**tCO2 Avoided**
2012	301,274				
2013	310,312				
2014	319,621				
2015	329,210				

2016	339,086	0.5	1,695	0.688	1,166
2017	349,259	1.0	3,492	0.688	2,402
2018	359,736	1.5	5,396	0.688	3,712
2019	370,528	2.0	7,410	0.688	5,098
2020	381,644	2.5	9,541	0.688	6,564
2021	393,094	3.0	11,792	0.688	8,113
2022	404,886	3.5	14,171	0.688	9,750
2023	417,033	4.0	16,681	0.688	11,477
2024	429,544	4.5	19,329	0.688	13,298
2025	442,430	5.0	22,121	0.688	15,219
Total			**111,628**		**76,799**

By the 10th year after the end of the project, the indirect GHG savings will be 15,219 per year. The GEF causality factor selected is 80% based on GEF definition: "The GEF contribution is dominant, but some of this reduction can be attributed to changes in the baseline."

Thus, the total indirect emissions reductions equal the annual amount in year 10 x the average useful lifetime of the equipment (in years) x the GEF causality factor: 15,219 x 20 x 0.80 = **243,504 tCo2**

5. Summary of Emission Reductions & Cost Effectiveness

The summary table below presents the CO2 Emission Reduction that may result from the project, and the cost effectiveness of the emissions reduction impacts of the project.

Project GHG emission reduction impacts

Time-frame	Direct: Project (20-year equipment life)	Direct: Post-Project	Indirect – Bottom Up: Post-project with replication (GEF Replication Factor of 3)	Indirect – Top Down: (GEF Causality Factor of 80%)
Installed PV (MW)	1.305	TBD	3.915	1.3 – 17.01
Total CO_2 emissions reduced (tons)	23,343	TBD	70,028	243,504
CO_2 emissions reduced (tons) per GEF $ (GEF Budget of $1,160,000)	$49.69	TBD	$16.56	$4.76

Annex 7: Pricing for Solar PV Systems in Seychelles

Assumption Regarding Purchase of PV Systems for Project: The Public Utilities Corporation has confirmed that either Crystalline and Amorphous PV systems (or a combined technology system) are appropriate for use in the Seychelles. Most potential auto-producers consulted have expressed a preference for purchase of crystalline systems.

1. Prices for Systems Previously Installed in the Seychelles

Two PV systems have been purchased and installed in the Seychelles in the past two years.

One of these systems was purchased in September 2010 from the German company Sea & Sun Technology GmbH. The details on this system are as follows:

- Total System Size: 3.4 kWp
- Total Cost: Euro 10,172
- Cost per kWp (CIF): US$4.19 per Wp (assumes exchange rate of 1 Euro = 1.40 US$)
  - Panels: Euro 7,100 (US$2.92 per Wp)
  - Inverters: Euro 1,384 (US$0.57 per Wp)
  - Mounting Systems: 277.20 (US$0.11 per Wp)
  - Transport / Insurance: 1,410 (US$0.58 per Wp)
- Installation Cost: US$0.23 per Wp (total cost was Seychelles Rupees 9,320; assumes exchange rate of 1 US$ = SR 12.2)
- Total **Cost for Installed System: US$4.42 per Wp**

The second system was a 10.8 kWp system purchased from a British company in late 2010. This system cost 22,000 Euros (CIF), which equals 2.04 Euros or US$2.85 per Wp. Assuming that installation costs were similar to that for the first system (US$0.23 per Wp), the **total cost for the installed system was US$3.08 per Wp.**

2. Global PV Market Prices

In researching general global market prices for Solar PV Systems, two websites were consulted: www.civicsolar.com and www.solarbuzz.com. The Civicsolar is an actual purchasing site for solar PV technology from numerous manufacturers. The Solarbuzz site is an industry information resource, and among other things tracks solar PV technology prices globally.

Analysis of prices on Civicsolar (as of October 2011) showed the following:

- Polycrystalline Panels: Average price of approximately US$2.00 per Wp
- Inverters: Average price of approximately US$0.60 per Wp

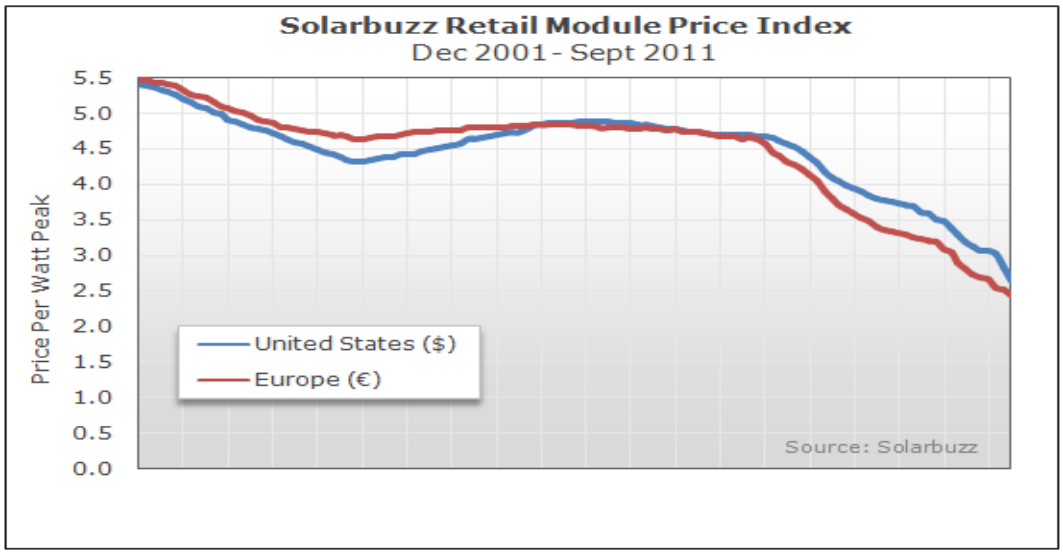
Solarbuzz tracks thousands of online retail prices for the primary components of a solar energy system including solar modules, batteries, inverters and charge controller. Updated monthly, these indices provide a guide to overall price movement. A comprehensive list of suppliers is available at http://www.solarbuzz.com/industry-news/directory. Table 1 shows purchase prices for the main components of Solar PV systems from late 2010 to late 2011. Although inverter prices have barely changed, solar panels (modules) have decreased by 27% during this period.

Table 1: Global Solar PV System Prices (Sept. 2010 – Sept. 2011)

	Unit	Sep 10	Nov 10	Jan 11	Mar 11	May 11	Jul 11	Sep 11
Module	US$/Wp (≥125 W)	$3.61	$3.51	$3.38	$3.19	$3.11	$3.02	$2.65
	Euro€/Wp (≥125 W)	€3.23	€3.19	€3.05	€2.80	€2.69	€2.54	€2.43
Inverter	US$/Continuous Watt	$0.715	$0.715	$0.715	$0.715	$0.715	$0.715	$0.714
	Euro €/Continuous Watt	€0.558	€0.508	€0.537	€0.515	€0.479	€0.500	€0.500

Source: http://www.solarbuzz.com/facts-and-figures/retail-price-environment

The graph below shows the Retail Module Price Index for a longer period (2001-2011) based upon the purchase of a single solar module (exclusive of sales taxes). This graph shows a clear and significant downward trend in the cost of Solar PV Modules during the past ten years.



Source: Solarbuzz

Solarbuzz Retail Price Index Methodology

- The majority (about 80%) of the companies surveyed are based in the United States, but most market globally. European dealers are the second largest surveyed group.
- Discounts are typically available for larger commercial customers, such as utilities and large OEMs. Therefore typical discounting has been taken into account in the solar electricity system indices, but not in the product pricing data.
- Product pricing: The module survey is weighted to take account of the fact that the majority of market demand occurs in the high power (>125 MW) module segment.
- Solar electricity pricing:
    - The index calculation includes a number of elements. Pricing covers the solar module and the other major components, other electrical components, assembly and installation costs, transportation and on-going maintenance.
    - System output is also a factor, including the system size in Watt peak, the life of the system and kilowatt hours generated.
- Assumptions include:
    - Financing charges of 5% on the purchase of the system
    - Impact of sunlight conditions

- The index is based on retail prices for system components but includes typical discounting for commercial and industrial system sizes.
- Tax is excluded
- Local government or utility incentives or subsidies are excluded

3. Overall Analysis based on Systems in Seychelles and Global Markets

Pricing data (in US$ per Wp) from the various sources listed above varies considerably:

Source	Date	Panels (poly-crystalline)	Inverters
3.4 kWp system installed in the Seychelles	Sept. 2010	2.92	0.57
10.8 kWp system installed in the Seychelles	Late 2010	3.08	
Civicsolar (actual retail prices)	Oct. 2011	2.00	0.60
Solarbuzz (global price averages)	Oct. 2011	2.65	0.71

Several factors should explain most or all of the discrepancy in pricing of panels. With regard to the system purchased in September 2010, it likely shows the highest price for the simple reason that since the time of that purchase, global average prices for panels have decreased by 27% (as noted previously); applied to the price of $2.92 in Sept. 2010, this would imply a current price of $2.13. In addition, this system was purchased from a German company whose prices are above those of most manufacturers in countries such as China, Korea and India (this was confirmed by the purchaser of this system). With regard to the Solarbuzz price, this price includes a 5% financing charge, which is not relevant to this analysis (financing is accounted for separately in our analysis). In addition, Solarbuzz shows average global prices, but these averages include numerous very high-end systems. This project does not intend to install state of the art technology, and it is reasonable to assume that purchases will be made from one of the many competitive manufacturers/suppliers who offer panels (and inverters) at prices well below the global average.

Thus, we believe that an assumption of US$2.00 per Wp for panels is not only reasonable but in fact is a conservative estimate, given that solar panels will likely to continue to decline in price between now and the time of the first purchases by project partners (expected in early 2013). Using that figure, we can estimate overall costs as follows:

Budget for PV System (per Wp): Breakdown of Costs

Breakdown of Budget Costs	Per Watt	Budget Notes
Capital Equipment Costs		
PV Panels (modules)	$2.00	Based on previous purchases and market conditions
Inverters	$0.60	Based on previous purchases and market conditions
Mounting Structure; Metering; Cabling; Transformer; etc.	$0.11	Assumes same price paid for 3.4 kWp system
Shipping, Insurance + Port Fees	$0.58	Assumes same price paid for 3.4 kWp system
Capital Equipment sub-total	**$3.29**	
Installation Costs		
Installation Labor	$0.23	Assumes same price paid for 3.4 kWp system
Design/Engineering	$0	Paid for with project funds
Project Mngmt. / Admin / Legal	$0	Paid for with project funds
Installation sub-total	**$0.23**	

Total CAPEX	**$3.52**	
Operation & Maintenance costs	$0.20	Based on PUC estimates
Re-equipment	$0.60	Assumes replacement of after 10-15 years
Total OPEX (over 20 years)	**$0.80**	
TOTAL (CAPEX + OPEX)	**$4.32**	

Capital Equipment as percentage of Overall Costs	76.16%
Installation as percentage of Overall Costs	5.32%
OPEX as percentage of Overall Costs	18.52%

Annex 8: Electricity Production Costs in Seychelles: Fossil Fuels and Renewable Energy Technologies

1. Electricity production costs at the Public Utilities Corporation (Seychelles)

The Assets of the Public Utilities Corporation have been totally funded by the Government of Seychelles (Source: UNDP Energy Policy Report, p.101). The summary of the electricity production of three power stations of PUC in 2009 is indicated in the table below:

Table 1: PUC Energy production - 2009

	Total	Mahe	Praslin
Units produced KWh	275,707,803	244,020,874	31,686,929
Units sent out KWh	264,934,900	234,087,531	30,847,369
Units sold KWh	238,690,000	211,796,000	26,894,000

Source PUC

Notes on Table 1:

- Units Produced = Energy coming out of PUC generators
- Units Sent Out = Units Produced less usage at the power station itself (including water pumping)
- Units Sold = Units Sent Out minus losses in transmission and distribution.

Table 2: PUC Costs of Production - 2009

	Mahe SR	Praslin SR
Direct costs of production		
Fuel and lubricant expenses	425,798,232	59,176,521
Materials, Equipment + Maintenance Expenses	111,485	1,718
Establishment Expenses	671,675	25,613
Transport Expenses	581,027	3,913
Employee Expenses	6,699,978	1,793,002
Admin Expenses	308,104	11,822
Depreciation charge	12,645,778	894,593
Interest and Loan	15,551,868	0
Total Direct Costs of Production (A)	**462,368,147**	**61,907,182**
Costs of maintenance		
Materials, Equipment + maintenance expenses	19,656,787	4,429,019
Establishment expenses	393,446	560,666
Transport expenses	175,609	100,303
Employee expenses	4,271,360	1,086,525
Administration Expenses	91,751	130,934
Depreciation	47,762	715,207
Total Cost of maintenance (B)	**24,636,715**	**7,022,653**
Total Costs of production (A+B)	**487,004,862**	**68,929,835**

Source PUC 2009 Profit & Loss Statement

Notes on Table 2:

- Depreciation Charge: Based on all PUC capital costs, including generators, buildings, power lines, etc. Although PUC shows depreciation costs on its balance sheet, the actual capital costs are paid by the Ministry of Finance, which is not reimbursed by PUC.
- Interest and Loan: This represents payments for various loans taken by PUC, but is not related to capital costs.

1.1 General Notes on PUC Electricity Production Costs

Existing Conditions

- PUC does not pay its own capital costs; funds for capital come from the Government of Seychelles. Despite this, PUC has incurred significant losses in every year since 2005. (Source UNDP Energy Report, Page 100)
- The price that PUC pays for fuel is not hedged; it is based on the market price paid by SEYPEC for every shipment that is delivered to PUC.
- According PUC's 2009 expense documents, it appears that PUC paid on average a price for fuel that would equal approximately US$55 per barrel of oil. During the first 7 months of 2011, the price for a barrel of oil on world markets averaged around US$105. PUC has confirmed that it is reasonable to estimate that the price it pays for fuel in April 2011 is about double the price it paid in 2009.

Projected Future Conditions

- PUC charges the same price for electricity on the islands of Praslin / La Digue as it does on the island of Mahe, even though the production costs are significantly different at the Mahe and Praslin power plants (due primarily to the increased costs to ship fuel to the Praslin plant, and the fact that the Praslin plant uses only diesel fuel, which is more expensive than the heavy fuel oil used at the Mahe plants). PUC does expect energy production costs on Praslin to come down in the next few years as that power plant switches to using heavy fuel oil.
- PUC has been authorized by the Government of Seychelles to establish a new tariff structure in late 2011. This will allow PUC, for the first time, to adjust prices to consumers based on adjustments in their fuel purchase prices.
- PUC expects that in the near future (2012 onward?), the Government of Seychelles will no longer subsidize its capital costs, and PUC will have to cover all capital costs from its own resources.

1.2 PUC Costs of Electricity Produced and Sold - Based on average 2009 fuel prices (figures in Seychelles Rupees, taken from Table 2)

1.2.1 Mahe Island

Capital Costs

- Annual Capital costs: 12,645,778 (based on depreciation cost)
- Annual production of electricity in 2009: 244,020,874kWh
- **Capital costs of electricity per kWh produced** during that period can be estimated at: 12,645,778 / 244,020,874 = **0.05 SR/kWh**

Operations and Maintenance Costs (including fuel costs)

- Operation & Maintenance costs: 487,004,862 - 12,645,778 = 474,359,084
- Annual production of electricity in 2009: 244,020,874kWh
- **Operations & Maintenance cost per kWh produced** during that period can be estimated at: 474,359,084 / 244,020,874 = **1.94 SR/kWh,** of which fuel costs represented 425,798,232 / 244,020,874 = **1.74 SR/kWh**

Cost of Electricity Produced

- Total Expenses of the Electricity Division: 487,004,862
- Annual Production of electricity in 2009: 244,020,874 kWh

- **Total cost of production of electricity per kWh** during that period can be estimated at: 487,004,862 / 244,020,874 = **1.99 SR/kWh**

Cost of Electricity Sold

- During 2009, the total electricity sold was 211,796,000 kWh.
- The **capital costs of electricity sold** per kWh for that period can be estimated at: 12,645,778/211,796,000 =**0.06 SR/kWh.**
- **The operations and maintenance costs of the electricity sold per kWh is:** 474,389,084 / 211,796,000 = **2.24 SR/kWh** of which fuel costs represented: 425,798,232 / 211,796,000 **= 2.01SR/kWh**
- **Total cost of the electricity sold per kWh** for that period can be estimated at: 487,004,862 / 211,796,000 = **2.3SR/kWh**

1.2.2 Praslin Island

Capital Costs

- Annual Capital costs: 894,593 (based on depreciation cost)
- Annual production of electricity in 2009: 31,686,929kWh
- **Capital costs of electricity per kWh produced** during that period can be estimated at: 894,593 / 31,686,929 = **0.028 SR/kWh**

Operations and Maintenance Costs (including fuel costs)

- Operation & Maintenance costs: 68,929,835 - 894,593 = 68,035,242
- Annual production of electricity in 2009: 31,686,929kWh
- **Operations & Maintenance cost per kWh produced** during that period can be estimated at: 68,035,242 / 31,686,929 = **2.147 SR/kWh** of which fuels costs represented 59,176,521/31,686,929=**1.87SR/kWh**

Cost of Electricity Produced

- Total Expenses of the Electricity Division: 68,929,835 SR
- Annual Production of electricity in 2009: 31,686,929 kWh.
- **Total cost of production of electricity per kWh** during that period can be estimated at: 68,929,835 / 31,686,929 = **2.175 SR/kWh**

Cost of Electricity Sold

- During 2009, the total electricity sold was 211,796,000 kWh.
- **Capital costs of electricity sold** per kWh for that period can be estimated at: 12,645,778/211,796,000 =**0.06 SR/kWh.**
- **Operations and maintenance costs of the electricity sold per kWh is:** 474,389,084 / 211,796,000 = **2.24 SR/kWh** of which fuel costs represented: 425,798,232 / 211,796,000 **= 2.01SR/kWh**
- **Total cost of the electricity sold per kWh** for that period can be estimated at: 487,004,862 / 211,796,000 = **2.3SR/kWh**

Cost of Electricity Sold

- During 2009, the total electricity sold was 26,894,000 kWh.
- **Capital costs of electricity sold** per kWh for that period can be estimated at: 894,593 / 26,894,000 = **0.03 SR/kWh**
- **Operations and maintenance costs of the electricity sold per kWh is:**

68,035,242 / 26,894,000 = **2.53 SR/kWh** of which fuel cost represents:
59,176,521 / 26,894,000 = **2.20SR/kWh**

- **Total cost of the electricity sold** per kWh for that period can be estimated at:
  68,929,835/26,894,000 = **2.56 SR/kWh**

1.3 PUC Costs of Electricity Produced and Sold - Based on average 2011 fuel prices (figures in Seychelles Rupees)

In 2009, the average price of oil on the international market was 53.48 USD per barrel. In the first 7 months of 2011, the average price of oil was 105.32 USD per barrel. This represents an increase of price of 96.93%.

Using today's fuel price, and assuming that all other costs have not changed since 2009; PUC costs would be as follows:

1.3.1 Mahe Island

Costs of Electricity Produced

- Fuel Costs: 425,798,232 + (425,798,232x96.93%) = 838,524,458
- Annual electricity produced: 244,020,874kWh
- Therefore fuel costs would have represented 838,524,458/244,020,874 = **3.43 SR/kWh** compared to the actual cost of fuel in 2009 of 1.74 SR/kWh
- The actual total cost of production of electricity per kWh in 2009 was 1.99 SR/kWh, of which 1.74SR/kWh represented the fuel costs
- In this Scenario, the total cost of electricity produced in 2009 would have been: 1.99 - 1.74 + 3.43 = **3.68SR/kWh**

Costs of Electricity Sold

- Fuel Costs: 425,798,232 + (425,798,232x96.93%) = 838,524,458
- Annual electricity sold: 211,796,000kWh
- Therefore fuel costs would have represented 838,524,458/211,796,000= **3.96 SR/kWh** compared to the actual cost of fuel in 2009 of 1.87 SR/kWh
- The actual total cost of electricity sold per kWh in 2009 was 2.30 SR/kWh of which 2.01SR/kWh represented the fuel costs
- In this Scenario, the total cost of electricity sold in 2009 would have been: 2.30 - 2.01 + 3.96 = **4.25SR/kWh**

1.3.2 Praslin Island

Costs of Electricity Produced

- Fuel Costs: 59,176,521+ (59,176,521x96.93%) = 116,536,323 SR
- Annual electricity produced: 31,686,929kWh
- Therefore fuel costs would have represented 116,536,323/31,686,929=**3.68 SR/kWh** compared to the actual cost of fuel in 2009 of 1.87 SR/kWh
- The total cost of production of electricity per kWh in 2009 was 2.175 SR /kWh of which 1.87 SR/kWh represented the fuel costs.
- In this scenario, the total cost of electricity produced in 2009 would have been: 2.175 - 1.87 + 3.68 = **3.98 SR/kWh**

Costs of Electricity Sold

- Fuel Costs: 59,176,521+ (59,176,521x96.93%) = 116,536,323 SR
- Annual electricity sold: 26,894,000kWh
- Therefore fuel costs would have represented 116,536,323/26,894,000= **4.33 SR/kWh** compared to the actual cost of fuel in 2009 of 1.87 SR/kWh
- The total cost of electricity sold per kWh in 2009 was 2.56 SR /kWh of which 2.20 SR/kWh represented the fuel costs
- In this scenario, the total cost of electricity sold in 2009 would have been: 2.56 - 2.20 + 4.33 = **4.69 SR/kWh**

Table 3: Summary of PUC Costs under different scenarios for Fuel Prices and Tariff Pricing (based on cost of electricity produced or cost of electricity sold)

	2009 Fuel Prices				**2011 Fuel Prices**			
	PUC Mahe Electricity Produced	PUC Praslin Electricity Produced	PUC Mahe Electricity Sold	PUC Praslin Electricity Sold	PUC Mahe Electricity Produced	PUC Praslin Electricity Produced	PUC Mahe Electricity Sold	PUC Praslin Electricity Sold
Fuel costs SR/kWh	1.74	1.87	2.01	2.20	3.43	3.68	3.96	4.33
CapEx cost SR/kWh	0.05	0.028	0.06	0.03	0.05	0.028	0.06	0.03
OpEx SR/kWh	0.20	0.277	0.23	0.33	0.20	0.277	0.23	0.33
Total Cost SR/kWh	**1.99**	**2.18**	**2.30**	**2.56**	**3.68**	**3.98**	**4.25**	**4.69**

2. Estimation of Electricity production costs from PV system

Purchase Price

Under current conditions and in the absence of any financial incentives, the estimated capital investment required to install 1MW of PV system in the Seychelles is 3.52 million USD (based on an analysis of quotations received from PV Suppliers and data collected from http://www.solarbuzz.com/facts-and-figures/retail-price-environment; see Annex 7 for details). This is equivalent to 42.94 million Seychelles Rupees at an exchange rate of 12.2 SR/ 1 USD.

Loan Costs

It is assumed that the capital investment is financed by a loan over a period of 15 years at 8.5% annual interest rate (Source: Development Bank of Seychelles). The monthly repayment of the loan can be calculated using the formula below:

P=IA / (1-(1+I)^-n)

P: Monthly Payment
A: Loan amount
I: monthly interest
n: number of months of the loan

(0.007083 x 42,944,000) / 1-(1+0.007083)^ -180 = 422,876 SR/month

The Annual repayment will be 675,137 x 12 = 5,074,512 SR/Year

The total repayment over 15 years will be 8,101,644 x 15 = 76,117,680 SR

Capital Costs per kWh

The Yearly Energy Production of a PV system (in kWh) is FLH x kWp. The average Theoretical Annual Full Load Hours (FLH) for PV systems in the Seychelles is 1,300 full load hours (Source PUC). Therefore, for a system of 1MW, Yearly Energy production is 1300 x 1000kw = 1,300,000kWh, and over the expected 20 year lifetime of the equipment, total energy production is 1,300,000kWh x 20 = 26,000,000 kWh

Therefore, the **Capital Cost per kWh** of electricity produced by PV Systems is the total loan repayment cost of 76,117,580 SR divided by the total energy production of 26,000,000 kWh = **2.93SR/kWh**

Operations & Maintenance Costs

The **Operational and Maintenance Cost** of electricity produced by PV systems is estimated at 4cUSD/Kwh (Source UNDP Energy policy Report page 84) or 0.04x12.2 = **0.49 SR/kWh**

Total Production Costs

The **Total Production Cost** of electricity generated by PV Systems is: 2.93 + 0.49 = **3.42SR/kWh**

3. Estimation of Electricity production costs from Wind turbine

Capital Costs

The estimated investment required to install a wind turbine of 1MW in the Seychelles is 3.5 million USD (Source: Masdar draft project documents), which is equivalent to 42.7 million SR at an exchange rate of 12.2 SR/USD

Loan Costs

It is assumed that the capital investment is financed by a loan over a period of 15 years at 8.5% annual interest rate (Source: Development Bank of Seychelles). The monthly repayment of the loan can be calculated using the formula below:

P=IA/1-(1+I)^-n

P: Monthly Payment
A: Loan amount
I: monthly interest
n: number of months of the loan

(0.007083 x42.7) / 1-(1+0.007083)^ -180 = 0.42 million SR/month

The Annual repayment will be 0.42 x 12 = 5.04 million SR/Year

Capital + Loan Costs per kWh

- The Capacity Factor of a wind turbine of 1MW under Seychelles conditions with an average wind speed at 10 meters height of 4.0m/s is estimated at: (900/24 x 365) x100 = 10% (Source: Seychelles Energy Commission, Masdar wind data 2010-2011).
- The Yearly Energy Production of 1MW wind turbine can be calculated as follow:
- Yearly Energy Production = number of hours/year x Capacity Factor x kWp
- 365 x 24 x 0.10 x1000kw = 876,000 kWh
- The **Capital Cost** of electricity produced by Wind Turbine is: 5.04x10^6 / 0.876x10^6 = **5.75SR/kWh**

Operations & Maintenance Costs

The **Operational and Maintenance Cost** of electricity produced by a wind turbine is estimated at 1.6cUSD/Kwh (Source UNDP Energy Policy Report page77) or 0.016x12.2 = **0.19 SR/kWh**

Total Production Costs

The **Total Production Cost** of electricity generated by wind turbine is: 5.75 + 0.19 = **5.94 SR/kWh**

4. Estimation of Electricity production costs from Hydro Power

Capital Costs

The estimated investment required to install a hydro power of 1MW is 6.12 million USD (Source: UNDP Energy Policy Report 2010, p. 85), which is equivalent to 74.6 million SR at an exchange rate of 12.2 SR/USD

Loan Costs

It is assumed that the capital investment is financed by a loan over a period of 15 years at 8.5% annual interest rate (Source: Development Bank of Seychelles). The monthly repayment of the loan can be calculated using the formula below:

P=IA/1-(1+I)^-n

P: Monthly Payment
A: Loan amount
I: monthly interest
n: number of months of the loan

0.0070833 x74.6/ 1-(1+0.0070833)^ -180 = 0.73 million SR/month

The Annual repayment will be 0.73 x 12 = 8.8 million SR/Year

Capital + Loan Costs per kWh

- The Capacity Factor of Hydro power under Seychelles conditions was estimated at 44% (Source: UNDP Energy Policy Report 2010, p. 85).
- The Yearly Energy Production of 1MW Hydro power can be calculated as follow:
- Yearly Energy Production = number of hours/year x Capacity Factor x kWp
- 360 x 24 x 0.44 x 1000kw = 3,801,600 kWh.
- The **Capital Cost** of electricity produced by Hydro power is: 8.8x10^6 / 3.801x10^6 = **2.32SR/kWh.**

Operations & Maintenance Costs

The **Operational and Maintenance Cost** of electricity produced by a hydro power is estimated at 1.36cUSD/Kwh (Source: UNDP Energy Policy Report, p. 85) or 0.013x12.2 = **0.16 SR/kWh**

Total Production Costs

The **Total Production Cost** of electricity generated by Hydro Power is: 2.32 + 0.16 = **2.48 SR/kWh**

5. Estimation of Electricity production costs from Biomass Residues and Municipal Solid Waste (MSW)

Capital Costs

The estimated investment required installing a steam turbine of 1MW to produce electricity from biomass residues and SMW is 13.6 million USD (Source UNDP Energy Policy Report 2010, p. 87), which is equivalent to 166 million SR at an exchange rate of 12.2 SR/USD.

Loan Costs

It is assumed that the capital investment is financed by a loan over a period of 15 years at 8.5% annual interest rate (Source: Development Bank of Seychelles).

The monthly repayment of the loan can be calculated using the formula below:

P=IA/1-(1+I)^-n

P: Monthly Payment
A: Loan amount
I: monthly interest
n: number of months of the loan

0.0070803 x166/ 1-(1+0.0070803)^ -180 = 1.63 million SR/month

The Annual repayment will be 1.63 x 12 = 19.60 million SR/Year

Capital + Loan Costs per kWh

The Capacity Factor was estimated at 90% (Source UNDP energy policy report 2010 page 87)
The Yearly Energy Production of 1MW can be calculated as follow:
Yearly Energy Production= number of hours/year x Capacity Factor x kWp
360 x 24 x 0.9 x1000kw=7,776,000 kWh.
The **Capital Cost** of electricity produced from Biomass residues and SMW is: 19.60x10^6 / 7.776x10^6 = **2.52 SR/kWh.**

Operations & Maintenance Costs

The **Operational and Maintenance Cost** of electricity produced from biomass residues and MSW is estimated at 2.5% of the investment (Source UNDP Energy Policy Report, p. 87)
166x10^6x0.025/7.776x10^6 = 0.**53 SR/kWh**

Total Production Costs

The **Total Production Cost** of electricity generated from Biomass Residues and MSW Hydro is:
2.52 +0.53 = **3.05 SR/kWh**

6. Comparison of Electricity Production Costs in the Seychelles using different production systems

Table 4: Summary costs of production of electricity in the Seychelles (in Seychelles Rupees)

					2009 Fuel Prices				2011 Fuel Prices			
	PV	**Wind**	**Hydro**	**Bio / MSW**	PUC Mahe (Elec. Prod.)	PUC Praslin (Elec. Prod.)	PUC Mahe (Elec. Sold)	PUC Praslin (Elec. Sold)	PUC Mahe (Elec. Prod.)	PUC Praslin (Elec. Prod.)	PUC Mahe (Elec. Sold)	PUC Praslin (Elec. Sold)
Fuel costs (SR/kWh)	0	0	0	0	1.74	1.87	2.01	2.20	3.43	3.68	3.96	4.33
CapEx cost SR/kWh	2.93	5.75	2.32	2.52	0.05	0.028	0.06	0.03	0.05	0.028	0.06	0.03
OpEx SR/kWh	0.49	0.19	0.16	0.53	0.20	0.277	0.23	0.33	0.20	0.277	0.23	0.33
Total Cost SR/kWh	**3.42**	**5.94**	**2.48**	**3.05**	**1.99**	**2.18**	**2.30**	**2.56**	**3.68**	**3.98**	**4.25**	**4.69**

Table 5: Summary costs of production of electricity in the Seychelles (in U.S. Dollars; exchange rate of USD1 = SR12.2)

					2009 Fuel Prices				2011 Fuel Prices			
	PV	**Wind**	**Hydro**	**Bio / MSW**	PUC Mahe (Elec. Prod.)	PUC Praslin (Elec. Prod.)	PUC Mahe (Elec. Sold)	PUC Praslin (Elec. Sold)	PUC Mahe (Elec. Prod.)	PUC Praslin (Elec. Prod.)	PUC Mahe (Elec. Sold)	PUC Praslin (Elec. Sold)
Fuel costs (USD/kWh)	0.00	0.00	0.00	0.00	0.14	0.15	0.16	0.18	0.28	0.30	0.32	0.35
CapEx cost USD/kWh	0.24	0.47	0.19	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OpEx USD/kWh	0.04	0.02	0.01	0.04	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.03
Total Cost USD/kWh	**0.28**	**0.49**	**0.20**	**0.25**	**0.16**	**0.18**	**0.19**	**0.21**	**0.30**	**0.33**	**0.35**	**0.38**

Summary Analysis: Based on the figures in Table 4, solar PV systems are currently a competitive option for energy production in the Seychelles. When compared to energy production from fossil fuels based on current (2011) prices and actual revenues from production (electricity sold), the cost of solar PV systems (SR3.42 per kWh) is actually less than current PUC costs on Mahe (SR4.25 per kWh) and Praslin (SR4.69 per kWh). Furthermore, PUC has reported that it expects that beginning in 2012 the Government of Seychelles will no longer subsidize its capital costs, and PUC will have to cover all capital costs from its own resources, thereby increasing their actual cost of production. As for other renewable energy technologies, while Hydropower and Biomass / Municipal Solid Waste show lower energy production costs than Solar PV, the amount of energy that can be produced from either of these technologies is highly limited in the Seychelles. The last option, wind power, is significantly more expensive than solar (SR5.94 per kWh).

Annex 9: Financial Incentive Schemes to support Solar PV in Seychelles

1. Development and Selection of Financial Mechanisms to support Purchase of Solar PV Systems

The use of a purchase rebate scheme is the expressed preference of the Seychelles Ministry of Finance, and for this reason this has been used as the presumed model for providing financial incentives to PV system installers during the project. However, during the first year of the project, a careful assessment of all possible financing options for the purchase of Solar PV systems will be carried out, including purchase rebate schemes, concessionary loan programs, feed-in tariffs, and other options. In addition, whether the purchase rebate scheme is retained, or other option(s) are selected, work will be carried out during this same time period to confirm details on the exact conditions of the selected financing scheme(s), such as required capitalization levels, eligibility, and conditions for participation, based on confirmation of such variables as PV system pricing; financing costs for PV purchasers (including possible concessionary loan programs); projections of PUC electricity pricing; and data on PV system electricity production levels. Changes to these variables may increase or decrease the % level of the purchase rebate scheme or other financial mechanism, which in turn may increase or decrease the total amount of installed capacity of PV systems. In addition, following risk analyses, discussions among relevant institutions and identification of suitable co-financing sources, various risk management mechanisms may also be considered during that time, including PV electricity production guarantees (in case power production targets are not met by developers), and insurance programs to safeguard auto-producers in case of non-payment for electricity already supplied to the grid.

2. How a Purchase Rebate scheme would function

If a purchase rebate scheme is pursued, each selected partner will sign a formal agreement with the Government of Seychelles covering the obligations and rights of the partners regarding installation, operation and maintenance of project pilot PV systems, including providing data on system costs, electricity production, reliability, etc. to the Seychelles Energy Commission. The purchase rebate scheme will be structured so that no rebates are paid until the equipment is purchased, installed, and connected to the grid (each participant will be responsible for buying their own equipment; however the rebate % will be based on a fixed "average reasonable price" for the equipment, so if some partners want to buy high-end equipment, they can do that but their rebate will not be any greater). Participants who purchase Solar PV systems and receive the purchase rebate will be required to operate the equipment for some minimum period of years or forfeit the rebate.

At present, the Development Bank of Seychelles (DBS) is expected to act as the fiduciary agency responsible for all of the financial incentives implemented by the project. These incentives include a purchase rebate scheme, whereby auto-producers will receive a reimbursement of approximately 35% (to be confirmed in first 6 months of project implementation) of the purchase price of the PV system capital equipment. Funds to enable this purchase rebate scheme will come from the Seychelles Ministry of Finance and the GEF and will flow through the DBS. In addition, the European Investment Bank intends to make a low-interest loan to the DBS so that it can establish a renewable energy and energy efficiency projects loan mechanism; this DBS loan mechanism is expected to be of sufficient size to provide low-interest loans for all of the PV system purchase costs (after the purchase rebates) anticipated in this project. The International Finance Corporation is also working with the Seychelles Ministry of Finance to develop a High Risk Capital Loan Program, which if implemented also will provide funding for renewable energy projects, including the purchase of Solar PV systems.

3. Selection Process for Project Demonstration Partners

The project will create a transparent public tender process for the opportunity to purchase for own use (not to provide/resale) Solar PV equipment for demonstration projects for grid-connected PV systems with partners on the three main islands of the Seychelles (Mahe, Praslin and La Digue). Criteria and procedures will be developed and implemented during the 9 months of the project (starting in approx. April 2012), with the tender process expected to begin no later than January 2013. Demonstration project partners on the main islands are expected to be primarily private (and possibly parastatal) commercial enterprises, as this sector is widely seen to be the most likely to adopt PV systems in the near to medium term, but private residences are also eligible. For the remaining smaller islands in the country, a separate public tender process will take place to select demonstration projects for small micro-grid PV systems. At least one partner has already been selected on one of the small outer islands (the Seychelles Island Foundation, on the island of Aldabra), but others will be considered, based on the results of any feasibility studies and the capacities and resources of the potential partners.

4. Summary Information on Project Financing

Targeted Rate of Return for Investors

- Consultations with finance institutions and private businesses confirmed that the rate of return over 10 years required by most businesses in the Seychelles to invest in capital equipment is between 13-18%; the project therefore established a target IRR of 15%
- Over the first 10 years of operation, the cost for installed PV systems in the Seychelles is US$3.62 per Wp (the overall cost is US$4.32 per Wp, but the following costs will only take place after 10 years: 1/2 of the US$0.20 per Wp for Operations & Maintenance, and US$0.60 per Wp for inverter replacement)
- Of the total cost of US$3.62 per Wp, the cost for capital equipment is US$3.29 per Wp
- It is assumed that most or all of the project partners who install PV systems will be "auto-producers" who use a high percentage of the power produced by their systems for their own use, and only occasionally sell electricity back to the grid. Based on this assumption, the "revenue" that these partners receive from their PV systems is the savings they gain by not purchasing electricity from the PUC at retail prices.
- The retail price of electricity from the PUC is approximately SR3.05 per kWh (US$0.25/kWh); it is assumed that this price will increase by 5% per year over the next 10 years
- The production level of PV systems in the Seychelles is estimated at 1,300 Full Load Hours (FLH) (see Annex 6 for details); it is assumed that production levels will decrease by 0.5% per year over the lifetime of the equipment
- The financing costs for the payments on the capital equipment and installation assume a loan interest rate of 9% (in Seychelles Rupees) with a 7-year payback period. This assumption is based on the likelihood of a concessionary loan program (through the European Investment Bank and/or the International Finance Corporation) being in place and available to private sector partners who purchase PV systems. It also assumes that purchasers will borrow in Seychelles Rupees; if they borrow in USD or Euros, financing costs will be lower.
- Given the above conditions, a purchase rebate on the capital equipment of 35% will produce an IRR of 15% over 10 years

Targeted System Size

- The 1,280 kWp target for installed capacity was estimated using the following assumptions:
- The total amount available from funders (GEF & Ministry of Finance) for the purchase rebate scheme for capital equipment is US$1,473,707
- The level of purchase rebate is set at 35% (as explained above)

- At a price of US$3.29 per Wp for capital equipment, and a 35% purchase rebate level, the total funds of US$1,473,707 for the purchase rebate scheme are sufficient to support the purchase of 1,280 kWp
- In addition, the Seychelles Islands Foundation is installing a 25 kWp system as part of the project. This brings the total installed capacity to 1,305 kWp.

Financing Details for 1,280 kWp installed with financing scheme

- The total cost for the 1,280 kWp of PV systems over their lifetime is estimated at US$5,528,800
- The total cost for the 1,280 kWp of PV systems during the 4 years of the project is estimated at US$4,632,930
- The total amount available for the purchase rebate scheme for capital equipment will be US$1,473,707; this represents 32% of the total cost of the PV systems during the 4 years of the project. Of this amount, the GEF will provide US$732,966 in funding for the purchase rebate scheme (16% of the cost of the systems during the project), and the Ministry of Finance will provide US$740,741 in funding for the purchase rebate scheme (16% of the cost of the systems during the project).
- Project partners who will install the 1,280 kWp of PV systems will contribute $3,159,223 during the 4 years of the project (without including financing costs); this represents 68% of the total cost of the PV systems during the 4 years of the project.

5. Detailed Financial Information on Costs of PV Systems, Funding Sources and Investor Return

Summary of PV System Costs (per kWp)	
Capital Equipment Costs	$3,290.00
Installation Costs	$230.00
OpEx Costs - Operations and Maintenance	$200.00
OpEx Costs - Re-equipment	$600.00
Total Installed System Cost per kWp	**$4,320.00**

Funds Available for Purchase Rebate Scheme	
GEF	$732,966
Ministry of Finance	$740,741
Total	**$1,473,707**

Timing and Use of Purchase Rebate Funds	**Total Funds**	**2012**	**2013**	**2014**	**2015**
Availability of MoF Funds	$740,741	$61,728	$246,914	$246,914	$185,185
Expected Use of MoF Funds		$-	$308,642	$246,914	$185,185
Expected Use of GEF Funds	$732,966	$-	$428,211	$195,198	$109,556
Estimated % of Capacity Installed During Year		0%	50%	30%	20%
PV System Rebate Expected Spending	$1,473,707	$-	$736,853	$442,112	$294,741

Calculation of Purchase Rebate and System Size	
Amount of Purchase Rebate on Capital Equip. per kWp	35%
Amount of Installed PV (kWp) possible with Purchase Rebates	1280

Total Cost for Installed PV Systems	
Capital Equipment Costs	$4,210,591

Installation Costs	$3294,357
OpEx Costs - Operations and Maintenance	$255,963
OpEx Costs - Re-equipment	$767,889
Total Installed System Cost	**$5,528,801**

Cost for Installed PV Systems during Years 1-10	
Capital Equipment Costs	$4,210,591
Installation Costs	$294,357
OpEx Costs - Operations and Maintenance	$127,981
OpEx Costs - Re-equipment	$0
Total Installed System Cost for Years 1-10	**$4,632,930**

Project Funding for PV Systems during years 1-10	
GEF Funding	$732,966
Ministry of Finance Co-Financing	$740,741
Partner Co-Financing	$3,159,223
Total	**$4,632,930**

Cost per kWp for CapEx (after rebate), Installation and Operations & Maintenance (amount to consider as co-financing):	**$2,468.50**

Financing of Capital Equipment Purchases*		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Capital equipment cost requiring financing	$2,288							
Beginning balance		$2,288.00	$1,961.14	$1,634.29	$1,307.43	$980.57	$653.71	$326.86
Principal payback (7 years)	7	$326.86	$326.86	$326.86	$326.86	$326.86	$326.86	$326.86
Ending balance		$1,961.14	$1,634.29	$1,307.43	$980.57	$653.71	$326.86	$-
Interest Payments for financing of capital equipment	9%	$191.21	$161.79	$132.38	$102.96	$73.54	$44.13	$14.71
Total Payments for Financed Capital Equipment		$518.07	$488.65	$459.23	$429.82	$400.40	$370.98	$341.57

*The financing costs for the payments on the capital equipment and installation assume a loan interest rate of 9% (in Seychelles Rupees) with a 7-year payback period. This assumption is based on the likelihood of a concessionary loan program (through the European Investment Bank and/or the International Finance Corporation) being in place and available to private sector partners who purchase PV systems. It also assumes that purchasers will borrow in Seychelles Rupees; if they borrow in USD or Euros, financing costs will be lower.

Internal Rate of Return for PV System Purchasers	**Factors**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Capital costs requiring financing (after purchase rebate)	$2,288	$518	$489	$459	$430	$400	$371	$342	$-	$-	$-
Operating Costs		$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Total Costs (CapEx & OpEx)		$528	$499	$469	$440	$410	$381	$352	$10	$10	$10
Electricity Production (in kWh) per kWp per year	1300	$1,300	$1,294	$1,287	$1,281	$1,274	$1,268	$1,261	$1,255	$1,249	$1,243
Annual Decrease in PV System electricity production	0.5%										
Cost per kWh to purchase PUC power (avoided cost)	$0.25	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Increase in price of PUC power	5%										
Total Value (avoided cost) of PV system per kWp per year		$325	$340	$355	$371	$387	$405	$423	$442	$461	$482
Net Annual Income / (Cost) of PV Systems per kWp		$(203)	$(159)	$(114)	$(69)	$(23)	$24	$71	$432	$451	$472
Internal Rate of Return	15%										

SIGNATURE PAGE

Country:

United Nations Development Programme

Country: Seychelles

PROJECT DOCUMENT

Project Title: Grid-Connected Rooftop Photovoltaic Systems

UNDAF Outcome(s): Given the limited number of UN resident agencies in Seychelles (only the World Health Organization), the country is not required to prepare a UNDAF.

UNDP Strategic Plan Environment and Sustainable Development Primary Outcome: Mainstreaming environment and energy: Strengthened national capacities to mainstream environment and energy concerns into national development plans and implementation systems

UNDP Strategic Plan Secondary Outcome: N/A

Expected CP Outcome(s): UN Country Programme 2012-2016 – Country Programme Outcome #2: By 2016, the governance systems, use of technologies and practices and financing mechanisms that promote environmental, energy and climate-change adaptation have been mainstreamed into national development plans.

Expected CPAP Output (s) Seychelles does not have a CPAP.

Executing Entity/Implementing Partner: Seychelles Energy Commission

Implementing Entity/Responsible Partners: United Nations Development Programme

Programme Period:	
Atlas Award ID:	TBD (CO)
Project ID:	TBD (CO)
PIMS #	4331
Start date:	April 2012
End Date	April 2016
Management Arrangements	NEX
PAC Meeting Date	TBD

Total resources required	7,287,138
Total allocated resources:	**7,287,138**
• **Regular (GEF)**	**1,160,000**
• **Other:**	**6,127,138**
○ Government	1,224,697
○ Multi-Lateral	237,480
○ Private Sector	3,159,223
○ Parastatal	1,405,738

Agreed by (Government):

Date/Month/Year

Agreed by (Executing Entity/Implementing Partner):

Date/Month/Year

Agreed by (UNDP):

Date/Month/Year

PROJECT IDENTIFICATION FORM (PIF)

PROJECT TYPE: FULL-SIZED PROJECT
THE GEF TRUST FUND

Submission Date: 4 November 2009
Re-submission Date: 3 December 2009

PART I: PROJECT IDENTIFICATION

GEF PROJECT ID[1]:
PROJECT DURATION: 36 months
GEF AGENCY PROJECT ID: 4331
COUNTRY: Seychelles
PROJECT TITLE: Grid-Connected Rooftop Photovoltaic Systems
GEF AGENCY: UNDP
OTHER EXECUTING PARTNER(S): Seychelles Energy Commission (Ministry of Environment, Natural Resources and Transport) and Public Utilities Corporation (PUC)
GEF FOCAL AREA: Climate Change
GEF-4 STRATEGIC PROGRAM(S): SP3 Promoting Market Approaches for Renewable Energy
NAME OF PARENT PROGRAM/UMBRELLA PROJECT: NA

INDICATIVE CALENDAR	
Milestones	**Expected Dates**
Work Program (for FSP)	Mar 2010
CEO Endorsement/Approval	Feb 2011
Agency Approval Date	Mar 2011
Implementation Start	Apr 2011
Mid-term Evaluation (if planned)	Oct 2012
Project Closing Date	Mar 2014

A. PROJECT FRAMEWORK

Project Objective: Increased use of grid-connected rooftop photovoltaic (PV) systems as a sustainable means of generating electricity in selected main islands and smaller islands of the Seychelles.

Project Components	Investment TA, or STA[b]	Expected Outcomes	Expected Outputs	Indicative GEF Financing[a]		Indicative Co-Financing[a]		Total ($) c = a + b
				($) a	%	($) b	%	
Component 1: Policy, strategy and legal framework	TA	Adapted and enhanced legislative and policy framework for PV system development	o Energy policy that prioritizes renewable energy and sets specific targets for renewable energy as a percentage of national energy production o Revised PUC Act that includes third party energy generation, and entry and sale of this energy to the grid, submitted to National Assembly o Completed education and awareness campaigns promoting PV systems, targeted at 3 groups: key policy stakeholders, potential adopters of PV technology, and general public o Financing mechanisms developed with local banks to support adoption of PV systems	20,000	11	141,000	89	161,000
Component 2: Strengthening of the technology support and delivery system	TA	Enhanced national capacity for the development, operation, and financing of PV systems	o Key policymakers at the Energy Commission, PUC, and the National Assembly trained in the technical and economic aspects of PV systems and their relation to energy policy o PV suppliers and financing institutions trained in business planning, life cycle costing, quality assurance, maintenance, procurement, and marketing for PV systems o Certified PV system technicians capable of installing, operating and maintaining	150,000	58	110,000	42	260,000

[1] Project ID number will be assigned by GEFSEC.

			PV systems to enable the expansion of PV technology in the Seychelles o Established international partnerships and alliances with PV industry players and technical partners, including a regional network of PV system operators					
Component 3: PV demonstration projects	Investment, TA	Increased electricity production from PV systems and interest among energy sector investors and operators.	o Completed PV pilot project system assessments (site selection and pre-feasibility analysis) o Completed life cycle cost analyses for PV pilot project systems (based on models developed in other countries) o Formal agreements/contracts with partners for installation, operation and maintenance of PV pilot project systems o Installed 3 grid-connected PV systems: 1) a 200kWp PV project on Mahé island; 2) a 48kWp Medium demonstration project on Praslin island; and 3) 1-2 small (2 kWp) demonstration projects on outer islands (with private sector co-financing)	920,000	41	1,337,357	59	2,257,357
4. Project management				70,000	35	130,000	65	200,000
Total project costs				1,160,000		1,718,357		2,878,357

[a] List the $ by project components. The percentage is the share of GEF and Co-financing respectively of the total amount for the component.
[b] TA = Technical Assistance; STA = Scientific & Technical Analysis

B. INDICATIVE CO-FINANCING FOR THE PROJECT BY SOURCE and by NAME (in parenthesis) if available, **($)**

Sources of Co-financing	**Type of Co-financing**		**Total Amount**
	Cash	**In-kind**	
Project Government Contribution			
- Public Utilities Corporation	101,980	315,377	417,357
- Ministry of National Development	16,000	10,000	26,000
- Energy Commission		70,000	70,000
- Ministry of Finance	980,000		980,000
GEF Agency (UNDP): Energy Policy Review	60,000		60,000
Bilateral Agency (Govt. of France – ARER)	100,000		100,000
Private Sector (Masdar Company)		45,000	45,000
NGO (Seychelles Islands Foundation)	10,000	10,000	20,000
Total Co-financing	1,267,980	450,377	1,718,357

C. INDICATIVE FINANCING PLAN SUMMARY FOR THE PROJECT ($)

	Previous Project Preparation Amount (a)[2]	**Project (b)**	**Total c = a + b**	**Agency Fee**
GEF financing	0*	1,160,000	1,160,000	116,000
Co-financing	0	1,718,357	1,718,357	
Total	0	2,878,357	2,878,357	116,000

* Expected PPG submission will be $67,000 in GEF funds plus $6,700 in Agency Fee.

[2] Include project preparation funds that were previously approved but exclude PPGs that are waiting for approval.

PART II: PROJECT JUSTIFICATION

A. THE ISSUE, HOW THE PROJECT SEEKS TO ADDRESS IT, AND THE EXPECTED GLOBAL ENVIRONMENTAL BENEFITS TO BE DELIVERED:

Scope/Strategy

The project proposed will support implementation of a grid-connected rooftop PV system, by carrying out pilot projects for rooftop PV systems for commercial buildings on the main islands of the Seychelles (population of 85,000), and for overall power generation on selected smaller outer islands (total population less than 1,000). The potential for PV systems in the Seychelles is excellent, as the country has high levels of solar radiation due to the fact that the main islands are situated only 4 degrees south of the Equator. At the same time, the cost of generating electricity is very high due to the archipelago's isolated location and its reliance on imported heavy fuel. The immediate potential for other alternative energies, such as hydro, wind or wave power is more limited, based on previous studies in the country. On the main islands, where the Public Utilities Corporation (PUC) is the supplier of almost all electricity, there is a well-established grid system that can support the feeding of PV generated electricity into the grid, although a well-defined feed-in tariff system is not yet in place. Most importantly, the PUC is willing, for the first time, to support the sale of power back to the grid (due in part to the country's desire for WTO accession, which requires it to "open up" its energy market). In addition, although there are only a handful of PV systems currently installed in the country, rising fuel costs have sparked interest among more isolated energy users, particularly those managing small or outer islands.

Problem statement

The Seychelles is almost 100% reliant on imported oil for energy needs, which is a significant economic and budgetary cost, and is the single largest contributor of greenhouse gases in the country (based on emissions during the shipping process and in the burning of fuel to produce electricity). There is also an ongoing risk of transshipment accidents and spillage, a particularly significant threat for the remote UNESCO World Heritage Site of Aldabra, an atoll which is located close to a major petroleum shipping route through the Mozambique Channel. A study in 2007 found that national primary energy consumption (petroleum fuels that are imported and consumed locally) increased by an average of 5.4% per year between 1996 and 2007, and in the 3-year period 2005-2007 the average rate of increase was 9.7% per year. In 2000, primary energy consumption stood at 84,817 toe (ton of oil equivalent), whereas by 2007 it had increased to 115,000 toe. Demand is likely to continue to increase as a result of continued expansion of the electricity distribution system, the rising standard of living and the deployment of projects created by a recent influx of foreign investment.

PV systems development and barriers related to it

Given that Seychelles is a tropical country receiving large amounts of sunshine, with an average 6.9 hours of sunshine per day, there is great potential to replace at least some of the current oil-generated (and polluting) electricity with solar energy systems. One opportunity with high economic, financial and environmental viability is the implementation of rooftop grid-connected PV systems. At present, the only active grid-connected PV system in the entire country is a 600-watt (4-panel) PV system installed by the Public Utilities Corporation (PUC). The PUC would like to expand its use of PV systems, but has not done so to date because of relatively low oil prices and a lack of investment capital. A few organizations and companies (Island Development Corporation, Seychelles Islands Foundation, etc.), which manage some of the smaller islands of the Seychelles archipelago, are investigating opportunities for alternatives to oil-generated electricity, in some cases including PV systems. The interest and experience of these other organizations represents an opportunity for partnerships in the demonstration of PV systems in the country.

The full potential of energy from the sun to produce electricity and to heat water has been only minimally exploited in the Seychelles. Previous efforts to promote and adopt renewable energy technologies in the country, including PV systems, wind, biomass and biomass gasification projects, have largely failed. In some cases, the proposed technology was not technologically feasible in the context of a Small Island Developing State. More often, however, these efforts have failed because of legal, regulatory, and policy constraints that have promoted fossil-fuel based energies and restrained the adoption of RETs; from a lack of understanding and political will among policy makers of the need to change the country's energy production strategy; and as a result of these conditions, from an unwillingness among government

agencies, the private sector, and other sectors of the society to investigate and pilot alternative energy production systems. These barriers to a more widespread utilization of PV systems in the Seychelles can be broken down into three categories:

- *Market barriers:* Although the availability of suitable PV systems has increased worldwide, there is as yet no market in place for the supply and maintenance of this technology in Seychelles for small-scale or large-scale producers. There is no well-established and functioning supply chain and technical support system in place that would ensure broad availability of PV systems and better service support for end-users. The high capital cost of PV systems, including existing Goods and Services Tax applied to solar panels, is a significant barrier to the adoption of PV systems, in particular in the Seychelles, where the very small market, represented by an isolated, mid-ocean Small Island Developing State (SIDS) (population c. 82,000; nearest suppliers South Africa or Southeast Asia), reduces economies of scale and greatly increases transport costs. For many of the smaller outer islands, which currently depend almost entirely on oil-generated electricity, the lack of demonstrated successful adoption of RE systems in the country and the high initial costs of adopting these systems (including PV) have resulted in lack of uptake, in spite of very high fuel transport costs resulting from the remoteness from the main islands. In addition, there is very little awareness and information on the opportunities and advantages of PV systems.
- *Institutional and regulatory barriers:* Currently there is only one institution, the Public Utilities Corporation, providing electricity to the majority of the population living on the three main islands (in the most recent census of 2002, 96% of households are connected to the public electricity distribution system). PUC generates electricity by means of generators running on heavy fuel oil alone, with associated high importation costs. PUC's interest lies mainly in producing a fully functioning public electricity supply at a profit. There is no administrative mechanism in place that allows for alternative producers to access and feed into the public electricity grid, nor is there a feed-in tariff system. Moreover, there are no laws or regulations in place that allow for such mechanisms to exist (though the Government has confirmed that this does not stand in the way of implementing a pilot project as proposed by this project). In addition, previous experience with solar water heating technology adoption shows that without incentives (financial or other kind), the uptake of alternative systems by commercial and private sectors is limited.
- *Technical barriers:* There is a lack of technical and institutional capacities for the installation and maintenance of PV systems, and of the technical information to enable grid access. The number of experts and technicians in Seychelles who are trained and experienced in the installation, maintenance and repair of PV systems is very small. Previous experience with solar water heating technology reveals that without adequately trained technicians to service and repair equipment, it will quickly fall into disuse. Furthermore, PV systems may require specific adaptations for the humid tropical climate and salt-laden air of Seychelles.

Description of PV systems

PV is the process whereby the light component of sunshine (made up of light and heat) is converted to electrical energy through PV (solar) panels. As these panels only produce DC current, this will be converted to AC (alternating current) using special inverters and stepped up through a step-up transformer, and then fed directly into the national grid. This would be an innovative concept as it would be the first attempt in the Seychelles to connect alternative energy producing systems to the established electrical grid system.

The three proposed systems would together have a total capacity of 250 kWp, using individual panels of 100 Wp. Using the average daily insolation of 5760 Wh/m2, these systems are expected to produce around 350,000 kWh of electricity per year. The 1st system will be on the island of Mahe, with an installed capacity of 200 kWp (using individual panels of 100Wp), producing 280,000 kWh of electricity, and covering an area of 1,400m2 on the roof of Power Station C at Roche Caiman, which is designed to hold significant weight. The 2nd system will be located on the island of Praslin, with an installed capacity of 48 kWp, producing 67,200 kWh of electricity to be fed into the grid for the islands of Praslin and La Digue. This system will be placed on the roof of the generating facilities on Praslin, covering an area of 336 m2. The 3rd system will be a 2 kWp system on the outer island of Aldabra, connected to the micro-grid and producing 2,800 kWh per year. This will cover an area of 14 m2. The conversion to AC will be through a bank of grid inverters that would be approved by PUC and fit the grid specifications (230/400 Volts AC). The cabling and transformers to tie to the low voltage grid will be the responsibility of PUC (cable only for the system on Aldabra). The system runs automatically as long as the grid supply is available.

Project strategy

The barriers described above are interrelated. These barriers will need to be addressed in a holistic manner to enable the introduction and successful deployment, diffusion and transfer of PV systems in the country. Although one approach is to demonstrate pilot PV projects on small islands with appropriate partners, this approach alone would not ensure that long-term benefits of sustainable energy production technology are applied to the energy production system for the majority of the Seychelles population. Therefore, suitable PV systems need to become an inclusive part of the main public grid systems of the 3 main islands - where the greater part of the population lives, almost all industrial production is carried out, and much of the tourism activities takes place. This requires the appropriate institutional, policy and legislative framework to be put in place.

The *objective of the project* is to increase the use of PV systems as a sustainable means of generating electricity, thereby significantly reducing reliance on fossil fuel, through pilot projects for rooftop PV systems on all of the main and selected smaller islands, of the Seychelles. The identified barriers to the deployment, diffusion and transfer of solar PV systems will be addressed through the following project components:

Component 1: Policy, strategies and legal framework

This project component aims to review current energy production policies and legislation to improve the opportunities for solar PV power generation systems applications in Seychelles, in particular to allow for third party generation of energy and for selling energy to the grid (this would be an innovative legislation for Seychelles). The project will investigate the possibility that Government could set targets for RE as a specified percentage of the electricity generated in the country. In this regard, particular attention will be directed towards PV systems and a suitable technical feed-in system to support it, but with the potential of adopting other RE technologies in the future.

Increasing the awareness of decision-makers will be an important aspect of the project strategy to strengthen the legislative, administrative and financial support for PV systems. Providing information and raising awareness about PV systems among investors, local businesses and island developers will also encourage support from the private sector and help to generate suitable partnerships for PV projects. These partnerships will be critical for the development and implementation of financing mechanisms to support the importation and adoption of PV systems. Possible financing mechanisms include: partnerships with PUC to provide funding (as well as technical support and in-kind contributions) to reduce start-up costs; establish built-in parity correction factors to the feed-in tariff, such as a “carbon tax” on energy production, to counter balance fluctuations in fossil fuel prices; reduction or elimination of taxes on PV systems equipment; analysis of potential carbon finance benefits which could increase the profitability of PV systems vis-a-vis generation of carbon credit offsets; and development and establishment of private sector loan programs to support the purchase of PV systems (facilitated by pilot projects showing the long-term cost savings/revenues provided by such systems). In addition, by increasing public awareness about the PV pilot projects (especially among NGOs and community organizations), the project will increase support for the adoption of PV and other RE technologies throughout the country.

Specific outputs are:

1.1 Energy policy that prioritizes renewable energy and sets specific targets for renewable energy as a percentage of national energy production
1.2 Revised PUC Act that includes third party energy generation, and entry and sale of this energy to the grid, submitted to National Assembly
1.3 Completed education and awareness campaigns promoting PV systems, targeted at 3 groups: key policy stakeholders, potential adopters of PV systems, and general public
1.4 Financing mechanisms developed with local banks to support adoption of PV systems

Component 2: Strengthening of the technology support and delivery system

Although there is already some knowledge of PV systems and equipment in Seychelles, significant capacity building will be required to enable adoption on a wider scale and to include grid feed-in systems. The type of training will depend on

the existing capacities and future requirements of various partners, including public sector personnel (particularly strengthening PUC's capacity to absorb and deliver PV systems), potential private sector partners (e.g. electricians, technology sales companies, end-users such as hotels and island developers), and managers of outer island infrastructure. For example, training for trainers courses and workshops for in-service personnel will be conducted to allow for the further dissemination of knowledge on PV technology and its installation, maintenance and repair. This will pave the way for further adoption of PV systems and/or other suitable technologies over the long term. The proposed demonstration projects (see Component 3) represent an opportunity to start capacity building and tie it directly to the installation and operation of pilot PV systems. In addition to technical know-how about PV systems, the transfer of knowledge must also include guidance and information on ownership and management models, financial mechanisms and supportive policy instruments. To enable this, training could be carried out through partners such as the Seychelles Institute of Technology (SIT) and the newly established Seychelles University (SU). Furthermore, partnerships will be developed with selected institutions and companies in those countries that have broad experience with PV systems (in particular those in other developing countries, such as South Africa, Kenya, China or India), to enable adoption of technology from these countries to the Seychelles. Finally, joint training workshops/courses and related information sharing will be implemented with the proposed UNDP-GEF technology transfer project "Removal of Barriers to Renewable Energy in Mauritius, Rodrigues and the Outer Islands".

Specific outputs are:

2.1 Key policymakers at the Energy Commission, PUC, and the National Assembly trained in the technical and economic aspects of PV systems and their relation to energy policy
2.2 Government, private sector, and NGO managers trained in business planning, life cycle costing, quality assurance, procurement, and marketing for PV systems
2.3 Certified PV system technicians capable of installing, operating and maintaining PV systems to enable the expansion of PV systems in the Seychelles
2.4 Established international partnerships and alliances with PV industry players and technical partners, including a regional network of PV system operators

Component 3: PV demonstration projects

The implementation of the entire project will be an innovative concept that will lay the groundwork (policy, legislative aspects, technical and market conditions) for the future of grid-connected RE Technology (RET) projects in the Seychelles. The PV demonstration projects will be able to show whether rooftop PV systems are technically feasible and cost effective for Seychelles, both for small-scale systems on the smaller islands and for commercial buildings on the main islands, with the possibility of scaling up, thus allowing a greater percentage of energy production in the form of PV systems. It will be particularly important to demonstrate whether or not PV is a cost effective means of energy production for outer islands, which currently rely on fuel-driven energy supplies. The demonstration project should include an analysis of the true costs of fuel supply for outer islands, which is not always taken into consideration. On the main island of Mahe, the project will work with the PUC to install a 200kWp system on the roof of one of their power stations. On the island of Praslin, the project will again work with PUC to install an 80kWp system on another of their buildings. On the outer island of Aldabra, the project will work in partnership with the Seychelles Islands Foundation to install a 1kWp system, which will be connected to a micro-grid that supports the 12 residential and operations buildings on the island.

Specific outputs are:

3.1 Completed PV pilot project system assessments (site selection and pre-feasibility analysis)
3.2 Completed life cycle cost analyses for PV pilot project systems (based on models developed in other countries)
3.3 Formal agreements/contracts with partners for installation, operation and maintenance of PV pilot project systems
3.4 Installed 3 grid-connected PV systems: 1) a 200kWp PV project on Mahé island; 2) an 48kWp demonstration project on Praslin island; and 3) 1-2 small (2 kWp) demonstration projects on outer islands (with private sector co-financing)

Global Benefits

The PV systems developed by the project are expected to produce approximately 350,000 kWh of electricity (figure based on actual output of PUC small PV pilot system). Since the electricity produced will be connected to the grid, or will replace existing fossil fuel based electricity production, this will reduce annual consumption of fuel oil by 81 metric tons

(station efficiency of 0.23kg fuel oil/kWh), and thereby reduce CO2 emissions by approximately 243 metric tons per year (1 metric ton of fuel oil produces 3.02 metric tons of CO2). Over the course of the project, the total reduction in CO2 emissions will be approximately 607.5 metric tons (assuming 2 ½ years of operation during the project), while the overall reduction in CO2 emissions will be 6,075 metric tons (expected lifetime of the PV system of 25 years). In addition, indirect reductions through replication of the PV systems in the Seychelles may be estimated. Based on a replication factor of 3 (project type: demonstration with capacity building), the additional total indirect CO2 emissions reduced (with investments after the project period) as a result of the project can be conservatively estimated (bottom-up approach) at 18,225 metric tons. Moreover it is important to recognize that the Government of Seychelles has discussed a target of 5% of national energy production from PV systems (pending Cabinet approval). One of the main expected outcomes of this project is to support such an energy policy that sets specific targets for renewable energy as a percentage of national energy production, and to promote the introduction of PV systems as the best technology option to meet such targets. Current overall annual power production is 270,490,000 kWh, so a 5% displacement by solar PV systems (13,524,500 kWh) would create additional reduction in CO2 emissions per year of 9,394 metric tons per year nationally.

B. CONSISTENCY OF THE PROJECT WITH NATIONAL/REGIONAL PRIORITIES/PLANS:

This project inserts itself in a very consistent manner into the framework of national priorities and plans. The current Environmental Management Plan for Seychelles (2000-2010), a government policy document intended to guide and coordinate sustainable development, includes as one of its objectives "to promote and implement energy conservation practices, use of renewable energy resources and technologies, and energy efficient and clean technologies." (p.77). However, it is only within the last two years that the government has begun to seriously address the RET aspect of this plan. In his State of the Nation address in February 2008, President James Michel stated: "The issue of energy is one that is critical for us, and for our future. The amount of petroleum products our country is consuming now is not sustainable in the long term. Government is presently drafting an energy policy that will look at radical solutions that we will have to adopt. Government will remove all taxes, including GST [Goods and Services Tax], on certain solar energy products such as solar panels."

The Ministry of National Development (which is also in charge of energy policy) established an Energy Security Steering Committee in 2008, with the aim of studying how the country can move away from its dependence on imported oil to satisfy its energy needs. A report from this committee, with a list of policy recommendations ranging from short- to long-term, identified the need to promote other viable technologies, including grid-connected PV, as part of the national energy mix. Recommendations for the medium-term measures were aimed at changing the energy mix to make it more sustainable and reduce the country's vulnerability. The report was produced in December 2008, updated in early 2009, and submitted to the Cabinet of Ministers, where it now awaits final approval. The MND is also negotiating with the Agence Reunionaise pour L'Energie Renouvelable (ARER) to conduct an assessment to determine to what degree renewable energy can contribute to the energy production mix of the country, in support of the Government's commitment to increase energy security. In addition, the recently established Seychelles Energy Commission also strongly supports the idea of implementing more PV systems in the Seychelles.

The National Greenhouse Gas Mitigation Options report, produced for the Second National Communication to the United Nations Framework Convention on Climate Change, recommends increased efforts to promote RET, and specifically PV systems, to reduce CO_2 emissions. This report states that with the use of current technologies, the average emission for the Seychelles for the period from 2000 to 2007 was 698 g CO_2/kWh. In addition, as part of its agreement under the Bali Action Plan, the Seychelles has legally committed itself to reducing its emission of greenhouse gases (GHG). The government has embarked on various initiatives, some with international partners, to promote alternative technologies to satisfy a more significant portion of its energy needs. For example, negotiations are currently underway with the Abu Dhabi-based company MASDAR to look into the feasibility of installing a small wind farm in Seychelles.

C. CONSISTENCY OF THE PROJECT WITH GEF STRATEGIES AND STRATEGIC PROGRAMS:

Promotion of grid-connected PV systems is consistent with national priorities on development of the energy sector, as described in Section B. Seychelles has not received previous GEF support for promoting PV systems. The activities proposed will remove barriers to the adoption of RET, consistent with GEF strategic objectives in climate change and those stated in the strategic programming for GEF-4. The project will undertake activities in support of all three of the

key indicators for SP3 under the GEF-4 Climate Change Mitigation program: 1) tons CO2eq avoided; 2) adoption of policy frameworks, allowing renewable generators equitable access to the grid; and 3) kWh generated from renewable sources. The project also will contribute to increased production of RE for supply in the electriciy grid, having a direct impact in market penetration (% of share from renewables).

D. JUSTIFY THE TYPE OF FINANCING SUPPORT PROVIDED WITH THE GEF RESOURCES:

The GEF will provide a grant for the funding of activities that will result in the establishment of a sustainable PV systems program in the Seychelles, and will substantially contribute to reductions in GHG emissions. The GEF funds will be used for developing and implementing legal and policy frameworks, carrying out capacity building activities necessary to enable the adoption and replication of grid-connected PV systems, and demonstrating such systems at several sites around the country. The proposed project is requesting a grant from the GEF, which will be used to support activities that are incremental to the existing baseline.

E. COORDINATION WITH OTHER RELATED INITIATIVES:

In the past few years, the Government of Seychelles (GOS) has recognized the need to review its national energy policies and practices, both to reduce dependence on oil imports (and thereby increase national energy security) and to address the country's contributions to climate change. The President of the Seychelles has directed the relevant agencies and institutions to review the country's existing energy supply system and to explore alternative energy production options. In addition, the GOS has instituted significant changes in its energy management, including the establishment of a new Seychelles Energy Commission within the Ministry of Environment, Natural Resources and Transport in July 2009, which has been charged with overseeing the development of integrated energy project planning.

The table below represents a summary of organizations that have an interest in renewable energy in general, and PV systems in particular, in the Seychelles. The Energy Commission will be the lead implementing agency for the project, and a coordinating committee will be set up inside the Energy Commission to oversee the coordination of activities under the project. This committee will include stakeholders who have an interest in renewable energy in general, and PV systems in particular, in the Seychelles. The table below represents a summary of the relevant stakeholder organizations:

Organization	**Activities**
Ministry of Environment, Natural Resources and Transport (MENRT)	Implements policies and energy conservation projects. In the past, an Energy Affairs Bureau (EAB) implemented a small stand-alone PV project on one of the smaller islands.
Seychelles Energy Commission	Established in July 2009 as part of MENRT; part of its role will be to promote the use of more sustainable and viable alternative technologies, especially RETs. The Commission will take the lead role in policy/legal issues related to renewable energy and PV systems in particular.
Public Utilities Corporation (PUC)	PUC is the sole producer and distributor of electricity in the Seychelles, with a monopoly on grid access. However, PUC has stated its interest in diversifying the energy mix, including the expansion of PV systems, and intends to support the project through providing labor, equipment, and maintenance for the pilot PV systems of the project. In addition, PUC is negotiating a contract with Agence Reunionaise pour L'Energie Renouvelable (ARER) to conduct an assessment to determine to what degree renewable energy can contribute to the energy production of the country.
United Nations Development Programme (UNDP)	UNDP is supporting a team of experts, including a renewable energy specialist, to develop a 2nd National Energy Policy during the period 2009-2010.
MASDAR	This Dubai-based company is active in renewable energy development in the Seychelles. Currently it is focused on wind power development, but it may also act as a partner in the provision and management of PV systems in Seychelles.
Seychelles Institute of Technology (SIT)	The SIT has expressed interest in offering courses in RETs; three lecturers from SIT recently undertook a short-term training in RETs on Reunion Island.
National Climate Change	Promoting use of clean technologies that will contribute to the reduction of GHGs

Committee (NCCC)	and coordination of climate change related policies and programs in the country.
GDFSUEZ	French multinational corporation that will be involved in the electricity sector and has major experience in this field in small island states.
SEYPEC (Seychelles Petroleum Company)	A government organization, SEYPEC has the responsibility for ensuring supply of fuel in the country.
Sustainability for Seychelles	A local NGO promoting the use of clean and renewable energy technologies

F. VALUE-ADDED OF GEF INVOLVEMENT IN THE PROJECT DEMONSTRATED THROUGH INCREMENTAL REASONING:

In the absence of the proposed project, government policy and political may continue their recent evolution towards support for RETs, but the specific legal and regulatory mechanisms necessary for their success will remain undeveloped. Furthermore, adoption of PV systems in the Seychelles is likely to be slow or non-existent in the absence of demonstrated examples of economically and technologically viable PV systems in the country, and the lack of technical, financial and strategic capacity to identify good opportunities for PV systems and to install, operate and maintain those systems. GEF funds will be used to specifically remove these barriers. In essence, these barrier removal activities are incremental activities that are needed to facilitate the deployment, diffusion and transfer of solar PV power generation systems in Seychelles. These barrier removal activities of the project will therefore contribute to the realization of global environmental benefits by facilitating the reduction of GHG emissions from the country's power generation sector. Moreover, this could also help initiate the development of other available RE resources of the country, based on the lessons learned and experienced gained from this project.

G. RISKS, INCLUDING CLIMATE CHANGE RISKS, THAT MIGHT PREVENT THE PROJECT OBJECTIVE(S) FROM BEING ACHIEVED, AND IF POSSIBLE INCLUDING RISK MITIGATION MEASURES THAT WILL BE TAKEN:

The following table shows a brief assessment of the main risks with regard to project sustainability and proposes suitable mitigation measures.

Risk	Risk Rating	Mitigation Measures
TECHNICAL RISKS		
System component may cause distortion on the grid.	Low	Research will be undertaken and a mechanism put in place to ensure appropriate technology.
ECONOMIC & FINANCIAL RISKS		
Economic conditions evolve so that PV (both grid-connected and off-grid) technology is not economically and/or financially viable in the Seychelles	Moderate	The project will reduce life cycle costs sufficiently to greatly minimize the economic risks of this project. In addition, the project will support the work of the Energy Commission to build in parity correction factors into the feed-in tariff, such as a "carbon tax" on energy production, which would counter balance any fluctuations in fossil fuel prices.
Lack of political and institutional support for financial mechanisms to enable adoption of PV systems.	Moderate	Seek commitment of Ministry of Finance and banks from the onset of the project.
MARKET RISKS		
Investment in PV systems is not large enough, given very small national economy, to create economies of scale, necessary to make PV systems financially competitive.	Low	The project will ensure that grid-connected PV systems in Seychelles have the regulatory approval to sell electricity back to the grid, as well as financial support through a feed-in tariff, both of which will make investment in PV systems much more attractive for both public and private sector players. In addition, the project will reduce and/or eliminate technical capacity barriers, such as the lack of expertise in the country for installation, operation and maintenance of PV systems, and for their integration (connection) to the power grid, which currently constrain investment in PV systems. These actions will help the Government of Seychelles to achieve its target of 5% of national energy production coming from renewable energy sources.

OTHER RISKS		
Reviewed legislation blocked by National Assembly.	Moderate	Through the UNFCCC Secretariat, lobby for the review and development of an appropriate regulatory framework to allow for the development of RE, especially grid-connected PV systems

H. THE EXPECTED COST-EFFECTIVENESS OF THE PROJECT:

The 250 kWp PV systems developed by the project are expected to produce approximately 350,000 kWh of electricity. Since the electricity produced will be connected to the grid, or will replace existing fossil fuel based electricity production, this will reduce the annual consumption of fuel oil by 81 metric tons per year (station efficiency of 0.23kg/kWh), and thereby reduce CO_2 emissions by approximately 243 metric tons per year. For the lifetime of the system (25 years), this will be about 6,075 metric tons CO2. Considering this direct CO2 emission reduction from the solar PV demonstrations, the unit abatement cost (GEF$/ton CO2) of the project is about US$ 191/ton CO2.

The project activities are expected to "jumpstart" the market for grid-connected PV systems in the Seychelles, which implies there are significant potentials for further avoided GHG emissions and additional improvements in economies of scale and improved cost efficiencies for PV systems in the country after the project has ended. If indirect CO2 emission reductions are considered (based on the introduction of an expected target of 5% share of solar PV in the national power generation mix systems - 13,524,500 kWh based on the current grid power production) the project would contribute to an additional reduction in CO2 emissions per year of 9,394 metric tons per year nationally. Assuming a 25 years lifetime for such investments and a GEF causality factor of 0.8 (dominant given that one of the main outcomes of the project will be supporting the establishment of such an RE target), the UAC for indirect emissions indirectly caused by the project would be as low as about US$ 6.0/ton CO2. These figures are indicative only. During the PPG phase the exact number of solar PV power generation facilities and total installed capacity with the corresponding CO2 emission reduction will be determined with more precision.

I. THE COMPARATIVE ADVANTAGE OF GEF AGENCY:

The project is a climate change capacity building for and demonstration of grid-connected photovoltaic systems, which falls under UNDP's comparative advantages as presented in Annex L of the document GEF/C.31/5 rev.1. In addition, UNDP is the leading international agency working on climate change related issues in the Seychelles, including ongoing programs to assist the Government of Seychelles in developing a 2nd National Energy Policy and a new National Climate Change Strategy.

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

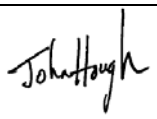
A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S):

(Please attach the country endorsement letter(s) or regional endorsement letter(s) with this template).

NAME	POSITION	MINISTRY	DATE *(Month, day, year)*
Dr. Rolph Payet	Special Advisor to the President National GEF Operational Focal Point	OFFICE OF THE SPECIAL ADVISOR TO THE PRESIDENT	8/12/2009

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF policies and procedures and meets the GEF criteria for project identification and preparation.

Agency Coordinator, Agency name	Signature	Date *(Month, day, year)*	Project Contact Person	Telephone	Email Address
John Hough UNDP/GEF Deputy Executive Coordinator		12/03/2009	Roland Alcindor Environment Programme Manager, UNDP Mauritius	230 212-3726	roland.alcindor@undp.org
			Lucas Black Regional Technical Advisor (acting) Climate Change Mitigation – East & Southern Africa UNDP	212-906-6230	lucas.black@undp.org

REQUEST FOR PROJECT PREPARATION GRANT (PPG)

PROJECT TYPE: FULL-SIZED PROJECT
THE GEF TRUST FUND

Submission Date: 4 November 2009
Re-submission Date: 3 December 2009
Re-submission Date: 06 May 2010

GEF PROJECT ID[1]: 4164
GEF AGENCY PROJECT ID: 4331
COUNTRY(IES): Seychelles
PROJECT TITLE: Grid-Connected Rooftop Photovoltaic Systems
GEF AGENCY(IES): UNDP
OTHER EXECUTING PARTNER(S): Seychelles Energy Commission (Ministry of Environment, Natural Resources and Transport) and Public Utilities Corporation (PUC)
GEF FOCAL AREA(S): Climate Change
GEF-4 STRATEGIC PROGRAM(S): SP3 Promoting Market Approaches for Renewable Energy
NAME OF PARENT/PROGRAM/UMBRELLA PROJECT (if applicable)**:**

A. PROJECT PREPARATION TIMEFRAME

Start date of PPG	July 2010
Completion date of PPG	December 2011

B. PAST PROJECT PREPARATION ACTIVITIES ($)

List of Past Project Preparation Activities	Output of the Activities	Project Preparation Amount (a)	Co-financing (b)	Total c = a + b
Total Project Preparation Financing				

C. PROPOSED PROJECT PREPARATION ACTIVITIES ($)

During the project preparation phase, a full-scale project document (Prodoc) will be developed based on the approved PIF, to be presented to project stakeholders with the specific intention of obtaining the necessary co-financing commitments. A core team of consultants will develop the Prodoc, working closely with technical experts from the Seychelles Energy Commission, the Public Utilities Corporation, and other national stakeholders. Attention will be given to identifying and applying international best practices and lessons from other GEF projects on PV system development, and in particular, to the policies, regulations and financial mechanisms that can support grid-connected systems. The preparatory activities necessary to develop the full-sized UNDP-GEF project are the following:

1. Baseline data collection and assessment of the location, size, precise technology, and technical requirements for pilot PV projects to be implemented during the full project

- Collect data on solar irradiation at potential demonstration sites;
- Collect and assess data on the structural design of buildings at potential demonstration sites to ensure sufficient load capacity to support PV panels and systems;
- Collect data on the current electricity delivery costs to different locations in the country, including

[1] Project ID number will be assigned by GEFSEC. If PIF has already been submitted, please use the same ID number as PIF.

potential demonstration sites;
- Based on above analyses, confirm project demonstration sites for installation of PV systems;
- Collect data on existing electricity generation and distribution system, including technical requirements, to ensure safety and enable feed-in for grid-connected PV systems;
- Develop a methodology to carry out an environmental impact assessment for the proposed full project activities;
- Determine required technical capacities/resources for installation and operation of grid-connected PV systems
- Analyze national technical capacity/resources with regard to PV systems, as well as the technical competence of project partners at different sites (islands of Mahé, Praslin and Aldabra), and develop a strategy for capacity improvement
- Identify potential suppliers for PV systems (with a focus on South-South partnerships); collect information on PV prices and potential end user financial mechanisms; and assess relevant technical specifications (such as weight and size (area) of the PV system) to ensure compatibility with selected rooftop sites and with Seychelles grid;
- Establish contact and share information with similar ventures in other developing countries (esp. Mauritius) that have implemented PV systems

2. Analysis of the existing energy policies, legislation, regulation and market structures and conditions for PV systems in Seychelles
- Carry out an energy policy review (co-financed by UNDP), with specific recommendations on renewable energy policies, including photovoltaic systems;
- Carry out a review of the existing legal and regulatory framework for electricity generation, including review of the PUC Act; identify barriers to grid-connected PV systems; and propose a plan to revise national laws and regulations (including the grid code) to allow for and support grid-connected PV systems, including potential for feed-in tariffs and other financing mechanisms;
- Assess electricity market conditions in Seychelles, and determine carbon finance potential for pilot PV systems installed by project

3. Stakeholder consultation and engagement (with Co-Financing)
The PPG will undertake a detailed stakeholder analysis (co-financed), including government agencies, NGOs, the private sector, and civil society. The potential roles for various stakeholders in PV systems will be assessed, and a series of stakeholder consultations will ensure national ownership of the project. Specific activities will include:
- Analysis of stakeholder capacities and interest in PV systems (to prepare a stakeholder matrix);
- Two national stakeholder workshops: one in the mid-term to present key elements of the project strategy and to develop a participatory logical framework for the project, including success indicators, definition of baseline and target values; and a second one at the end of the project preparation phase to present the final draft of the project document to all concerned stakeholders in the Seychelles;
- A completed stakeholder matrix and a completed stakeholder involvement and capacity building plan;
- Detailed recommendations for stakeholder involvement activities during the Full Project

4. Project Costing, Risk Assessment and M&E Planning
Based on the above steps, project costs and risks will be assessed and an M&E plan will be elaborated, which will include analysis and identification of:
- Common barriers to deployment of grid-connected PV systems, and of the diffusion and transfer of PV technology;
- Design of project components that address the barriers to solar PV systems deployment, diffusion and transfer, with a complementary strategy for partnerships, financial mechanisms and co-funding;

- Project management arrangements, specifying roles of the Seychelles Energy Commission (overall project coordination and implementation) and other key partners, as well as a Memorandum of Understanding with the Public Utilities Corporation for the installation, testing, operation, maintenance and performance monitoring of PV systems;
- A replication plan to support diffusion of PV systems throughout the Seychelles;
- An analysis of project risks and mitigation measures;
- A cost benefit analysis to identify the most effective project alternatives;
- Analysis of the social, institutional, economic and financial sustainability of proposed project activities;
- An overall project Monitoring and Evaluation Plan, including a methodology for a monitoring plan to measure direct and indirect GHG emission reductions resulting from the installed PV systems

List of Proposed Project Preparation Activities	Output of the PPG Activities	Project Preparation Amount (a)	Co-financing (b)	Total c = a + b
1. Baseline data collection and assessment of the location, size, precise technology, and technical requirements for pilot PV projects to be implemented during the full project	List of project sites and selected PV system technology, with supporting analysis	25,000	23,000	48,000
2. Analysis of the existing energy policies, legislation, regulation and market structures and conditions for PV systems in Seychelles	List of barriers to the development of PV systems in Seychelles, and related legal and policy development strategy	12,000	18,000	30,000
3. Stakeholder consultation and engagement (with Co-Financing)	Detailed stakeholder involvement plan	0	10,000	10,000
4. Project Costing, Risk Assessment and M&E Planning	Full project scoped and costed	30,000	12,000	42,000
Total Project Preparation Financing		67,000	63,000	130,000

D. FINANCING PLAN SUMMARY FOR PROJECT PREPARATION GRANT: ($)

	Project Preparation	Agency Fee
GEF financing	67,000	6,700
Co-financing	63,000	
Total	130,000	6,700

E. PPG REQUESTED BY AGENCY(IES), FOCAL AREA(S) AND COUNTRY(IES)[1]

GEF Agency	Focal Area	Country Name/ Global	(in $)		
			PPG (a)	Agency Fee (b)	Total c = a + b
Total PPG Requested					

[1] No need to provide information for this table if it is a single focal area, single country and single GEF Agency project

F. PPG BUDGET REQUEST

Cost Items	Total Estimated Person Weeks for GEF Grant (PW)	GEF ($)	Co-financing ($)	Total ($)
Local consultants*	50	27,000	53,000	80,000
International consultants*	10	30,000	0	30,000
Travel		6,000	0	6,000
Other (consultation meetings, reporting, office, stationary, technical equipment)		4,000	10,000	14,000
Total PPG Budget		67,000	63,000	130,000

* Additional information regarding consultants is provided in Annex A.
** The estimated number of person-weeks in this table refers only to the GEF amount, and hence does not include consultant costs that are financed by project partners through in-kind or cash co-financing
*** Project partners (Seychelles Energy Commission and Public Utilities Corporation) will do most of the technical information collection and analysis using their own staff.

G. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF policies and procedures and meets the GEF criteria for project identification and preparation.

Agency Coordinator, Agency name	Signature	Date *(Month, day, year)*	Project Contact Person	Telephone	Email Address
Yannick Glemarec UNDP/GEF Executive Coordinator	Y. Glemarec	May 06, 2010	Lucas Black Regional Technical Advisor, Climate Change Mitigation	**+ 212 906 6230**	lucas.black@undp.org

Annex A

Consultants Financed by the Project Preparation Grant (PPG)

Position / Titles	$/ Person Week[1]	Estimated PWs[2]	Tasks to be performed
Local			
Project formulation and capacity building expert	350	40	• Analysis of the training / capacity building needs for PV systems, and finalizing the project's capacity training strategy and activities. • Manage stakeholder outreach processes, including two national workshops, and develop a stakeholder involvement plan
Legal and Regulatory Expert	1,500	6	▪ Review of legal and regulatory framework for electricity generation and distribution, including the existing PUC Act; changes necessary to allow for PV systems to feed-in to the grid and a possible feed-in tariff ▪ Assistance to the SEC in drafting a memorandum of understanding with the PUC for installation, testing, operation, maintenance, and monitoring of grid-connected PV systems
Economist with environmental expertise	1,000	4	• Quantify the direct and indirect greenhouse gas emission reductions generated by project demonstration PV systems • Undertake analysis of potential carbon finance benefits of demonstration PV systems
International			
Lead consultant, project design	3,000	10	• Provide expertise on the design of the full project (FP) taking into account international best practices and lessons learnt from PV systems projects elsewhere • Prepare all detailed budgets in line with GEF requirements and take into account co-financing expected • Leading the workshops for the logical framework analysis and preparation of project's M&E plan • Establish clear project outputs and activities and schedules and work plan • Guiding the inputs of other local and international experts working for the project and finalizing the project design and presentation as elaborated under component 4 of the PPG

[1] Provide dollar amount per person week.

[2] Provide person weeks needed to carry out the task and corresponds to the dollar amount per person week in the previous column.

Scientific and Technical Advisory Panel

The Scientific and Technical Advisory Panel, administered by UNEP, advises the Global Environment Facility
(Version 5)

STAP Scientific and Technical screening of the Project Identification Form (PIF)

Date of screening: May 05, 2010 Screener: Lev Neretin

Panel member validation by: Nijavalli H. Ravindranath
Consultant(s):

I. PIF Information *(Copied from the PIF)*
FULL SIZE PROJECT GEF TRUST FUND
GEF PROJECT ID: 4164
PROJECT DURATION : 3
COUNTRIES : Seychelles
PROJECT TITLE: Grid-Connected Rooftop Photovoltaic Systems
GEF AGENCIES: UNDP
OTHER EXECUTING PARTNERS: Seychelles Energy Commission (Ministry of Environment, Natural Resources and Transport) and Public Utilities Corporation (PUC)
GEF FOCAL AREA: Climate Change
GEF-4 STRATEGIC PROGRAMS: CC-3;

II. STAP Advisory Response *(see table below for explanation)*

Based on this PIF screening, STAP's advisory response to the GEF Secretariat and GEF Agency(ies): **Consent**

III. Further guidance from STAP

This project aims at the increased use of grid-connected roof top PV systems for generating electricity in the islands of Seychelles. The project is comprehensive in terms of inclusiveness for policy and legal framework development, technology demonstration and capacity building. STAP supports this project and makes a few suggestions to be taken into account during project document preparation:

1. Barrier analysis: The project presents a clear set of barriers and has also developed a targeted set of measures to overcome the barriers. The project rightly recognizes legal, regulatory and policy as key barriers to promotion of PV systems. But there is a need to assess the financial viability of PV systems before implementing strategies to overcome legal, regulatory and policy barriers.

2. Grid-connected: What is the rationale for focusing only on grid-connected rooftop photovoltaic systems? Why have off-grid photovoltaic systems for households and small establishments not been considered? Off-grid photovoltaic systems may be more economically feasible since the cost of grid interface could be avoided. Since this is a demonstration project, it may be desirable to demonstrate and monitor off-grid photovoltaic systems as well.

3. Capacity of the systems and end users: Power capacity of the systems is critical in determining the financial viability of PV systems. Thus it is necessary to conduct a systematic analysis to identify financially viable capacities for PV systems. Who will be the dominant users of the solar power generated, particularly in the small islands?

4. Financial viability and investment cost: Large scale spread of SPV systems depends on the investment and O&M costs. What is the strategy to reduce the cost of the PV systems beyond the 3 demonstration units?

5. Baseline scenario: There is a need to develop a baseline scenario estimating the current and projected dependence on fossil fuels and the associated GHG emissions. This would enable calculation of the net GHG benefits of the current project.

STAP advisory response	*Brief explanation of advisory response and action proposed*
1. Consent	STAP acknowledges that on scientific/technical grounds the concept has merit. However, STAP may state its views on the concept emphasising any issues that could be improved and the proponent is

	invited to approach STAP for advice at any time during the development of the project brief prior to submission for CEO endorsement.
2. Minor revision required.	STAP has identified specific scientific/technical suggestions or opportunities that should be discussed with the proponent as early as possible during development of the project brief. One or more options that remain open to STAP include: (i) Opening a dialogue between STAP and the proponent to clarify issues (ii) Setting a review point during early stage project development and agreeing terms of reference for an independent expert to be appointed to conduct this review The proponent should provide a report of the action agreed and taken, at the time of submission of the full project brief for CEO endorsement.
3. Major revision required	STAP proposes significant improvements or has concerns on the grounds of specified major scientific/technical omissions in the concept. If STAP provides this advisory response, a full explanation would also be provided. Normally, a STAP approved review will be mandatory prior to submission of the project brief for CEO endorsement. The proponent should provide a report of the action agreed and taken, at the time of submission of the full project brief for CEO endorsement.