GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

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February 21, 2012

Dear Council Member:

UNIDO as the Implementing Agency for the project entitled: ***Cape Verde: SPWA-CC Promoting market based development of small to medium scale renewable energy systems in Cape Verde,*** *under the Regional: SPWA-CC: GEF Strategic Program for West Africa: Energy Component (PROGRAM)*, has submitted the attached proposed project document for CEO endorsement prior to final approval of the project document in accordance with UNIDO procedures.

The Secretariat has reviewed the project document. It is consistent with the objectives of the program approved by the Council in March 2010. The scope of the project activities, however, has changed since work program entry. The GEF grant amount has increased by $40,000 to cover eligible incremental costs. The changes in the various cost elements from the original concept approved by the Council and as recommended in the final project design is summarized in the attached note from the UNIDO.

We have today posted the proposed project document on the GEF website at www.TheGEF.org for your information. We would welcome any comments you may wish to provide by March 20, 2012 before I endorse the project. You may send your comments to gcoordination@TheGEF.org.

If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

Monique Barbut
Chief Executive Officer and Chairperson

Attachment: Project Document

Copy to: Country Operational Focal Point
GEF Agencies
STAP
Trustee

REQUEST FOR CEO ENDORSEMENT/APPROVAL

PROJECT TYPE: FULL-SIZED PROJECT
THE GEF TRUST FUND

Submission Date: October 2011

PART I: PROJECT INFORMATION

GEFSEC PROJECT ID: 3923
GEF AGENCY PROJECT ID: XX/CVI/09/X01
COUNTRY(IES): Cape Verde
PROJECT TITLE: Promoting market-based development of small to medium-scale renewable energy systems in Cape Verde
GEF AGENCY(IES): UNIDO
OTHER EXECUTING PARTNER(S): Ministry of Industry and Energy, ECOWAS Centre for Renewable Energy and Energy Efficiency
GEF FOCAL AREA(s): Climate Change
GEF-4 STRATEGIC PROGRAM(s): **CC-SP3**-RE
NAME OF PARENT PROGRAM/UMBRELLA PROJECT: A National Level Project in Cape Verde under the GEF Programmatic Approach on Access to Energy in West Africa

Expected Calendar (mm/dd/yy)	
Milestones	**Dates**
Work Program (for FSPs only)	March 2010
Agency Approval date	October 2011
Implementation Start	March 2012
Mid-term Monitoring	August 2013
Project Closing Date	February 2015

A. PROJECT FRAMEWORK (Expand table as necessary)

Project Objective: To create market conditions conducive to the development of small to medium scale renewable energy systems in Cape Verde

Project Components	**Indicate whether Investment, TA, or STA[2]**	**Expected Outcomes**	**Expected Outputs**	**GEF Financing[1]**		**Co-Financing[1]**		**Total (1000$)** c=a+ b
				(1000$) a	%	(1000$) b	%	
1. Demonstrating technical feasibility and commercial viability of small to medium scale RE projects and establishment of seed fund for project replication	Investment,	Feasibility and viability of small to medium scale renewable energy technologies demonstrated. Renewable energy installed capacity of 1.6MW	1.1 Three demonstration projects designed and implemented	1013.900	15	5534.900	85	6548.800
		Over 2MW installed capacity is realized from the Scaling of renewable energy projects making used of the seed funding with contributions from the ECOWAS Renewable Energy Facility (EREF) and GEF.	1.2 Specialised renewable energy seed fund established for Cape Verde with contributions from ECREEE's ECOWAS Renewable Energy Facility (EREF) and GEF	413.302	37	706.400	63	1119.702
2. Resource Assessment and scaling up strategy	TA	Investment and business strategy for scaling up established.	2.1 Investment and business strategy for scaling up or replicating small to medium scale renewable energy projects in the country developed and presented to policy makers for adoption.	73.600	98	1.662	2	75.262
	TA	Report detailing options to provide 100% RE	2.2 Study of options to provide 100% RE electricity for Brava	0.00	0	52.000	100	52.000

		electricity to Brava						
3. Consolidating a comprehensive legal and regulatory framework conducive to the development of small to medium scale renewable energy projects.	TA	Establishment of legal and regulatory framework for promoting and supporting small to medium scale renewable energy in Cape Verde	3.1 Regulation, strategy and action plan for developing small to medium scale renewable energy technologies developed and presented to lawmakers for adoption.	12.600	23	41.062	77	53.662
			3.2 Policy and regulatory propositions for integrating small to medium scale renewable energy into economic and social sectors such as education, health etc developed and adopted.	12.600	22	45.399	78	57.999
4. Capacity building and awareness raising	TA	National institutions and private stakeholders are in a position to effectively support the market for small to medium scale renewable energy projects	4.1 Training programme directed at 10 MTIE and ECREEE staff on project management developed, and training conducted on a train-the-trainer basis. 4.2 Awareness raising programmes including targeted seminars; coaching clinics held. 12 half a day meetings targeting 50 companies organised 4.3 Training programmes for market enablers and market players especially entrepreneurs, banks etc developed and training conducted. Within this output 20 RE experts will be trained as trainers, 40 people trained in RE project identification, design, implementation and operation. 4.4 The demonstration project are independently evaluated and lessons learnt are widely disseminated through various media.	82.880	37	142.718	63	225.598
5. Project management and coordination	TA	MTIE and ECREEE manage and coordinate the project effectively with support from stakeholders.	5.1 Project management office is established at the ECREEE Secretariat and key staff of the PMO in place 5.2 Project dedicated website established and project milestones, reports etc regularly posted on the website.	149.300	31	332.280	69	481.580
Total Project Costs				1758.182 82		6856.421		8614.603

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

B. SOURCES OF CONFIRMED CO-FINANCING FOR THE PROJECT (expand the table line items as necessary)

Name of Co-financier (source)	*Classification*	*Type*	*Project*	*%**
UNIDO	Implementing Agency	Cash	60,000	0.88%
UNIDO	Implementing Agency	In Kind	140,000	2.04%
Government of Cape Verde	National Government	In-kind	131,613	1.92%
Government of Cape Verde	National Government	Cash	68,059	0.99%
ECREEE	Regional Center	Cash/	780,000	11.38%
ECREEE	Regional Center	In-kind	176,172	2.57%
Electra	National Utility	Cash	3,513,400	51.24%
Água Brava Electric	Private Sector	Cash	1,287,220	18.77%
Brava Island Municipality	Municipality	Cash	50,400	0.74%
Mindelo Hospital	Private Sector	Cash	67,100	0.98%
Ribeira Grande Minucipality	Municipality	Cash	319,000	4.65%
Carriçal Municipality	Municipality	Cash	187,500	2.73%
São Nicolau Minicipality	Municipality	Cash	67,837	0.99%
IEFP	Government Institution	In-Kind	8,120	0.12%
Total Co-financing			**6,856,421**	**100.00%**

* Percentage of each co-financier's contribution at CEO endorsement to total co-financing. UNIDO's in-kind contribution mentioned in table above refers to time and effort of the Project Manager to the project especially in overall project management, monitoring and reporting.

C. FINANCING PLAN SUMMARY FOR THE PROJECT ($)

	Project Preparation a	***Project b***	***Total c = a + b***	***Agency Fee***	***For comparison: GEF and Co-financing at PIF***
GEF financing	60,000	1,758,182	1,818,182	181,818	1,758,182
Co-financing	90,000	6,856,421	6,946,421		5,950,000
Total	150,000	8,614,603	8,764,603	181,818	7,708,182

D. GEF RESOURCES REQUESTED BY AGENCY(IES), FOCAL AREA(S) AND COUNTRY(IES)[1]

GEF Agency	***Focal Area***	Country Name/ ***Global***	***(in $)***		
			Project (a)	***Agency Fee (b)[2]***	***Total c=a+b***
N/A	N/A				
Total GEF Resources			0	2	0

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

[2] Relates to the project and any previous project preparation funding that have been provided and for which no Agency fee has been requested from Trustee.

E. CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

Component	*Estimated person weeks*	*GEF amount ($)*	*Co-financing ($)*	*Project total ($)*
*Local consultants**	212	64,480	101,120	165,600
*International consultants**	140	235,200	184,800	420,000
Total	352	299,680	285,920	585,600

* Details to be provided in Annex C.

F. PROJECT MANAGEMENT BUDGET/COST

Cost Items	*Total Estimated person weeks*	*GEF amount ($)*	*Co-financing ($)*	*Project total ($)*
*Local consultants**	94.5	81,500	80,000	161,500
International consultants(M&E)*	6	18,000	60,000	78,000
*Office facilities, equipment, vehicles and communications**		34,800	157,480	192,280
*Travel**		15,000	34,800	49,800
Total	**100.5**	**149,300**	**332,280**	**481,580**

* Details to be provided in Annex C.

G. DOES THE PROJECT INCLUDE A "NON-GRANT" INSTRUMENT? yes ☐ no ☒

(If non-grant instruments are used, provide in Annex E an indicative calendar of expected reflows to your agency and to the GEF Trust Fund).

H. DESCRIBE THE BUDGETED M &E PLAN:

Project monitoring and evaluation (M&E) will be carried out in accordance with established UNIDO and GEF guidance and procedures. The overall objective of the monitoring and evaluation process is to ensure successful and quality implementation of the project by: i) tracking and reviewing project activities execution and actual accomplishments; ii) providing visibility into progress as the project proceeds so that the implementation team can take early corrective action if performance deviates significantly from original plans; and iii) adjust and update project strategy and implementation plan to reflect possible changes on the ground, results achieved and corrective actions taken.

A detailed monitoring plan for tracking and reporting on project time-bound milestones and accomplishments will be prepared by UNIDO in collaboration with the Project Management Office (PMO) and project partners at the beginning of project implementation and then periodically updated. By making reference to the impact and performance indicators defined in the Project Results Framework, the monitoring plan will track, report on and review project activities and accomplishments in relation to:

a) Renewable energy generation and GHGs emission reductions directly generated by the UNIDO GEF project. These will include the type and the number of small to medium scale renewable energy projects developed and implemented.
b) Renewable energy generation and GHGs emission reductions in-directly generated by the UNIDO GEF project. These will include type and the number of small to medium scale renewable energy projects developed and implemented due to the increased capacity and conducive environment for the projects.
c) Renewable energy investment generated by the UNIDO GEF project, directly and indirectly.
d) Development of policy, legislative and regulatory frameworks aimed to promote and support a renewable energy market.
e) Level of awareness and technical capacity for small to medium scale renewable energy within relevant institutions, in the market and within enterprises.
f) Private sector contribution to the implementation of the project.
g) Overall socio-economic impacts of the project to include increase in productive capacities, gender balance etc

The National Project Manager will be responsible for continuous monitoring of project activities execution, performance and track progress towards milestones. However, monitoring and evaluation of the demonstration projects with respect to energy generation, technical performance, commercial viability and GHGs emission reduction, and

related information, will be integral part of the evaluation component of Project Component 1. The UNIDO project manager will be responsible for tracking overall project milestones and progress towards the attainment of the set project outputs. The UNIDO project manager will be responsible for narrative reporting to the GEF. Two project evaluations will be carried out – one mid-term evaluation and a final external evaluation 6 months after operational completion of the project. The following table provides the tentative budget for the evaluation and each evaluation will cost around US$ 39,000.

Source of funding	USD
GEF funding	60,000
Co-financing (UNIDO)	18,000
Total	78,000

PART II: PROJECT JUSTIFICATION:

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

1. The Issue

Cape Verde is a small country consisting of 10 small islands and 13 islets located in the Atlantic Ocean due west of the westernmost point of Africa. It has total area of 4033 square kilometres and total population of about 542,000 inhabitants of which 55% live in urban areas according to recent census. The 9 inhabited islands rely heavily on imported fuel (particularly diesel and heavy oil) for their power generation and transportation needs.

The country receives very minimal and infrequent rainfall. Sea water desalination is the only source of potable water for most of the islands that do not have micro climates. As such, water desalination consumes a significant part of the power generated in the country, implying that the power and water supply sectors are closely linked.

Each island operates its own local electricity grid that runs on petroleum products (renewable energy production represents only 3% of the generation capacity in 2009). Due to the grid-connected wind and solar power projects the renewable energy penetration rate is expected to increase to 15% by the end of 2011. As a result of the electrification projects that have been developed in recent years electricity coverage in Cape Verde is around 90%, varying from island to island. For most of the non electrified areas, there is dependence on localised power grids that run on fossil fuels. At the country level and at the levels of specific islands, power demand is rapidly growing and is already close to the supply capacity. As a result the dependence an imported petroleum products is increasing and exerting a heavy burden on the national budget. Besides electricity, others forms of energy used for cooking are biomass and gas. The government promotes the adoption of cooking gas as a strategy to reduce deforestation in rural areas.

Cape Verde has, in the recent past, continued to register positive socio-economic growth as demonstrated by the transition of its status to a middle income country. There has also been a corresponding positive change in affluence amongst the population. In parallel to this, the country's tourism sector has continued to grow particularly on some islands. These changes have contributed to a corresponding increase in demand for petroleum products, electricity and desalinated water and consequently carbon emissions. Therefore, Cape Verde as a country and particularly some islands are faced with increasing power deficit that is already hampering economic and social development. Although considerable investments have been made in power infrastructure in the last few years, they have largely failed to address the ever widening power supply shortage on some islands (particularly the main city and the tourist islands such as Sal and Boa Vista). Besides, these investments have focused on expanding the current fossil fuel based power generation capacity and distribution networks. This is however so despite of the country being endowed with different renewable energy resources mainly wind and solar energy that, if developed, could augment current power supply systems. The high electricity tariffs that the country experiences would potentially make investments in grid connected and decentralized renewable energy projects financially viable even without subsidies or feed-in tariffs. In 2011 the electricity consumer tariffs reached 25 Euro/cents per kwh (below 60 kwh consumption) and 32 Euro/cents (higher than 60 kwh consumption). Likewise, replacing the fossil fuel based capacity in localised grids in remote areas that are not connected to the central grid in each island with renewable energy resources would reduce cost of energy services, reduce GHG emissions, and improve supply security. The distributed nature of power grids i.e. one grid for each island, would also support the possibility of integrating small to medium scale renewable energy systems into existing grids or stand alone grids for areas that are not currently accessed by the central grids. In addition, the relatively small sized nature of the islands, ranging from 991 to 35 km^2, supports the possibility of small to medium scale and localised renewable energy systems, either grid connected or stand alone.

According to the First National Communication (FNC), in 1995 Cape Verde emitted 330,901 tonnes of CO_2 equivalent (tCO_2e) of which carbon dioxide emissions (CO_2) accounted for approximately 74.1% of this total. The emissions from fossil fuels were responsible for 66.5 % of the total emissions in Cape Verde, while agriculture, biomass and solid residues & wastewater were responsible, respectively, for 11.9%, 11.5 % and 10.1%. The origin of emissions from energy sources in 1995 was mainly from fossil fuels (65%) and fuel wood and biomass (35%), totalizing 337.3Gg of CO2 equivalent. With increased fossil fuel based power systems having developed in the recent past, the current levels of GHG emissions from this sector is expected to be much higher than this estimate. In addition, this estimate is set to

grow as more fossil fuels based power plants are built to address the current power deficit both for grid connected and remote areas.

The traditional response to the widening power supply gap faced by the country entails increased oil-based power generation capacity that would have global environmental impacts as well as budgetary implications at national level. This would effectively lock the country into an electricity infrastructure based on fossil fuels. Therefore, market based development of power systems that are based on locally available renewable energy resources in the country would usher a double dividend of global environmental and local socio-economic benefits. More specifically, the benefits to be realised include, increased energy supply security, avoided GHG emissions, and relief on the budget of the state, private households and companies.

The Government of Cape Verde has launched a commendable plan to reduce the country's dependence on imported fossil fuels through increased energy production from renewable resources. Through private-sector investment and government-supported projects, Cape Verde intends to generate at least 25% of electricity from renewable sources by the year 2011 and 50% by the year 2020. The Government initiated the development of a comprehensive green investment plan which identified possible grid-connected solutions with an overall investment volume of 250 million Euros. Major grid-connected projects in solar power (5 MW for Santiago and 2.5 MW for Sal) and wind power (28 MW for Santiago, S.Vicente, Sal and Boavista in total) are in the final stage of implementation. The solar parks were inaugurated in 2010 and the construction works for the wind power projects is intended to be finalized in 2011. Apart from grid-connected solutions the Cape Verdean Government envisages to increase the utilization of small- and medium sized solutions which could provide competitive electricity to remote settlement, decrease the peak load and has the potential to create local employment. With that the Government also responds to the technical limitations of the grids (grid stability) to increase the share of intermediate renewable energy power sources (wind and PV) to more than 25%.

According to data from ELECTRA in 2009, the electricity production in Cape Verde is based on thermal power stations running on heavy fuel or diesel (97%); and a small percentage of wind energy (3%). With the introduction of the above referred large renewable energy projects the RE penetration rate is expected to increase from 3% in 2009 to 20% to 25% after the implementation of these projects.

The introduction of large renewable energy projects in Cape Verde is on the way, however by developing only large scale energy projects with high up-front investment costs the Government targets will probably not be completely achieved. Large scale projects have high infrastructural development needs and may pose a great stress to the existing grid and thus they will not constitute the only solution to address the electricity production and supply in smaller islands of Cape Verde, in remote areas for which there is no grid connection and electricity is only available a few hours a day and for small areas with smaller electricity demand needs. Furthermore, the fragmented nature of power grids due to the geographical characteristics of the country tends to discourage potential large-scale investors due to the perceived limited market potential. Therefore there is need for a deliberate effort to promote investments in small to medium scale renewable energy projects that would both meet the country’s needs and would not need huge and complex financial arrangements that are required in the case of large scale projects. Small to medium scale renewable energy systems have much smaller infrastructural development needs, reduced up-front investment and maintenance costs and, in the cases of the grid connected ones, will pose much smaller stress to the existent grid when connected to it. Moreover only when coupling the installation of large systems with small to medium scale renewable energy systems, the existing renewable energy potential may be utilized to its maximum potential, electricity can be provided on a 24 hours basis to remote populations that use isolated fuel based systems and Government targets can be achieved in a cost-efficient way.

The Government has projects under way to identify renewable energy resources available in Cape Verde however only the installation of large scale renewable energy projects is being pursued. Renewable energy resource analysis that was carried out in Cape Verde not only identified renewable energy resources that can be utilised for large scale development but also refers to a large potential for smaller to medium scale systems to be taped. This project looks into the potential for the development of small to medium scale renewable energy projects that can play a significant role in achieving the Governments targets and addressing some of the currently existing barriers to market-based development of renewable energy projects in Cape Verde. This project also aims to create a potential market in Cape Verde for small to medium scale renewable energy systems which requires smaller up-front investments, for which money can be raised from international support and locally, and will lead to great local economic savings and shorter periods for investment return.

An analysis of the energy sector in Cape Verde was carried out as part of the PPG activities; this is provided in Annex F6 of the Project Document. As a result of this analysis barriers to the development of small to medium scale renewable energy projects were identified and the objectives of this project refined to assist in overcoming these barriers. The barriers identified are summarised below.

Financial Barriers

Financial barriers fall into two categories - affordability and access to finance. Affordability is a problem due to the high upfront investment cost of renewable energy technologies and inadequate financing mechanisms. Some financial institutions perceive renewable energy technologies as unreliable and lacking long-term viability. For smaller projects it is particularly difficult to mobilise due to the risk capital for the development (e.g. feasibilities, measurements). The sector has been relying more or less on external donor funding (e.g. soft loan credit line of Portugal, grants for project development from different donors).

In Cape Verde , with the recent introduction of the Decree-law n.1/2011 of 3rd of January on Promotion and Incentive for the Use of Renewable Energy rules concerning the promotion, incentives and access to licence and exploration of the independent production of electricity using renewable energy sources were introduced in Cape Verde. This Decree Law with the objective of promoting and incentivising the use of renewable energy in Cape Verde, introduces a group of incentives for renewable energy development such as: fiscal incentives; a transparent and stable system of remuneration for the sale of energy produced during a period of 15 years with payment options that offer guarantees to sponsors, namely the creation of the Renewable Production Credits; a special regime for micro-generation, with the right to sell the produced energy at the same price at which the electricity is purchased and a fund for the Promotion of Decentralized Rural Electrification. This decree-law is expected to address to a great extent financial barriers for the development of renewable energy in Cape Verde, however it is still quite recent and the sector is expected to keep relying more or less on external donor funding (e.g. soft loan credit line of Portugal, grants for project development from different donors) for up-front investment costs. Still with the introduction of this decree the difficulty of mobilising risk capital for the development of smaller scale projects (e.g. feasibilities, measurements) is expected to continue. For energy efficiency projects there are so far no national programs or incentives to foster its development and implementation

High capital costs / Limited budgets

Although lower fuel and operating costs may make renewable energy cost-competitive on a life-cycle basis, higher initial capital costs can mean that renewable energy provides less installed capacity per dollar invested than conventional HFO or diesel generation. Renewable energy therefore requires a greater level of financing for the same capacity. Financial institutions may require a premium in lending rates because more capital is being risked up-front compared to conventional generation projects.

Small to medium scale renewable energy systems present smaller up-front investment costs than large scale projects, as well as a better adaptation to the geographical nature of the country. However when compared to larger projects, small to medium scale renewable energy projects have high development (e.g. feasibilities, measurements) costs, as the potential to generate dividends is smaller. Potential investors include the public sector (ELECTRA and the Government) and the private sector (IPPs, potential customers and households). However the high capital of most renewable energy makes it out-of-reach of most Cape Verdeans. Government and ELECTRA budgets are limited and the demand for financing various national priority areas is great so allocating resources for renewable energy projects is difficult. For the private sector there are also competing priorities for their budgets. The concern of households is the initial capital cost, so it may be necessary to organize a financial package which allows householders to purchase renewable energy systems and spread the payment.

High transaction costs

Renewable energy projects are typically smaller size than conventional energy projects. Projects may require additional information not readily available, or may require additional time or attention to financing or permitting because of unfamiliarity with the technologies or uncertainties over performance. For these reasons, the transaction costs of renewable energy projects—including resource assessment, sitting, permitting, planning, developing project proposals, assembling financing packages, and negotiating power-purchase contracts with utilities—may be much larger on a per-

kilowatt (kW) capacity basis than for conventional power plants. These higher transaction costs add to the costs of renewable projects.

Financing institutions / Banking sector loan rates
There is no experience within the financial institutions in lending on renewable energy projects so there are no dedicated financing mechanisms that take into consideration the nature of small to medium scale renewable energy based investment projects especially the need for high capital upfront and the long payback periods. In addition the capacity within financial institutions and power utilities to appraise renewable energy proposals is limited or non-existent. The cost of borrowing capital in Cape Verde is high and the longer pay-back periods required for renewable energy projects are deems risky to finance. The bank's interest rates on loans in Cape Verde are currently higher than 7.5%. Foreign currency loans are available at lower costs however since the revenues for renewable energy projects within the country will be in local currency the financial institutions are unwilling to lend in foreign currency.

Experience from past efforts in developing renewable energy projects in Cape Verde, in particular wind energy projects shows that the process of mobilising finance from different sources for large projects normally takes too long to realise. As such the private sector would need to make significant investments in the preparation of such projects and setting up the financial arrangements to realise potential investments. Given the sizes of the investment required for such projects and the associated costs, potential small to medium scale investors tend not to be able to participate in such projects. On the other hand, the fragmented nature of power grids due to the geographical characteristics of the country tends to discourage potential large-scale investors due to the perceived limited market potential.

Regulatory Barriers
Support for renewable energy and lack of institutional capacity
Cape Verde has made positive steps towards a supportive framework for renewable energy and has already implemented some of the support mechanisms recommended internationally such as allowing the private sector to operate through Independent Power Producers (IPPs), a licensing regime, a regulatory body (ARE) and clear responsibilities within the energy sector for policy, regulation and provision of energy. Also it has recently enacted the Decree-Law on the Promotion and Incentives for the Use of Renewable Energy (DLn.1/2011, of 3rd of January) that supports renewable energy development and creates the instruments to incentivize the development of this market in Cape Verde. This decree-law establishes a much needed conductive regulatory framework that will stimulate investment by both local and international investors into small to medium scale renewable energy projects.

However this decree-law is still quite recent and there is a need to make it operational. Moreover more needs to be done if renewable energy is to be actively incentivized and encouraged. Within the Cape Verde National Energy Policy is stated Cape Verde's goals in terms of renewable energy as well as indicates the renewable energy technologies that will be targeted and developed in the short term. In addition, and in order to facilitate business planning, and guide national efforts and facilitate investment in renewable and alternative energy, the policy also creates the National Renewable Energy Company. However there is a need to lay out a plan to achieve the proposed objectives. More legislation should be formulated and presented to the Government to further strengthen the market.

Furthermore the institutional capacity and competencies within the energy sector are limited, especially in relation to the formulation and implementation of policies as well as in regulation. The recently enacted the Decree-Law on the Promotion and Incentives for the Use of Renewable Energy was developed by Cape Verde's Government.

Although there is a now a robust package of legislation and incentives for developing renewable energy projects in the country, there have been no efforts to coordinate efforts to develop the renewable energy sector in conjunction with other sectors such as education, health, tourism etc where such interventions would be appropriate and cost effective. Thus although there is conductive legal and regulatory framework supporting small to medium-scale renewable energy projects there is as a lack of expertise to implement substantive and effective policies and programmes to promote and support renewable energy development.

Cape Verde already has the legal framework to allow the operation of IPPs and there is experience with a few IPPs negotiating power purchase agreements (PPAs) with ELECTRA. Now with the introduction of the new decree law on the Promotion and Incentives for the Use of Renewable Energy, there is a clear mechanism for the calculation of the

tariff in the PPA for renewable energy projects. However, in order to accelerate the process and assure consistency, there is a need to establish a standard PPA for renewable energy.

There is also a lack of capacity by institutions, market players and market enables that would be needed to establish and operate a market for small to medium scale renewable energy projects. For the implementation of small to medium scale renewable energy projects there is a need to enhance not only institutional capacity and set up so as to effectively support the development of this projects but as well to enhance the capacity of the other market players, such as market enablers (policy makers) regulators, entrepreneurs, project developers and financial institutions as these players often have often problems to appraise small to medium scale renewable energy projects. All these players need to strength their capacity and competencies on small to medium scale renewable energy projects, their benefits as well as in the importance of their active role on that.

Technical barriers

Insufficient technical capacity in the market to identify, develop and implement renewable energy projects

There is a limited technical capacity to design, install, operate, manage and maintain renewable energy based modern energy services, mainly due to a lack of experience in this (new) field.

Meetings and discussions during the PPG show that there is a limited understanding of the opportunities for renewable energy and weak capacity to be able to develop and implement any small to medium scale renewable energy projects. Existing local companies in the sector are further weakened through strong international competition entering the market, lack of north-south business partnerships and non-existing support for local companies in the sector. ELECTRA, which is the entity to develop electricity generation projects, has a low capacity for managing as well as attending electricity demand. There is a need to demonstrate the technical viability of small to medium scale renewable energy technologies that would be suitable for Cape Verde needs, i.e. solar and wind.

Bulk procurement of renewable energy technologies is limited due to the current small market for renewable energy based modern energy services. Hence the local infrastructure to support small to medium scale renewable energy development does not exist or is very limited and local manufacturing and/or assembly of renewable energy technology components is lacking, along with knowledge, skills, expertise and facilities.

Finally there is a need to ensure that installers/contractors are suitably qualified to ensure that small to medium scale renewable energy systems do not fail because of unsatisfactory installation and maintenance practices. There are no quality control, norms and standards in terms of renewable energy performance, manufacture, installation and maintenance and thus there is a danger that poorer quality goods are imported.

Technical limitation of integrating renewable energy systems in to the grid

Regarding grid-connected renewable energy one of the most significant barriers is the technical limitation of integrating variable wind and solar resources in to the grid. The existent grid is quite weak, which does not ensure that produced energy is in fact delivered to the consumers due to structural problems as well as restricts the addition of capacity, and thus restricts the development of small to medium scale renewable energy projects. Furthermore there is a mismatch between peak electricity demand in the evening and lower solar radiation and wind resources.

Information and awareness barriers

Limited information on small to medium scale renewable energy technology and opportunities

There is poor awareness of small to medium scale renewable energy technologies and the opportunities they can offer beyond the solar water pumping systems and large wind farms and other available cost-effective technology options have not been considered systematically (e.g. solar thermal systems, energy efficiency improvements). Therefore there is limited knowledge of the small to medium scale renewable energy market potential and availability and access to existing renewable energy resource information is also limited.

Lack of understanding of the commercial viability of renewable energy projects

Since energy costs are so high most enterprises now pay great attention to energy costs, however they have limited awareness and understanding of the financial and qualitative benefits that renewable energy can deliver. This is consequence of lack of information about what is technically feasible and what is commercially available. There are no demonstration projects and no structured renewable energy dissemination and education programmes. Knowledge on,

for example, the fact that life cycle costs of renewable energy technologies are often competitive or even lower, is mostly absent. Availability of renewable energy resources is very site specific, requiring detailed analysis of the local specific conditions.

2. How the Project Seeks to Address the Issue

The ultimate goal of the project is to reduce greenhouse gas emissions and to support sustainable development in Cape Verde by creating market conditions conducive to the development of small to medium scale renewable energy systems in line with national energy policy objectives of making the country less dependent on imported fossil fuels. The project seeks to address many of these existing barriers to renewable energy, to deliver measurable results and to make an impact on investment in small to medium scale renewable energy in Cape Verde an integrated approach that combines substantial capacity building with technical assistance interventions at the policy and demonstration project level. Primary target beneficiaries of the project are energy regulators and implementing institutions, potential energy generators (managers and engineers), energy users, training institutes, energy professionals and service providers and the financial sector.

The project consists of four technical components.

Project Component 1 (PC1) will demonstrate the technical feasibility and commercial viability of small to medium scale renewable energy systems, either in grid connected or stand alone format. The objective of this component is to mitigate technical and information barriers through the installation of demonstration projects and deliver GHG emission reductions as well as financial barriers through the creation of a dedicated seed fund (with contributions from ECREEE's ECOWAS Renewable Energy Facility (EREF) and GEF) to provide co-funding to support the development of small to medium scale renewable energy projects which will generate added emission reductions. The component will also generate national case studies and best practices on small to medium scale renewable energy projects that would be relevant to and have good replication potential in Cape Verde. The projects will create best practice examples for the country for further dissemination and to help raise awareness through the identification and installation of small to medium scale renewable energy pilot projects. This component will also help develop the market and increase confidence for small to medium scale renewable energy. In the case of the UNIDO/GEF project, only part of EREF that is ring-fenced to Cape Verde will be contributed to the Seed Fund.

The ECOWAS Renewable Energy Facility (EREF) for rural and peri-urban areas launched in May 2011, managed by the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency (ECREEE), provides grants for small and medium sized renewable energy and energy efficiency (RE&EE) projects and businesses in rural and peri-urban areas of West Africa. The Project Management Office (PMO) of this UNIDO-GEF project will be hosted by ECREEE and ECREEE through EREF will provide co-finance for the establishment of the dedicated seed-fund for the replication of the demonstration projects.

The following diagram illustrates the relations of the GEF funding and EREF with the outputs expected in this component.

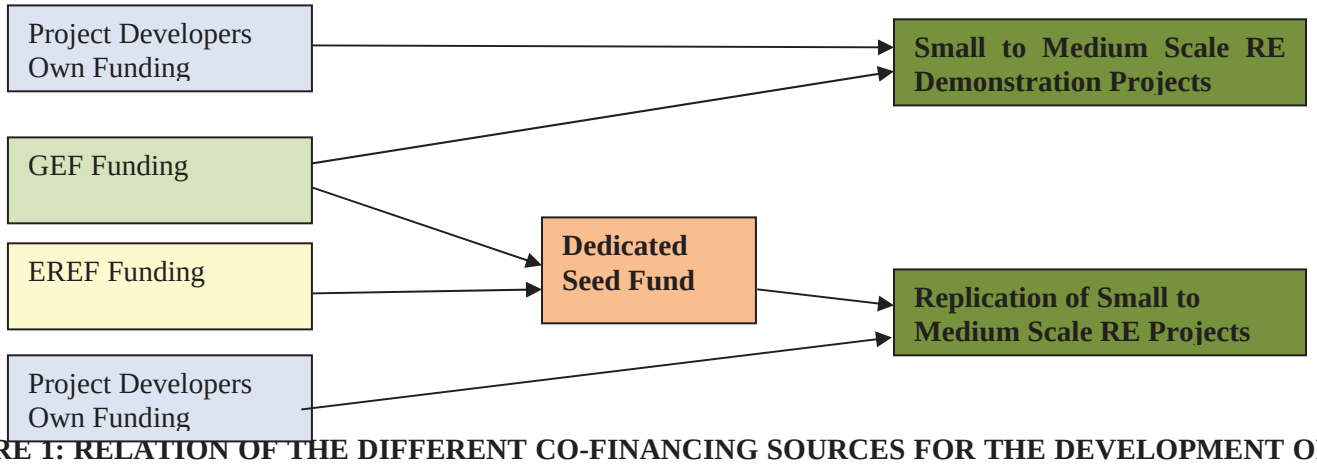


FIGURE 1: RELATION OF THE DIFFERENT CO-FINANCING SOURCES FOR THE DEVELOPMENT OF DEMONSTRATION PROJECT AND FOR THEIR REPLICATION IN CAPE VERDE

Project Component 2 (PC2) aims to address financial barriers for further small to medium scale renewable energy projects in Cape Verde. This aim will be achieved through two activities, firstly through the preparation of a national investment strategy and business plan for scaling up or replicating small to medium scale renewable energy demonstration projects. Secondly through the development of the study on how Brava Island can run on 100% RE electricity, in which more small to medium scale renewable energy projects will be identified.

Project Component 3 (PC3) aims to strengthen the regulatory framework to effectively promote and support small to medium scale renewable energy development into economic and social sectors. This component will review the current regulations concerning the installation of small to medium scale renewable energy projects and identify barriers to small to medium renewable energy projects and will present to the Government of Cape Verde and Agência de Regulação Económica (ARE) a series of recommendations on any revisions or additions need to the current regulatory framework to help overcome any regulatory barriers to the development of small to medium scale renewable energy projects.

Project Component 4 (PC4) primarily focuses on strengthening the institutional capacity as well as addressing the insufficient technical capacity within market enablers and market players (especially entrepreneurs, banks etc) to identify, develop and implement small to medium scale renewable energy projects. This component aims to build and strengthen technical capacity with respect to small to medium scale renewable energy at the institutional, market and enterprises levels through both a “train-the-trainers” approach and direct training.

The final project component comprises the project management (PC5) which includes the establishment of a Project Management Office (PMO), providing training to PMO staff on project implementation and other related matters as well as establishing a dedicated website for the project.

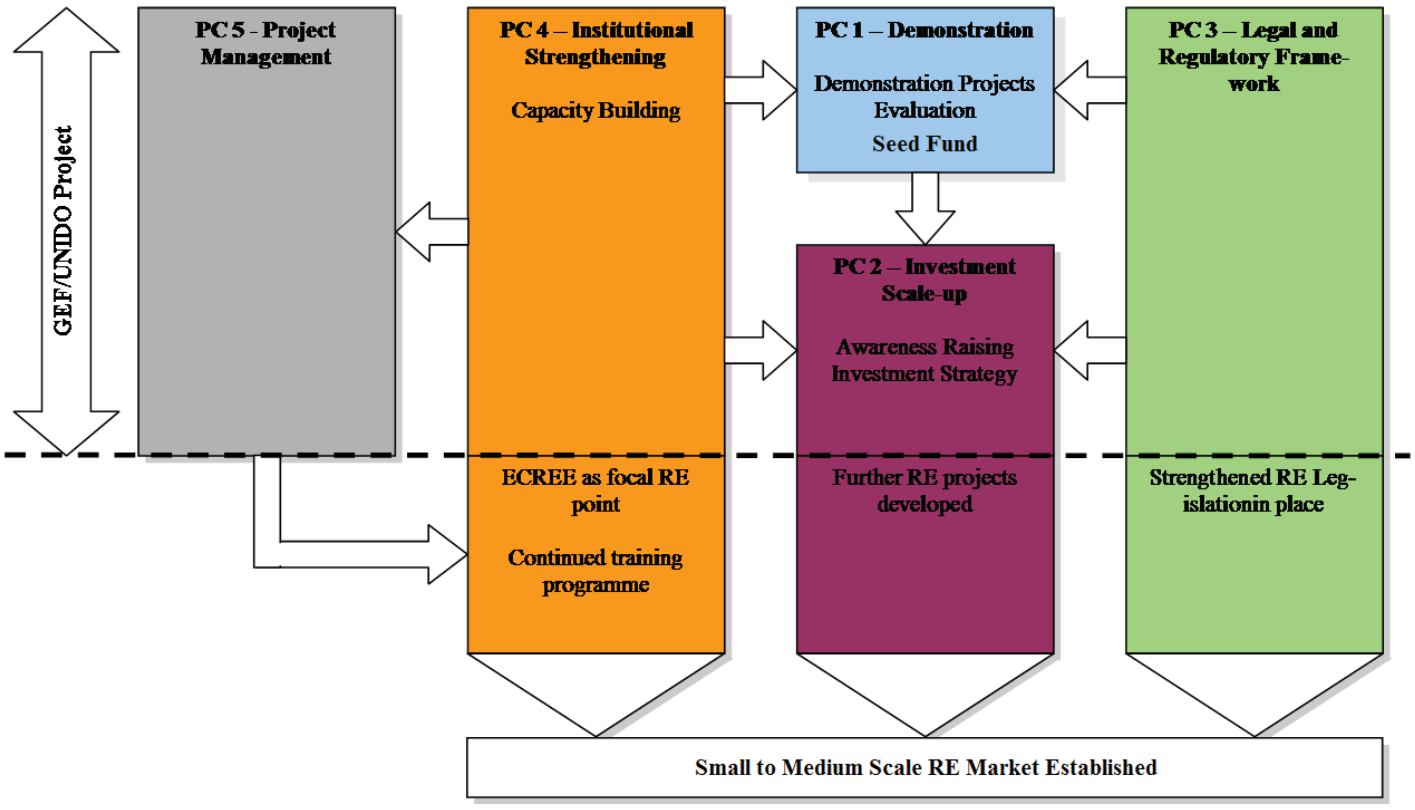


FIGURE 2: PROJECT COMPONENTS

Below further details about the expected outputs and outcomes of the project components are provided:.

Project Component 1. Demonstrating technical feasibility and commercial viability of small to medium scale RE projects

The objective of this component is to mitigate technical and information barriers through the installation of demonstration projects and deliver GHG emission reductions. The component will also generate national case studies and best practices on small to medium scale renewable energy projects that would be relevant to and have good replication potential in Cape Verde. These demonstration projects can then be fed into a dissemination programme. In addition to the demonstration project this component will develop an investment plan to facilitate further renewable energy projects by providing technical assistance and some seed finance.

Output 1.1. Three renewable energy projects designed, implemented, independently evaluated and lessons learned widely disseminated to stakeholders

The selection of the renewable energy projects was a two staged process to ensure that the projects are additional, are incremental and are replicable, co-finance would be available and that they would be viable. During the PPG visits meetings were held with various stakeholders involved in renewable energy and they were all asked if they were able to propose any projects. In addition meetings were held with ELECTRA, with various ministries and with individual project developers. Criteria were developed to select identified projects.

Initial information on projects interested and eligible to receive funding was received from potential developers. This information was then further screened and pre-feasibility studies were carried out for each of the short-listed projects. Finally a list of three projects was selected. These projects all meet the objectives of the GEF projects and in total will mean an additional 1.6 MW of renewable energy is installed in Cape Verde and an estimated 82,076 tonnes of GHG are avoided over the lifetime of the projects.

As mentioned above the demonstration projects to be implemented were selected based on criteria including the number of enterprises that, at the end of the PPG phase, have agreed to partner with the GEF UNIDO project and will make co-financing commitments.

Table below shows some of the characteristics of the selected projects:

Project Name	**Project size**	**Total capital costs**	**GEF Grant**	**Cost/kW**	**Estimated annual energy generation**	**Annual Estimated GHG reduction tCO2**	**Capital cost/tonne GHG saved**	**Annual net savings/ income**
	kW	kUSD	kUSD	USD	kWh	Tonnes	USD/tonne	kUSD
Wind Power for Electricity Generation – Fogo and São Vicente	1,490	5,455	654.6	3,661	5,592,105	4,015.7	67.9	796
Solar Power for Productive uses – Brava and São Vicente	61	168	51	2,780	102,594	73.7	114.3	32
Hybrid Rural Electrification – Santo Antão and São Nicolau	54	776	201.9	14,283	115,253	68.3	568	60
Total	**1,605**	**6,400**	**907.5**	**3,988**	**5,809,952**	**4,158**	**77**	**889**

These projects all meet the objectives of the GEF projects and in total will mean an additional 1.6 MW of small to medium scale renewable energy is installed in Cape Verde and an estimated 82,076 tonnes of GHG are avoided over the

lifetime of the projects. Detailed pre-feasibility studies for the selected demonstration projects are included in Annex F8 in Annex F – UNIDO Project Document.

The fund allocation of 907,531 USD for Output 1.1. leaves some flexibility in the finalization of the collaboration agreements with the partner enterprises. It is envisaged that if all the funds are not utilised by the end of Year 1 of the GEF UNIDO project implementation, the funds would be redistributed as seed finance for Output 1.2.

This task will be led by the National Project Manager with significant support from an International RE Expert.

The first task is to finalise the design and costs for each of these projects. In each case an outline design has already been carried out and the first task will be, in cooperation with the project developers, to finalise these designs, the capital costs and co-finance. This will also include an identification of the technical assistance required for each project, if any. This TA expertise is expected to be minimal and to be supplied from the national and international RE experts. Each project will be given the approval to start implementation based on the completion of the above activities.

In addition to providing TA help the Project Manager will be responsible for monitoring progress on each demonstration project. Regular reporting on the progress of each project will be required.

The evaluation of the demonstration projects will be carried out by an independent national consultant with the help of a local economist. Each project evaluation should follow the same reporting structure developed and established for this project. This will include as a minimum:

- Monitoring and verifying the energy generated and GHG emissions avoided directly due to the GEF project:
- Assessing the operational record of the projects
- Assessing the commercial operation of the project
- Identifying any problems
- Compiling lessons learnt

For each project a case study will be prepared for dissemination purposes. The case studies should be designed in such a way that they are easily accessible by different stakeholder groups. These will also be included on the project website established as part of the project management activities. The dissemination programme will also form part of the project management component.

Output 1.2 Dedicated seed funding provided as grant and co-financing to investments in small to medium scale renewable energy projects and businesses.

This task will be led by the National Project manager with support from and international and national RE expert team and ECREEE. Seed financing for setting up the seed fund to provide co-financing for replicating the demonstration projects will be provided as part of the ECOWAS Renewable Energy Facility (EREF) operated by ECREEE and by GEF.

ECOWAS Renewable Energy Facility (EREF) provides seed funding for pre-investment activities (measurements, feasibilities, financial structuring) and business development (e.g. development of business plans) for small to medium scale renewable energy and energy efficiency projects in the ECOWAS region, which includes Cape Verde. The EREF provides a maximum grant amount of €50,000 and a minimum of €5,000 per project. The eligible EREF grant is determined on a project-by-project basis but shall not exceed 75% of the total eligible direct project costs for companies and non-profit private applicants, and 90% for public institutions. The grant may not be less than 25% of the total project costs. The first call for proposal was already undertaken in May/June 2011. The EREF received 16 project proposals from Cape Verde which could create synergies to the GEF project. Further details of this fund are provided in Annex F10

As the objectives of EREF are in line with those of this GEF-UNIDO project, part of EREF targeted to Cape Verde, will be provided as seed fund co-finance for replicating small to medium scale renewable energy projects within this GEF-UNIDO project. As the objective of this GEF-UNIDO project is only to scale up small to medium scale renewable

energy projects in Cape Verde, the GEF funding and co-financing from EREF for this Output will be ring fenced within the EREF and only available to projects developed in Cape Verde.

The fact that EREF will provide co-finance for the seed fund for replicating renewable energy projects of small to medium scale in Cape Verde within the GEF-UNIDO project, does not mean that EREF finance will not be provided for other small to medium scale renewable energy or energy efficiency projects in Cape Verde. In fact several cycles of financing will be open for which small to medium scale renewable energy and energy efficiency project developers can apply to develop their project within the ECOWAS region.

The first task is to identify those projects that will be provided with some support from the GEF-UNIDO project. The project developers will be responsible for the final designs and the feasibility studies but ECREEE and the national and international RE experts will help in their preparation. Final capital costs for each project will be agreed. Any further TA required will be identified at this time.

Advice will be provided to the project developers on sourcing finance and where considered appropriate by the project team some limited seed finance will be available from the project if required (approx. 10% of project costs). Technical assistance will be provided during the project development and implementation according to the needs identified during the project selection.

The National Project Manager will be responsible for over-seeing each of the scale-up projects and for the disbursement of any funds to these projects. Regular reporting on the progress of each project will be required.

The evaluation of the scale-up projects will be carried out by an independent national consultant with the help of a local economist. Each project evaluation should follow the same reporting structure developed and established in Project Component 1.1.

Project Component 1. Demonstrating technical feasibility and commercial viability of small to medium scale RE projects	
The objective of this component is to mitigate technical and information barriers through the installation of demonstration projects and deliver GHG emission reductions. The component will also generate national case studies and best practices on small to medium scale renewable energy projects that would be relevant to and have good replication potential in Cape Verde. These demonstration projects can then be fed into a dissemination programme. In addition to the demonstration project this component will develop an investment plan to facilitate further renewable energy projects by providing technical assistance and some seed finance.	
Output 1.1 Three demonstration projects designed, implemented, independently evaluated and lessons learned widely disseminated to stakeholders.	
Outline Activities	**Responsibility**
<u>Planned and envisaged activities:</u> (i) Finalize design of RE demonstration projects in collaboration with organisations that have signed co-financing commitment letters.	UNIDO, International Expert, PMO, Partner organisations
(ii) Clearly define GEF project technical assistance support and organisation's contribution	
(iii) Provision of technical assistance for demonstration project development and/or implementation	International and national experts
(iv) Monitoring and evaluation of demonstration projects	International evaluation expert
(v) Preparation of case studies	ECREEE, International and National Experts
(vi) Dissemination	ECREEE, and national experts
The selection of the GEF demonstration projects was a two staged process to ensure that the projects are additional, are incremental and are replicable, co-finance would be available and that they would be viable. During the PPG visits	

meetings were held with various stakeholders involved in renewable energy and they were all asked if they were able to propose any projects. In addition meetings were held with ELECTRA, with various ministries and with individual project developers. Criteria were developed to enable projects to be judged against.

Initial information on projects interested and eligible to receive funding was received from potential developers. This information was then further screened and pre-feasibility studies were carried out for each of the short-listed projects. Finally a list of three projects was selected. These projects all meet the objectives of the GEF projects and in total will mean an additional 1.6 MW of renewable energy is installed in Cape Verde and an estimated 82,076 tonnes of GHG are avoided over the lifetime of the projects.

As mentioned above the demonstration projects to be implemented were selected based on criteria including the number of enterprises that, at the end of the PPG phase, have agreed to partner with the GEF UNIDO project and will make co-financing commitments.

- Wind power for electricity
- Solar power for productive uses
- Hybrid rural electrification

The fund allocation of 907,531 USD for Output 1.1. leaves some flexibility in the finalization of the collaboration agreements with the partner enterprises. It is envisaged that if all the funds are not utilised by the end of Year 1 of the GEF UNIDO project implementation, the funds would be redistributed as seed finance for Output 1.2.

This task will be led by the National Project Manager with significant support from an International RE Expert.

The first task is to finalise the design and costs for each of these projects. In each case an outline design has already been carried out and the first task will be, in cooperation with the project developers, to finalise these designs, the capital costs and co-finance. This will also include an identification of the technical assistance required for each project, if any. This TA expertise is expected to be minimal and to be supplied from the national and international RE experts. Each project will be given the approval to start implementation based on the completion of the above activities.

In addition to providing TA help the Project Manager will be responsible for over-seeing each of the demonstration projects and for the disbursement of funds to the demonstration projects. Regular reporting on the progress of each project will be required.

The evaluation of the demonstration projects will be carried out by an independent national consultant with the help of a local economist. The National Project Manager will prepare the Terms of Reference for the evaluations. Each project evaluation should follow the same reporting structure developed and established for this project. This will include as a minimum:

- Monitoring and verifying the energy generated and GHG emissions avoided directly due to the GEF project:
- Assessing the operational record of the projects
- Assessing the commercial operation of the project
- Identifying any problems
- Compiling lessons learnt

For each project a case study will be prepared for dissemination purposes. The case studies should be designed in such a way that they are easily accessible by different stakeholder groups. These will also be included on the project website established as part of the project management activities. The dissemination programme will also form part of the project management component.

Output 1.2 Dedicated seed funding provided as grant and co-financing to investments in small to medium scale renewable energy projects and businesses.

Outline Activities	**Responsibility**

Planned and envisaged activities: (i) Identification of potential renewable energy projects from feedback from Output 2.1, the long list from project preparation and submitted Cape Verdean proposals to the ECREEE's ECOWAS Renewable Energy Facility (EREF).	PMO, International and National expert Team, ECREEE
(ii) Define level of technical assistance support required for each project and assist projects in identifying potential project finance. Seed financing will be available for some of the projects identified	
(iii) Provision of technical assistance for project development and/or implementation	International and national consultants
(iv) Monitoring and evaluation of the projects after 1 year of operation	National consultant

This task will be led by the National Project manager with support from and international and national RE expert team and ECREEE.

Seed financing for setting up the seed fund to provide co-financing for replicating the demonstration projects will be provided as part of the ECOWAS Renewable Energy Facility (EREF) operated by ECREEE and by GEF.

ECOWAS Renewable Energy Facility (EREF) provides seed funding for pre-investment activities (measurements, feasibilities, financial structuring) and business development (e.g. development of business plans) for small to medium scale renewable energy and energy efficiency projects in the ECOWAS region, which includes Cape Verde. The EREF provides a maximum grant amount of 50.000 EUR and a minimum of 5.000 EUR per project. The eligible EREF grant is determined project by project individually but shall not exceed 75% of the total eligible direct project costs for companies and non-profit private applicants, and 90% for public institutions. The grant may not be less than 25% of the total project costs. The first call for proposal was already undertaken in May/June 2011. The EREF received 16 project proposals from Cape Verde which could create synergies to the GEF project. Further details of this fund are provided in Annex F10

Has the objectives of EREF and this GEF-UNIDO project are the same, part of EREF will be provided as seed fund co-finance for replicating small to medium scale renewable energy projects within this GEF-UNIDO project. As the objective of this GEF-UNIDO project is only to scale up small to medium scale renewable energy projects in Cape Verde, the GEF funding and co-financing from EREF for this Output will be ring fenced within the EREF and only available to projects developed in Cape Verde.

The fact that EREF will provide co-finance for the seed fund for replicating renewable energy projects of small to medium scale in Cape Verde within the GEF-UNIDO project, does not mean that EREF finance will not be provided for other small to medium scale renewable energy or energy efficiency projects in Cape Verde. In fact several cycles of financing will be open for which small to medium scale renewable energy and energy efficiency project developers can apply to develop their project within the ECOWAS region.

The first task is to identify those projects that will be provided with some support from the GEF-UNIDO project. The project developers will be responsible for the final designs and the feasibility studies but ECREEE and the national and international RE experts will help in their preparation. Final capital costs for each project will be agreed. Any further TA required will be identified at this time.

Advice will be provided to the project developers on sourcing finance and where considered appropriate by the project team some limited seed finance will be available from the project if required (approx. 10% of project costs). Technical assistance will be provided during the project development and implementation according to the needs identified during the project selection.

The National Project Manager will be responsible for over-seeing each of the scale-up projects and for the disbursement of any funds to these projects. Regular reporting on the progress of each project will be required.

The evaluation of the scale-up projects will be carried out by an independent national consultant with the help of a local economist. Each project evaluation should follow the same reporting structure developed and established in Project Component 1.1.

Project Component 2 - Investment and business strategy for the creation of a market for small and medium sized renewable energy solutions.

The objective of this component is to mitigate financial barriers for small and medium sized renewable energy projects and businesses through the provision of an investment and business strategy to foster the creation of a market of small to medium scale renewable energy solutions within Cape Verde.

Output 2.1 Investment and Business strategy for the replication of renewable energy projects and stimulation of local entrepreneurial activities in the renewable energy sector is finalised.
This output will result in an investment plan that will identify where potential small and medium sized RE projects can be developed the scale of capital expenditure required and for each project show the possible returns available. The plan will also evaluate the situation of local small and medium sized companies (e.g. solar installers) in the sector and give recommendations for the market development and financial interventions to stimulate the sector. The plan will identify further sources of funding including international donor agencies, international financial institutions and domestic institutions. The plan will contribute to the overall renewable energy investment plan which is currently under development by the CV Government. This plan will differ from the recent study carried out by Martifer which focused in large-scale electricity production. This investment plan will focus in small to medium scale RE projects.

This activity will be led by an International RE finance and business expert with significant support from the National Project Manager and a local financial expert. Close co-ordination will be required with the awareness raising activities.

A consultation meeting will be held with the market participants to discuss the limitations to renewable energy investment and to brainstorm possible ways to access finance. A number of additional RE projects to will be identified during the consultation meeting that can be developed in the short term. This will identify both new projects and analyse the scope for replication from the demonstration projects from Output 1.1 for submission for seed financing from Output 1.2.

The RE finance expert will identify possible sources of funding for RE projects both internationally and nationally to feed into the investment plan. A full RE investment plan will be developed including the detailed cost plan for RE development and the identification of finance. This plan will be used by the Government of Cape Verde to help raise finance for small to medium scale RE projects. The plan will identify where potential small to medium scale renewable energy projects can be developed, the scale of capital expenditure required and for each project show the possible returns available. The plan will identify further sources of funding including international donor agencies, international financial institutions and domestic institutions.

Output 2.2 Study of options to provide 100% RE electricity for Brava
This activity will be led by an International RE finance expert with support from the National Project Manager. The Government of Cape Verde set out within the Cape Verde National Energy Policy 2008 the requirement for one of the islands to have electricity provided by 100% RE, the island selected for this is Brava.

A study will be carried out to assess the RE resource of the island, and analysis the various options to provide the island with electricity from 100% RE. This study will review the different feasible renewable technologies and energy storage systems appropriate for the island and provide a report detailing the technical options to meet this 100% RE target along with an outline budget to implement these options.

Project Component 2. Investment and business strategy for the creation of a market for small and medium sized renewable energy solutions and establishment of a targeted seed fund.

Output 2.1 Investment and Business strategy for the replication of pilot projects and stimulation of local entrepreneurial activities in the renewable energy sector is finalised.	
Outline Activities	**Responsibility**
Planned and envisaged activities: (i) Identification of potential renewable energy projects and businesses in each economic sector of Cape Verde – resource assessment making use of already existing tools like RETScreen, assessment of status and opportunities of small and medium sized companies in the sector etc.	International and National Expert Team, PMO, ECREEE
(ii) Consultation meeting on opportunities and limitations of renewable energy investment and business in Cape Verde	
(iii) Detailed cost plan prepared based on the projects identified	International and National Expert Team,, PMO
(iv) Identify potential sources of funding	International Expert
(v) Prepare full investment and business strategy/plan	International Expert Team, PMO.
This output will result in an investment plan that will identify where potential small and medium sized RE projects can be developed the scale of capital expenditure required and for each project show the possible returns available. The plan will also evaluate the situation of local small and medium sized companies (e.g. solar installers) in the sector and give recommendations for the market development and financial interventions to stimulate the sector. The plan will identify further sources of funding including international donor agencies, international financial institutions and domestic institutions. The plan will contribute to the overall renewable energy investment plan which is currently under development by the CV Government. This plan will differ from the recent study carried out by Martifer which focused in large-scale electricity production. This investment plan will focus in small to medium scale RE projects. This activity will be led by an International RE finance and business expert with significant support from the National Project Manager and a local financial expert. Close co-ordination will be required with the awareness raising activities. A consultation meeting will be held with the market participants to discuss the limitations to renewable energy investment and to brainstorm possible ways to access finance. A number of additional RE projects to will be identified during the consultation meeting that can be developed in the short term. This will identify both new projects and analyse the scope for replication from the demonstration projects from Output 1.1 for submission for seed financing from Output 1.2. The RE finance expert will identify possible sources of funding for RE projects both internationally and nationally to feed into the investment plan. A full RE investment plan will be developed including the detailed cost plan for RE development and the identification of finance. This plan will be used by the Government of Cape Verde to help raise finance for small to medium scale RE projects. The plan will identify where potential small to medium scale renewable energy projects can be developed, the scale of capital expenditure required and for each project show the possible returns available. The plan will identify further sources of funding including international donor agencies, international financial institutions and domestic institutions.	

Output 2.2 Study of options to provide 100% RE electricity for Brava	
Outline Activities	**Responsibility**
Planned and envisaged activities: (i) RE resource assessment for the island of Brava	International Expert, PMO
(ii) Analysis of options to provide 100% RE for the island.	
(iii) Report detailing technical options and outline budget to provide 100% RE to Brava.	

This activity will be led by an International RE finance expert with support from the National Project Manager. The Government of Cape Verde set out within the Cape Verde National Energy Policy 2008 the requirement for one of the islands to have electricity provided by 100% RE, the island selected for this is Brava.

A study will be carried out to assess the RE resource of the island, and analysis the various options to provide the island with electricity from 100% RE. This study will review the different feasible renewable technologies and energy storage systems appropriate for the island and provide a report detailing the technical options to meet this 100% RE target along with an outline budget to implement these options.

Project Component 3. Consolidating a comprehensive regulatory framework conducive to the development of small to medium scale renewable energy projects.

This component will review the current regulations concerning the installing of RE and identify barriers to small to medium renewable energy projects and will present to the Government of Cape Verde and Agência de Regulação Económica (ARE) a series of recommendations on any revisions or additions need to the current regulatory framework to help overcome any regulatory barriers to the development of small to medium scale renewable energy projects.

Output 3.1 Existing legal and regulatory framework reviewed and a conducive regulatory framework focusing on small to medium scale renewable energy projects proposed and presented to national authorities

This task will be led by an international energy policy consultant with input from national legal and policy consultants and the PMO.

The first tasks is to carry out a comprehensive review of current regulations related to small and medium scale renewable energy projects. From the analysis carryout so far, there is a need to develop a concise plan and strategy to develop small to medium scale renewable energy projects, has the strategies and plans in place in Cape Verde are only focused on larger scale RE projects. Propositions on revision/additions to the current system will be made, which will integrate a strategy for promoting the development of small to medium scale RE projects in general as well as incentives for developing this projects within the social, educational and heath sectors.

Following this review a stakeholder consultation will be held with relevant government agencies, ELECTRA, Agência de Regulação (ARE) and potential project developers. This workshop is to identify any regulatory barriers to the development of small to medium scale renewable energy projects and discuss how these could be overcome through revisions or additions to the current legal and regulatory framework. The propositions for revisions additions to the current legal system will also be presented and discussed within this workshop .

Output 3.2 Policy and regulatory propositions for integrating small to medium scale renewable energy into economic and social sectors such as education, health etc developed.

Using the results from the review and workshop in Output 3.1 a report will be produced with propositions for policy and regulations to enable the development of small to medium scale renewable energy into economic and social sectors.

Following review by the MTIE and ARE the document will be revised to include comments provided and submitted to the Government of Cape Verde for consideration.

Project Component 3. Consolidating a comprehensive regulatory framework conducive to the development of small to medium scale renewable energy projects.

This component will review the current regulations concerning the installing of RE and identify barriers to small to medium renewable energy projects and will present to the Government of Cape Verde and Agência de Regulação Económica (ARE) a series of recommendations on any revisions or additions need to the current regulatory framework to help overcome any regulatory barriers to the development of small to medium scale renewable energy projects.

Output 3.1 Existing legal and regulatory framework reviewed and a conducive regulatory framework focusing on small to medium scale renewable energy projects proposed and presented to national authorities.	
Outline Activities	**Responsibility**
Planned and envisaged activities: (i) Review of current regulations related to small and medium scale renewable energy projects.	International and national consultants
(ii) Stakeholder consultation workshop	PMO, International and national consultants
This task will be led by an international energy policy consultant with input from national legal and policy consultants and the PMO. The first tasks is to carry out a comprehensive review of current regulations related to small and medium scale renewable energy projects. From the analysis carryout so far, there is a need to develop a concise plan and strategy to develop small to medium scale renewable energy projects, has the strategies and plans in place in Cape Verde are only focused on larger scale RE projects. Propositions on revision/additions to the current system will be made, which will integrate a strategy for promoting the development of small to medium scale RE projects in general as well as incentives for developing this projects within the social, educational and heath sectors. Following this review a stakeholder consultation will be held with relevant government agencies, ELECTRA, Agência de Regulação (ARE) and potential project developers. This workshop is to identify any regulatory barriers to the development of small to medium scale renewable energy projects and discuss how these could be overcome through revisions or additions to the current legal and regulatory framework. The propositions for revisions additions to the current legal system will also be presented and discussed within this workshop.	
Output 3.2 Policy and regulatory propositions for integrating small to medium scale renewable energy into economic and social sectors such as education, health etc developed.	
Planned and envisaged activities: (i) Report detailing recommendations of revisions or additions needed to current policy and regulatory framework	International and national consultants
Using the results from the review and workshop in Output 3.1 a report will be produced with propositions for policy and regulations to enable the development of small to medium scale renewable energy into economic and social sectors. Following review by the MTIE and ARE the document will be revised to include comments provided and submitted to the Government of Cape Verde for consideration.	

Project Component 4. Strengthening capacity and awareness raising

Project Component 4 aims to build and strengthen technical capacity with respect to renewable energy at the institutional, market and enterprises levels through both the “train-the-trainers” approach and direct training.

Output 4.1. Institutional capacity needs evaluated, training programmes developed, and training conducted.

This output aims to strengthen the capacity of institutions that support the development of small to medium scale renewable energy projects. This training will be primarily aimed at the PMO for the project to ensure that the MTIE has the capacity to undertake the project management but also for ECREEE to be a focal point for renewable energy within Cape Verde.

The first stage of this output is to evaluate the current capacity of these institutions in regards to project management for the PMO and MTIE, and for ECREEE to provide: awareness raising and capacity building; business development advice; market assessments; technology assessments; project identification and development; quality assurance for RE equipment; monitoring and evaluation of RE projects; and also to hold a database of RE resources and projects.

Following this evaluation a training programme will be developed and this training will consist of on-the-job training as well as including some formal aspects of training on project management. It is envisaged to be carried out by an international expert and will help the MTIE to establish all the project reporting procedures required as well as identifying what is required and helping to develop ECREEE as a focal point for this project. This training will be in addition to any technical training on RE which will be provided as part of Output 4.3.

Output 4.2. Awareness raising programmes including targeted seminars; coaching clinics held.
This output will result in a series of awareness raising meetings on renewable energy targeted to market enablers and players. Meetings will be mainly held by the national experts trained by the GEF UNIDO project under Output 4.3.

½ day Awareness Raising Meetings on Renewable Energy
This ½ day meeting is designed as an introduction to the topic of renewable energy for various sectors within Cape Verde and a networking opportunity. The objective of this meeting is to raise awareness and to encourage managers to authorize their staff to look into opportunities for renewable energy at their sites/hotels etc. This will be a high-level meeting that is presented in the language of management and speaks on issues such as life cycle analysis, in improving the bottom line, competitiveness, meeting national legislation requirements as well as climate change targets. The meeting will present and highlight the potential renewable energy opportunities available to that target group. It will also highlight the proposed training and assistance that will be available as part of this GEF project to companies that show interest in taking forward a small to medium scale renewable energy project. A guest speaker from the same or a similar sector who is involved in a demonstration project or already engaged in renewable energy will be sought for each meeting.

A series of 10-12 of these meetings is envisaged with the target of reaching out to 50 organisations. It is assumed that as outcome of this series of meetings at least 20% of the companies reached will decide to look into the options for renewable energy and consider attending the in-depth training delivered in Output 4.3.

The UNIDO international expert team will train national experts on use of the ½ day meeting programme. This programme will be introduced to the national experts in three stages: observing the international experts delivering the first meeting; co-delivering/ delivering the second meeting with the international experts; and delivering the third meeting with international experts observing and providing feedback of delivering techniques. The remaining meetings will be delivered by the national experts alone. The output of the meetings will be the identification of potential renewable energy projects that could form part of the investment strategy for Outputs 1.2 and 2.1.

Output 4.3. Training programmes for market enablers and market players especially entrepreneurs, banks etc developed and training conducted.
This output will build the capacity of market players and enablers to successfully implement small to medium scale renewable energy projects. The following training programmes are envisaged however, following the evaluation of training needs, these programmes may be revised.

It is hoped that this training will not only result in further RE project development but that it will also result in a number of experts who will be able to train others in the market beyond the GEF project. As a result the training incorporates training targeted at the potential market participants as well as at organizations that will be able to provide the lasting training such as ECREEE, ELECTRA, the University of Cape Verde, the Professional Educational Institute and the Business School. It is envisaged that some of the training developed will be able to be incorporated as modules in existing courses and as short courses for existing technicians and engineers who wish to update their skills to include renewable energy. Synergies between the developed training program and the current ECREEE training program will be created.

The following table highlights the training programmes, main contents and target groups to which the programmes/modules of the programmes of the training programmes are directed to.

Training Programme / Modules of the Programme	**Contents of training programme/ module of the programme**	**Target Groups**
(1) Train the Trainers – Energy	• Providing technical assistance to enterprises	DGE, ECREEE,

Training Programme / Modules of the Programme		Contents of training programme/ module of the programme	Target Groups
Expert Training -		and coaching on renewable energy implementation • Conducting short (one-half day) awareness raising meetings for managers on the benefits and opportunities of renewable energy and showcasing the support available to participating companies (1/2 day meetings are included in Project Component 2) • Conducting training sessions for stakeholders interested in developing their own renewable energy projects	ELECTRA, ARE, University of Cape Verde, Professional Educational Institute (IEFP, Instituto do Emprego e Formação Profissional) and Business School
(2) Renewable Energy Training	Module 1: Identification, Development and Management of Renewable Energy Projects Training	• Identify what sort of projects each participant could develop at their sites • Identify the technical issues ; • Carry out a life cycle cost analysis of the project • Use a software for RE potential analysis such as RETScreen and COMFAR.	Management and technical people involved in developing RE projects who are looking to develop a project, possibly with support from the GEF project
	Module 2: Design and Development of Renewable Energy Projects	• Understand all the issues relating to the design and development of renewable energy projects from assessing the site specific resource available, to sizing and designing a system, to either writing or commissioning someone to write a specification, planning and permitting and providing links to additional information resources. • Incorporate specific issues of small to medium scale RE development in tendering • Oversee the project installation	Technical persons responsible for developing renewable energy project and is designed as a follow-on from the Identification training (Module 1)
	Module 3: Financing instruments for RE projects	• Analyse existent financing instruments, including carbon financing, available for small to medium scale renewable energy projects • Analyse the financial viability of these types of projects.	Project developers and financial institutions that want to develop and/or provide financing for RE project and who wish to understand the issues better, as well as technicians who want to expand their services to small to medium scale renewable energy.
	Module 4. Operation and Management of Renewable Energy Projects	Guidance on operational and management issues of renewable energy projects including monitoring and quality control	Project developers looking to develop a RE project who wish to understand the issues better, as well as technicians who want to expand their services to renewable energy
	Module 5: Technical grid connection issues	• Distribution, stability, power grid quality concepts; • Effects of renewable energy into the grid	ELECTRA and the RE project developers

Training Programme / Modules of the Programme	Contents of training programme/ module of the programme	Target Groups
for renewable energy	and how to minimise disruptions	
(3) Development of Modules for University of Cape Verde	The Renewable Energy Training contents will be edited to become modules for insertion in technicians training course and electrical engineering courses at the University of Cape Verde	University of Cape Verde and previously qualified technicians or engineers
(4) Development of Modules for Professional Educational Institute	The Renewable Energy Training contents outlined above will be edited so that they become modules for insertion in technicians training course and electrical engineering courses at the Professional Educational Institute	Professional Educational Institute and previously qualified technicians or engineers
(5) Development of Modules for Business School	The Renewable Energy Training contents outlined above will be edited so that they become modules for insertion in technicians training course and electrical engineering courses at the Business School.	Business School and previously qualified technicians or engineers

Further details on these programmes and programme modules are provided below

Training Programme 1: Train the Trainers – Energy Expert Training

A group of approximately 20 professionals will be trained through a classroom, on-the-job and mentoring by the international expert team and equipped with the expertise and the tools required for providing the following services:

- Providing technical assistance to enterprises and coaching on renewable energy implementation
- Conducting short (one-half day) awareness raising meetings for managers on the benefits and opportunities of renewable energy and showcasing the support available to participating companies (1/2 day meetings are included in Project Component 2)
- Conducting training sessions for stakeholders interested in developing their own renewable energy projects.

It is expected that the 20 personnel will come from DGE, ECREEE, ELECTRA, ARE, University of Cape Verde, Professional Educational Institute (IEFP, Instituto do Emprego e Formação Profissional) and Business School. Some of the trained professionals will subsequently assume roles as RE Experts and become a source of expertise and services for the GEF project as well as for the nascent renewable energy sector.

The Train-the-Trainers training follows the following steps:

Step 1 Preparation of the training programme

This involves the preparation of the training material, the selection of trainees, the identification of 1-2 demonstration projects for the practical training, securing approval for site visits, classroom logistics, etc.

Step 2 1st training period

International experts provide training to national trainees in classroom and at demonstration projects. The training will cover the:

- Renewable Energy opportunities and potential
- Identification, development and management of RE projects
- Design and development of RE projects (wind, solar and biomass specific)
- Financing instruments for RE projects
- Operation and maintenance of RE projects
- Technical grid connection issues

The training will be both in the classroom as well as at the demonstration projects in Output 1.2 for on-the-job training. The training will be provided both directly to the future experts and also with the future experts as participants in the training sessions that they will go onto teach later. So for each of the courses the international expert team will train national RE experts on use of the training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching/ delivering the first training; co-teaching/ delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback of teaching/ delivering techniques. Any future meetings will be delivered by the national experts alone.

Step 3 Trainees apply knowledge, skills and tools provided
Trainees coming from potential project developers apply the knowledge, skills and tools that have been provided to identify potential projects and to start on the design and development of the projects. During this period of time, trainees have access to international experts' "remote" coaching and technical advice.

Step 4 2nd training period
International experts provide advanced training to national trainees in classroom and at demonstration project sites. They review and discuss RE project development and the status that the participants have reached. They observe and provide feedback to trainees in the application of skills in project development.

Training Programme 2 –Renewable Energy Training

Module 1: Identification, Development and Management of Renewable Energy Projects Training
This two-day training is targeted to the management and technical people involved in developing RE projects. It is expected that the participants will be identified as part of the meeting in Project Component 2 who are looking to develop a project, possibly with support from the GEF project. The training will provide an overview of all the issues relating to renewable energy project development and will also act as an introduction to the more detailed design and operation training courses. The training will help to identify what sort of projects each participant could develop at their sites and will help them to identify the technical issues as well as to carry out a life cycle cost analysis of the project and provide an overview on software for RE potential analysis such as RETScreen and COMFAR. Given UNIDO's experience with COMFAR software will also be used in such trainings.

A series of 3 of these two-day trainings is envisaged with the target of training 40 managers/personnel.
The UNIDO international expert team will train national RE experts on use of the two-day training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching/ delivering the first training; co-teaching/ delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback of teaching/ delivering techniques. Any future meetings will be delivered by the national experts alone.

Module 2: Design and Development of Renewable Energy Projects
This two-day training is targeted to the technical person responsible for developing a renewable energy project and is designed as a follow-on from the Identification training (Module 1). There will be one day that is technology generic and then the training programme will split into two separate sessions for solar and wind projects. Training will ensure that the participants understand all the issues relating to the design and development of renewable energy projects from assessing the site specific resource available, to sizing and designing a system, to either writing or commissioning someone to write a specification, planning and permitting and providing links to additional information resources. The training will include issues to incorporate in tendering and how to oversee the project installation. The intention is that the training would be split with an initial two day training session and then the participants apply their knowledge before a final day of advanced training where issues that have come up are explored.

A series of 3 of these two-day trainings is envisaged with the target of training 40 managers/personnel.
The UNIDO international expert team will train national RE experts on use of the training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching/ delivering the first training; co-teaching/ delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback of teaching/ delivering techniques. Any future meetings will be delivered by the national experts alone.

Module 3: Financing instruments for RE projects

This three-days course is targeted at project developers and financial institutions they want to develop and/or provide financing for RE project and who wish to understand the issues better, as well as technicians who want to expand their services to renewable energy. The training will guide participants through an analysis of the existing financing instruments, including carbon financing, available for renewable energy projects and on to analyse the financial viability of these types of projects. The training is intended to be classroom. A series of 3 of these one-day trainings is envisaged with the target of training 30 participants. ECREEE has undertaken a regional train-the-trainers workshop on RETScreen from 24 to 26 August 2011 in Ghana. The participating universities and experts from all ECOWAS countries will undertake national replication trainings in their respective countries in 2012. Synergies to the GEF project will be created to this activity of ECREEE.

Module 4. Operation and Management of Renewable Energy Projects

This two-day training is targeted at project developers, those looking to develop a RE project who wish to understand the issues better, as well as technicians who want to expand their services to renewable energy. The training will guide participants through operational and management issues of renewable energy projects including monitoring and quality control. This will include the maintenance requirements for different types of projects including daily checks and maintenance to unplanned overhauls as well as the resources needed and the spares required. The training is intended to be classroom and project based with visits and demonstrations at the pilot projects. A series of 3 of these two-day trainings is envisaged with the target of training 40 technicians.

The UNIDO international expert team will train national RE experts on use of the two-day training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching/ delivering the first training; co-teaching/ delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback of teaching/ delivering techniques. Any future meetings will be delivered by the national experts alone.

Module 5: Technical grid connection issues for renewable energy

This training is primarily targeted at ELECTRA and the project developers to ensure that there are no negative consequences either to the operation of the transmission and distribution networks or to the smooth operation of the renewable energy project. The course will cover the distribution, stability, power grid quality concepts and the effects of renewable energy into the grid and how to minimise disruptions. It is envisaged that this training will be one week long at ELECTRA and will be provided by International Experts.

Training Programme 3: Development of Modules for University of Cape Verde

The courses outlined above will be edited so that they become modules for insertion in technicians training course and electrical engineering courses at the University of Cape Verde. In addition the modules will be offered as separate short courses for previously qualified technicians or engineers who wished to upgrade their skills to include renewable technologies.

Training Programme 4:. Development of Modules for Professional Educational Institute

The courses outlined above will be edited so that they become modules for insertion in technicians training course and electrical engineering courses at the Professional Educational Institute. In addition the modules will be offered as separate short courses for previously qualified technicians or engineers who wished to upgrade their skills to include renewable technologies.

Training Programme :. Development of Modules for Business School

The courses outlined above will be edited so that they become modules for insertion in technicians training course and electrical engineering courses at the Business School. In addition the modules will be offered as separate short courses for previously qualified technicians or engineers who wished to upgrade their skills to include renewable technologies.

Project Component 4. Strengthening institutional capacity through targeted capacity building

Project Component 4 aims to build and strengthen technical capacity with respect to renewable energy at the institutional, market and enterprises levels through both a "train-the-trainers" approach and direct training.	
Output 4.1. Institutional capacity needs evaluated, training programmes developed, and training conducted.	
Planned and envisaged activities: (i) Evaluation of institutional capacity.	UNIDO, International Expert Team, Local Economist, PMO
(ii) Development of a detailed working plan for the execution of training programme (schedule, role and responsibilities, milestones, etc.)	UNIDO, International Expert Team; Local Economist, PMO.
(iii) Execution of the Training programmes	International Expert Team. Local Economist, PMO.
(iv) Evaluation of training	Trainees, PMO
This output aims to strengthen the capacity of institutions that support the development of small to medium scale renewable energy projects. This training will be primarily aimed at the PMO for the project to ensure that the MTIE has the capacity to undertake the project management but also for ECREEE to be a focal point for renewable energy within Cape Verde. The first stage of this output is to evaluate the current capacity of these institutions in regards to project management for the PMO and MTIE, and for ECREEE to provide: awareness raising and capacity building; business development advice; market assessments; technology assessments; project identification and development; quality assurance for RE equipment; monitoring and evaluation of RE projects; and also to hold a database of RE resources and projects. Following this evaluation a training programme will be developed, this training will consist of on-the-job training as well as including some formal aspects of training on project management. It is envisaged to be carried out by an international expert and will help the MTIE to establish all the project reporting procedures required as well as identifying what is required and helping to develop ECREEE as a focal point for this project. This training will be in addition to any technical training on RE which will be provided as part of Output 4.3.	
Output 4.2. Awareness raising programmes including targeted seminars; coaching clinics held.	
Outline Activities	**Responsibility**
Planned and envisaged activities: (i) Development of a detailed working plan for the execution of a series of awareness raising meetings on renewable energy opportunities (schedule, venues, trainers, etc.)	UNIDO, International and National Expert Team, PMO, ECREEE
(ii) Execution of a series of 10-12 half-day meetings on Renewable Energy	
a. First 3-4	International Experts, PMO.
b. Remaining 7-8	National Experts, PMO, ECREEE

This output will result in a series of awareness raising meetings on renewable energy targeted to market enablers and players. Meetings will be mainly held by the national experts trained by the GEF UNIDO project under Output 4.3.

½ day Awareness Raising Meetings on Renewable Energy

This ½ day meeting is designed as an introduction to the topic of renewable energy for various sectors within Cape Verde and a networking opportunity. The objective of this meeting is to raise awareness and to encourage managers to authorize their staff to look into opportunities for renewable energy at their sites/hotels etc. This will be a high-level meeting that is presented in the language of management and speaks on issues such as life cycle analysis, in improving the bottom line, competitiveness, meeting national legislation requirements as well as climate change targets. The meeting will present and highlight the potential renewable energy opportunities available to that target group. It will also highlight the proposed training and assistance that will be available as part of this GEF project to companies that show interest in taking forward a small to medium scale renewable energy project. A guest speaker from the same or a similar sector who is involved in a demonstration project or already engaged in renewable energy will be sought for each meeting.

A series of 10-12 of these meetings is envisaged with the target of reaching out to 50 organisations. It is assumed that as outcome of this series of meetings at least 20% of the companies reached will decide to look into the options for renewable energy and consider attending the in-depth training delivered in Output 4.3.

The UNIDO international expert team will train national experts on use of the ½ day meeting programme. This programme will be introduced to the national experts in three stages: observing the international experts delivering the first meeting; co-delivering/ delivering the second meeting with the international experts; and delivering the third meeting with international experts observing and providing feedback of delivering techniques. The remaining meetings will be delivered by the national experts alone. The output of the meetings will be the identification of potential renewable energy projects that could form part of the investment strategy for Outputs 1.2 and 2.1.

Output 4.3. Training programmes for market enablers and market players especially entrepreneurs, banks etc developed and training conducted.

Outline Activities	**Responsibility**
Planned and envisaged activities: (i) Evaluation of training needs of market enablers and market players.	International Expert, Local Economist, PMO.
(ii) Development of a detailed working plan for the execution of the training programme (schedule, role and responsibilities, milestones, etc.)	International Expert, Local Economist PMO.
(iii) Execution of the Training programmes	
c. Preparation of the training material and logistics including the training guides for the Train-the-Trainers	UNIDO, International Expert, Local Economist, PMO.
d. 1st training period – Train the Trainers	International Experts, PMO.
e. 2nd training period	National Experts, PMO.
(iv) Evaluation of training	Trainees, PMO

This output will build the capacity of market players and enablers to successfully implement small to medium scale renewable energy projects. The following training programmes are envisaged however, following the evaluation of training needs, these programmes may be revised.

It is hoped that this training will not only result in further RE project development but that it will also result in a number of experts who will be able to train others in the market beyond the GEF project. As

a result the training incorporates training targeted at the potential market participants as well as at organizations that will be able to provide the lasting training such as ECREEE, ELECTRA, the University of Cape Verde, the Professional Educational Institute and the Business School. It is envisaged that some of the training developed will be able to be incorporated as modules in existing courses and as short courses for existing technicians and engineers who wish to update their skills to include renewable energy. Synergies between the developed training program and the current ECREEE training program will be created.

Training Programme 1: Train the Trainers – Energy Expert Training

A group of approximately 20 professionals will be trained through a classroom, on-the-job and mentoring by the international expert team and equipped with the expertise and the tools required for providing the following services:

- Providing technical assistance to enterprises and coaching on renewable energy implementation
- Conducting short (one-half day) awareness raising meetings for managers on the benefits and opportunities of renewable energy and showcasing the support available to participating companies (1/2 day meetings are included in Project Component 2)
- Conducting training sessions for stakeholders interested in developing their own renewable energy projects.

It is expected that the 20 personnel will come from DGE, ECREEE, ELECTRA, ARE, University of Cape Verde, Professional Educational Institute (IEFP, Instituto do Emprego e Formação Profissional) and Business School. Some of the trained professionals will subsequently assume roles as RE Experts and become a source of expertise and services for the GEF project as well as for the nascent renewable energy sector.

The Train-the-Trainers training follows the following steps:

Step 1 Preparation of the training programme

This involves the preparation of the training material, the selection of trainees, the identification of 1-2 demonstration projects for the practical training, securing approval for site visits, classroom logistics, etc.

Step 2 1st training period

International experts provide training to national trainees in classroom and at demonstration projects. The training will cover the:

- Renewable Energy opportunities and potential
- Identification, development and management of RE projects
- Design and development of RE projects (wind, solar and biomass specific)
- Financing instruments for RE projects
- Operation and maintenance of RE projects
- Technical grid connection issues

The training will be both in the classroom as well as at the demonstration projects in Output 1.2 for on-the-job training. The training will be provided both directly to the future experts and also with the future experts as participants in the training sessions that they will go onto teach later. So for each of the courses the UNIDO international expert team will train national RE experts on use of the training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching/ delivering the first training; co-teaching/ delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback of teaching/ delivering techniques. Any future meetings will be delivered by the national experts alone.

Step 3 Trainees apply knowledge, skills and tools provided

Trainees coming from potential project developers apply the knowledge, skills and tools that have been provided to identify potential projects and to start on the design and development of the projects. During this period of time, trainees have access to international experts' "remote" coaching and technical advice.

Step 4 *2nd training period*
International experts provide advanced training to national trainees in classroom and at demonstration project sites. They review and discuss RE project development and the status that the participants have reached. They observe and provide feedback to trainees in the application of skills in project development.

Training Programme 2 –Renewable Energy Training

Module 1:Identification, Development and Management of Renewable Energy Projects Training
This two-day training is targeted to the management and technical people involved in developing RE projects. It is expected that the participants will be identified as part of the meeting in Project Component 2 who are looking to develop a project, possibly with support from the GEF project. The training will provide an overview of all the issues relating to renewable energy project development and will also act as an introduction to the more detailed design and operation training courses. The training will help to identify what sort of projects each participant could develop at their sites and will help them to identify the technical issues as well as to carry out a life cycle cost analysis of the project and provide an overview on software for RE potential analysis such as RETScreen and COMFAR. Given UNIDO's experience in developing COMFAR software, this software will be actively used in the training.

A series of 3 of these two-day trainings is envisaged with the target of training 40 managers/personnel.
The UNIDO international expert and a National Economist will train national RE experts on use of the two-day training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching/ delivering the first training; co-teaching/ delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback of teaching/ delivering techniques. Any future meetings will be delivered by the national experts alone.

Module 2: Design and Development of Renewable Energy Projects
This two-day training is targeted to the technical person responsible for developing a renewable energy project and is designed as a follow-on from the Identification training. There will be one day that is technology generic and then the training programme will split into two separate sessions for solar and wind projects. Training will ensure that the participants understand all the issues relating to the design and development of renewable energy projects from assessing the site specific resource available, to sizing and designing a system, to either writing or commissioning someone to write a specification, planning and permitting and providing links to additional information resources. The training will include issues to incorporate in tendering and how to oversee the project installation. The intention is that the training would be split with an initial two day training session and then the participants apply their knowledge before a final day of advanced training where issues that have come up are explored.

A series of 3 of these two-day trainings is envisaged with the target of training 40 managers/personnel.
The UNIDO international expert team will train national RE experts on use of the training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching/ delivering the first training; co-teaching/ delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback of teaching/ delivering techniques. Any future meetings will be delivered by the national experts alone.

Module 3: Financing instruments for RE projects
This three-days course is targeted at project developers and financial institutions they want to develop and/or provide financing for RE project and who wish to understand the issues better, as well as

technicians who want to expand their services to renewable energy. The training will guide participants through an analysis of the existing financing instruments, including carbon financing, available for renewable energy projects and on to analyse the financial viability of these types of projects. The training is intended to be classroom. A series of 3 of these one-day trainings is envisaged with the target of training 30 participants. ECREEE has undertaken a regional train-the-trainers workshop on RETScreen from 24 to 26 August 2011 in Ghana. The participating universities and experts from all ECOWAS countries will undertake national replication trainings in their respective countries in 2012. Synergies to the GEF project will be created to this activity of ECREEE.

Module 4: Operation and Management of Renewable Energy Projects
This two-day training is targeted at project developers, those looking to develop a RE project who wish to understand the issues better, as well as technicians who want to expand their services to renewable energy. The training will guide participants through operational and management issues of renewable energy projects including monitoring and quality control. This will include the maintenance requirements for different types of projects including daily checks and maintenance to unplanned overhauls as well as the resources needed and the spares required. The training is intended to be classroom and project based with visits and demonstrations at the pilot projects. A series of 3 of these two-day trainings is envisaged with the target of training 40 technicians.

The UNIDO international expert team will train national RE experts on use of the two-day training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching/ delivering the first training; co-teaching/ delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback of teaching/ delivering techniques. Any future meetings will be delivered by the national experts alone.

Module 5: Technical grid connection issues for renewable energy
This training is primarily targeted at ELECTRA and the project developers to ensure that there are no negative consequences either to the operation of the transmission and distribution networks or to the smooth operation of the renewable energy project. The course will cover the distribution, stability, power grid quality concepts and the effects of renewable energy into the grid and how to minimise disruptions. It is envisaged that this training will be one week long at ELECTRA and will be provided by International Experts.

Training Programme 3: Development of Modules for University of Cape Verde
The courses outlined above will be edited so that they become modules for insertion in technicians training course and electrical engineering courses at the University of Cape Verde. In addition the modules will be offered as separate short courses for previously qualified technicians or engineers who wished to upgrade their skills to include renewable technologies.

Training Programme 4:. Development of Modules for Professional Educational Institute
The courses outlined above will be edited so that they become modules for insertion in technicians training course and electrical engineering courses at the Professional Educational Institute. In addition the modules will be offered as separate short courses for previously qualified technicians or engineers who wished to upgrade their skills to include renewable technologies.

Training Programme :. Development of Modules for Business School
The courses outlined above will be edited so that they become modules for insertion in technicians training course and electrical engineering courses at the Business School. In addition the modules will be offered as separate short courses for previously qualified technicians or engineers who wished to upgrade their skills to include renewable technologies.

Project Component 5. Project management and co-ordination

Project Component 5. Project management and co-ordination	
Output 5.1 Project management office is established, dedicated website for the project is set-up, dissemination programme is implemented and project milestones/reports etc are regularly posted on the website**.**	
The objective of this activity is to ensure the efficient and effective management of the whole project. Activities are envisaged as follows:	
Outline Activities	**Responsibility**
1. Establishment of project management office and team 2. Development of a detailed working plan for the execution of the project (schedule, role and responsibilities, milestones, etc.)	UNIDO, ECREEE, International Expert Team, PMO
3. Establishment of Project Steering committee and periodic convening of steering committee	UNIDO, MTIE, ECREEE, ELECTRA, ARE, Ministry of Finance
4. Liaison with UNIDO	Project manager
5. Design, development and maintenance of a website	UNIDO, ECREEE, International Expert Team, PMO
6. Preparation and implementation of a dissemination programme covering all of Cape Verde	PMO
7. Preparation of TORs & recruitment of evaluation consultant	PMO
8. Regular reporting	Project manager
9. Day to day coordination, management and monitoring of all project activities	PMO

At the beginning of project implementation a detailed working plan for the entire duration of the project will be developed by UNIDO in collaboration with the PMO, ECREEE and the MTIE. The working plan will clearly define roles and responsibilities for the execution of project activities, including monitoring and evaluation; it will set milestones for deliverables and outputs. The working plan will be used as management and monitoring tool by PMO and UNIDO and reviewed and updated as appropriate on a biannual basis.

The PMO will be responsible for the day-to-day management, monitoring and evaluation of project activities as in the agreed project work plan. The PMO will coordinate all project activities being carried out by project national experts and partners. It will also be in charge of the organization of awareness raising and the seminars and training to be carried out under Project Component 4. .

The PMO will also be responsible for the communication and dissemination of the opportunities and results from this project which is important for the sustainable development of the renewable energy market in Cape Verde. The dissemination programme will be designed to raise awareness of the demonstration projects. This feeds directly into the awareness raising of Project Component 2 and should be planned together. Further promotional material on renewable energy should also be compiled to feed into the dissemination and sensitisation programme. A programme of sensitisation of stakeholders will be designed and implemented to ensure the project has lasting results. These stakeholders will include regional governments, manufacturers, hotel associations, and local business. The website for the GEF website will be integrated into the ECREEE website (www.ecreee.org.).

3. Global Environmental Benefits

Reduction in greenhouse gas emissions will be achieved directly and indirectly by the project implementation at different stages: through the development and implementation of small to medium scale renewable energy projects (PC1) and through replicating small to medium scale renewable energy projects (PC2).

The reduction in greenhouse gas emissions were calculated using the methodology defined in the manual for calculating GHG benefits of GEF projects: energy efficiency and renewable energy projects.

Direct Emission Reductions

Part of the outputs of the project will be the finance of demonstrations projects with the support of a concession fund. These investments will result in direct greenhouse gas emission reductions during the project's implementation phase. As a result of these activities during the project implementation period of three years, direct greenhouse gas emission reductions totalling 82,076 tonnes of CO_2 eq will be achieved over the useful lifetime of the investments of twenty years for the wind turbines and ten years for the other projects. In the non-GEF case, these energy needs would be satisfied by diesel generation capacity with an average emission factor of 0.775 t CO_2 eq / MWh.

Indirect Emissions Reductions

Using the GEF bottom-up methodology, indirect emission reductions attributable to the project are 164,153 tonnes of CO_2 eq. This figure assumes a replication factor of 2. Using the GEF top-down methodology, indirect emission reductions attributable to the project are 15,097 tonnes of CO_2 eq. This figure assumes that total technological and economic potential for GHG emission reductions in this area over 10 years is 25,162 tonnes of CO_2 eq, and a project causality factor of 60 percent.

Institutional Continuity and Replicability, and Sustainability of Global Environmental Benefits

The outputs to be generated by the GEF UNIDO Project will contribute to creating an enabling environment for a national market in small to medium scale renewable energy as well as providing links to developments at a regional level through UNIDO. All planned outputs are consistent with and instrumental to achievements of the objectives of Cape Verde's key energy policies and legislation as well as recommended plan of actions. The 4 project components are designed so as to ensure the sustainability of global environmental benefits beyond the life of the project

Under Project Component 1 Demonstration projects will show the technical feasibility and commercial viability of small to medium scale renewable energy projects and provide national examples that can be replicated across the country. The pilots have been selected on a number of criteria including their GHG emission reductions and their replicability. Not only will the demonstration projects show what is viable to invest in small to medium scale renewable (which the examples could be disseminated widely in the country) but also that the implementation and operation of these projects will build up the technical capacity within the project developer institutions to help in the replication of these projects. Given the commercial interest in these projects, the different proponents will have an interest in keeping the projects running and hence sustain the global environmental benefits beyond the life of the project.

The Investment Strategy developer as part of Project Component 2 will play a major role in determining the growth rate of small to medium scale renewable energy projects implementation during and after completion of the GEF project implementation. It is likely to be the first step in the replication of small to medium scale renewable energy projects. It is expected to generate the level of awareness needed to boost the interest in and demand for small to medium scale renewable energy projects. It will see the involvement and active participation of private sector organizations, and other industry/sector associations, which can rely on well established national networks and platforms. The Investment Strategy and Business Plan for small to medium scale renewable energy scale-up will also identify potential finance for projects to help take the potential projects forward. This scaling up is seen as the first step in the widespread replication of small to medium scale renewable energy projects. The investment strategy and business plan will facilitate the further replication through both the identification of projects around the county and of potential finance. Alongside this Investment Strategy seed financing will be offered to small to medium scale renewable energy projects available through application to the ECREEE's ECOWAS Renewable Energy Facility. This financing will encourage investment and replication of small to medium scale renewable energy projects beyond the timescales of this project.

Cape Verde already has legislation in place to support renewable energy projects, however under Project Component 3 propositions for policy and regulations specifically to support the development of small to medium scale renewable

energy into economic and social sectors as well as develop a standard PPA will be made. This component will encourage more investors in small to medium scale renewable energy projects by removing some of the regulatory barriers and provide conductive market conditions for progressive and sustained scaling-up of small to medium scale renewable energy projects, and consequent global environmental benefits. The coherence and alignment of this component with the existing energy policy objectives and plan of actions, combined with the commitment of resources pledged by the Government of Cape Verde provide strong foundations for institutional continuity, sustainability and further development of the GEF UNIDO project outputs as well as achievement of expected project's outcomes.

The creation of a group of renewable energy experts under Project Component 4 skilled and fully equipped in the development and implementation of small to medium scale renewable energy projects, provision of and other services, is expected to play a most important role in generating and implementing new small to medium scale renewable energy projects during and after the completion of the GEF project implementation. During the GEF project implementation period not only will stakeholders be trained directly but trainers will be trained to ensure that the training continues beyond the timeframe of the project. It is anticipated that the training modules are incorporated into new or existing courses run by the University of Cape Verde and the Employment and Vocational Training Institute. Trained renewable energy experts will continue offering and providing renewable energy training as result of increased demand, kicking-off the development of provider start-ups and the growth of a national small scale renewable energy market.

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

The Government of Cape Verde is promoting renewable energy through various policies and institutional measures. The key policies are set out below.

Cape Verde National Energy Policy, 2008

Cape Verde National Energy Policy was approved in June 2008 by the Council of Ministries. The policy sets out the objectives for the Government for the energy sector and also the aims for the renewable energy sub-sector. The vision in the long term for the Cape Verde energy sector is to "build up a future independent of fossil fuels". The main aims of the electricity sub-sector are to:

- Renewable energy: invest and adopt renewable energy and alternative technologies (wind, solar, geothermal, ocean thermal energy conversion, wave energy, waste energy and biofuels) for continually decrease Cape Verde's dependence on fossil fuels;
- Energy security and reduction of the imports dependency: ensure the reduction of the dependency of energy imports and facilitate the access to a continuous supply of energy;
- Sustainability: ensure the sustainability of the energy sector in terms of environmental, socio-political and economic point of view;
- Efficiency: ensure an adequate and efficient supply, distribution and consumption system in all Cape Verde

Within this policy, and in particular in terms of the increase of the renewable energy penetration in the next years, Cape Verde Council of Ministers has put forward the following targets: 25% of electricity production from renewable energy by 2011, 50% by 2020; and at least one island with 100% of electricity supplied from renewable energy in 2020. For electricity coverage the Council of Ministers fixed a target of 95% and 100% of coverage at the national level by 2011 and 2015, respectively.

This UNIDO project will help the Government of Cape Verde to achieve the objectives and goals set out in terms of renewable energy generation. Due to the geographical nature of Cape Verde (not interconnected small islands) the ambitious objectives of Cape Verde Energy Policy can only be achieved through a combination of both large scale and small to medium scale renewable energy project developments. Although small to medium scale renewable energy projects have a high potential in the country they require different requirements in terms of technical and financial capacity which the UNIDO project will help to obtain.

Decree-law n.1/2011 of 3 January, on the Promotion and Incentive for the Use of Renewable Energy

This DL establishes the rules concerning the promotion, incentive and access to licence and exploration of the independent production of electricity using renewable energy sources. It has the objective of promoting and

incentivising the use of renewable energy in Cape Verde. It creates several planning instruments for the development of renewable energy projects (Renewable Energy Master Plan and Sectoral Renewable Energy Plan), incentives and simplified licensing regimes (different from the one established by the Decree-Law n.30/2006).

At the planning level, it creates:

- The Renewable Energy Master Plan which establishes the energy policy objectives in term of renewable energy, goals and maximum capacity to be installed in the network by energy source;
- The Sectoral Renewable Energy Plan (PESER, "Plano Estratégico Sectorial das Energias Renováveis") which creates the Areas for the Development of Renewable Energy (ZSER), areas restricted for renewable energy projects and that allows the exemption for conducting Environmental Impact Assessment of those projects developed in those areas.

This DL also establishes a large group of incentives for renewable energy development:

- Fiscal incentives: custom duties exemptions and a reduction of taxes on the income of renewable energy producers;
- Transparent and stable system of remuneration for the sale of energy produced during a period of 15 years with payment options that offer guarantees to sponsors, namely the creation of the Renewable Production Credits.
- A special regime for micro-generation, with the right to sell the produced energy at the same price at which the electricity is purchased; and a
- Fund for the Promotion of Decentralized Rural Electrification.

Although by enacting this decree-law Cape Verde has made positive steps towards a supportive framework for renewable energy, it is still quite recent and there is a need to make it operational. More needs to be done if renewable energy, and especially small to medium scale renewable energy, is to be actively incentivized and encouraged. Moreover there is a need to coordinate efforts to develop the renewable energy sector in conjunction with other sectors such as education, health, tourism and there is also a need to increase the capacity of institutions, market players and market enablers to establish and operate a small to medium scale renewable energy market. The UNIDO/GEF project will address these issues by reviewing and consolidating the legislation and regulations already in place in Cape Verde so that conditions to foster the creation of a small to medium scale renewable energy market are created and small to medium scale renewable energy projects are implemented in Cape Verde.

ECOWAS Treaty and ECOWAS Regional Centre for Renewable Energy and Energy Efficiency

Against a background of rising energy security and climate change concerns the promotion of renewable energy and energy efficiency has been acknowledged as important areas of regional cooperation/integration by the Economic Community of West African States (ECOWAS). ECOWAS has gradually taken steps to mainstream RE into its regional activities and policies. In 2003 the ECOWAS Energy Protocol envisaged the improvement of energy efficiency and increased use of RE sources. In 2006 the ECOWAS/UEMOA White Paper on access to energy services for populations in rural and peri-urban areas foresees that at least 20% of new investments in electricity generation will be driven by local and renewable resources, in order to achieve self-sufficiency, reduced vulnerability and sustainable environmental development in keeping the regional plan.

The Ouagadougou Declaration, adopted at the ECOWAS conference for peace and security in on 12 November 2007, articulated the need to establish a regional Centre to promote RE and energy efficiency. The proposal was also facilitated by international energy and climate policy decisions. The regulation C/REG.23/11/08 of the 61st Session of ECOWAS Council of Ministers (2008) formally established the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency (ECREEE, www.ecreee.org) in Cape Verde. In competition with other ECOWAS countries Cape Verde applied successfully for the seat of the organization. With support of the ECOWAS Commission, the Austrian and Spanish Governments and technical assistance of UNIDO, the Secretariat of the Centre was established and inaugurated on 6th July 2010 in Praia, Cape Verde.

ECREEE acts as a renewable energy and energy efficiency promotion agency for West Africa which opens up opportunities for Cape Verdean business to export obtained renewable expertise, knowledge but eventually also

products to the West African region. ECREEE will be also an important implementing partner in this GEF project. The specific objective of ECREEE is to create favorable framework conditions for RE and EE markets by supporting activities directed to mitigate existing technical, legal, institutional, economic, financial, policy and capacity related barriers. The Centre undertakes key activities in the areas of project development, knowledge management, capacity building, awareness raising and business and investment promotion. ECREEE employs a team of local and international technical experts which can contribute to the success of the GEF projects. ECREEE will create synergies to its annual work plans approved by its Executive Board. ECREEE launched the ECOWAS Renewable Energy Facility (EREF) which will contribute to the scaling-up of small and medium sized renewable energy projects in Cape Verde.

The One Programme in Cape Verde / UNDAF

Cape Verde is one of the eight countries to pilot the UN Delivering as One Reform. UN assistance in Cape Verde is embodied in a multiyear planning instrument, the UN Development Assistance Framework (UNDAF), which in 2008 became known as the One UN Programme. The One UN Programme, initially set to run from 2006 to 2010 was extended one year to be aligned with the national planning framework, covering now 2008 to 2011.

The One Programme 2008-2011, together with the UNDAF 2006-2010, have been taking into consideration the major challenges that the country faces, particularly the management of the post-graduation period, within the framework of the phase of post-accession to the World Trade Organisation (WTO) as well as attaining the MDG's by 2015, an objective of the DECRP II. The One Programme therefore responds to a very wide range of national priorities, grouped into four thematic areas, each of which is subdivided into one or several sub-programmes. The four areas in which The One Programme has been acting are: (i) good governance; (ii) Promotion of Growth and Economic Opportunities; (iii) Environmental, Energy, Disasters, Prevention and Response; and (iv) Human Capital and Social Protection.

Since 2010, the UNCT with the government have been engaged in a common country programming process for the development of the new UNDAF and UNDAF Action Plan (UNDAP or One Programme) for the cycle 2012-2016. To date, priority areas (UNDAF Outcomes) for UN coordinated and coherent response to support national development priorities identified and validated in July 2011 are:

(i) Poverty and hunger reduction;
(ii) Institution building, democracy and citizenship;
(iii) Reduction of disparities and inequities
(iv) Environmental sustainability and climate change adaptation

The UNIDO-GEF project is clearly integrated within the current (in the Environmental, Energy, Disaster, Prevention and Response area) and future One Programme (in the Environmental sustainability and climate change adaptation) and will help Cape Verde to reduce its dependency of fossil fuels as well as mitigate climate change.

GEF Strategic Program for West Africa: Energy Component (SPWA-CC)

This UNIDO-GEF project is part of GEF Programmatic Approach to Access to Energy in West Africa, approved by GEF Council in November 2008. Its goals and objectives are in line with the focus of the Programmatic approach i.e. promoting market based dissemination of renewable energy technologies. This regional programme is being coordinated by ECREEE.

As this UNIDO-GEF project will also be implemented through ECREEE, this will ensure that there will be close coordination between the national project (UNIDO-GEF project) and the regional programme. Also this close coordination of the two projects will ensure that the lessons leant from the implementation of the UNIDO-GEF project will be disseminated throughout the West Africa Region and that the project will contribute towards the achievement of to the region's main objectives and goals.

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

Designed to promote the dissemination of renewable energy technologies in Cape Verde, the project will contribute to the GEF Climate Change focal area's Strategic Program 3 – Promoting market approaches to renewable energy. This project is part of GEF Programmatic Approach to Access to Energy in West Africa, approved by GEF Council in

November 2008. Its goals and objectives are in line with the focus of the Programmatic approach i.e. promoting market based dissemination of renewable energy technologies. With this national project being anchored at ECREEE, this will ensure close coordination between the national project and regional programme since ECREEE will be coordinating the regional programme.

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

The context and barriers analysis as well as stakeholders discussions carried out during the PIF preparation and PPG implementation has clearly shown that:

- the Government has insufficient resources, lacks the technical expertise and institutional capacity to autonomously structure and implement programmes to promote and support renewable energy in the short- to medium-term
- the limited renewable energy expertise currently available in the country is not going to be addressed without training and the transfer of expertise and best practices
- to convince the utility and other companies that investing in renewable energy makes commercial and environmental sense, the availability of a sufficient number of national success stories is a critical component of any effective promotional and educational campaign.

The GEF resources being requested for this project will be targeted towards establishing a market environment that will promote investments in renewable energy in rural areas. More specifically, the GEF funding will be used to co-finance the following project activities: (i) developing three pilot projects to demonstrate the technical feasibility and economic viability of renewable energy projects in selected rural areas that focus on energy for productive uses; (ii) technical assistance to establish a legal and regulatory framework that will create a level playing field for renewable energy technologies in general; (iii) technical assistance in institutional strengthening, capacity building and awareness raising; and (iv) technical assistance in the creation of renewable energy markets and supporting the project management office.

The ECREEE's ECOWAS Renewable Energy Facility (EREF) will be also be intrinsically involved in this project as: it will provide co-finance for the establishment of the seed fund for replicating small to medium scale renewable energy projects in Cape Verde; will receive the financing from GEF for the seed fund and ring fence this financing values to projects only developed in Cape Verde. Besides this, it will also provide co-finance for: (i) technical assistance on the development of a strategy and business plan for the replication of small to medium scale renewable energy projects; (ii) technical assistance in institutional strengthening, capacity building and awareness raising; and (iv) technical assistance in the creation of renewable energy markets and supporting the project management office.

E. OUTLINE THE COORDINATION WITH OTHER RELATED INITIATIVES:

At national level, this project will be closely coordinated with the following past and ongoing projects that seek to promote renewable energy technologies in Cape Verde:

At the regional level, there will be important coordination and harmonization of this project with the several similar projects implementing market transformations to promote the uptake of small to medium scale renewable energy as part of the GEF Programmatic Approach on Access to Energy in West Africa (The Gambia, Côte d'Ivoire, Chad, Guinea, Liberia, Nigeria, Sierra Leone). This regional harmonization and coordination will be undertaken through ECOWAS (the Economic Commission of West African States), of which Cape Verde and all the other countries are members. ECOWAS has a focus on promoting energy access through renewable energy among its members, as stipulated in the ECOWAS/UEMOA White Paper in Energy Access, so it is by far the most suited regional institution to organize the coordination between these GEF projects. Through ECOWAS, policies and strategies to promote market-based small to medium scale renewable energy will progressively be expanded to all countries in the region. The present project will therefore liaise with these specific regional activities under the umbrella of the GEF Programmatic Energy project for West Africa led by UNIDO.

UNIDO has also helped to establish the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency (ECREEE) within Cape Verde. Therefore, this institution will naturally have a symbiotic relationship with the GEF regional programme. ECREEE acts as a renewable energy and energy efficiency promotion agency for West Africa which opens up opportunities for Cape Verdean business to export renewable expertise and know-how but eventually

also products to the West African region. ECREEE will be also an important implementing partner in this GEF project. The specific objective of ECREEE is to create favorable framework conditions for RE and EE markets by supporting activities directed to mitigate existing technical, legal, institutional, economic, financial, policy and capacity related barriers. The Centre undertakes key activities in the areas of project development, knowledge management, capacity building, awareness raising and business and investment promotion. ECREEE employs a team of local and international technical experts which can contribute to the success of the GEF projects. ECREEE will create synergies to its annual work plans approved by its Executive Board. ECREEE launched the ECOWAS Renewable Energy Facility (EREF) which will contribute to the scaling-up of small and medium sized renewable energy projects in Cape Verde..

Special efforts will be made to exchange information on lessons learned, best practices and experience gained under these and other relevant ongoing projects to ensure synergies for wide scale replication and dissemination of results.

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

GEF funding is being requested to help remove the barriers to market based promotion of investments in appropriate and viable small to medium scale renewable energy technologies in direct response to the prevailing energy circumstance and in line with overall sustainable development objectives of the country. GEF financing will provide the necessary catalytic support to create and sustain a market environment conducive to investments in small to medium scale renewable energy technologies. More specifically, GEF will be used to demonstrate the technical and commercial viability of selected and high replicable small to medium scale renewable energy projects with high replication potential. The demonstration effect will be significant in helping to remove identified barriers currently preventing potential stakeholders from implementing small to medium scale renewable energy projects. GEF financing will provide technical assistance to develop an investment strategy and business plan to scale-up small to medium scale renewable energy and will provide the technical assistance to strengthen a legal and regulatory framework that would create support for small to medium scale renewable energy. Further, GEF financing would provide technical assistance for institutional strengthening, capacity building and awareness raising to create a supportive institutional framework. Finally GEF support will provide project management and co-ordination.

Baseline

Cape Verde relies almost entirely on imported fossil fuels to meet its energy requirements. At the country level and at the levels of specific islands, power demand is rapidly growing and is already close to the supply capacity. As a result the dependence an imported petroleum products is increasing and exerting a heavy burden on the national budget.

Each island operates its own local electricity grid that runs on petroleum products (renewable energy production represented only 3% of the generation capacity). The GHG emissions from fossil fuels were responsible for 66.5 % of the total emissions in Cape Verde, approximately 220, 049 liquid tCO_2e. With increased fossil fuel based power systems having developed in the recent past, the current levels of GHG emissions from this sector is expected to be much higher than this estimate. In addition, this estimate is set to grow as more fossil fuels based power plants are built to address the current power deficit both for grid connected and remote areas.

In Cape Verde , with the recent introduction of the Decree-law n.1/2011 of 3rd of January on Promotion and Incentive for the Use of Renewable Energy rules concerning the promotion, incentives and access to license and exploration of the independent production of electricity using renewable energy sources were introduced in Cape Verde. This Decree Law with the objective of promoting and incentivizing the use of renewable energy in Cape Verde, introduces a group of incentives for renewable energy development such as: fiscal incentives; a transparent and stable system of remuneration for the sale of energy produced during a period of 15 years with payment options that offer guarantees to sponsors, namely the creation of the Renewable Production Credits; a special regime for micro-generation, with the right to sell the produced energy at the same price at which the electricity is purchased and a fund for the Promotion of Decentralized Rural Electrification. This decree-law is expected to address to a great extent financial barriers for the development of RE in Cape Verde, however it is still quite recent and the sector is expected to keep relying more or less on external donor funding (e.g. soft loan credit line of Portugal, grants for project development from different donors) for up-front investment costs. Still with the introduction of this decree the difficulty of mobilising risk capital for the development of smaller scale projects (e.g. feasibilities, measurements) is expected to continue.

Although there are legislation and incentives for developing renewable energy projects in the country, there have been no efforts at national level to have a coordinated approach to the development the renewable energy sector in conjunction with other sectors such as education, health, tourism etc where such interventions would be appropriate and cost effective. Thus although there is conductive legal and regulatory framework supporting large-scale renewable energy projects there is as a lack of expertise to implement substantive and effective policies and programmes to promote and support small to medium scale renewable energy development. Furthermore the institutional capacity and competencies within the energy sector are limited, especially in relation to the formulation and implementation of policies as well as in regulation. The recently enacted the Decree-Law on the Promotion and Incentives for the Use of Renewable Energy was developed by the Cape Verde's Government.

Baseline trajectory

The Government of Cape Verde has launched a plan to reduce the country's dependence on imported fossil fuels through increased energy production from renewable resources. Through private-sector investment and government-supported projects, Cape Verde intends to generate at least 25% of electricity from renewable sources by the year 2011 and 50% by the year 2020. To achieve these objectives, major projects in solar energy (5 MW for Santiago and 2.5 MW for Sal) and wind energy (28 MW for Santiago, S.Vicente, Sal and Boavista in total) are in process of implementation.

The Government has projects under way to identify renewable energy resources available in Cape Verde however only the installation of large scale renewable energy projects is being pursued. Renewable energy resource analysis that was carried out in Cape Verde not only identified renewable energy resources that can be utilised for large scale development but also refers to a large potential for smaller to medium scale systems to be taped. By developing only large scale energy projects with high up-front investment costs the Government targets will probably not be completely achieved. Large scale projects have high infrastructural development needs and may pose a great stress to the existing grid and thus they will not constitute the only solution to address the electricity production and supply in smaller islands of Cape Verde, in remote areas for which there is no grid connection and electricity is only available a few hours a day and for small areas with smaller electricity demand needs. Furthermore, the fragmented nature of power grids due to the geographical characteristics of the country tends to discourage potential large-scale investors due to the perceived limited market potential. Without GEF assistance, the baseline response will entail increased installation of fossil fuel power generation capacity in different areas, especially those with low demand. Therefore there is need for a deliberate effort to promote investments in small to medium scale renewable energy projects that would both meet the country's needs and would not need huge and complex financial arrangements that are required in the case of large scale projects. Small to medium scale renewable energy systems have much smaller infrastructural development needs, reduced up-front investment and maintenance costs and, in the cases of the grid connected ones, will pose much smaller stress to the existent grid when connected to it. Moreover only when coupling the installation of large systems with small to medium scale renewable energy systems, the existing renewable energy potential may be utilized to its maximum potential, electricity can be provided on a 24 hours basis to remote populations that use isolated fuel based systems and Government targets can be achieved in a cost-efficient way.

Furthermore with the economic development of Cape Verde, power demand per capita is expected to grow and alongside with that the consumption of imported fossil fuel. The increased use of fossil fuels to face increase power demand consequently lead to an increase in greenhouse gas emissions. The adoption this UNIDO-GEF project together will slow down the need for increased imported fossil fuel consumption, as it will face the increase in power demand by using endogenous renewable energy resources.

GEF Project Alternative

The proposed UNIDO-GEF project would provide the incremental policy, technical and financial inputs required to support and effectively leverage national efforts in setting up and maintaining an infrastructure capable to support small to medium scale renewable energy project development and implementation, stimulate the creation of a market for small to medium scale renewable energy and obtain relevant GHG emission reductions. In doing so the project would greatly multiply the impact and global environmental returns of resources allocated to renewable energy by the Government as well as by other international initiatives and programmes.

At the policy level the project would provide the additional technical assistance needed to strengthen the legal and regulatory support frameworks to provide the incentives and assurances required to facilitate investment in small to medium scale renewable energy. GEF financing is sought to support a review of the current regulations concerning the installing of RE and identify barriers to small to medium renewable energy projects and will present to the Government of Cape Verde and a series of recommendations on any revisions or additions needed to the current regulatory framework to help overcome any regulatory barriers to the development of small to medium scale renewable energy projects.

At the renewable energy project implementation level the project would provide renewable energy project-specific technical assistance and financing support through Project Component 1 by facilitating the implementation of selected small to medium scale renewable energy pilot projects with high replication potential in Cape Verde. GEF financing is sought to provide assistance to three renewable energy projects ranging from 54 kW up to 1500 kW. The GEF co-financing would facilitate these projects to get off the ground by leveraging co-finance and where necessary providing technical assistance. Without the GEF support these projects would not go ahead. GEF would support 12-30% of the incremental investments and will be responsible for an additional 1.6 MW on installed small to medium scale renewable energy. The implementation of these projects would generate case studies and demonstrated success stories to be then disseminated through the other GEF UNIDO project activities. This is expected to fuel the interest in renewable energy and reduce the associated perceived investment risk.

The implementation of these projects will target gender issues, especially with the implementation of the electrification projects in which it will allow women to have access to electricity 24hours a day, with all benefits that it brings: refrigeration of food – which can to a certain extent rationalize food preparation leaving more time for women for example to be dedicated to educate themselves and their children –; utilisation of electrical appliances such as electric grinding mills to replace hand pounding of grains and of oil seeds, irons and blenders that ease some of the more tedious tasks within the household. These technologies that can only be used with electricity access frees women from unnecessary labour, and presents an opportunity for development.

At the investment level the GEF financing would be used as seed financing to be provided as part of the EREF operated by ECREEE. This facility provides seed funding for pre-investment activities (measurements, feasibilities, financial structuring) and business development (e.g. development of business plans) for RE projects. Through this seed financing it is estimate that 2MW of further RE will be installed with associated 10,000tCO_2 emissions savings.

At the institutional level the GEF financing would add the technical assistance needed to strengthen local expertise, knowledge and capacity in developing, implementing and maintaining effective renewable energy projects and programmes. Also at this level GEF financing will target gender issues as it will provide training to all genders, trying to integrate more women in the market. The participation of women in the training meetings will be encouraged through advertising the training courses in and by Associations directed to women.

At the market level the project would target all players. To financiers**,** managers and engineers, the project would provide the knowledge to fully understand the economic and environmental benefits of small to medium scale renewable energy; and the technical capacity and tools to take renewable energy projects forward. Industry wide and increased awareness of renewable energy potential and benefits delivered by the project will boost demand for renewable energy services and products generating the pull for market creation. The project would also enable the creation of the basis of an on-going sustainable training programme that will enable the market to continue to develop and create technicians and engineers (man and women) able to service the future growing market.

G. INDICATE RISKS, INCLUDING CLIMATE CHANGE RISKS, THAT MIGHT PREVENT THE PROJECT OBJECTIVE(S) FROM BEING ACHIEVED AND OUTLINE RISK MANAGEMENT MEASURES:

The project major risks and risk management measures are identified in the table below:

Risk	Potential Impact	Probability	Management/Mitigation
Institutional risk 1: Low government commitment to renewable energy and the GEF UNIDO project The project objectives and activities should be in line with national energy policy objectives and actions plans for increasing the energy from renewable energy and helping to enable the market. MTIE should be committed to the project and should commit resources to the project. Another risk is that small and medium sized renewable energy projects are not considered as a priority due to other large scale implementations.	High	Very Low	MTIE is fully committed to the project and the objectives are in line with its policies. The project will contribute to the overall renewable energy policy and renewable energy investment plan of the Government. It will focus on small and medium scale projects which demonstrate a high relevance due to their local added value creation (jobs, companies) and importance for rural areas. It also responds also to the existing technical limitations to include more grid-connected intermediate solar and power plants into some of the small island grids. ECREEE is highly committed and co-funds the project with its own sources. ECREEE will be responsible for the management of the project and there is commitment from the Ministry of Finance, MTIE and the National Environment Agency to sit on the steering committee. Close coordination, regular communication and delegation of responsibility will ensure continuous active involvement of key policy/institutional counterparts.
Institutional risk 2: ELECTRA does not accept RE electricity into its grids Some of the proposed demonstration projects rely on selling power to ELECTRA, either on the national grid or a mini-grid, for their income. If ELECTRA does not accept the input of electricity to the grid these specific projects will fail.	High	Low	ELECTRA has been fully consulted in the demonstration projects and will be actively involved in some of them. In addition they are keen for additional generation capacity and keen to also off-set some of their fossil fuel generation. They have expressed interest in signing PPAs with potential generators. The MTIE is fully committed to the project and will also ensure that the projects are connected to the grids. Moreover, Cape Verde adopted a renewable energy law in 2011 which provides a legal basis for feeding into the grid.
Technical risk: limited experience in Cape Verde in RE technologies There is a technical risk associated with the demonstration projects due to limited experience in the country with the proposed technology and with similar projects. In addition there is a risk that the technologies are not technically viable. There are no noteworthy technical risks associated with the policy measures and capacity building activities proposed by the UNIDO-GEF project. All of them are well proven interventions, tested by national experiences and in many other countries.	High	Very Low	Execution of activities to be implemented under Project Component 1 will be carried out with the support of international experts/companies with demonstrated and successful past experience. The specialised ECREEE team will assist locally. Only mature and proven small to medium scale renewable energy technologies are being proposed. With respect to the capacity building and enabling activities special attention will be given to further defining the existing baseline in order to develop effective tailored and well-targeted training programmes and curricula.

Risk	Potential Impact	Probability	Management/Mitigation
Market risk: Sector stakeholders do not participate/ engage actively in the project Due to the lack of information and awareness in small to medium scale renewable energy there is a risk that there is not active participation from stakeholders. However the project aims to address this barrier and the very high cost of traditional energy in the country means that organizations are looking for alternatives. The level of interest and collaboration shown by enterprises during the PPG phase leads to legitimately expect strong participation.	High	Very Low	During the project preparation phase members of the ECREEE, Hotels, MTIE, ARE, Hospitals, Municipalities, Public and Private Organisations and Financing Institutions in Cape Verde were all approached. The general response was of strong support and interest to participate in the project. A well-structured national dissemination campaign demonstrating the viability of the pilot projects and outlining the opportunities during project implementation combined with an active dialogue and involvement of associations at the national and local level during the whole project duration will ensure the desired stakeholder response to the project.
Economic and Financial risk 1: Investment in RE is not economically and/or financially viable. The risk is that investment in small to medium scale renewable energy projects is shown not to be commercially viable and so demonstration projects are not able to provide replicable examples and impact on the potential small to medium scale market for RE.	High	Low-Medium	The focus of the demonstration projects is small to medium scale renewable energy projects. Feasibility studies have been carried out for each of these projects and they have been shown to be financial viable. The replication of the projects is expected to focus on the same areas – small to medium scale renewable energy projects where the tariff will be cost reflective so that only financial viable projects will go ahead.
Economic and Financial risk 2: Financial and credit constraints prevent enterprises from investing in RE. The ability of companies to invest in small to medium scale renewable energy projects will impact the replication of the demonstration projects and the long term market for small to medium scale renewable energy. Access to finance in Cape Verde is possible but at high interest rates. Also there is no experience in Cape Verde on the involvement of the local finance sector in providing financing for this type of projects.	High	Low-Medium	One of the key advantages to invest in small to medium scale renewable energy is the offset of either grid electricity or diesel fuel – both of which are very expensive within Cape Verde. As part of the training in Project Component 4 life cycle analysis will be taught to show the life time benefits of renewable energy, particularly in a volatile fossil fuel market. Demonstrating these benefits is expected to lead to further investment in small to medium scale renewable energy projects. For the scale-up investment projects additional technical assistance will be provided to help the projects off the ground. Training will also be provided to local financial institutions so that they fully understand the risks and benefits of small to medium scale renewable energy projects.
Implementation risk UNIDO has long-standing direct experience in the development and implementation of renewable energy projects and it has a strong knowledge of the key variables that determine the success and the failure of project implementation.	Medium	Very low	UNIDO will mitigate this risk through detailed development of activities plans in close cooperation with in-country project partners, stakeholders and developers. Agreed and transparent modus operandi will be defined before the start of the project implementation. ECREEE employs a specialised team of local and international experts which will contribute to the success for the UNIDO-GEF project. Moreover, ECREEE has access to other donor

Risk	Potential Impact	Probability	Management/Mitigation
			funding (e.g. European Commission, Spain, USAID) which can co-fund some of the activities or ensure follow-up and sustainability.
Climate Change risk Cape Verde is composed of islands and thus all proposed demonstration projects are on the coast and some of them are near to sea level. Cape Verde is vulnerable to sea level rise which could have a significant impact on the long-term sustainability of some of the pilot projects: Carriçal hybrid-electrification project in São Nicolau Island and the PV for Ice factory in the Brava Island.	High	Low	To begin with, Climate Risk Assessment tools will be used to assess the vulnerability of all the projects to ensure that potential impacts of climate variability and change are fully integrated into the project design. The proposed hybrid system electrification technologies and PV technologies can be considerate relatively mobile. They can be disassembled and be assembled by a Cape Verde based company. Should sea levels rise to pose a risk to these projects it will be possible to move the assemblies using skills and equipment already in Cape Verde.

H. EXPLAIN HOW COST-EFFECTIVENESS IS REFLECTED IN THE PROJECT DESIGN:

The project takes a comprehensive approach to address many of the barriers that are preventing small to medium scale renewable energy being taken up widely, in particular those related to awareness and capacity as well as a supportive regulatory framework. The strategy for the project to achieve good cost-effectiveness is based on a number of principles: 1) build on and maximize leverage of national public and private resources; 2) training-the-trainers approach for industry-wide awareness raising of and capacity building in small to medium scale renewable energy; 3) select small to medium scale pilot projects primarily on the basis of their replication potential (and therefore direct and indirect avoided GHG emissions); and 4) searching and maximizing synergies with institutions for investment in small to medium scale renewable energy.

Given its focus on addressing policy and technical capacity barriers, the GEF-UNIDO project will generate the biggest share of GHG emission savings after the project implementation period, when the new legislation, capacity built and the training programmes established will deploy their full impact in terms of new renewable energy projects.

The project is expected to generate cumulative direct GHG emission savings in the range of 82,076 tonnes CO_{2eq} and indirect GHG emission savings in the range of 154,153 tonnes CO_{2eq}. The GEF resources cost- efficiency for the direct GHG emission savings would be around 21.42 USD/tonne of CO_{2eq}; for the indirect GHG emission savings cost-efficiency would significantly improve, going down to 11.41 USD/tonne CO_{2eq} .

PART III: INSTITUTIONAL COORDINATION AND SUPPORT

A. INSTITUTIONAL ARRANGEMENT:

UNIDO is the only GEF Implementing Agency involved in this project and no specific arrangement with other GEF Agencies is required.

B. PROJECT IMPLEMENTATION ARRANGEMENT:

UNIDO holds the ultimate responsibility for the implementation of the project, the delivery of the planned outputs and the achievement of the expected outcomes. The project will be directly executed by UNIDO in collaboration with the Ministry of Tourism, Industry and Energy (MTIE), ELECTRA and ECREEE.

UNIDO will be responsible for the general management and monitoring of the project, and reporting on the project performance to the GEF. In UNIDO headquarters a senior project manager will be responsible for the general management and monitoring of the project, and reporting on the project performance to the GEF. UNIDO will be in charge of procuring the international and national expertise, technologies, services etc needed to deliver the outputs planned under the four project components. It will manage, supervise and monitor the work of the international teams and ensure that deliverables are technically sound and consistent with the requirements of the project.

As agreed with the Government of Cape Verde, the MTIE will have overall project coordination responsibility. A Project Management Office (PMO) will be hosted by the Secretariat of ECREEE based in Praia, Cape Verde. The PMO-ECREEE will consist of a National Project Manager (NPM) and a Project Administrative Assistant (PAA). Operating as an entity, the PMO will be responsible for the day-to-day management, monitoring and evaluation of project activities as in the agreed project work plan. The PMO will coordinate all project activities being carried out by project national experts and partners. It will also be in charge of the organization of awareness raising, seminars and training to be carried out under Project Component 3. The PMO will be part-funded by the GEF budget plus in-kind funding and co-finance from the Government of Cape Verde and ECREEE. During the whole implementation period of the project UNIDO will provide the PMO with the necessary management and monitoring support. The PMO will also be responsible for the communication and dissemination of the opportunities and results from this project which is important to the sustainable development of the small to medium scale renewable energy market in Cape Verde.

A Project Steering Committee will be established for periodically reviewing and monitoring project implementation progress, facilitate co-ordination between project partners, provide transparency and guidance, and ensuring ownership, support and sustainability of the project results. The Steering Committee will have a balanced representation from key ministries, public institutions, private sector, NGOs, UNIDO and other international organizations partnering in the project or having relevant ongoing programmes. The final composition of the Steering Committee will be defined during the project implementation start-up phase.

At the beginning of project implementation a detailed work plan for the entire duration of the project will be developed by UNIDO in collaboration with the PMO, MTIE, ECREEE and the international and nation team of experts. The working plan will clearly define roles and responsibilities for the execution of project activities, including monitoring and evaluation; it will set milestones for deliverables and outputs. The working plan will be used as management and monitoring tool by PMO and UNIDO and reviewed and updated as appropriate on a biannual basis. UNIDO aims at the strengthening of local capacities throughout project implementation. International expert implement activities only in cooperation with local partners or experts.

This project will be implemented in line with existing UN accords. *The Government of the Republic of* ***Cape Verde*** *agrees to apply to the present project, mutatis mutandis, the provisions of the Standard Basic Assistance Agreement between the United Nations Development Programme and the Government, signed on 31 January 1976 and entered into force on 14 January 1978.*

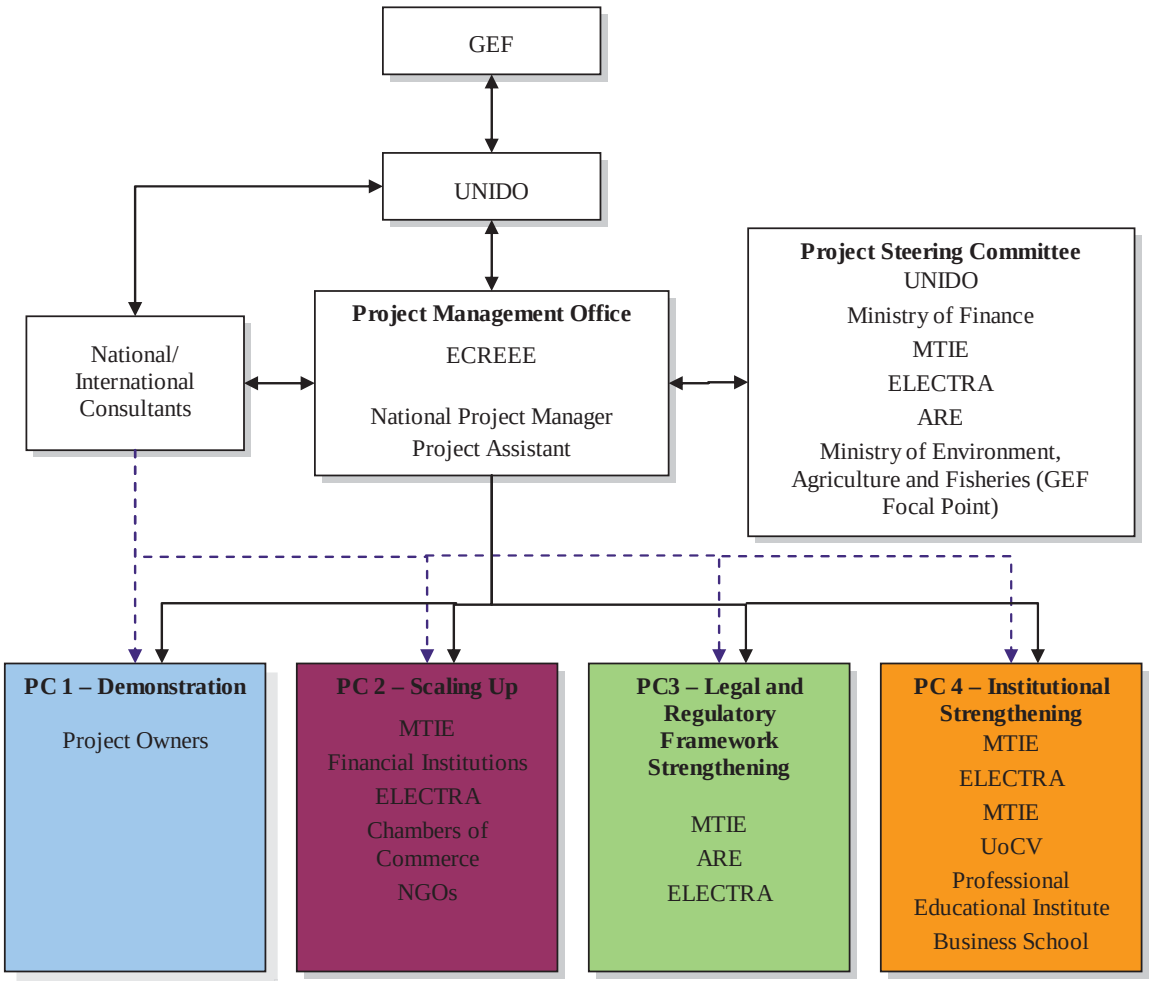


FIGURE 3: PROJECT IMPLEMENTATION ARRANGEMENT

PART IV: EXPLAIN THE ALIGNMENT OF PROJECT DESIGN WITH THE ORIGINAL PIF:

The project design is strongly aligned with the original PIF. However some amendments have been made following findings during the PPG activities.

The final design of the project is broadly in line with the approved PIF but has been amended following findings during the PPG activities and comments received in the PIF. Further context analysis, review of existing barriers, and meetings with various stakeholder groups carried out during the PPG phase, have confirmed the strong relevance of the original UNIDO GEF project and its additionality to ongoing and planned national and international programmes to promote and support renewable energy in Cape Verde.

Project Component 1 (PC1) is broadly similar to that identified in the PIF, however the investment strategy, Output 1.3, which is a technical assistance task has been made a separate component to allow for support activities to be more fully defined for the funding.

Three pilot projects were identified for inclusion as per the PIF. The overall capacity installed as pilot projects has been reduced to 1.6MW, along with associated CO_2 emissions reductions, however an increase in scale-up project capacity has been identified to compensate. As foreseen at the PIF stage the activity will include the projects being implemented and each one will be independently evaluated for widespread dissemination to relevant stakeholders. More effort that initially planned was put on developing the pre-feasibility studies of the demonstration project as in Annex F8 of Annex F – UNIDO Project document. This step was deemed necessary to ensure greater commitment and co-financing to these projects by the private sector.

Financing sources for the creation of a seed fund for the replication of small to medium scale renewable energy projects has been created has part of this component accordingly to the PIF. This seed fund will be used to provide co-finance for the replication projects indentified in the financing strategy for project replication (originally output 1.3 of the PIF and now Project Component 2). The established seed fund will provide co-finance for the development and installation of an additional 2MW capacity of small to medium scale renewable energy projects in Cape Verde (which is higher than what was previewed in the PIF). This seed financing will be allocated through the ECREEE EREF, this is a new addition from the PIF but will allow the projects to access technical assistance through this facility and increase the chances of successful implementation.

Project Component 2 (PC2) now concerns the use of seed financing, which was originally output 1.3 in the PIF. This is to allow a creation of a financing strategy, as well as identification of renewable energy projects, particularly on the island of Brava to be included.

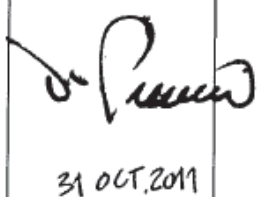
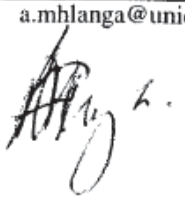
Project Component 3 (PC3) contains the activities under the PIF Component 2. These activities have been amended slightly following analysis during the PPG activities on the current legal and regulatory framework. The Government of Cape Verde has already in place legal and regulatory support for renewable energy. Therefore this component has been altered to analyse this existing legislation to identify gaps and barriers to renewable energy project development, particularly in terms of small to medium scale projects.

Project Component 4 (PC4) contains the activities under the PIF Component 3. These activities have been broadened so that not only does it include the institutional strengthening of national institutions, through the provision of 'train-the-trainers' courses, but it will now also provide the framework for strengthening on-going renewable energy training programmes in Cape Verde. These two activities together will help to support the market for small to medium scale renewable energy into the future.

The activities of **Project Component 5 (PC5)** contain the original project Component 4 activities from the PIF, these remain unchanged.

PART V: AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF policies and procedures and meets the GEF criteria for CEO Endorsement.

Agency Coordinator, Agency name	Signature	Date *(Month, day, year)*	Project Contact Person	Telephone	Email Address
Dmitri **PISKOUNOV** Managing Director Programme Development and Technical Cooperation Division UNIDO - GEF FOCAL POINT	 31 OCT.2011		Mr Alois Posekufa Mhlanga Industrial Development Officer, Energy and Climate Change Branch, UNIDO	0043 1 260 26 5169	a.mhlanga@unido.org 

ANNEX A: PROJECT RESULTS FRAMEWORK

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
Goal	To reduce energy use related emissions of greenhouse gases produced by the energy sector of Cape Verde	1. Incremental avoided CO2eq emission (tonnes of CO2eq) 2. Energy generated from renewable energy (in kWh and as % of total)	1. No direct CO2eq emission reductions 2. No indirect CO2eq emission reductions	Cumulative reduction of GHG of around 246,239 tCO2 over the lifetime of the projects (20 years for wind turbines and 10 years for other projects) 138,600 MWh of renewable energy generated over the period 2013-2024	1. ECREEE 2. Project reports	The Government of Cape Verde remains committed in the medium and long-term to renewable energy. Life cycle energy costs reduction becomes a priority for consumers.
Objective of the project	To create market conditions conductive to the development of small to medium scale renewable energy systems in Cape Verde.	1. Installed capacity of renewable energy (kW) 2. Energy generated from renewable energy (kWh) 3. Adoption of policy frameworks supporting renewable energy	1. 0 kWh generated from renewable energy 2. No conducive regulations	1. 3.6 MW installed 2. 12,600 MWh generated per year by 2014 3. Renewable energy regulations in place	1. Reports on the demonstration projects installed 2. Regular project reporting on generation capacity 3. Report on regulations in place	The Government of Cape Verde remains committed in the medium and long-term to renewable energy. Life cycle energy costs reduction becomes a priority for consumers.
Project Component 1						

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Outcome 1	**Technical feasibility and commercial viability of small to medium scale renewable energy projects in Cape Verde demonstrated.** **Capacity of installed renewable energy increased by at least 1.6 MW and GHG emissions avoided.**	**1. Number of RE projects implemented** **2. Installed capacity of RE installed (kW)**	**1. No projects installed.**	**1. 3 RE projects installed between 2012 and 2014 with installed capacity of over 1.6 MW** **2. Seed fund established to provide support for the development of at least 5 new projects correspondent to 2 MW further RE installed**	**1. Evaluation reports** **2. Project reports** **3. Project website**	**Fossil fuel prices remain high in the medium and long-term** **Co-finance is available for each project and there is the technical capacity to install the project.**
Output 1.1	Four renewable projects installed to demonstrate the technical feasibility and commercial viability of such projects.	1. Number of RE projects implemented with direct support from GEF. 2. Installed capacity of new RE projects (kW) 3. Annual RE electricity generated (MWh) 4. GHG avoided (tonnes CO_2)	1. No projects installed 2. 0 kW of RE installed	1. 3 projects implemented with direct support from GEF. 2. Installed capacity of > 1.6 MW of RE. 3. Annual RE electricity generated of 5,800 MWh 4. Annual GHG avoided of 4,158 tonnes CO2	1. Project implementers' records. 2. Independent evaluation reports 3. Project reports 4. ECREEE project records	Companies partnering with the GEF project fulfil their co-financing commitments Fossil fuel prices remain high
Output 1.2	Specialised renewable energy seed fund established for Cape Verde with contributions from ECREEE's ECOWAS Renewable Energy Facility (EREF) and GEF	1. Number of pre-feasibility and feasibility studies funded. 2. Number of RE projects invested in. 3. Installed capacity of new RE projects (kW)	1. No projects outside of the demonstration projects. 2. Installed capacity equal to demonstration project capacity	1. 5 new projects invested in partly funded by the seed fund 2. 2 MW further RE installed	1. Project evaluations 2. Project reports 3. Project website 4. EREF	Sustained Government support to agreed project activities EREF managed by ECREEE if fully operational Reduction in energy bills remains a priority for companies' top management Fossil Fuel prices remain high.

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
Project Component 2						
Outcome 2	**Market environment for deployment of small to medium-scale renewable energy projects established.**	**1. Investment and Business strategy prepared and approved** **2.Number of pre-feasibility and feasibility studies and business plans funded** **3.Number of investment and business promotion projects invested in** **4.New RE projects installed capacity**	**1. No investment strategy for SMS RE projects** **2. Installed capacity equal to demonstration capacity**	**1. Investment strategy and business plan prepared** **2. Identification of at least 5 new projects for 2MW of further RE installed** **2. Strategy for development of 100% RE fro Brava produced**	**1. Project evaluations** **2. Project reports**	**Fossil fuel prices remain high in the medium and long-term** **The ECOWAS Renewable Energy Facility (EREF) managed by ECREEE if fully operational**
Output 2.1	Investment and Business strategy for scaling up or replicating pilot projects in the country finalized	1. Investment and Business strategy for RE report.	1. No investment strategy for RE	1. An investment strategy prepared	1. Project reports	Sustained Government support to agreed project activities
Output 2.2	Study of options to provide 100% RE electricity for Brava	1. Report on 100% RE options for Brava 2. Strategy document for development of 100% RE for Brava.	1. No report produced 2. No strategy for Brava	1. Report produced	1. Project evaluations 2. Project reports	Sustained Government support to 100% RE electricity in Brava
Project Component 3						
Outcome 3	**Legal and Regulatory frameworks conducive to the development of small to medium scale renewable energy projects are strengthened and operationalized.**	**1. Existing legal and regulatory framework covering small to medium-scale renewable energy systems are strengthened.**	**1. Existing legalisation and regulations for large RE systems.**	**1. New regulations supporting small to medium scale RE development prepared and accepted by national authorities which overcome barriers to development of small to medium RE projects.**	**1. RE regulations** **2. Project reports**	**Sustained Government support to agreed project activities.**

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Output 3.1	Existing regulatory framework reviewed and conductive regulatory framework focusing on small to medium scale renewable energy projects proposed and presented to national authorities.	1. Document on the review of current RE regulations related to small and medium scale RE projects. 2. Document indentifying barriers to development of small and medium scale RE projects.	1. Robust package of legislation for large RE development.	1. Strengthening current legislation (definition of a strategy and plan for developing small to medium scale renewable energy projects).	1. Project reports	GoCV / Electricity Regulator/ ELECTRA acceptance of the new legislation supporting small to medium scale RE developed
Output 3.2	Policy and regulatory propositions for integrating small to medium scale renewable energy into economic and social sectors such as education, health etc developed.	1. Document on policy and regulations to enable the development of small to medium scale renewable energy into economic and social sectors	1. No renewable energy regulations that assist the integration of SMS RE in the different sectors of activity	1. Propositions for policy and regulations (such as on incentives promoting the implementation of small to medium scale RE projects in the social, educational and heath sectors)..	1. Project reports	GoCV / Electricity Regulator/ ELECTRA acceptance of the new legislation supporting small to medium scale RE development
Project Component4						
Outcome 4	**Technical capacity with respect to renewable energy at the institutional, market and enterprises level is build and strengthened.**	**1. Number of trained personnel** **2. Number of training sessions conducted.** **3. Number of meetings held to give advice to stakeholders**	**1. Weak institutional support to the small to medium scale RE market.** **2. No trained personnel.** **3. No training sessions** **4. No advice provided to stakeholders.**	**ECREEE, ELECTRA, and the University of Cape Verde, Professional Educational Institute and Business School have fully trained staff able to provide training and advice on RE.** **12 training seminars given.**	**Project records** **ECREEE records**	**The Government of Cape Verde remains committed in the medium and long-term to renewable energy.**
Output 4.1	Institutional capacity needs evaluated, training programmes developed, and training conducted.	1. Number of trained staff at ECREEE and MTIE	1. Weak institutional capacity to support RE market in MTIE.	1. 10 trained staff	1. Project progress report	Sustained Government support to agreed project activities

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Output 4.2	Awareness raising programmes including targeted seminars; coaching clinics held.	1. Number of companies participating in the project seminars 2. Number of interested companies and potential RE projects identified	1. No information available on RE 2. Few commercial small to medium scale RE projects identified	1. 50 companies participating in the project seminars and meetings 2. 10 companies interested in small to medium scale RE projects and projects identified	1. Training reports 2. Project progress report	Sustained Government support to agreed project activities Reduction in energy bills remains a priority for companies' top management.
Output 4.3	Training programmes for market enablers and market players especially entrepreneurs, banks etc developed and training conducted.	1. Number of RE experts and trainers in Cape Verdean market 2. Number of RE seminars and trainings delivered 3. Number of people trained in RE	1. No RE trainers in Cape Verdean market 2. RE train-the-trainers seminars and trainings bound to be delivered by international experts. 3. No training in RE 4. No-one trained in RE	1. 20 RE experts trained as trainers 2. 12 seminars and trainings for enterprises managers and engineers delivered by international national experts trained by the GEF project 3. 40 people trained in RE project identification, design, implementation and operation.	1. Training records 2. Project reporting	ECREEE, ELECTRA, and the University of Cape Verde, Professional Educational Institute and Business School remain supportive of RE training Sustained Government support to agreed project activities Stakeholders interested in RE projects due to high energy prices.
Output 4.4	Independent evaluation of pilot projects and dissemination of lessons.	1. Reports on the pilot projects. 2. Number of reports send out to stakeholders and number of hits on the reports that would be on the project webpage	1. No information on projects that are ongoing or implemented in the past.	1. 1 report on the lessons from the pilots. 2. 50 reports send out and over 150 hits on the web posted reports	Report. Website activity reports	Reports from the pilot show successful implementation and good lessons.

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF)

No comments received.

ANNEX C: CONSULTANTS TO BE HIRED FOR THE PROJECT USING GEF RESOURCES

Position Titles	*$/ person week**	*Estimated person weeks***	*Tasks to be performed*
For Project Management			
Local			
Project manager	1350	46	Project management, regular reporting, advice and training on RE
Project assistant	400	48.5	Project management, regular reporting, advice and training on RE
International			
International project evalulator	3000	6	Evaluation of the whole proejct
Justification for Travel, if any: Travel budget (49,800 USD) to cover visits to project sites, organization and participation to project seminars and trainings, liaison with project partners.			
For Technical Assistance			
Local			
National RE trainers	800	20	Provide training on all aspects of RE from technical to commercial and social
National RE expert	800	18	Evaluation of demonstration + upscale projects
National evaluation expert	800	16	Ensuring contract terms and specifications are in line with national laws and regulations.
National policy expert	800	15	Preparation of draft RE law, strategy and action plan with int'l expert
National finance consultant	800	11.6	Provide local input into CV RE investment strategy
International			
International RE expert	3000	27	Overall project management, RE advice and project development of the pilot projects, and training on RE
International RE policy expert	3000	18	Consult and draft RE law, strategy and action plan
International energy regulation specialist	3000	13	Consult and draft RE law, strategy and action plan
International RE finance expert	3000	12.4	Prepare and consult on a detailed investment strategy and identify finance for RE in Cape Verde
Training expert	3000	8	Preparation and execution of training in biomass, solar and wind project design, development and operation
Justification for Travel, if any: Missions to Cape Verde and travels within the countries will be required to international and national staff. National travel is included within the project management travel budget. The travel budgets for the international experts have been incorporated into their monthly rates.			

* Provide dollar rate per person weeks or months as applicable; ** Total person weeks/months needed to carry out the tasks.

ANNEX D: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS

A. EXPLAIN IF THE PPG OBJECTIVE HAS BEEN ACHIEVED THROUGH THE PPG ACTIVITIES UNDERTAKEN.

The PPG objectives have been largely achieved.

Activity 1: Collection of supplementary data

This activity was completed in full, the resources were used to conduct a detailed diagnostic study of the energy sector in Cape Verde and identify challenges and opportunities for renewable energy development. This detailed study is included in Annex F as Annex F6.

Activity 2: Consultation with market players and enablers

During the PPG, the project development teams met with many stakeholders either in groups or in bilaterally meetings. Groups meetings were organized between the project development team and the following ; representatives of most commercial banks operating in Cape Verde, representatives of government departments with operations linked or related to energy, representatives of NGOs operating in Cape Verde. Bilateral meetings were organized between the project development team and representatives of most development partners operating in the country, etc. Once a draft project document was ready, a validation workshop was organised to present the document and get feedback.

Activity 3: Design of pilot/demonstration project

The pilot projects were identified for this project and the detailed pre-feasibility studies were carried out. The detailed pre-feasibility studies are herein included in Annex F as Annex F8.

Activity 4 : Project strategy and implementation detailing.

The project strategy and implementation were developed. This process involved, among others, the assessment of social, economic and financial sustainability of project activities, GHG emissions calculations, developing of a Monitoring and Evaluation plan. The details of the work undertaken are included in the project document in Annex F.

B. DESCRIBE FINDINGS THAT MIGHT AFFECT THE PROJECT DESIGN OR ANY CONCERNS ON PROJECT IMPLEMENTATION, IF ANY: NONE

C. PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES AND THEIR IMPLEMENTATION STATUS IN THE TABLE BELOW[1]:

Project Preparation Activities Approved	*Implementation Status*	*GEF Amount ($)*				*Co-financing ($)*
		Amount Approved	*Amount Spent To date*	*Amount Committed*	*Uncommitted Amount**	
Collection of supplemental data	Completed	10,000	9,066	934	0	15,000
Stakeholder consultation	Completed	15,000		2,814	0	5,000
Design of pilot/demonstration projects	Completed	15,000	13,235	1,765	0	50,000
Project strategy and implementation detailing.	Completed	20,000	17,153	2,847	0	20,000
Total		60,000	51,640	8,360	0	90,000

* Any uncommitted amounts should be returned to the GEF Trust Fund. This is not a physical transfer of money, but achieved through reporting and netting out from disbursement request to Trustee. Please indicate expected date of refund transaction to Trustee.

[1] Committed resources will be used for activities leading to the start-up phase of the project implementation

ANNEX E: CALENDAR OF EXPECTED REFLOWS

Provide a calendar of expected reflows to the GEF Trust Fund or to your Agency (and/or revolving fund that will be set up)

Not Applicable

ANNEX F – COFINANCING LETTERS

See separate file

ANNEX G – PROJECT TIMELINE AND PRE-FEASIBILITY STUDIES

See separate file

ANNEX G – PROJECT TIMELINE AND FEASIBILITY STUDIES

List of Annexes included.

Annex G1 : Project Time-line and Budget

Annex G2 : Estimate of Energy Savings and GHG Emission Reductions

Annex G3 : Energy Analysis and Recommendations

Annex G4 : Criteria Used to Select Demonstration Projects

Annex G5 : Pre-feasibility Studies of Demonstration Projects

Annex G6 : List of project for the scale-up phase

Annex G7 : ECOWAS Renewable Energy Facility

Annex G8 : Terms of Reference of Key Project Staff

ANNEX G1 : Project timeline

Activity	Year 1				Year 2				Year 3			
	IV	I	II	III	IV	I	II	III	IV	I	II	III
Project Component 1 – Demonstration RE projects												
1.1 Development and implementation of RE demonstration projects												
Finalization of identification and selection of demonstration projects												
Definition of detailed agreements with partner enterprises												
Provision of technical assistance for project development and implementation												
Monitoring and evaluation												
Preparation of case studies												
Dissemination												
Reporting												
Project Component 2 – Investment and business strategy for the creation of a market for small and medium sized renewable energy solutions and establishment of a targeted seed fund.												
2.1 Investment and Business Strategy												
Identification of projects (investment & business promotion)												
Consultation meetings on opportunities and limitations of RE investment in CV												
Detailed cost plan prepared based on the investment and business promotion projects identified												
Identify possible sources of financing												
Prepare full investment plan												
2.2 Dedicated seed funding												

Activity	Year 1				Year 2				Year 3			
	IV	I	II	III	IV	I	II	III	IV	I	II	III
Seed finance for projects - Identify RE projects and prepare and submit CV proposals to the ECOWAS Renewable Energy Facility (EREF)												
Definition of the level of TA required for each project												
Provision of TA through project development/implementation												
Monitoring and evaluation of projects												
2.3 - 100% RE for Brava												
Production of report												
Project Component 3 - Consolidating comprehensive legal and regulatory framework												
3.1 Revision of RE legal framework												
Review of the current regulations related to SMS RE projects												
Stakeholders consultation meeting												
3.2. Policy and regulatory propositions for integrating small to medium scale renewable energy into economic and social sectors such as education, health etc developed.												
Preparation of draft SMS RE prepositions												
Recommendations of revisions or additions needed to current policy and regulatory framework												
Validation workshop												
Project Component 4 – Institutional Strengthening												
4.1 Institutional Capacity Strengthened												
Evaluation of institutional capacity												
Development of a detailed working plan for the execution of the training programme												

Activity	Year 1				Year 2				Year 3			
	IV	I	II	III	IV	I	II	III	IV	I	II	III
Specific project management training												
On-the-job training and evaluation of training												
4.2 Training programme for market enablers and market players developed and delivered												
Evaluation of training needs												
Development of a detailed working plan												
Preparation of training material												
Validation Workshop												
Train-the-trainers												
Delivery of training												
4.3 - Awareness raising programmes including targeted seminars, coach clinics												
Development of detailed worksing programme												
Execution of half day meetings on RE												
Project Component 5 – Project Management												
Establishment of Project Management Office at ECREEE												
Development of a detailed activity plan and schedule												
Establishment of Project Steering Committee												
Periodic convening of Steering Committee meeting												
Establishment of a website												
Preparation of TORs & recruitment of evaluation consultant												
Reporting												
Day-to-day coordination, management and monitoring of all project activities												

PROJECT BUDGET – UNIDO FORMAT

BL	Activity	GEF	UNIDO	Total
11-00	International RE expert	138,000		138,000
11-00	International RE policy expert	12,600		12,600
11-00	International energy regulation specialist	12,600		12,600
11-00	International project evaluator/economist	18,000		18,000
11-00	International RE finance expert	24,000		24,000
11-00	Training expert	48,000		48,000
13-00	Project assistant	24,000		24,000
15-00	National travel	7,500		7,500
16-00	Personnel Costs - Monitoring	0	42,000	35,000
17-00	Project manager	57,500		57,500
17-00	National RE trainers + Economist	10,880		10,880
17-00	National RE expert and Economist	44,800		44,800
17-00	National evaluation expert	0		0
17-00	National policy expert	0		0
17-00	National finance consultant	12,800		12,800
21-30	Pilot projects parallel co-financing	1,269,202		1,269,202
35-00	Travel expenses	7,500		7,500
51-00	Workshops/training venues/printing	10,800		10,800
51-00	Sundries	0		0
82-00	Evaluation	60,000	18,000	78,000
	Sub-Total	**1,758,182**	**60,000**	**1,818,182**
	Support cost @ 10%	**175,818**	**-**	**175,818**
	TOTAL	**1,934,000**	**60,000**	**1,994,000**

Budget line 2130 refers to GEF contribution to the identified pilot projects that will be used as parallel co-financing. GEF funding will be targeted at covering incremental costs of the pilot projects such as feasibility studies and equipment. UNIDO, through the PSC, will be involved in the technical specifications of the equipment for the pilots. Once this is agreed, the counterparts will then proceed to procure the equipment and GEF

resources will then be paid on completion of specific milestones. UNIDO will have a contract with the counterparts for ensuring quality delivery and operation of the project to achieved the GEBs.

ANNEX G2: ESTIMATE OF ENERGY SAVINGS AND GHG EMISSION REDUCTIONS

Number	Name	Implementing Organisation	Technology	Description	Size (kW)	Estimated Annual Generation (kWh)	Estimated Annual GHG Reductions (Tonnes)	Estimated GHG Reductions for the lifetime of the projects[1] (tonnes)
A1	Wind Power for Electricity	- Electra - Electric - Água Brava	Wind	Three grid connected 330kW wind turbines in S.Vicente. and grid connected wind turbine to offset the energy costs with water pumping.	1,490	5,592,105	4,016	80,314
A2	Solar Power for Productive Uses	- Baptista de Sousa Hospital - Brava Muncipality	Solar PV and Solar Water Heating	PV panels to produce electricity for an ice factory. And solar collector to heat water for the use of Mindelo hospital.	61	102,594	73.7	587
A3	Hybrid Rural Electrification	Municipalities of: - Ribeira Grande, S.Antao - Tarrafal, S.Nicolau - Ribeira Branca, S.Nicolau	Hybrid Wind / PV / Diesel System	Hybrid PV / wind / diesel / batteries systems to produce electrify for remote communities.	54	115,253	68.3	1026
				Total	**1,605**	**5,809,952**	**4,158**	**82,076**

[1] Lifetime of the projects: 20 years for wind turbines and 10 years for other projects

ANNEX G3: ENERGY ANALYSIS AND RECOMMENDATIONS

See separate file.

ANNEX G4: CRITERIA USED TO SELECT DEMONSTRATION PROJECTS

Selection Criteria for the Small to Medium Scale Renewable Energy Demonstration Projects

1. Pilot projects must be implemented in Cape Verde and the beneficiaries must be permanent residents of Cape Verde.
2. Pilot projects should demonstrate a replicable approach to renewable energy.
3. Technology should be appropriate and there should be proven renewable energy resource
4. Technology should be proven and have been previously demonstrated at other projects.
5. Pilot projects must be able to show that they are commercially viable.
6. Private enterprises should be encouraged to participate in the project.
7. Economic pay back for the projects should be within the project lifetime.
8. The non GEF finance must be at least 50% of the total pilot investment costs, from this at least 15% of the total investment costs must be borne by the beneficiary.
9. A significant proportion of the electricity (more than 20%) must be dedicated for productive/income generation uses or sold to the grid.
10. If connected to the grid then the intention must be that a PPA should be in place with ELECTRA.
11. The plant design and the quality of equipment and the operation (maintenance) must ensure a plant life time of at least 15 years.
12. The project beneficiaries should apply for the project on a voluntary basis
13. The organizations should be able to provide the complete set of legally required documentation for any project permitting or licensing by the Government
14. The beneficiaries should have the management and technical capability to run the project.
15. The beneficiaries should have a good economic basis, the capacity to repay loans, provide the required security and the required contribution. Total assets must be larger than the total liabilities.
16. The project should be able to be viewed and visited by others so that it acts as a true demonstration project.
17. All proposed projects must show environmental benefits as compared to using alternate conventional energy sources.
18. The project should have no secondary pollution
19. Beneficiaries should not infringe on nature reserves.
20. Any project emissions have to be controlled according to local environmental legislation.

ANNEX G5: PRE-FEASIBILITY STUDIES OF DEMONSTRATION PROJECTS

TABLE OF CONTENTS

PROJECT A - PRE-FEASIBILITY STUDY FOR WINDPOWER FOR ELECTRICITY GENERATION

Introduction

This is one of three feasibility reports for a pilot renewable energy projects as part of UNIDO's Market Based Development of Small to Medium Scale Renewable Energy Systems in Cape Verde project.
The project aims to create market conditions conductive to the development of small to medium scale renewable energy systems in Cape Verde. This will be achieved through three components:

- Demonstrate the technical feasibility and commercial viability of renewable energy projects and dedicated seed fund to scale up.
- Strengthening legal and regulatory framework conductive to the development of small to medium scale renewable energy projects.
- Strengthening institutional capacity and raise awareness of market players, enablers and general public;

The shortlist of candidate projects included:

- Wind power for electricity generation
- Solar power applications in Cape Verde
- Hybrid rural electrification

The feasibility report covers:

- the technical aspects in developing the proposed scheme;
- the costs of the scheme and value of energy resulting from it;
- operation and maintenance, environmental and other issues that the developer will likely encounter; and
- Replication of the proposed scheme.

Background

Cape Verde is a small archipelago of 10 islands within the zone of North-East trade winds in the tropical North Atlantic; 800km west of Senegal (see Figure 1). This area is characterised by strong, stable trade winds for a large part of each year.

Figure 1: The archipelago of Cape Verde

The country relies almost exclusively in diesel and heavy fuel oil for electricity generation which is reflected in the high cost of electricity (>0.32 USD per kWh) and the high variability of the tariff. Such energy prices should have made investment in large-medium scale renewable energy generation – especially in wind energy - more attractive; however, the lack of finance and interested investors has contributed to modest penetration rates of renewables.

Even with an electrification rate close to 90%, the fragmented nature and the small size of the grids are two important reasons hindering private investment into the energy market. Investors in this market usually prefer projects involving a significant number of wind turbines combined with large investments in order to reduce the share of transaction costs in the project and achieve economies of scale in deploying wind turbines.

Another issue in implementing this type of projects is the state of the electric grid. In some stretches the grid is significantly old and do not have the capacity to accept the transfer of added energy. These are often located in remote areas of the islands with very good wind energy resources. Therefore, installing sometimes only a couple of wind turbines requires the upgrade and/or extension of existing grids making the investment less attractive as these costs will in most cases be assumed by the investor in the wind farm.

Wind Power Technology

Wind turbines are used to convert the energy in wind into electricity. Wind turbines can generate a few watts to multi-megawatts. Each turbine operates most effectively at a typical wind speed of between 10-15 m/s. Due to the varying nature of wind speed the electrical output from a turbine is variable.

Wind turbines operate most effectively in a strong and turbulence-free wind. The presence of any buildings, trees and surrounding hills means that wind speed can be reduced. This is significant as the power in the wind is proportional to the cube of the wind speed, meaning that a small increase in wind speed results in a considerable increase in the amount of energy being generated. For instance, a 20% increase in wind speed means a 70% increase in instantaneous power. This also means at low wind speeds of 2-4 m/s, very little energy is generated, making large scale development potentially uneconomic.
Wind developments typically require well-exposed sites free from surrounding obstacles such as trees and buildings which will increase the turbulence in the wind. Higher turbulence levels in the wind will result in weaker wind turbine performance. The sites are also required to have adequate road access, able to accommodate trailers carrying the longest loads (usually the blades), as well as the heaviest and widest loads (generally the cranes required in erection).

Proposed Wind Power Developments

Wind power in São Vicente

Electra is the promoter of this project. The figures related to this project are based on a proposal submitted by Mr. Rui Spencer and Mr. Manuel Silva Electra's Executive Director and Commercial Director, respectively, to the project team on 28th August 2010.
Electra is the principal supplier of electricity and water in Cape Verde. The company is controlled by the Government of Cape Verde with minority participation by local municipalities.
The current strategy of Electra is to improve the capacity, efficiency and reliability of its generation and distribution to better serve the country. Electra is also committed to reduce costs and cut losses across all its operations. This will allow the company to eliminate negative cash flows and other financial problems.
Electra sees investments in renewable energies as a fundamental step in its progress towards long-term financial sustainability by reducing its dependency on fossil fuel imports and protecting the company from fossil fuel price escalation. However, the company's financial situation is a major barrier for attracting investment for these power generation technologies.

Current Electricity Production in São Vicente

In São Vicente Island, Electra relies on thermal plants and wind farms to produce electricity. However, despite the good resources and success of past projects, renewable energy penetration remains low at approximately 6% of the total energy generated in São Vicente. Electra produces electricity in São Vicente Island based on the following installed capacity:

- Six diesel and heavy fuel oil generators totalling 18.3MW
- Three 300kW Nordtank wind turbines commissioned in 1994 totalling 0.9 MW

The electricity demand in São Vicente has been growing fast as shown in Figure 2. During the last two years, electricity production from fossil fuels has increased by more than 10%.

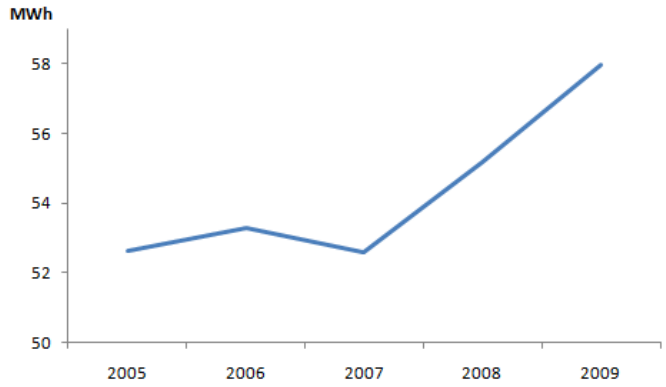


Figure 2: Electricity produced with fossil fuels in São Vicente by Electra FROM 2005-2009

Water demand is also growing steadily every year in São Vicente with consequent impacts on the energy demand. In 2009, energy consumed for desalination and water pumping comprised 11% of the total energy produced by Electra in São Vicente.

Project Description

The proposed project plans to install three new Enercon 330kW wind turbines model E33 in the south-west of Mindelo in São Vicente. The main reason for the choice of a combined capacity of 990 kW in São Vicente is the island energy and peak demand, and the land available at the site. The turbines will be placed on a hill which has extremely good wind resources; however, the main wind direction constrains the number and size of the turbines to be installed.

The Enercon E33 turbine was chosen due their performance, reliability and reduced transport costs. The turbine is designed in modules which allow the transport in common containers by ship and truck.

Datasheets for the turbines are provided in Annex 1.

Location

The proposed location to install the turbines in S. Vicente is in the Southwest of Mindelo (see Figure 3). The site has currently 10 disused 30kW wind turbines (see Figure 4) which were installed under a programme from the German Government aimed at promoting wind power in developing countries. These wind turbines achieved a capacity factor of 48% but have long stopped working due to lack of spare parts.

Figure 3: Proposed location for the installation of three wind turbines in S. Vicente

Figure 4: Disused wind farm at the proposed location

The approximate coordinates of the proposed location is:

- Monte Montona - 16°51'59.20"N 24°59'56.91"W

This location benefits from wind uninterrupted by geographic obstacles, buildings and trees for the prevailing winds from the Northeast. The lack of turbulence should result in a better wind turbine performance.

Connection

The proposal is to connect the turbines to the grid to export the electricity. This connection will be owned by developer and must be operated under its control.

Wind Resource

There is wind data available for the proposed actual sites of the wind turbines collected by the German programme which installed the turbines (see Annex 2). However, it is not possible to assess the precision and accuracy of the data due to the lack of equipment calibration reports.
Without an accurate wind resource assessment it is not possible to estimate, with a good degree of certainty, the energy which will be generated by the wind turbines. Nevertheless, the energy produced by the ten wind turbines is a good indicator of the site wind resource.

Output

Using RETScreen the output of the three wind turbines is calculated to be 4,411MWh per year assuming a 90% availability to allow for downtimes for planned and unplanned maintenance. This corresponds to a capacity factor of 50.9%.

Operation and Maintenance

The turbine would be owned and operated by Electra. To allow for the generation of electricity and its export, a licence to generate must be applied for from the Direcção Geral de Energia (Directorate General of Energy). In addition, an environmental impact assessment needs to be submitted for approval to the Direcção Geral do Ambiente (Directorate General of Environment). However, a request for EIA exemption can be requested.
The maintenance of the turbine is proposed to be carried out by Electra. The company has staff already competent on wind turbine maintenance having experience in conducting similar tasks for wind turbines currently operating in Cape Verde. A two week training course is foreseen by Enercon to cover all aspects of operation and maintenance of the turbine and desalination plant.
An operation and maintenance plan covering maintenance activities, insurance, repairs and spares is expected to cost US$132,330 per annum.

Wind Power in Fogo Island

Água Brava and Electric are the promoters of this project.
Água Brava is the water distribution company for Fogo and Brava Islands. These two islands are located in the Southwest part of the archipelago of Cape Verde (see Figure 1). The company is responsible for the collection, treatment, distribution and sell of water in these two islands.
Electric is a renewables and electrification consultancy company and a developer of renewable energy projects. The company is based in Mindelo, S. Vicente Island.
Electric has already a significant portfolio of renewable energy projects. Recently, the company started the first privately developed wind power project in Cape Verde. The project consists of two 250kW wind turbines in Santo Antão Island. The energy is sold to Electra under the also first renewable energy PPA in the country.
This project is the result of a study presented by Electric to Água Brava and Lux-Development (the implementing agency of the Luxemburg Cooperation).
Springs and groundwater sources in these islands are located almost at sea level. Therefore, the fresh water before reaching the consumers through a gravity system has to be pumped to reservoirs located at high altitudes. Pumping water across such differences of height requires a great amount of energy. It is estimated that approximately 1,480 MWh of electricity are annually used by Água Brava just in water pumping.
In 2007, energy costs represented 33% of Água Brava's cost structure. This percentage is expected to rise with the increase in the electricity tariff which has been happening in recent

years, influenced by the escalation in the fuel prices. However, Água Brava is not allowed to freely set the water tariff to reflect the energy costs.

Government of Luxemburg Interest in Água Brava

The Government of Luxemburg is deeply committed to the eradication of poverty in developing countries in collaboration with local authorities and communities. Luxemburg has already a long history of cooperation with Cape Verde going back to late 80's. In 2002, both countries signed the first Indicative Cooperation Programme (PIC from the French acronym Programme Indicatif de Coopération) in order to provide greater coherence, flexibility and continuity to the Luxemburgish priorities.

The PICs run a four year cycle and the PIC III has already been approved and will provide 60M€ to Cape Verde from 2011-2015. The programme will follow the same line as previous PICs focusing on: education, health and, water and sanitation. Assisting Água Brava in the development of a sustainable management model is one the targets of the cooperation.

Current Electricity Supply in Fogo Island

Electra operates the electricity grid in Fogo Island based on 7 diesel generators with a total installed capacity 3.80 MW.

Project Description

The proposed project plans to install two new Wind Technik Nord 250kW wind turbines model WTN 250, to sell energy in medium voltage to Água Brava (see Figure 5). The project would be developed under a joint-venture of Água Brava and Electric.
The electricity would be sold under a PPA at a lower price in comparison with Electra's tariff and with a long term fixed tariff. This situation would allow Água Brava to reduce its operational costs and avoid sudden increases in the price of energy.

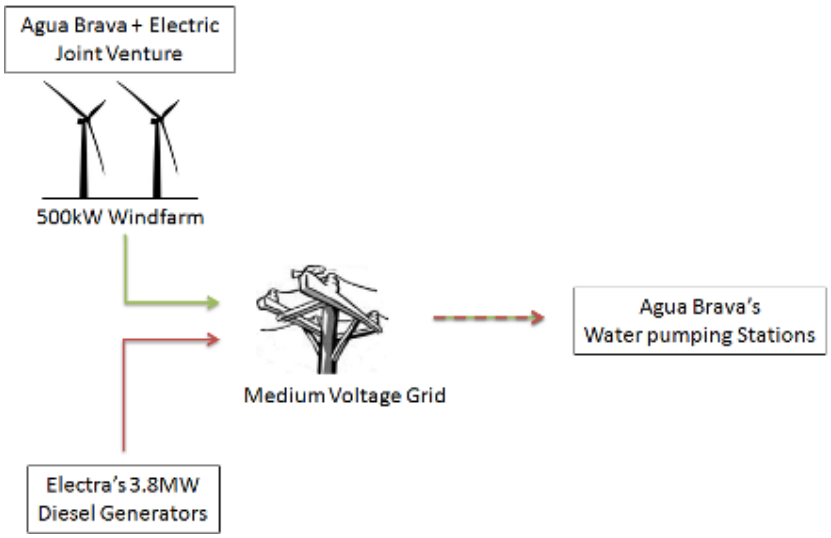


Figure 5: Electricity usage scheme of the proposed project

Electricity generated by the wind turbines is fed into the medium voltage grid. This energy will be later discounted in Água Brava's medium voltage electricity bill[2].

[2] Água Brava's water pumping stations operate with medium voltage electricity

Turbines

The proposed project plans to install two new Wind Technik Nord 250kW wind turbines model WTN 250. The main reason for the choice of a combined capacity of 500 kW in Fogo is the island energy and peak demand. There are also other logistic reasons for the choice of these 250 kW turbines. Medium size wind turbines are usually designed to allow the transport in regular containers which facilitate the transport by truck and ship reducing the transport costs.
The WTN 250 turbine was chosen due their performance, reliability and reduced transport costs. The turbine is designed in modules which allow the transport in common containers by ship and truck. Wind Technik Nord estimates the necessity of two 40' OT ($56m^3$) containers for each turbine.

Location

Error! Reference source not found. shows the two proposed locations to install the turbines in Fogo. They were chosen based in previous studies by Riso. The sites were selected due to their estimated wind resources, proximity to the grid, and distance from households.
The proposed locations and their approximate coordinates:

- Vale dos Cavalheiros Port - 14°55'18"N 24°29'59"W
- Cova Figueira - 14°53'44.00"N 24°17'55"W

Figure 6: Wind turbines location in Fogo Island

These locations benefit from wind uninterrupted by geographic obstacles, buildings and trees for the prevailing winds from the North East. The lack of turbulence should result in a better wind turbine performance. The first location has another advantage. It is close to the port, so a crane brought by boat can avoid narrow and winding roads.
The definite location will be decided after wind monitoring studies at both proposed sites.

Figure 7: Tree inclination in the two proposed locations: Vale dos Cavalheiros (left) and Cova Figueira (right)

Connection

The proposal is to connect the turbines to the grid to transport the electricity do Água Brava's water pumping stations. The connection from the windfarm to the grid will be owned by the joint venture and must be operated under its control.

Wind Resource

There is no wind data available for the proposed sites of the wind turbines. There is, however, some data available from the wind turbine installed at Brava Island[3] by the German Cooperation in 1996 which can be found in Annex 3. This was the data used to estimate the wind resource at Fogo (see Figure 8).

It is expected that wind monitoring studies will provide an accurate wind resource assessment to estimate, with a good degree of certainty, the energy which will be generated by the wind turbines.

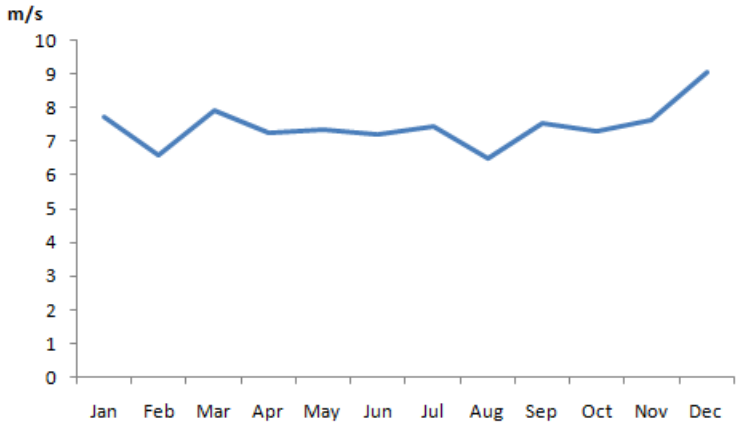


Figure 8: Monthly average wind speed in 2007 monitored in the wind turbine located in Brava Island

[3] Approximately 20 kilometres from Fogo Island

Output

Using RETScreen the output of the wind turbines is calculated to be 1,181 MWh for both turbines per year assuming 90% availability to allow for downtimes for planned and unplanned maintenance and 11% of losses. This corresponds to a capacity factor of 27.0%. Wind Technik Nord states, for the wind resource mentioned in the section above, an annual production of 0.736 MWh for each turbine (see Annex 4). This figure, however, does not consider any downtime or efficiency losses.
In case the generation of electricity exceeds the energy used by Água Brava in their pumping stations, the excess electricity will be fed to Electra's grid under a Power Purchasing Agreement (PPA).

Operation and Maintenance

The turbine would be owned and operated by the joint venture - Água Brava - Electric. To allow for the generation of electricity and its export, a licence to generate must be applied for from the Directorate General of Energy (Direcção Geral de Energia). In addition, an environmental impact assessment needs to be submitted for approval to the Direcção Geral do Ambiente (Directorate General of Environment). However, EIA exemption can be requested to DGA based on the reduced environmental impact of the project.
The maintenance of the turbine is proposed to be carried out by Electric, which already has the experience of the windfarm in Santo Antão. This maintenance would be on a contract with different activities carried out on a monthly rotation. A two weeks training course is foreseen by Wind Technik Nord to cover all aspects of operation and maintenance of the turbine.
An operation and maintenance contract covering maintenance activities, insurance, repairs and spares is expected to cost US$35,430 per annum.

Replicability and Demonstration

The escalation of fuel prices in recent years have been reflected in the oscillation of the electricity tariffs and also placed a heavy burden on the water sector as it relies heavily on energy for water pumping and water desalination. This has drawn more attention to renewables in Cape Verde and its benefits. Utilities, water distribution companies, municipalities and private investors are now actively looking for possible projects.

Wind power appears to be an ideal source of energy for Cape Verde as almost all the islands have abundant wind resources which have yet to be tapped. Potential projects have, however, to face the lack of finance and experience in country to develop them.

Successful projects would undoubtedly encourage further investments in similar projects. Furthermore, it would contribute to mitigate water scarcity and economic difficulties caused by fossil fuel price escalation and consequent impact on energy tariffs.

Costs and Economics

Capital Costs

The total budget is estimated as CVE 443 million broken down as follows.

Table 1: Scheme capital costs

Scheme components	**Wind São Vicente** (CVE)	**Wind Fogo** (CVE)	**Total** (CVE)
	CVE	(CVE)	**CVE**
Turbines	223,327,500	75,119,250	**298,446,750**
Insurance	6,699,825	2,253,578	**8,953,403**
Transport	13,805,700	7,308,900	**21,114,600**
Installation	69,840,600	19,084,350	**88,924,950**
Wind Monitoring	4,060,500	4,060,500	**8,121,000**
Project Management	6,496,800	6,090,750	**12,587,550**
Land Cost	-	4,872,600	**4,872,600**
Total	**324,230,925**	**118,789,928**	**443,020,853**

Funding

It is proposed to fund the energy component project with about 12% from the Global Environment Facility and the remaining will be sourced by Electra, Electric and Água Brava accordingly with the following table.

Table 2: Scheme Funding

	Wind São Vicente (CVE)	**Wind Fogo** (CVE)	**Funding** %	**Total** (CVE)
GEF Grant	38,907,711	14,254,791	**12%**	**53,162,502**
Electra	285,323,214		**64%**	**285,323,214**
Água Brava and Electric		104,535,136	**24%**	**104,535,136**
Total	**324,230,925**	**118,789,928**	**100%**	**443,020,853**

Economic Evaluation

The electricity produced in both projects will be evaluated at CVE 14 per kWh (approximately USD 0.17).
The project in Fogo will sell the electricity to Água Brava according to this tariff. In the case the generation of exceeds the energy consumed by the water distribution company in their pumping stations, the excess electricity will be fed to Electra's grid under a Power Purchasing Agreement (PPA).

Evaluating the electricity according with the above conditions would result in an income of approximately CVE 64,665,422 per year. Assuming Electra, Água Brava and Electric provide 88% of the capital costs, this results in a simple payback of 6.0 years.

Table 3: Annual Income

	Wind São Vicente (CVE)	**Wind Fogo** (CVE)	**Total** (CVE)
Electricity production income	61,756,422	16,533,045	**78,289,467**
O&M per year	10,746,941	2,877,104	**13,624,045**
Annual net Revenue	51,009,481	13,655,941	**64,665,422**
Payback with GEF grant	5.6	7.7	**6.0**

Sensitivity Analysis

The economic evaluation above is based the average wind speed of 9.28m/s and 7.33m/s, respectively, for São Vicente and Fogo Projects. The economics of this project rely heavily on there being an adequate wind resource at the site. A lower average wind speed will result in less electricity generation, leading to lower revenue and a longer payback. A sensitivity analysis for different average wind speeds prices is shown in Table 4 and Table 5.

Table 4: Sensitivity Analysis for the São Vicente project

Variation	-10%	0%	10%
Wind Speed (m/s)	**8.35**	**9.28**	**10.21**
Output (MWh)	4025	4,411	4706
Electricity production income (CVE)	56,350,000	61,756,422	65,884,000
O&M (CVE)	9,806,108	10,746,941	11,465,228
Annual net revenue (CVE)	46,543,893	51,009,481	54,418,772
Emission Reduction (tCO_2)	2,890	3,168	3,379
Simple Payback (years)	**6.1**	**5.6**	**5.2**

Table 5: Sensitivity Analysis for the Fogo Island project

Variation	-10%	0%	10%
Wind Speed (m/s)	**6.60**	**7.33**	**8.06**
Output (MWh)	961	1,181	1,392
Electricity production income (CVE)	13,454,000	16,533,045	19,488,000
O&M (CVE)	2,341,284	2,877,104	3,391,330
Annual net revenue (CVE)	11,112,716	13,655,941	16,096,670
Emission Reduction (tCO_2)	690	848	1,000
Simple Payback (years)	**9.4**	**7.7**	**6.5**

Environmental Impacts

Noise - Noise from wind turbines arises from blades passing though the air and the gearbox (where one exists). Current guidance in the UK suggests that noise should be limited to an absolute level within the range of 35–40dBA. The simplest, most effective method of reducing noise is by maintaining a distance between the turbines and any residential properties.

Air Traffic and Electromagnetic Interference - Wind energy developments may cause adverse impacts on aircraft flight safety and radar use for air traffic control and aircraft instruments. Early consultation between developers and statutory authorities can help with siting and mitigation measures.

The movement of a wind turbine can interfere with radar, as it may be interpreted as a moving object. This could cause it to be mistaken for an aircraft or reduce the ability to track aircraft by radar in the vicinity of a wind energy development.

In addition to aviation, communication links such as microwave corridors need to be taken into consideration. These are clear air corridors between two masts allowing data to be transmitted between the two points. Placing a turbine between the points would interfere with the signal and is unlikely to be permitted.

Both air traffic and electromagnetic interference considerations must be considered on a site by site basis. Typically these require detailed studies and the cost is typically borne by the developer.

Site Access - Wind turbines are large structures with blade lengths ranging from 15m for a 250 kW to 40m for a 2.5 MW wind turbine. The logistics in whether blades and tower can be delivered to site needs to be taken into consideration as blades come as one unit. This either restricts sites to smaller turbines with shorter blades or prevents the site from being developed as currently not economically viable. The ideal situation is to have sites close to main roads with no sharp bends, and without obstacles such as signs, bollards, traffic lights, buildings and roundabouts.

Carbon Emissions- The generation of electricity using the wind turbines would result in carbon dioxide emissions savings. At present there is no official grid carbon emission factor for Cape Verde, therefore a grid factor was assumed to be 0.7181kg/kWh[4] for use in this study.

Using this grid factor the carbon emissions savings are calculated to be 4,016 tonnes per annum. During the economic lifetime of the turbine - 20 years - the GHG savings are estimated at 80,314 tonnes of CO_2.

Construction - Construction and maintenance of the towers, substations, access roads and transmission lines will generate a limited amount of solid waste which should be disposed at approved designated sites. Construction and operation will also increase the risk of soil contamination from oils and lubricants leaking from construction equipment and during turbine maintenance.

Conclusions

Despite Electra's best efforts with the current system, investment in renewable energies is urgent. Installing wind turbines would allow Electra to continue to provide electricity to Cape Verde without be beholden to fluctuating world oil prices and associated investment risk.

[4] Emission factor for Boavista Island.

The site proposed for the installation of the three wind turbines appears to have excellent wind resources. However, a grant may be necessary for Electra to mobilise the necessary capital to implement the project.

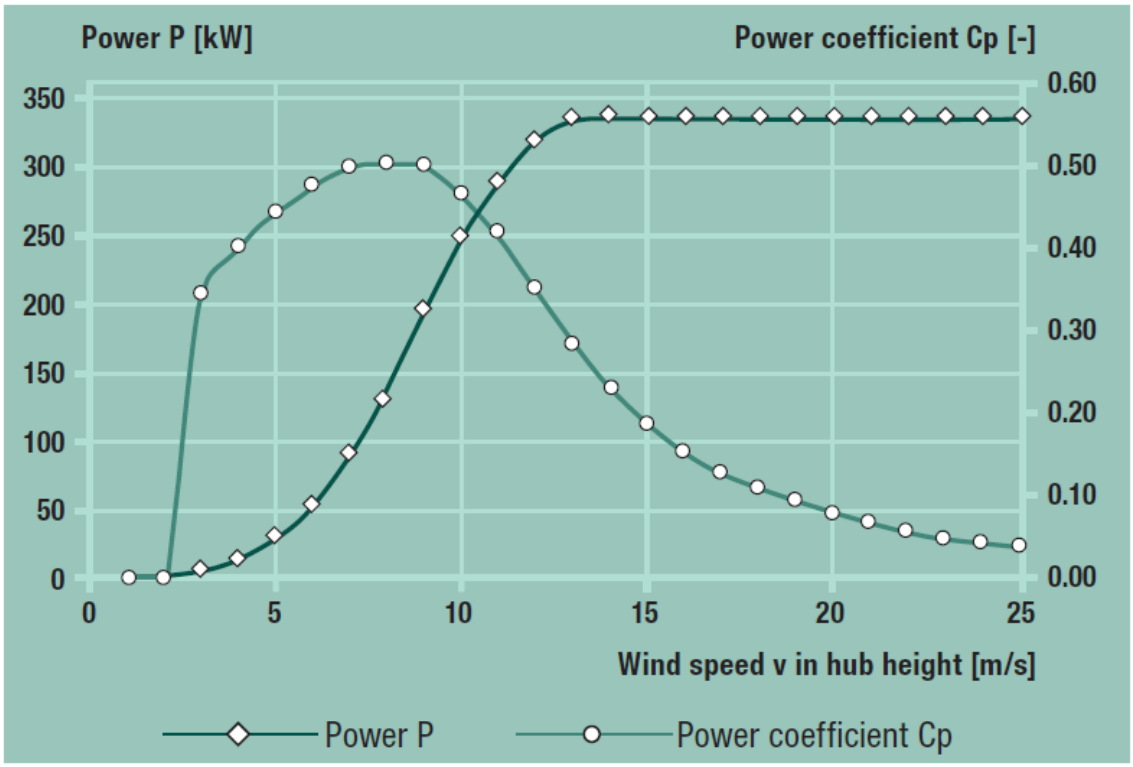
Água Brava has been suffering from the rise in the electricity tariff as a consequence of the escalation of fossil fuel prices. This has lead to an increase of the energy costs in the company's cost structure which cannot be reflected in the water tariff due to governmental regulations. The project would contribute to the alleviation of Água Brava's financial situation.

The two sites proposed for the installation of the three wind turbines appear to have good wind resources.

The implementation of both projects is expected to increase the interest for wind power in Cape Verde by proving the viability and benefits of this technology.

Annex 1

Enercon E33 Wind Turbine Power Curve



Annex 2
Wind Speed Data

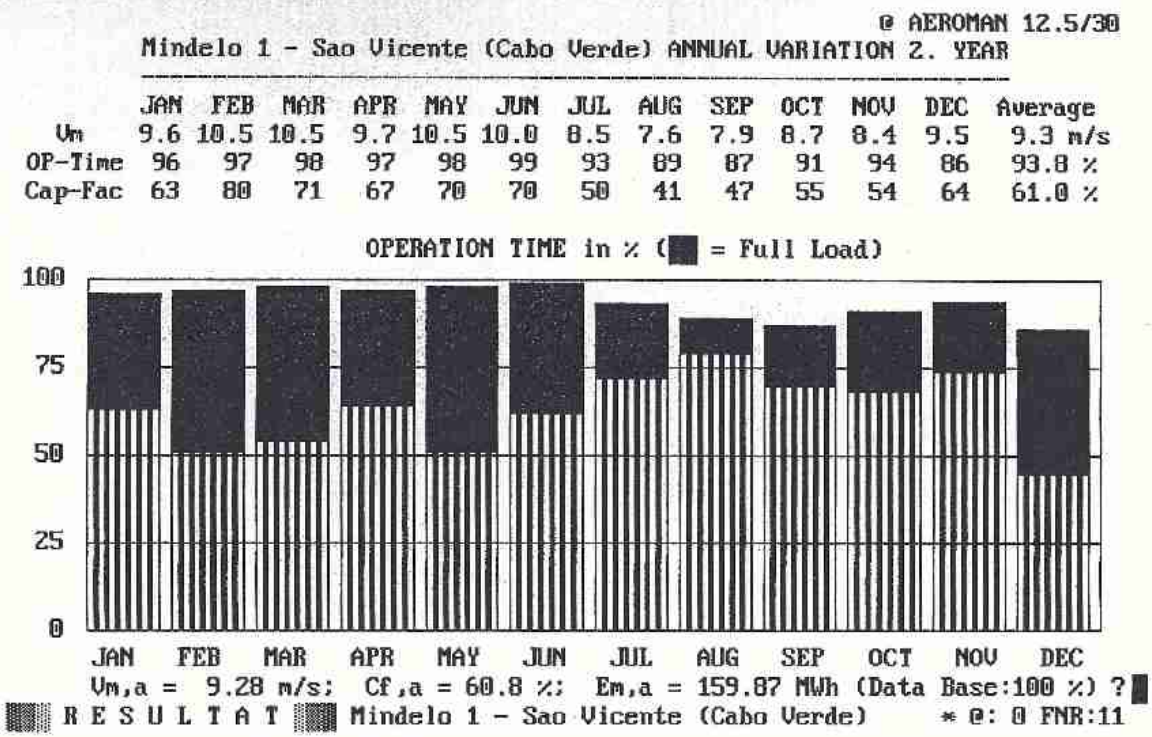
Wind Park Mindelo, Cape Verde

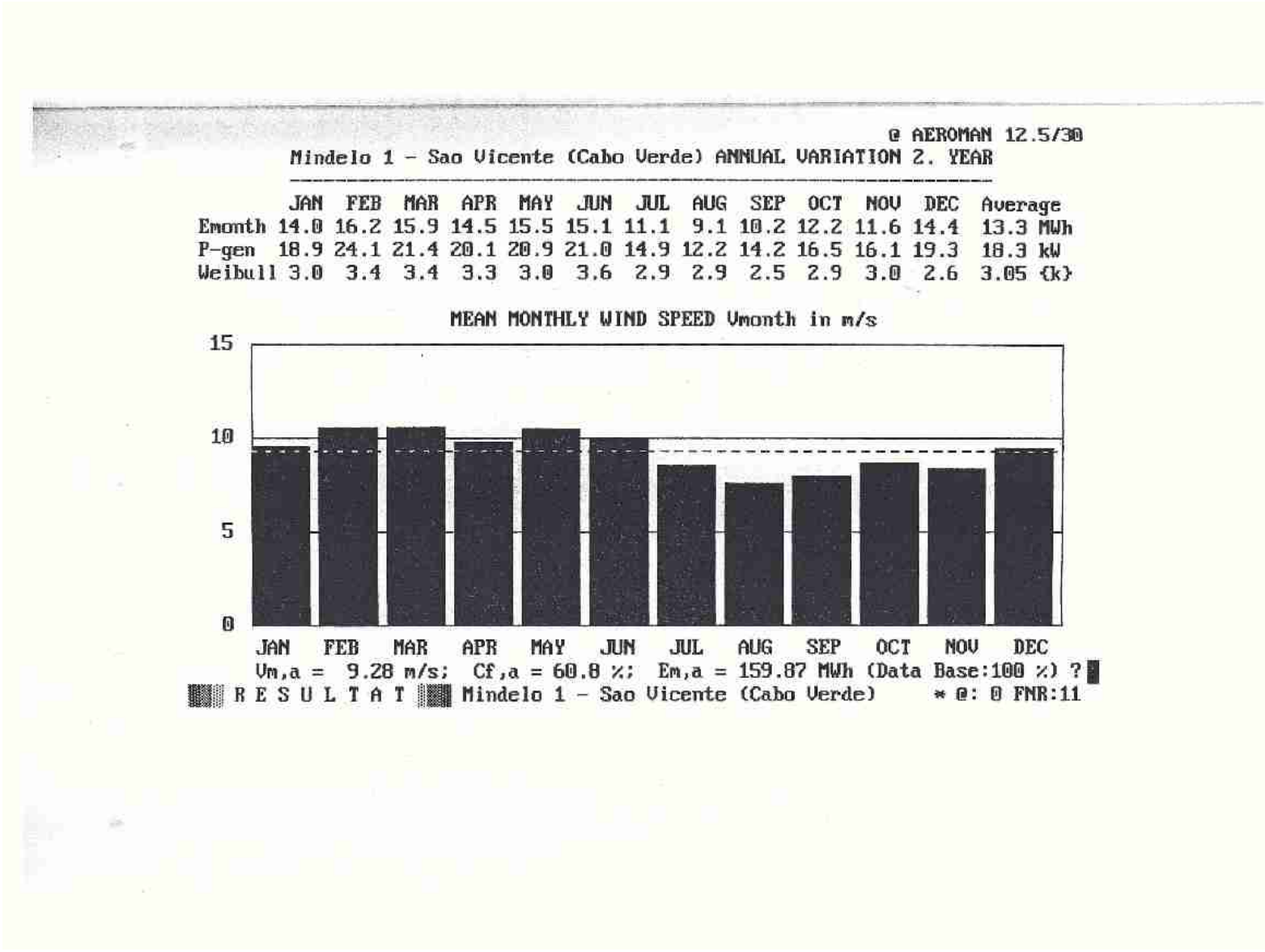
Second Year Results (9/90 to 8/91)
Theoretical and Actual Generation in MWh

		Anemometer 1		Anemometer 2		Anemometer 3		Average		Total			Technical
		v (m/s)	E (MWh)	v (m/s)	E (MWh)	v (m/s)	E (MWh)	v (m/s)	E (MWh)	E theor. (MWh)	E act. (MWh)	E act./E theor.	Availability
1990	Sep	7.94	10.23	8.55	11.83	8.73	12.28	8.41	11.45	114.45	69.32	60.57%	76.4%
	Oct	8.68	12.25	7.87	10.69	9.55	14.70	8.70	12.55	125.47	95.31	75.96%	90.1%
	Nov	8.35	11.56	10.01	15.47	9.19	13.29	9.18	13.44	134.41	85.63	63.71%	91.9%
	Dec	9.49	14.37	10.24	15.40	10.44	16.45	10.06	15.41	154.08	118.92	77.18%	94.2%
1991	Jan	9.56	14.05	10.30	15.40	10.52	16.09	10.13	15.18	151.79	122.21	80.51%	95.2%
	Feb	10.54	16.20	11.32	17.31	11.59	17.82	11.15	17.11	171.10	117.54	68.70%	91.8%
	Mar	10.53	15.92	11.27	17.19	11.38	17.55	11.06	16.89	168.88	137.82	81.61%	95.8%
	Apr	9.75	14.45	10.43	15.61	10.83	16.57	10.34	15.54	155.42	123.34	79.36%	91.4%
	May	10.47	15.53	11.20	16.77	11.60	17.06	11.09	16.45	164.54	117.45	71.38%	88.3%
	Jun	10.01	15.11	10.71	16.32	10.97	16.96	10.56	16.13	161.30	101.99	63.23%	80.9%
	Jul	8.51	11.09	9.11	11.98	9.43	13.15	9.02	12.07	120.72	63.50	52.60%	72.2%
	Aug	7.57	9.11	8.10	9.84	8.33	11.13	8.00	10.03	100.26	64.56	64.39%	73.3%
Average		9.28		9.93		10.21		9.81					86.8%
Total			159.87		173.81		183.05		172.24	1722.43	1217.59	70.69%	

Estimated Wind Speed and Generation

---------- BMFT/KfW Wind Energy Project - Monitoring Programme ----------


@ AEROMAN 12.5/30
Mindelo 1 - Sao Vicente (Cabo Verde) ANNUAL VARIATION 2. YEAR
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC Average
Vm 9.6 10.5 10.5 9.7 10.5 10.0 8.5 7.6 7.9 8.7 8.4 9.5 9.3 m/s
OP-Time 96 97 98 97 98 99 93 89 87 91 94 86 93.8 %
Cap-Fac 63 80 71 67 70 70 50 41 47 55 54 64 61.0 %
OPERATION TIME in % (= Full Load)
100
75
50
25
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Vm,a = 9.28 m/s; Cf,a = 60.8 %; Em,a = 159.87 MWh (Data Base:100 %) ?
R E S U L T A T Mindelo 1 - Sao Vicente (Cabo Verde) * @: 0 FNR:11



@ AEROMAN 12.5/30

Mindelo 1 - Sao Vicente (Cabo Verde) ANNUAL VARIATION 2. YEAR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average	
Emonth	14.0	16.2	15.9	14.5	15.5	15.1	11.1	9.1	10.2	12.2	11.6	14.4	13.3	MWh
P-gen	18.9	24.1	21.4	20.1	20.9	21.0	14.9	12.2	14.2	16.5	16.1	19.3	18.3	kW
Weibull	3.0	3.4	3.4	3.3	3.0	3.6	2.9	2.9	2.5	2.9	3.0	2.6	3.05	(k)

MEAN MONTHLY WIND SPEED Vmonth in m/s

15
10
5
0

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Vm,a = 9.28 m/s; Cf,a = 60.8 %; Em,a = 159.87 MWh (Data Base:100 %) ?

R E S U L T A T Mindelo 1 - Sao Vicente (Cabo Verde) * @: 0 FNR:11

Annex 3

Wind Speed Data from GTZ – Proposals for Maintenance and Operation of the Wind Turbine, December 1998

Annex:

Windkraftanlage Brava - Kapverden
Monatswerte 1997

	Produktion Diesel in kWh	Wind-geschw. in m/s	Produktion Wind theoret. in kWh	Produktion Wind real in kWh	Produktion Wind real/ theor.	Gesamt Produk. Brava	Kraftstoffersparnis in l	Kraftstoffersparnis in Esc
Januar	39,972	7.73	21,186	15,920	75 %	55,892	4,776	105,072
Februar*	30,000	6.60	16,644	15,951	96 %	45,951	4,785	105,277
März	32,368	7.93	20,724	9,906	48 %	42,274	2,972	65,380
April	53,120	7.26	18,414	16,439	89 %	69,559	4,932	108,497
Mai	55,552	7.33	17,490	13,927	80 %	69,479	4,178	91,918
Juni	53,740	7.22	17,160	6,084	35 %	59,824	1,825	40,154
Juli	55,552	7.43	18,480	13,603	74 %	69,155	4,081	89,780
August	79,526	6.50	22,630	10,220	45 %	89,746	3,066	67,452
September	79,382	7.52				79,382		
Oktober	94,929	7.31				94,929		
November	87,582	7.61				87,582		
Dezember	86,533	9.06				86,533		
Schnitt		7.33	19,091	12,756	68 %		3,827	84,191
Total	748,256			102,050		850,306	25,839	568,458

*) Produktion Kraftwerk Schätzung

Windanteil im Netz im ganzen Jahr	12.0%
Windanteil im Netz (Jan - Aug)	20.3%

Windkraftanlage Brava - Kapverden
Monatswerte 1998

	Produktion Diesel in kWh	Wind-geschw. in m/s	Produktion Wind theoret. in kWh	Produktion Wind real in kWh	Produktion Wind real/ theor.	Gesamt Produk. Brava	Kraftstoffersparnis in l	Kraftstoffersparnis in Esc
Januar	107,662	7.63	29,170			107,662		
Februar	97,820	5.22	9,560			97,820		
März	101,972	6.86	22,090			101,972		
April	95,883	8.04	34,860	7,910	23 %	103,793	2,373	52,206
Mai	68,051	8.47	38,650	15,990	41 %	84,041	4,797	105,534
Juni	101,614	7.07	24,610	4,700	19 %	106,314	1,410	31,020
Juli	104,499	5.69	15,640			104,499		
August	95,475	6.72	23,850			95,475		
September	89,020	7.29	29,490			89,020		
Oktober	92,539	6.73	23,780			92,539		
November	95,000	6.56	20,080			95,000		
Dezember								
Schnitt		6.94	24,804	9,533	28 %		2,860	62,920
Total	1,049,535			28,600		1,078,135	8,580	188,760

*) Produktion Kraftwerk Schätzung

Windanteil im Netz im ganzen Jahr	2.7%
Windanteil im Netz (Apr - Juni)	9.7%

Annex 4

Estimated annual electricity generation of a Wind Technik Nord 250kW wind turbines model WTN 250 (source: Wind Technik Nord).

ANNUAL ENERGY OUTPUT

WTN 250

Measured powercurve (-2 deg)

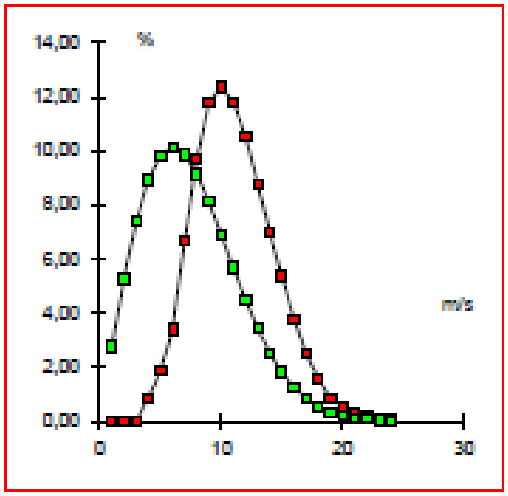
Name: Name
Site: Site

Wind:	6,4	m/s	in	10,0	m	Height
Is:	7,3	m/s	in	24,5	m	Height
Hubheight:	7,50	m/s	in	30,0	m	Height
at:	a	=		0,14		
	C	=		2,00	Hubh.	
	A	=		8,6	Hubh.	

Annual Output: 735.683 kWh

Average Output: 84,0 kW

m/s	% v	% tot.	m/s	kW	kWh	% kWh
0	0,03	99,78	0	0,0	0	0,00
1	2,75	99,78	1	0,0	0	0,00
2	5,28	97,01	2	0,0	0	0,00
3	7,38	91,73	3	0,0	0	0,00
4	8,93	84,35	4	8,0	8.255	0,85
5	9,84	75,42	5	18,0	13.793	1,87
6	10,13	65,58	6	28,0	24.845	3,38
7	9,88	55,45	7	57,0	49.224	6,69
8	9,14	45,60	8	89,0	71.258	9,69
9	8,11	36,46	9	122,0	86.696	11,78
10	6,92	28,34	10	150,0	90.869	12,35
11	5,68	21,43	11	175,0	87.010	11,83
12	4,49	15,75	12	197,0	77.533	10,54
13	3,43	11,28	13	215,0	64.668	8,79
14	2,54	7,83	14	232,0	51.585	7,01
15	1,81	5,29	15	248,0	39.428	5,36
16	1,26	3,47	16	253,0	27.848	3,79
17	0,84	2,22	17	249,0	18.378	2,50
18	0,55	1,37	18	243,0	11.656	1,58
19	0,35	0,83	19	205,0	6.196	0,84
20	0,21	0,48	20	200,0	3.694	0,50
21	0,12	0,27	21	200,0	2.169	0,30
22	0,07	0,15	22	200,0	1.259	0,17
23	0,04	0,07	23	200,0	703	0,10
24	0,02	0,03	24	200,0	381	0,05
25	0,01	0,01	25	200,0	200	0,03
				Gesamt:	735.683 kWh	



Frequent distribution

Energy distribution

Wind distribution

PROJECT B - PRE-FEASIBILITY STUDY FOR SOLAR POWER FOR PRODUCTIVE USES

Introduction

This is one of three feasibility reports for a pilot renewable energy project as part of UNIDO's Market Based Development of Small to Medium Scale Renewable Energy Systems in Cape Verde project.
The project aims to create market conditions conductive to the development of small to medium scale renewable energy systems in Cape Verde. This will be achieved through three components:

- Demonstrate the technical feasibility and commercial viability of renewable energy projects and dedicated seed fund to scale up.
- Strengthening legal and regulatory framework conductive to the development of small to medium scale renewable energy projects.
- Strengthening institutional capacity and raise awareness of market players, enablers and general public;

The shortlist of candidate projects included:

- Wind power for electricity generation;
- Solar power for productive uses;
- Hybrid rural electrification.

The feasibility report covers:

- the technical aspects in developing the proposed scheme;
- the costs of the scheme and value of energy resulting from it;
- operation and maintenance, environmental and other issues that the developer will likely encounter; and
- Replication of the proposed scheme.

Background

Cape Verde is a small archipelago of 10 islands within the zone of North-East trade winds in the tropical North Atlantic; 800km west of Senegal (see Figure 1). This area is characterised by a high solar insolation due to its proximity from the equator.

Figure 9: The archipelago of Cape Verde

The country relies almost exclusively in diesel and heavy fuel oil for electricity generation which is reflected in the high cost of electricity (>0.32 USD per kWh) and the high variability of the tariff. Such energy prices should have made investment in small-medium scale renewable energy generation – especially in solar and wind energies - more attractive; however, the lack of finance and interested investors has contributed to modest penetration rates of renewables.
Potential users of RE technologies (e.g. municipalities, water distribution companies and hotels) are in many cases not aware of the economical benefits of investing in these types of technologies. As this report will show, solar power project have already reasonable short payback periods, however, the reduced number of successful applications of either PV or solar water heating technologies does not contribute to remove this barrier.

Solar Power Technology

Solar photovoltaics

Photovoltaics (PV) can be used to convert the sun's light energy into electricity. PV systems have the advantages of being silent in operation and low maintenance with no moving parts. PV panels produce DC electricity; this is converted to AC electricity for export to the grid or for use on site by inverters.
PV systems can be integrated into the building structure, can be retrofitted onto the top of existing roofs or can be mounted on free standing frames.

Solar Water Heating

Solar water heating is a mature and commercially viable technology and can often be the most cost effective way to incorporate on site generation from renewable sources. Solar water heating systems have been shown to be effective in the world and can contribute to hot water demand during all year.

A solar water heating system uses solar collector panels. The collectors are designed to absorb heat energy from the sun and transfer this to the collector fluid (usually a mixture of water and an anti freeze fluid) which flows through the collector. A controller determines the rate of flow through the collector, based on the temperatures of the fluid flowing into and out of the collector. Heat is transferred from the collector fluid to provide hot water through a heat exchanger.

Important considerations in planning a solar system are orientation (azimuth) and inclination. To maximise the capture of the solar resource in Cape Verde, it is recommended to install the collectors facing south (0º) and with an inclination of 15º to avoid dust accumulation. Especial consideration should also be given to the distribution of the collectors to avoid any overshadowing.

Glazed flat plate collectors are recommended for the hospital system as they allow for a higher temperature of the water. They are also more efficient at collecting the sun's energy per surface comparing with non-glazed collectors. The system should include protection against freezing in winter, over heating in summer and corrosion.

A hot water store of approximately 75 litres per m^2 of collector is generally recommended. A twin coil hot water tank is the typical method of integrating the solar system with the conventional boiler. The hot water tank should be well insulated in order to gain maximum benefit from the solar system.

Proposed Solar Energy Developments

PV for the Ice-Factory in Brava Island

The Municipality of Brava proposed this project to the project team during a visit to the island in August 2010.

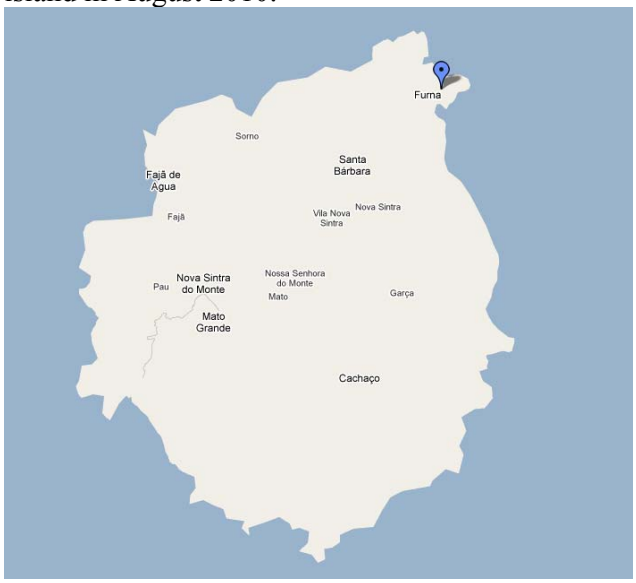


Figure 10: Ice factory location in Brava Island

The ice making factory is located in Furna in the north-west of the island of Brava and is owned and operated by the municipality. The ice is mainly used by fisherman to preserve fish before it is transported and sold in Praia (capital), the ice is sold for 11CVE/kg. Monthly invoices for electricity are between 60,000 and 70,000CVE, this equates an average monthly consumption of 2,268kWh based on the tariff paid of 28.65CVE/kWh.
For the purpose of this study an annual consumption of 27,216kWh is assumed based on this monthly average.
The proposed project is to install 9.9 kWp of photovoltaic panels in Furna to offset the electricity costs of this ice factory. The panels would be installed in the roof of the building which houses the ice factory and in a structure which will be constructed to cover the existing terrace (see Figure 11). The system would consist of 43 of 230 Wp panels, this would have a collector area of 71m^2.

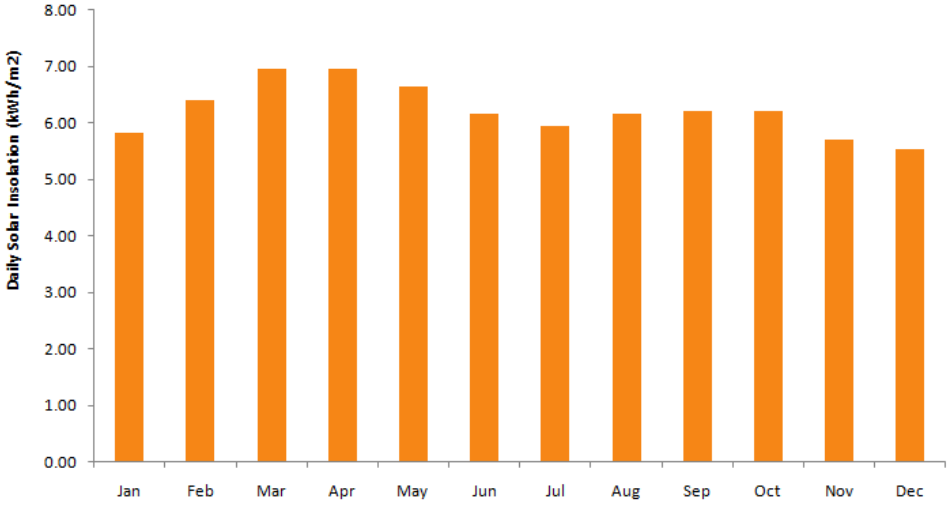
Connection

The proposal is to connect the PV system to the grid so that any excess energy can be fed into the grid.

Figure 11: Ice factory in Furna, Brava Island

Solar Resource

The solar resource at Furna was estimated using RETScreen. The optimal angle to install the PV panels is 15°. The estimated daily solar insolation at this angle is shown in Graph 1.



Graph 1: Daily solar resource estimation at Furna, Brava Island at a 15° angle

System energy output

The estimated output of a 9.9 kWp system was calculated using RETScreen Version 4; the result is shown in Table 6. The total would be approximately 16,694 kWh per annum. This is based on a 71 m^2 array of polycrystalline photovoltaic panels at the optimal angle of 15° to the horizontal.

It is estimated that the majority of the energy produced will be consumed on site. However, if a significant amount of excess energy is produced it can be fed into the grid pending an agreement with Electra.

Table 6: Estimated energy output of a 9.9 kWp PV system at a 15° angle

Month	Output (kWh)
Jan	1,342
Feb	1,328
Mar	1,590
Apr	1,537
May	1,517
Jun	1,360
Jul	1,351
Aug	1,394
Sep	1,353
Oct	1,398
Nov	1,256
Dec	1,270
Year	**16,694**

Operation and Maintenance

The PV system should require minimum maintenance with the panels requiring frequent cleaning. The inverters for the PV system require checking to ensure they are still functioning correctly. The inverters have a mean time between failures of 10 years. PV modules typically have 20+ years power warranty.
Typical annual operation and maintenance costs for PV panels are 1% of capital costs, this cost allows for the replacement of the occasional inverter.

Solar Water Heating System for the Baptista de Sousa Hospital

Baptista de Sousa Hospital is the proponent of this development and is one of the two central hospitals in the archipelago of Cape Verde. It is located in Mindelo, São Vicente Island (see Figure 1) and has a total capacity of 219 beds (2009) to serve mostly the populations of the northern islands.
The hospital is one of the largest electricity consumers in São Vicente with an average monthly bill of CVE 1,650,000. This energy is used for several applications such as lighting, medical appliances and IT, however, the main share of energy is used in water heating.
The yearly energy requirements with water heating was estimated to be 356 MWh.

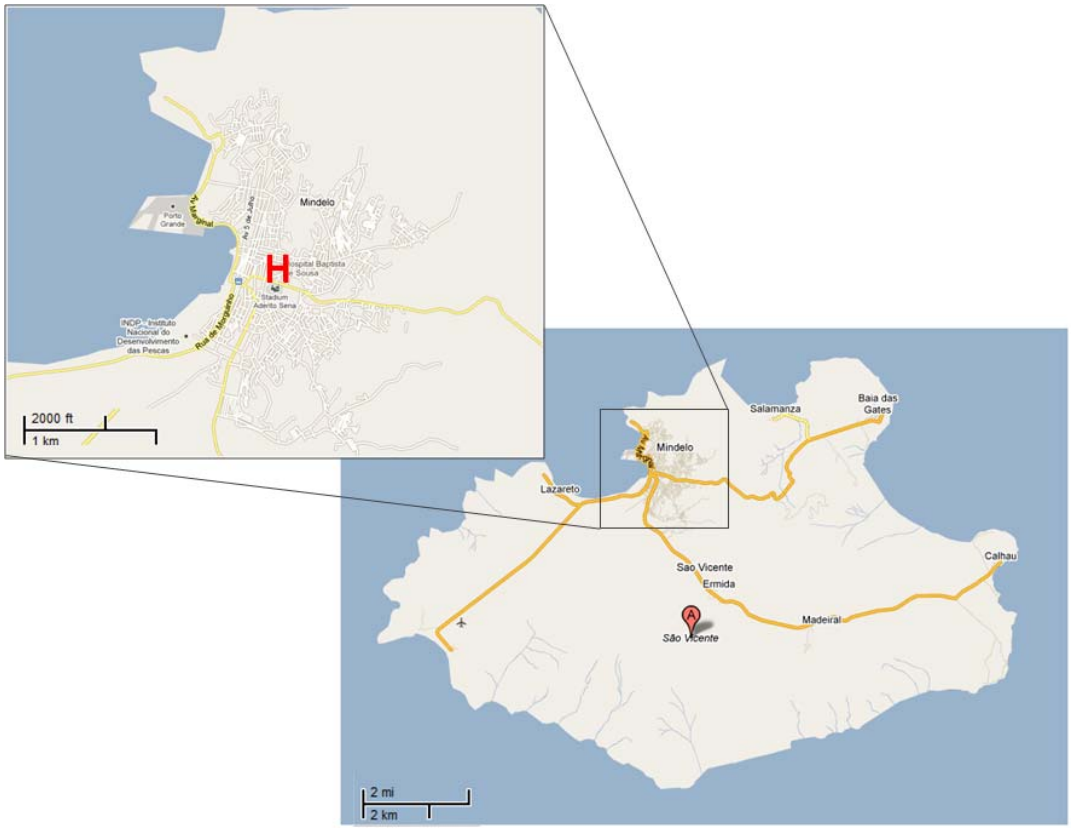


Figure 12: Location of Baptista de Sousa Hospital

The following table highlights the equipment of the proposed solar water heating (SWH) system.

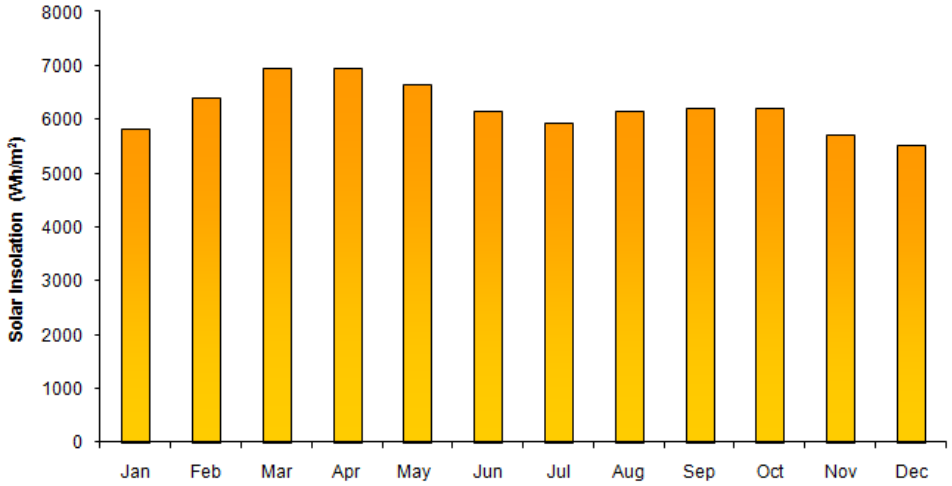
Table 7: System design specification for proposed SWH for the hospital

Proposed system specifications	
No. Solar Collectors	32
Model of the collectors	Meireles Hi V
Gross area per Solar collector	2.31 m^2
Aperture area per solar collector	1.99 m^2
Solar Collector Area	73.60 m^2
Capacity	44.60 kW
Storage Capacity	5000 L

The solar collectors will be installed in the top of the roof of the hospital. The roof is flat and with available area for the proposed number of collectors, therefore, it is not expected any constraints during the installation of the equipment. Other auxiliary equipments such as, water storage, hydraulic pumps, expansion vases and thermostatic mixing valve will also be installed.

Solar Resource

The solar resource at Mindelo was estimated using RETScreen. The optimal angle to install the PV panels is 15^{o} with an azimuth of 0^{o} (facing south). The estimated daily solar insolation at this angle is shown in Graph 1.



Graph 2: Solar resource estimation at Mindelo, São Vicente Island at a 15^{o} angle

System output

The 44.60 kW SWH system proposed is expected to delivered approximately 85.9 MWh per annum. The system is expected to consume approximately 1.9MWh per annum of electricity with water pumping.
The solar fraction of the system – percentage of energy delivered by the system comparing with the existing system energy demand - was estimated at 24%.

Operation and Maintenance

SWH systems can run for 20 years without specialist maintenance work, thus annual maintenance requirements are minimal. For large systems it is advisable to have a yearly inspection by a specialist. The inspection normally includes the checking of the pressure of the system, collector fluid levels and flow rates.

The operation and maintenance costs were estimated to be 0.5% of the systems total costs, in order to account with annual check of the equipment as well as possible small repairs and spares.

Replicability and Demonstration

There are a number of small energy intensive businesses around Cape Verde such as ice-making factories, water pumping systems, mechanics, welders which could use PV systems in a similar way to offset their electricity costs.
Hot water consumers with energy requirements similar to the Baptista de Sousa Hospital occur in most of the islands. If this project is successful, it can be easily replicated in:

- Agostinho Neto Central Hospital (Cape Verde's largest hospital)
- Regional Hospitals
    - Santiago Norte Hospital (Santa Catarina Island)

- São Filipe Hospital (Fogo Island)
- Ribeira Grande Hospital (Santo Antão)

- 18 Four Stars Hotels across the archipelago

Using a local firm to supply and install the SWH system will be an important step to transfer technology and technical capacity.

Costs and Economics

Capital Costs

The total budget is estimated at CVE 13,680,718 broken down as follows.

Table 8: Scheme capital costs

	PV Ice Factory (CVE)	SWH Hospital (CVE)	Total (CVE)
Equipment	3,816,870	5,849,069	9,665,939
Infrastructure	1,218,150	647,000	1,865,150
Installation	812,100	1,337,529	2,149,629
Total	**5,847,120**	**7,833,598**	**13,680,718**

Funding

It is proposed that 30% of the additional costs for the project are funded from the Global Environment Facility and the remaining 70% of the costs will be funded by the Municipality of Brava and Baptista de Sousa Hospital accordingly with the following table.

Table 9: Scheme Funding

	PV Ice Factory (CVE)	SWH Hospital (CVE)		Total (CVE)
GEF Grant	1,754,136	2,350,079	30%	4,104,215
Municipality	4,092,984	-	30%	4,092,984
Hospital	-	5,483,518	40%	5,483,518
Total	**5,847,120**	**7,833,598**	**100%**	**13,680,718**

Economic Evaluation

If the municipality and the hospital chose not to install a renewable energy system, the alternative would be to continue to use electricity from the local grid.
The PV system for the ice factory is estimated to produce 16,694 kWh of useful energy. The cost of buying the equivalent quantity from the grid would be CVE 434,044.

The solar water heating system for the hospital is estimated to avoid the use of 85,900 kWh of electricity. The cost of buying the equivalent quantity of energy from the grid would be CVE 2,233,400.
Taking into account these savings and assuming the municipality and the hospital provide 70% of the capital costs, the scheme has a simple payback of 3.7 years.

Table 10: Estimated annual net savings of the proposed scheme

	PV Ice Factory (CVE)	**SWH Hospital** (CVE)	**Total** (CVE)
Avoided energy costs	434,044	2,233,400	2,667,444
O&M per year	50,350	32,480	82,831
Project savings	383,694	2,200,920	2,584,613
Payback (with grant)	**10.7**	**2.5**	**3.7**

Sensitivity Analysis

The economic evaluation above is based on a current tariff for electricity of CVE 26 per kWh. As electricity production in Cape Verde relies significantly in fossil fuels, its prices are subject to fluctuation due to global oil prices. Higher oil prices will results in greater operational costs for the utility which will then be reflected in the tariffs. Consequently, an increase in the tariff will result in shorter payback periods for the scheme.
A sensitivity analysis for different electricity tariffs is shown in Table 11 and Table 12.

Table 11: Sensitivity analysis for the ice factory project

Variation	-10%	0%	10%
Tariff (CVE/kWh)	23.40	26.00	28.60
Energy savings (CVE)	390,640	434,044	477,448
O&M (CVE)	50,350	50,350	50,350
Project savings (CVE)	340,289	383,694	427,098
Simple Payback with grant (years)	**12.0**	**10.7**	**9.6**

Table 12: Sensitivity analysis for the hospital project

Variation	-10%	0%	10%
Tariff (CVE/kWh)	23.40	26.00	28.60
Energy savings (CVE)	2,010,060	2,233,400	2,456,740
O&M (CVE)	32,480	32,480	32,480
Project savings (CVE)	1,977,580	2,200,920	2,424,260
Simple Payback with grant (years)	**2.8**	**2.5**	**2.3**

Environmental Impacts

Environmental Impacts

Equipment - Installing PV panels and solar water heating collectors has little impact on the environment as the panels are silent in operation, and produce no emissions. The PV panels and the collectors would either be mounted on existing buildings or on a frame, neither of these options requires a large amount of construction and there will be minimum disruption or impact on the environment due to installation.
Carbon emissions - The generation of electricity using renewable energy compared to using electricity from the grid would result in carbon dioxide emissions savings. The emissions displaced by using the renewable energy system are based on an emission factor for the grid electricity of 0.7181kg/kWh[5].
Using this emissions factor the carbon emissions savings are calculated to be approximately 74 tonnes per year compared to using grid electricity.

Conclusions

Installing these solar powered equipments at the factory and hospital will enable them to produce electricity without resorting to expensive and polluting grid electricity which utilises diesel generators.
The main barrier that can be identified for this type of RE system is the high upfront capital cost of the equipments.
If these systems can be shown to work at these locations, then there is a high chance of replicating them across other small energy intensive businesses across Cape Verde.

[5] Emission Factor of Boavista Island, Cape Verde.

PROJECT C - PRE-FEASIBILITY STUDY FOR HYBRID RURAL ELECTRIFICATION

Introduction

This is one of three feasibility reports for a pilot renewable energy project as part of UNIDO's Market Based Development of Small to Medium Scale Renewable Energy Systems in Cape Verde project.
The project aims to create market conditions conductive to the development of small to medium scale renewable energy systems in Cape Verde. This will be achieved through three components:

- Demonstrate the technical feasibility and commercial viability of renewable energy projects and dedicated seed fund to scale up.
- Strengthening legal and regulatory framework conductive to the development of small to medium scale renewable energy projects.
- Strengthening institutional capacity and raise awareness of market players, enablers and general public;

The shortlist of candidate projects included:

- Wind power for electricity generation;
- Solar power for productive uses;
- Hybrid rural electrification.

The feasibility report covers:

- the technical aspects in developing the proposed scheme;
- the costs of the scheme and value of energy resulting from it;
- operation and maintenance, environmental and other issues that the developer will likely encounter; and
- Replication of the proposed scheme.

Background

Cape Verde is a small archipelago of 10 islands within the zone of North-East trade winds in the tropical North Atlantic; 800km west of Senegal (see Figure 13). This area is characterised by a high solar insolation due to its proximity from the equator.

Figure 13: The archipelago of Cape Verde

Although the country has already an electrification rate of more than 90%, some isolated communities have only access to electricity during short periods of the day. The mini-grids which are installed to distribute electricity in these communities are powered by diesel generators which run only during a few hours per day due their high operational costs.
The sections bellow will provide some background on the proposed locations for the implementation of the hybrid electrification schemes.

Figueiras and Ribeira Alta

Figueiras and Ribeira Alta are two small remote rural communities supplied by two diesel micro-power networks in Ribeira Grande Municipality, located in Santo Antão Island. Figure 14 shows the location of these two populations within the island.
In Santo Antão there are two types of electricity networks:

- ELECTRA electricity network which in 2008, according to statistical data from ELECTRA on Santo Antão national grid, supplied electricity to 4,121 domestic consumers in Ribeira Grande; 3,335 in Porto Novo and 1,407 in Paúl, which represented a served population in that year of approximately 85%, 77% and 74%, respectively.
- Local mini-grids powered by small diesel generator sets supply electricity for a significant proportion of island's population. The following mini-grids are installed and in operation in Santo Antão:

- Municipality of Porto Novo - runs eight micro-power stations (Ribeira Fria, Ribeira dos Bodes, Ponte Sul, Dominguinhas, Tarrafal, Monte Trigo, Lombo Figueira e Chã de Norte) supplying a total population of approximately 2,500 people representing 14.6% of the population of the county;
- Municipality of Ribeira Grande- runs three micro-power stations (Lagoa, Figueiras and Ribeira Alta) supplying an estimated population of 1,300 people, representing about 6.0% of the population of that county.
- Municipality of Paúl – there are no micro-power stations operating.

The 1997 Santo Antão Master Plan of Electricity recognised that it would be a real dilemma to keep a large number of micro-power stations running with small diesel generator sets as they represent a heavy financial burden to the municipalities who struggle with technical and management issues when the benefits are limited to a few hours a day. Traditionally the alternative solution would be the extension of the medium voltage networks on the island (ELECTRA network), which in these specific cases involves heavy investment costs as these are locations far away from central power grids.

Ribeira Grande Municipality wants to implement a new technical solution which incorporate renewable energy technologies and that can solve the problems of the current systems. The electrification project analysed in this report is a higher quality and sustainable technical solution for small towns located far away from the central power grid and often with access difficulties, such as Figueiras and Ribeira Alta.

Figure 14: Location of Figueiras and Ribeira Alta, Santo Antão Island

Current Electricity Supply

The Municipality of Ribeira Grande developed electrification projects in Figueiras and Ribeira Alta at the end of 1999 and beginning of 2000. The electrification projects comprised 2 micro-power stations one at each location. Table 13 shows the specification of the micro-power stations implemented.

Table 13: Figueiras and Ribeira Alta micro-power station specifications

Micro-Power Station	Start of Operation	Installed Capacity	Operating Hours	Fuel Consumption	Number of Consumers
Figueiras	April 2000	40 KVA PERKINS	19h00 – 23h00	20 l/day 3 barrel/month	60
Ribeira Alta	October 1999	40 KVA	18h00 – 23h00	17/18 l/day 3 barrel/month	24

These two micro-power stations are connected to low voltage networks including 37 public lighting columns in Figueiras and 27 lighting columns in Ribeira Alta.
The load curves recorded on May 13, 2009 showed the following values (see Table 14).

Table 14: Figueiras and Ribeira Alta load curves

Time	19H00	20H00	21H00	22H00	23H00
Figueiras	8.0kW	14.3kW	12.8kW	11.8kW	11.2kW
Ribeira Alta	-	±6.6kW	±6.6kW	-	-

Figueiras micro-power station has a power output of 50kWh/day, Ribeira Alta micro-power station has an estimated power output of 40kWh/day. In addition in Ribeira Alta there is a 2,800W water pump that pumps water for domestic consumption, which normally operates during the operating times of the micro-power station.
Fuel supply is through the provision of 3 barrels (600 litres) of diesel per month to both stations, the fuel is divided in several plastic bottles and transported primarily by car, then by boat (in case of Ribeira Alta) and then by animals to the micro-power stations. This route offers many opportunities for fuel diversion and there are no guarantees that the fuel invoiced every month (600 litres) is the amount consumed at the micro-power stations.
Consumers do not have energy meters to measure their monthly electricity consumption, they pay a fixed amount every month of 60CVE/lamp installed, independently of whether or not they have other electrical equipment.
In Figueiras the population does not have TVs as there is no TV signal, but in Ribeira Alta a large part of the population has a TV.
Public lighting represents approximately 16% of the total energy consumption in Figueiras and 19% in Ribeira Alta.
The average energy consumption by consumers in both areas is around 20kWh. With this consumption it is estimated that the consumers each have domestic lighting systems, a radio and some other electric equipment (TV, fridge). Due to the fixed value that is charged to each consumer household, it is thought that the energy consumption is above what it would be if electricity meters were installed. In this case, the expected average energy consumption would be of 15kWh.
The estimated monthly total costs of the existing Figueiras and Ribeira Alta mini-grid systems are CVE 111,663 and CVE 101,663 respectively. The breakdown of the cost of these two systems is shown in the following table.

Table 15: Monthly cost of the existent Figueiras and Ribeira Alta micro-power systems

Location	Monthly Cost (CVE)						
	Fuel	Transport			Maintenance	Operation	Total
		Car	Boat	Animal			
Figueiras	55,380	11,000	-	13,000	15,000	17,283	111,663
Ribeira Alta	55,380	-	8,000	6,000	15,000	17,283	101,663

The production cost of a kWh of electricity is of CVE 73.42/kWh in Figueiras and CVE 83.56/kWh in Ribeira Alta. These costs do not take into account either the system management costs or the system's investment costs. It is estimated that the monthly income from consumers in Figueiras is between CVE 11,000-15,000 and in Ribeira Alta between CVE 5,000-6,000. Thus, the income from existing micro-power systems cannot cover costs for the operator, the fuel transport, the maintenance or the fuel used.
These costs represent a huge financial burden for the Municipality of Ribeira Grande and a presents a concern every time there is a need to solve a technical problem. Moreover the fixed cost payment system in place does not incentivise consumer energy efficiency.

Proposed technical solution

Ribeira Grande Municipality wants to implement a new technical solution which incorporates renewable energy technologies that can solve the problems of the current systems. The following are the main requisites of the new energy systems:

- Provide a quality and reliable electricity system that provides electricity to the population 24h/day;
- Use primarily renewable energy resources, solar and wind, to produce electricity;
- Limit the power used by each consumer through energy-efficiency appliances and low consumption equipment;
- Minimise fuel (diesel) consumption and hence operating hours of the generator set;
- Reduce significantly the cost and logistical burden of work associated with fuel transport to the locations;
- Assure financial sustainability of the system operation.

To attain these objectives Ribeira Grande Municipality commissioned a study by Electric to study the feasibility of possible technical solutions, this study is provided in Annex 1. A solar/wind/diesel hybrid system was considered by Electric to be the best solution as it:

- Enables combined use of various energy sources: solar, wind and diesel fuel, providing a robust system in which the possibility of disruption in energy supply is low;
- Takes advantage of existing making this solution probably less costly than the others considered (individual PV systems in each household); and
- Allows the choice of optimal locations for the production systems according to the wind and solar resources available around the villages.

The following table lists the components of the proposed system.

Table 16: Proposed hybrid systems for Figueiras and Ribeira Alta

	Figueiras	Ribeira Alta
PV(kW)	4.2	1.05
Wind Turbine (kW)	10	8
Diesel generator (kW)	32	20
Batteries	72 x 800Ah	72 x 420Ah
Inverter (kW)	15	12

Carriçal

Carriçal is a remote rural community with approximately 191 domestic consumers distributed through 33 households in Ribeira Brava Municipality, São Nicolau Island. Figure 15 shows the location of Carriçal within the island.

Figure 15: Location of Carriçal in São Nicolau Island, Cape Verde

The Municipality installed a mini-grid which is providing electricity to only 20 houses and is running on a 16.5 kVA diesel generator. Each consumer pays a fixed rate of CVE 1,600 (US$20) for 4 hours of electricity per day. This revenue is used to cover the operating and maintenance costs.

The closest Medium Voltage grid is located at approximately 18 km from Carriçal. This distance combined with the low number of consumers makes connecting the community to the island grid economically unrealistic. The estimated cost of the connection is CVE45,000,000 which represents an investment of CVE 235,602 per consumer. As it will be shown in this study, this cost is more than the double of the proposed project which will provide 24 hour electricity.

Carriçal hosted in the past an important canned fish factory which employed directly or indirectly the majority of the population. The factory has been deactivated and is now in ruins which lead to a significant number of residents to leave the community. Agriculture and fishing are now the only sources of income for the local population. The Municipality has plans to install an ice factory to assist fisherman in preserving fish.

Ribeira Brava Municipality wants to implement a new technical solution which incorporate renewable energy technologies in order to solve the limitations and reduce the costs of the

current system. The electrification project analysed in this report is a higher quality and sustainable technical solution for small towns located far away from the central power grid and often with access difficulties, such as Carriçal.

Current Electricity Supply

The Municipality of Ribeira Brava installed a micro grid electrification project running on a diesel generator in Carriçal. Table 13 shows the specification of the installed power generation system.

Table 17: Carriçal micro-power station specification

Micro-Power Station	Installed Capacity	Operating Hours	Fuel Consumption	Consumers
Carriçal	16.5 kVA	19h00 – 23h00	13 l/day	20 households

Currently, consumers do not have energy meters to measure their electricity usage; they pay a fixed amount every month of CVE 1,600. This corresponds to an yearly revenue of CVE 384,000.
The average energy consumption by household is around 20kWh. With this consumption it is estimated that the consumers each have domestic lighting systems, a radio and some other electric equipment such as TVs and fridges.
The estimated yearly total cost of the existing system is approximately CVE 478,000. The breakdown of the total cost is shown in the following table.

Table 18: Yearly cost of the existent Carriçal micro-power system

Current system costs	CVE	USD
Fuel	446,979	5,504
Transport	14.000	172
Maintenance	15,000	185
Operation	17,000	209
Total	492,979	6,070

As it can be seen the revenue from the households' monthly bills does not cover the costs with fuel. Ribeira Brava Municipality is therefore providing electricity in Carriçal at an economic loss. The Municipality is eager to implement a new system to provide 24h electricity at a sustainable cost.

Proposed technical solution

Ribeira Brava Municipality wants to implement a new technical solution which incorporates renewable energy technologies to solve the limitations of the current system. The following are the main requisites of the new energy systems:

- Provide a quality and reliable electricity system that provides electricity to the population 24h/day;
- Use primarily renewable energy resources, solar and wind, to produce electricity;

- Limit the power used by each consumer through energy-efficiency appliances and low consumption equipment;
- Minimise fuel (diesel) consumption and hence operating hours of the generator set;
- Assure financial sustainability of the system operation.

To attain these objectives Ribeira Brava Municipality is considering a solar, wind and diesel hybrid system in order to:

- Enable the combined use of various energy sources: solar, wind and diesel fuel, providing a robust system in which the possibility of disruption in energy supply is low; and
- Allows the choice of optimal locations for the production systems according to the wind and solar resources available around Carriçal.

The following table lists the components of the proposed system.

Table 19: Proposed hybrid systems for Carriçal

	Carriçal
PV(kW)	2
Wind Turbine (kW)	10
Diesel generator (kW)	20
Batteries	24 x 1000Ah
Inverter (kW)	12

Praia Branca Irrigation Project

The Municipality of Tarrafal, in São Nicolau Island, in collaboration with the Ministry of Environment and Agriculture (MADRM[6]), is developing a horticulture project for local families. The project is located in Praia Branca, a remote rural village in the Western part of the island. The project, when concluded, will be pumping water from a well to irrigate 32 land parcels. These parcels will be given to 32 local families which will practice horticulture with the assistance of the MADRM. The project is expected to result in opportunities for self employment and in the improvement of the local dietary needs. The local school will also have a small parcel for education purposes and production of food for the school canteen.
The project is currently operating at approximately half its capacity with 17 families already using their assigned land parcels. Water is being pumped with an 11 kW pump for 7-8 hours per day. When fully operational, it is expected that the daily usage of the pump will increase to 12 hours.

[6] Ministério do Ambiente, do Desenvolvimento Rural e dos Recursos Marinhos

Figure 16: Praia Branca, São Nicolau Island, Cape Verde

Irrigation System Electricity Consumption

The water pump will be used exclusively in irrigation and is expected to be operated for 12 hours per day. Based on this assumption and a 100% availability of the pump, the annual electricity consumption would be 48,180 kWh.

Proposed technical solution

The Municipality of Tarrafal wants to implement a new technical solution which incorporates renewable energy technologies that contribute to lower energy costs of the horticulture project. The proposed system consists of a renewable energy hybrid system based on wind and photovoltaic energies which will be connected to the water pump as shown in Figure 17.

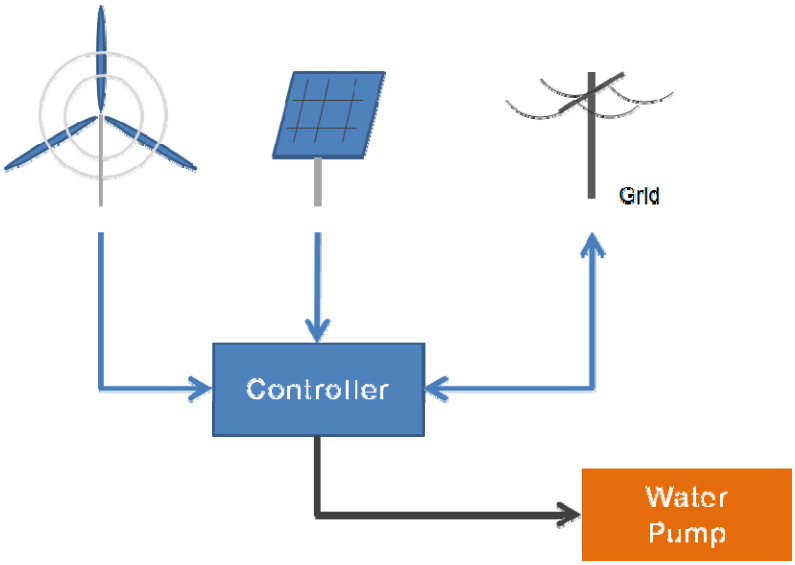


Figure 17: Proposed renewable energy hybrid system

Connection to the grid will ensure that the pump has sufficient energy to operate when both wind and solar resources are not enough to power the pump. Moreover, this will also allow the system to feed the grid with any excess energy and generate an additional income.
The following table lists the components of the proposed system.

Table 20: Proposed hybrid systems for Praia Branca Irrigation system

	Irrigation
PV(kW)	5.04
Wind Turbine (kW)	12
Inverter (kW)	12

Hybrid Elecrification Technologies

A solar/wind/diesel hybrid system combines the inputs of three proven systems: solar PV, wind turbines and diesel generators.

Photovoltaics

Photovoltaics (PV) can be used to convert the sun's light energy into electricity. PV systems have the advantages of being silent in operation and low maintenance with no moving parts. Cables run from the PV modules to inverters to convert DC electricity produced by the PV panels into AC electricity, which can be used with normal appliances. PV systems can be integrated into the building structure, can be retrofitted onto top of the existing roofs or can be mounted on free standing frames.

Wind Turbines

Wind turbines are used to convert the energy in wind into electricity. Wind turbines can generate a few watts to multi-megawatts. Each turbine operates most effectively at a typical wind speed of between 10-15 m/s. Due to the varying nature of wind speed the electrical output from a turbine is variable.

Wind turbines operate most effectively in a strong and turbulence-free wind. The presence of buildings, trees and surrounding hills means that wind speed can be reduced. This is significant as the power in the wind is proportional to the cube of the wind speed, meaning that a small increase in wind speed results in a considerable increase in the amount of energy being generated.

Wind developments typically require well-exposed sites free from surrounding obstacles such as trees and buildings which will increase the turbulence in the wind. Higher turbulence levels in the wind will result in weaker wind turbine performance. The sites are also required to have adequate road access, able to accommodate trailers carrying the longest loads (usually the blades), as well as the heaviest and widest loads (generally the cranes required in erection).

Diesel generators

Diesel generators are frequently used in hybrid systems to assure power supply when renewable energy resources are low. Diesel has been used in these localities for electricity generation. However in these new systems, much smaller quantities of diesel will be used.

Renewable Resources and System Design

Figueiras and Ribeira Alta

Renewable Energy Resources

There are no wind and insulation data available for the proposed actual sites of the hybrid systems. Thus the local wind conditions were estimated by Electric using the Mindelo average wind speed (Wind Finder website). Solar radiation conditions estimated from the Ponta do Sol locality (which is a located in the cost of Santo Antão Island and is very exposed to the sun). The solar radiation data were collected from FAO "World Climatological Data, Ponta do Sol, Santo Antão". The following table shows the wind velocity and solar radiation data.

Table 21: Wind velocity and solar radiation data available[7]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Wind velocity S. Vicente (m/s)	14.8	10.7	11.2	11.2	11.2	10.7	8.2	8.2	12.2	13.8	9.7	6.7	**10.9**
Solar Radiation Ponta do Sol (kWh/m^2)	4.3	5.1	5.8	6.4	6.4	6.1	5.7	5.4	5.3	5.0	4.5	3.9	**5.3**

Wind Resource

Having taken into account the data referred to above and in-loco observations the Figueiras and Ribeira Alta monthly average wind speeds were estimated.

For Figueiras the estimated annual average wind speed is of 7.1m/s, with the maximum value registered in January (9.6m/s) and the minimum value registered in June and August (5.3m/s) (see Figure 18). For Ribeira Alta the estimated annual average wind speed is of 6.0m/s, with the maximum value and minimum values registered of 8.1m/s and 4.5m/s, respectively (see Figure 19).

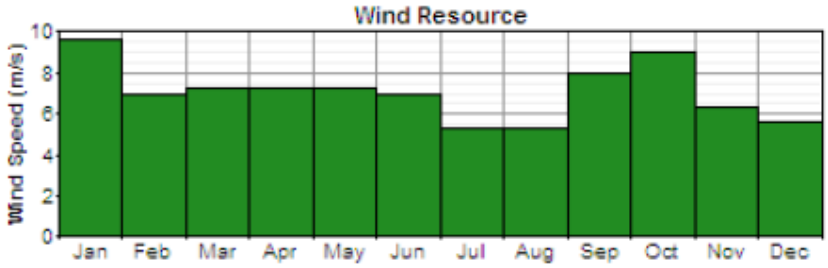


Figure 18: Monthly average wind speed for Figueiras

[7] ELECTRIC, Projecto de Fornecimento de Energia Eléctrica para Figueiras e Ribeira Alta através de Sistemas Hibridos Eólico-Solar-Diesel, June 2009

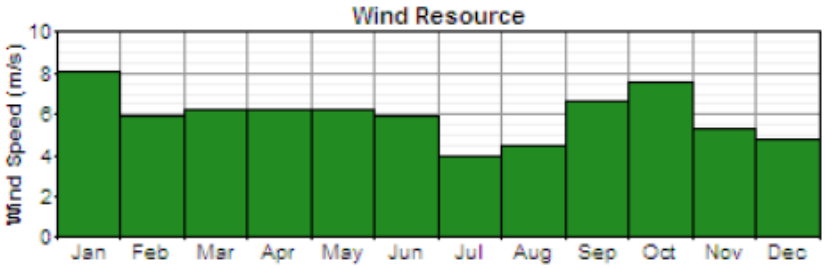


Figure 19: Monthly average wind speed for Ribeira Alta

Solar Resource

The solar radiation values for Figueiras and Ribeira Alta were estimated by using the Ponta do Sol values.

For Ribeira Alta the average solar contribution to energy generation is of 4.52kWh/m^2/day. The minimum solar radiation occurs in December and the maximum in April and May. Figure 20 and Figure 21 show the monthly distribution of the solar radiation for Figueiras and Ribeira Alta.

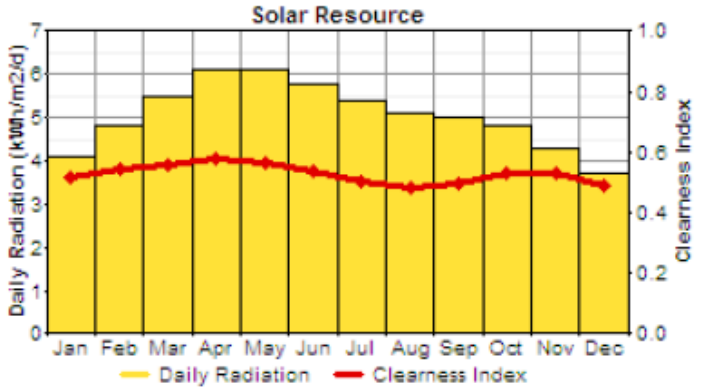


Figure 20: Figueiras monthly Average Global Solar Radiation distribution

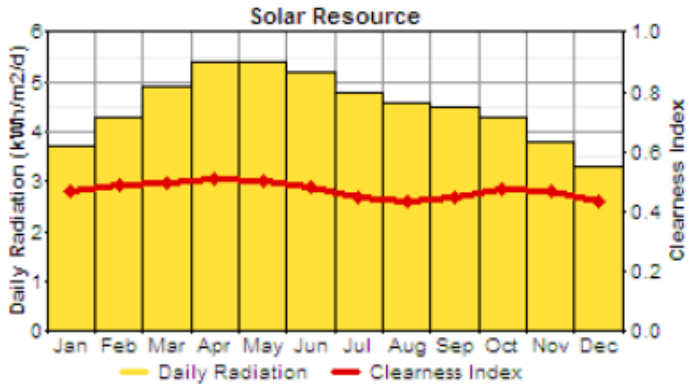


Figure 21: Ribeira Alta monthly Average Global Solar Radiation distribution

Estimated Demand

The investment cost per unit of installed power for hybrid systems is usually very high, thus the utilisation of these systems requires a great discipline of consumption and a careful selection of electrical equipment. Rules of rational consumption and use of energy efficient equipment and

appliances should be adopted by the consumers. Average monthly and daily consumption were estimated assuming:

1. The maximum number of families in Figueiras will stabilize at 120, and in the medium term (5 years) they are all connected to the network;
2. The maximum number of families in Ribeira Alta will stabilize at 35, and in the medium term (5 years) they are all connected to the network;
3. All families will adhere to the directives of installing efficient electrical equipment and adopt rules of rational consumption;
4. There will be differentiation of customers depending on the type of appliances installed.

Having taken these assumptions into account, it was considered that:

- For Figueiras:
  - Each of the 120 households in Figueiras will install 4 lamps and 1 radio. In terms of other equipments and appliances 30% will have TV and fridges and 20% DVD and stereo equipment and 10% will have electric irons;
  - Figueiras public lighting demand was estimated having into account the system in place at the moment: 37 lamps of 70W used between 19h00 and 23h00 (4 hours), totalising an estimated average consumption of 10.36kWh/day.
- For Ribeira Alta:
  - Each of the 35 households in Figueiras will install 4 lamps and 1 radio. In terms of other equipments and appliances 85% will have TV, 30% fridges, 20% DVD and stereo equipment and 10% will have electric irons;

The following tables show the estimated average total demand for the two locations.

Table 22: Figueiras average total demand

			Power			Load factor	Consumption	
	%	No.	W	No.	h/day		kWh/day	kWh/month
Lamps	100	4	11	120	5	0.5	13.20	396.00
Radio	100	1	15	120	8	1	14.40	432.00
TV	30	1	60	120	4	1	8.64	259.20
DVD	20	1	40	120	2	1	1.92	57.60
Fridge	30	1	100	120	10	1	36.00	1080.00
Electric Iron	10	1	1000	120	1	0.25	3.00	90.00
Public lighting							10.36	310.80
Losses (10%)							8.75	262.60
						Total	96.27	2888.16

Table 23:Ribeira Alta average total demand

			Power			Load factor	Consumption	
	%	No.	W	No.	h/day		kWh/day	kWh/month
Lamps	100	4	11	35	5	0.5	3.85	115.50
Radio	100	1	15	35	8	1	4.20	126.00
TV	85	1	60	35	4	1	7.24	214.20
DVD	20	1	10	35	2	1	0.14	4.20
Fridge	30	1	100	35	10	1	10.50	315.00
Electric Iron	10	1	1000	35	1	0.25	0.88	26.25
Public lighting							7.56	226.80
Losses (10%)							3.43	102.80
						Total	37.69	1130.75

For Figueiras the estimated average daily load is shown in Figure 22 and represents an average demand of 96kWh/day. The expected peak load in the medium term, with 120 customers, is approximately equal to the peak that takes place today with 60 consumers. This means that extending the operating period to 24 hours in conjunction with the use of low-energy appliances and procedures towards energy savings leads to a lower peak demand.

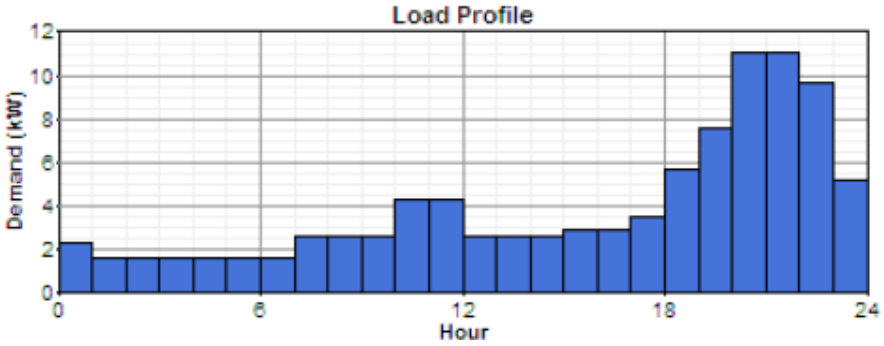


Figure 22: Figueiras annual average daily profile

For Ribeira Alta the estimated average daily load is shown in Figure 23 and represents an average demand of 36kWh/day. This profile does not include the water pump demand estimated at 14kWh/day. The question of the water pump should be studied separately as it represents one third of final consumption.

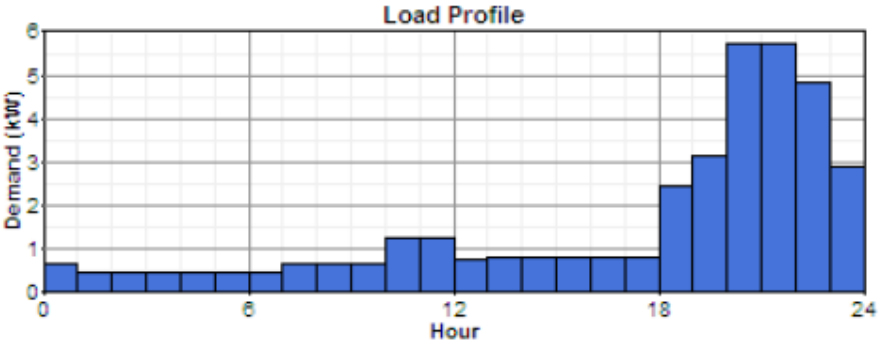


Figure 23: Figueiras annual average daily profile

The demand for both Figueiras and Ribeira Alta was estimated for the next 5 years, at which time all potential households will be connected to the grid. Naturally before that time the load will be lower than the estimated and after that there will be maybe a tendency for demand

growth, however that is expected to be quite small taking into account the rational consumption measures implemented at that time.

Systems Output

Simulations of the systems specified above were carried out in the study carried out by Electric using HOMER – an energy modelling software. The following table shows the estimated energy production and energy mix achieved with both systems.

Table 24: Estimated energy production and energy mix achieved with both hybrid systems

	Figueiras		Ribeira Alta	
Energy Production				
PV (kWh)	7,161	16%	1,613	6%
Wind Turbine (kWh)	32,458	71%	21,563	82%
Battery (kWh)	15,448	-	6,395	-
Diesel generator (kWh)	6.383	14%	3,187	12%
Energy Balance				
Total Production (kWh)	46,001	100%	26,363	100%
Consumption (kWh)	34,047	-	18,263	-
Demand not attended (kWh)	1,015	2%	489	2%
Energy Excess (kWh)	5,585	12%	5,020	19%
Battery life time (year)	12.78		17	
N. Starts of the Diesel Generator (#)	131		96	
Diesel Generator Operting Hours (h)	231		160	
Fuel (diesel) consumption (l/year)	1,979		798	
Containers Transport (Containers/year)	10		4	
Renewable Energy Generation (%)	86.1%		87.9%	

It was verified that the renewable energy contribution in both systems are close to 90%. The operating hours of the diesel generators represent on average less than 1h/day, which results in a monthly average fuel consumption of 200 litres. This represents approximately one barrel per month instead of the current three. The contribution from the PV panels for is around 6%-16% while wind energy is of around 71%-82%.

Operation and Maintenance

The two systems would be owned by the Ribeira Grande Municipality, which will remain in charge of operation and maintenance.
O&M costs, equipment replacement and diesel cost were estimated around 829,044CVE per year for Figueiras and 449,536 CVE per year for Ribeira Alta.

Table 25: Estimated total annual cost for the proposed systems

	Figueiras (CVE)	**Ribeira Alta** (CVE)
O&M	222,044	89,536

Fuel Cost (diesel)	182,662	73,655
Total Annual Costs	**829,044**	**449,536**

Carriçal

Renewable Energy Resources

There are no wind and insulation data available for the proposed site of the hybrid system. The local wind conditions were estimated using the Mindelo average wind speed (RETScreen). Solar radiation conditions estimated from the Ponta do Sol locality (which is located in the cost of Santo Antão Island and is very exposed to the sun). The solar radiation data were collected from FAO "World Climatological Data, Ponta do Sol, Santo Antão". The following table shows the wind velocity and solar radiation data.

Table 26: Wind velocity and solar radiation data for Carrriçal

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Wind velocity Mindelo (m/s)	7.4	6.7	6.1	6.4	6.2	6.0	4.6	4.4	5.0	5.7	5.9	6.6	**5.9**
Solar Radiation Ponta do Sol (kWh/m^2)	5.4	5.8	6.7	6.9	7.1	7.4	7.0	6.7	6.5	6.2	5.6	5.2	**6.4**

Wind Resource

The estimated annual average wind speed is 5.9 m/s, with the maximum value registered in January (7.8m/s) and the minimum value registered in September (5.0m/s).

Solar Resource

The average solar contribution to energy generation is of 6.38 kWh/m^2/day. The minimum solar radiation occurs in December and the maximum in April and May. Figure 20 shows the monthly distribution of the solar radiation.

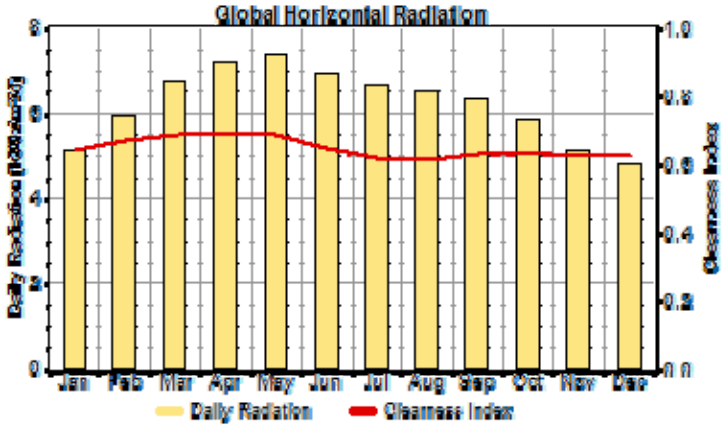


Figure 24: Estimated monthly average solar radiation distribution in Carriçal

Estimated Demand

Average monthly and daily consumption were estimated assuming:

- The maximum number of households in Carriçal will stabilize at 33, and they are all connected to the network;
- All households will adhere to the directives of installing efficient electrical equipment and adopt rules of rational consumption.

Having taken these assumptions into account, it was considered that:

- Each of the households will install 4 lamps and 1 radio. In terms of other equipments and appliances 85% will have TV, 30% fridges, 20% DVD and stereo equipment and 10% will have electric irons;

The following tables show the estimated average total demand in Carriçal.

Table 27: Carriçal average total demand

			Power			Load factor	Consumption	
	%	No.	W	No.	h/day		kWh/day	kWh/month
Lamps	100	4	11	35	5	0.5	3.85	115.50
Radio	100	1	15	35	8	1	4.20	126.00
TV	85	1	60	35	4	1	7.24	214.20
DVD	20	1	10	35	2	1	0.14	4.20
Fridge	30	1	100	35	10	1	10.50	315.00
Electric Iron	10	1	1000	35	1	0.25	0.88	26.25
Public lighting							7.56	226.80
Losses (10%)							3.43	102.80
						Total	**37.69**	**1130.75**

Systems Output

Simulations of the systems specified above were carried out in the study carried out by Electric using HOMER – an energy modelling software. The following table shows the estimated energy production and energy mix achieved with both systems.

Table 28: Estimated energy production and energy mix of the proposed hybrid system

Energy Production		
PV (kWh)	3,743	13%
Wind Turbine (kWh)	24,499	85%
Battery Throughput (kWh)	6,427	-
Diesel generator (kWh)	714	2%
Energy Balance		
Total Production (kWh)	28,957	100%
Consumption (kWh)	13,870	-
Energy Excess (kWh)	12,648	43.7%
Battery life time (year)	12.8	
N. Starts of the Diesel Generator (#)	80	
Diesel Generator Operating Hours (h)	119	
Fuel (diesel) consumption (l/year)	297	
Renewable Energy Generation (%)	94.9%	

It is expected that the renewable energy contribution for the total demand to be close to 94%. The operating hours of the diesel generators results in a monthly average fuel consumption of 60 litres.

Operation and Maintenance

The system would be owned by the Ribeira Brava Municipality, which will be responsible for the system operation and maintenance.
O&M costs, equipment replacement and diesel cost were estimated around CVE 440,670 per year.

Table 29: Estimated total annual cost for the proposed system

	Carriçal (CVE)
O&M	350,000
Fuel Cost (diesel)	33,323
Total Annual Costs	**383,323**

Praia Branca Irrigation Project

Renewable Energy Resources

There are no wind and insulation data available for the proposed site of the hybrid system. Thus the local wind and solar resources were estimated using the Santo Antão data from FAO "World Climatological Data".

Wind Resource

The estimated annual average wind speed is 5.9 m/s, with the maximum value registered in January (8.1 m/s) and the minimum value registered in July (4.0m/s).

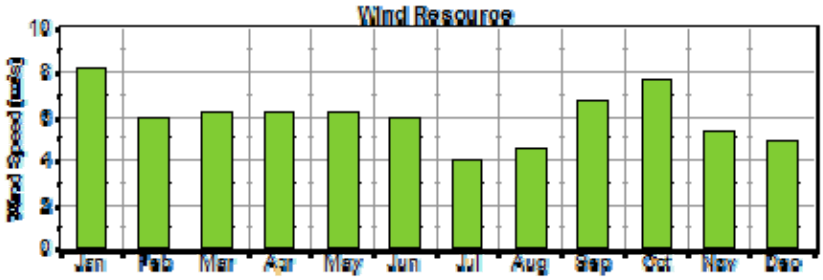


Figure 25: Estimated monthly average wind resource in Praia Branca

Solar Resource

The average daily radiation is 5.3 kWh/m^2. The minimum solar radiation occurs in December and the maximum in April and May.

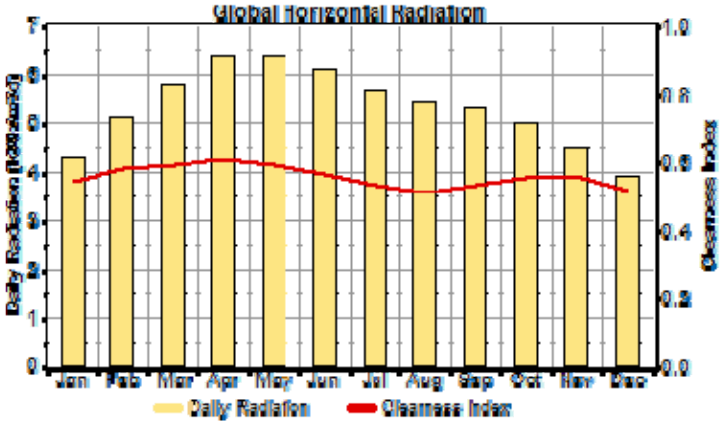


Figure 26: Estimated monthly average solar radiation in Praia Branca

Estimated Demand

The water pump will be used exclusively in irrigation and is expected to be operated for 12 hours per day. Based on this assumption and a 100% availability of the pump, the annual electricity consumption would be 48,180 kWh.

System Output

Simulations of the hybrid system were carried out using HOMER – an energy modelling software. The following figure shows the estimated monthly average energy production.

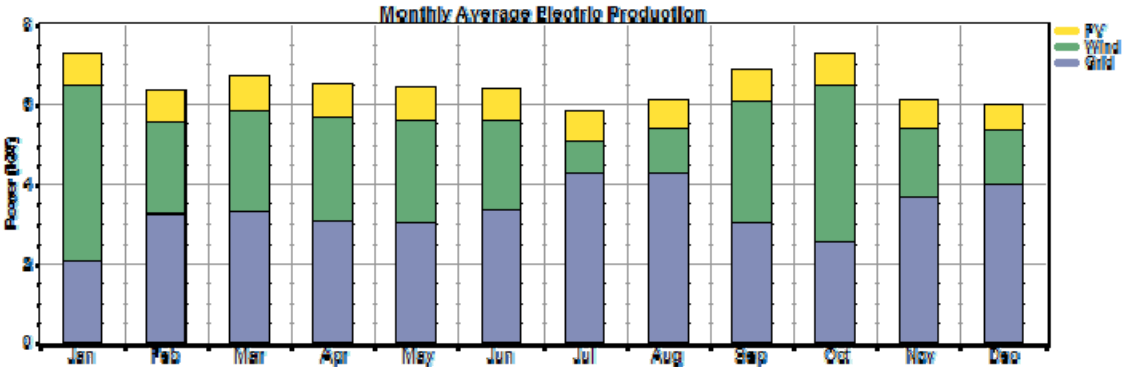


Figure 27: Monthly average electricity production from the proposed system

It was verified that the wind turbine and the PV panels contribute with, respectively, 37% and 12% of the total energy production. The remaining energy (51%) will have to be purchased from the grid. It was also estimated an excess renewable energy production of 7,990 kWh per year which will be feed into the grid.
Table 30

Table 30: Summary of the proposed system energy output

	kWh
Solar PV	6,940
Wind energy	20,928
Total Renewable Energy	**27,868**
Grid Electricity	28,996

Total Energy Consumption	**56,170**
System load	48,180
Grid sales	7,990
Renewable Fraction	**49%**

Operation and Maintenance

The system would be owned by the Municipality of Tarrafal, which will remain in charge of operation and maintenance.
The annual O&M costs were estimated to be approximately 2% of the total equipment costs – **USD 1,640.00**.

Table 31: Estimated total annual cost for the proposed system

	Praia Branca (CVE)
O&M	133,184
Energy Cost (electricity)	546,156
Total Annual Costs	**679,340**

Replicability and Demonstration

There are several communities and agriculture projects in Cape Verde with the same conditions as the ones targeted in this study. Only in Santo Antão there are 9 other populations with limited access to electricity and who are supplied by micro diesel power stations:

- Ribeira Fria, Ribeira dos Bodes, Ponte Sul, Dominguinhas, Tarrafal, Monte Trigo, Lombo Figueira e Chã de Norte located in the Porto Novo Municipality; and
- Lagoa in Ribeira Grande Municipality.

It may be possible to replicate this project in these communities; however a study of the local conditions (landscape, winds profiles and solar radiation) should be carried out.

All of these sites could potentially install a hybrid solar-wind-diesel system to get access to electricity 24h a day as well as to offset diesel consumption. The key constraint with the replicability of this project will be finding locations with suitable wind speeds, as it will be the main source of energy. By monitoring the wind energy production at the proposed locations, there will be a more accurate picture of the wind resources, and likely energy outputs for wind turbines in similar locations.
Using a local firm to supply, install and maintain the hybrid systems will be an important step to transfer technology and technical capacity.

Costs and Economics

Capital Costs

The total budget is estimated at CVE 64,507,014 broken down as follows.

Table 32: Scheme capital costs in CVE

	Figueiras (CVE)	Ribeira Alta (CVE)	Carriçal (CVE)	Irrigation (CVE)	**Total** (CVE)
PV(kW)	2,500,000	850,000	1,250,000	3,021,012	**7,621,012**
Wind Turbine (kW)	2,700,000	2,100,000	2,500,000	2,801,745	**10,101,745**
Diesel (kW)	1,500,000	900,000	900,000	-	**3,300,000**
Battery	3,500,000	2,300,000	1,750,000		**7,550,000**
Inverter (kW)	1,200,000	800,000	800,000	836,463	**3,636,463**
Total equipment	**11,400,000**	**6,950,000**	**7,200,000**	**6,659,220**	**32,209,220**
Transportation	1,800,000	1,200,000	925,000	998,883	**4,923,883**
Design	1,100,000	1,000,000	1,000,000	319,643	**3,419,643**
Installation	2,200,000	1,700,000	1,910,000	1,664,805	**7,474,805**
Low voltage grid	-	-	4,500,000		**4,500,000**
Technical Assistance	5,000,000	3,000,000	3,500,000	479,464	**11,979,464**
Total	**21,500,000**	**13,850,000**	**19,035,000**	**10,122,014**	**64,507,014**

Funding

It is proposed that 30% of the additional costs for the project are funded from the Global Environment Facility and the remaining 70% of the costs will be funded by the municipalities accordingly with the following table.

Table 33: Scheme Funding

	Figueiras (CVE)	Ribeira Alta (CVE)	Carriçal (CVE)	Irrigation (CVE)	**Total** (CVE)	
Capital Costs	CVE	CVE	CVE	CVE	%	**CVE**
GEF Grant	6,450,000	4,155,000	5,710,500	3,036,604	30%	**19,352,104**
Promoter	15,050,000	9,695,000	13,324,500	7,085,410	70%	**45,154,910**
Total	**21,500,000**	**13,850,000**	**19,035,000**	**10,122,014**	**100%**	**64,507,014**

Economic Evaluation

If the municipalities chose not to install a hybrid renewable energy system, the alternative would be to continue to use diesel to power a generator or, in the case of the irrigation system, to continue to use electricity from the local grid.

Taking into consideration the avoided costs account these savings and assuming the municipalities provide 70% of the capital costs, the scheme has a simple payback of 9.5 years.

Table 34: Estimated annual net savings of the proposed scheme

	Figueiras (CVE)	Ribeira Alta (CVE)	Carriçal (CVE)	Irrigation (CVE)	**Total** (CVE)
Hybrid System Estimated Annual Cost					
O&M	607,000	360,000	350,000	133,184	1,450,184
Fuel Cost	222,044	89,536	33,323		344,903
Electricity from grid				546,156	546,156
Total	**829,044**	**449,536**	**383,323**	**679,340**	**2,341,243**
Alternative diesel only scenario estimated annual costs					
O&M	1,368,000	684,000	1,140,000	133,184	3,325,184
Fuel Cost	1,190,054	638,352	484,802		2,313,207
Electricity from grid				1,460,420	1,460,420
Total	**2,558,054**	**1,322,352**	**1,624,802**	**1,593,604**	**7,098,812**
Net Annual Savings	**1,729,010**	**872,816**	**1,241,478**	**914,264**	**4,757,569**
Simple Payback with grant	**8.7**	**11.1**	**10.7**	**7.7**	**9.5**

Sensitivity Analysis

The economic evaluation above is based on a current diesel price of CVE112.20 and on a tariff for electricity of CVE 26 per kWh. As electricity production in Cape Verde relies significantly in fossil fuels, its prices are subject to fluctuation due to global oil prices. Higher oil prices will results in greater operational costs for the utility which will then be reflected in the tariffs. Consequently, an increase in the tariff will result in shorter payback periods for the scheme. The applies for the retail diesel price.
A sensitivity analysis for different electricity tariffs is shown in Table 11 and Table 12.

Table 35: Sensitivity analysis for the Figueiras project

Variation	-10%	0%	10%	20%
Diesel cost (per litre)	**100.98**	**112.20**	**123.42**	**134.64**
Hybrid system annual cost (CVE)	806,839	829,044	851,248	873,453
Diesel only scenario annual cost (CVE)	2,439,049	2,558,054	2,677,059	2,796,065
Project savings	1,632,209	1,729,010	1,825,811	1,922,612
Simple Payback with grant (years)	**9.2**	**8.7**	**8.2**	**7.8**

Table 36: Sensitivity analysis for the Ribeira Alta project

Variation	-10%	0%	10%	20%
Diesel cost (per litre)	**100.98**	**112.20**	**123.42**	**134.64**

Hybrid system annual cost (CVE)	806,839	829,044	851,248	873,453
Diesel only scenario annual cost (CVE)	2,439,049	2,558,054	2,677,059	2,796,065
Project savings	1,632,209	1,729,010	1,825,811	1,922,612
Simple Payback with grant (years)	**9.2**	**8.7**	**8.2**	**7.8**

Table 37: Sensitivity analysis for the Carriçal project

Variation	-10%	0%	10%	20%
Diesel cost (per litre)	**100.98**	**112.20**	**123.42**	**134.64**
Hybrid system annual cost (CVE)	379,991	383,323	386,656	389,988
Diesel only scenario annual cost (CVE)	1,576,322	1,624,802	1,673,282	1,721,762
Project savings	1,196,331	1,241,478	1,286,626	1,331,774
Simple Payback with grant (years)	**11.1**	**10.7**	**10.4**	**10.0**

Table 38: Sensitivity analysis for the Praia Branca irrigation project

Variation	-10%	0%	10%	20%
Electricity tariff (per kWh)	**23.40**	**26.00**	**28.60**	**31.20**
Hybrid system annual cost (CVE)	624,725	679,340	733,956	788,572
Diesel only scenario annual cost (CVE)	1,314,378	1,460,420	1,606,462	1,752,504
Project savings	689,653	781,080	872,506	963,932
Simple Payback with grant (years)	**9.2**	**8.7**	**8.2**	**7.8**

Environmental Impacts

Environmental Impacts

Equipment - Installing PV panels has little impact on the environment as the panels are silent in operation, and produce no emissions. The PV panels would either be mounted on existing buildings or on a frame, neither of these options requires a large amount of construction and there will be minimum disruption or impact on the environment due to installation.
Carbon emissions - The generation of electricity using a hybrid system compared to using a diesel generator only or energy from the grid would result in carbon dioxide emissions savings. The emission factor for the diesel and electricity that are displaced by using the renewable energy system was calculated on the following assumptions:

- 2.67 kg of CO_2 per litre of diesel displaced;
- 0.718 kg of CO_2 per kWh of electricity displaced.

The resulting carbon emission savings from this scheme are presented in the following table.

Table 39: Scheme emission reductions

	Figueiras	Ribeira Alta	Carriçal	Sao Nicolau - Irrigation	**Total**

Avoided diesel consumption (litres)	8,628	5,891	4,024	-	**17.543**
Avoided electricity consumption (kWh)	-	-	-	27,174	**27,174**
Emission reductions (tCO_2)	**23.1**	**13.1**	**10.8**	**21.5**	**68.3**

The diesel generator from the hybrid systems will only work intermittently and for short periods of time (works as a backup system in case there is not enough power generated by renewable energy). Diesel generators are generally noisy and polluting, reducing the reliance on these generators will have a positive effect on the local environment.

Conclusions

Installing hybrid wind-solar-diesel system to replace the current diesel generation system operating in Figueiras, Ribeira Alta and Carriçal will improve the life quality of the local populations by providing an uninterrupted, reliable electricity supply system in these remote rural areas with minimal input from expensive and polluting diesel generators.
The operation and maintenance costs will be the main barrier to the success of these projects, particularly the need to replace inverters every 8-10 years, and batteries every 5 years, especially if additional savings from this projects (such as reduction of the generation cost of electricity and the installation of a metering service for charging real consumption of electricity to the consumers) are not taken into account.
In the case of the Praia Branca Irrigation project, installing and hybrid wind-solar system to partially replace the necessary energy required by the horticulture project will lower the costs of the project and improve its sustainability. The investment costs will be the main barrier to the success of this project. However, by lowering the purchases of electricity from the grid the project would be capable of withstand steep increases in the electricity tariff.
If these renewable energy systems can be shown to be successful, then there is a high chance of replicating this across other communities in Cape Verde.

ANNEX G6: LIST OF POTENTIAL PROJECTS FOR THE SCALE-UP PHASE

No.	Project Name	Implementing Org.	Proposed tech.	Project size	Use of electricity	Short description of project	Total capital costs	Cost/kW	Source of other finance
				kW			kUSD	USD	
1	Windpower in S. Nicolau	Municipality/ Private		900	For Desalination Plant	Energy to offset energy costs in desalination and water pumping.	3075	**3417**	Municipality/Private/Bank
2	Hospital da Praia (Santiago)	Hospital Praia	SWH	50	Water Heating	SWH to heat hospital water, offset electricity costs	100	**2000**	Hospital/ Government
3	Hospital de Santa Catarina (Santiago)	Hospital S.Catarina	SWH	50	Water Heating	SWH to heat hospital water, offset electricity costs	100	**2000**	Hospital/ Government
4	Hospital de Sal (Sal)	Hospital Sal	SWH	40	Water Heating	SWH to heat hospital water, offset electricity costs	90	**2250**	Hospital/ Government
5	Electrification Ribeira Prata (S. Nicolau)	Municipality	Hybrid wind/PV/Diesel system	20	Domestic and commercial buildings	Hybrid wind/PV/batteries/diesel system, to electrify remote community	400	**20000**	Municipality/Government/ International Cooperation
6	PV/Wind System for water pumping (Ribeira Prata - S. Nicolau)	Municipality/ Ministry of Agriculture	PV/Wind connected to the grid	17	water pumping for irrigation	PV and Wind System, conneted to the electrical grid, offset electricity costs of the pumping system	150	**8824**	Municipality/International Cooperation
7	PV/Wind System for water pumping -municipality water supply (10 systems)	Municipalities	PV/Wind connected to the grid	40	fresh water pumping for water supply	PV System, conneted to the electrical grid, offset electricity costs of municipality water supply	180	**4500**	Municipality/International Cooperation
8	PV/Wind System for water pumping (10 Private	Ministry of Agriculture/Private	PV/Wind connected to the grid	30	water pumping for irrigation	PV and Wind System, conneted to the electrical grid, offset electricity costs of the pumping	135	**4500**	Private/International Cooperation

No.	Project Name	Implementing Org.	Proposed tech.	Project size	Use of electricity	Short description of project	Total capital costs	Cost/kW	Source of other finance
	systems)					system			
9	SWH for Hotels (5 hotels - 200 rooms)	Private	SWH	100	Water heating	SWH to heat hotel water, offset electricity costs	250	**2500**	Private
10	Solar Cooling System for the National Assembly	National Assembly (NA)	Solar Cooling	100	Cooling	Cooling system is biggest consummer at the Assembly building. Ecreee is developing a feasibility study for the SCS of NA to offset electricity costs.	580	**2071**	National Assembly/International Cooperation
11	RE Micro-grid in rural area in Santiago	ITC	Rural electrification	100	for domestic and productive uses	co-funded by the Canary Government (Spain); micro-grid project using different RE technologies; ECREEE coordinates activity;	520	**5200**	Government of Canary Islands
	Total			**1447**			**5580**	**3856**	

ANNEX G7: ECOWAS RENEWABLE ENERGY FACILITY (EREF)

BACKGROUND AND RELEVANCE

The ECOWAS Renewable Energy Facility (EREF) for rural and peri-urban areas was launched in May 2011 and is **managed by the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency (ECREEE)** based in Praia, Cape Verde. Under the Facility, ECREEE undertakes **regular demand-driven call for proposals.** The EREF **provides grants for small and medium sized renewable energy and energy efficiency (RE&EE) projects and businesses** in rural and peri-urban areas of West Africa. The EREF is established with initial support of the Austrian Development Cooperation (ADC), the Spanish Agency for International Development Cooperation (AECID) and technical assistance of the United Nations Industrial Development Organization (*UNIDO*). The Facility is open to other donor partners.

The Facility refers directly to the objectives and action plan of the **ECOWAS/UEMOA White Paper on Energy Access** in Peri-urban and Rural Areas. The policy document foresees that at least 20% of new investments in electricity generation in rural and peri-urban areas should originate from renewable sources. Action line 2 on investment promotion foresees the establishment of an RE&EE investment and innovation fund which raises funding for at least 200 demonstration projects and support local manufacturing and service companies.

With the Facility, ECREEE contributes also to the achievement of the UN Millennium Development Goals (MDGs), the **UN Goal on Universal Access to Clean, Affordable Energy by 2030** and the international agreements to reduce GHG emissions to keep the global average temperature rise below two degrees Celsius. Best practices and lessons learned from the executed EREF projects will be disseminated through the ECREEE network and the ECOWAS Renewable Energy Observatory (EREO).

The **first call for proposal of the EREF was launched in May 2011**. ECREEE received 151 proposals from all fifteen ECOWAS countries with an overall volume of 13 million EUR (requested EREF grant and indicated co-funding).

For more information on ECREEE and EREF please consult the website: http://www.ecreee.org/

ANNEX G8: TERMS OF REFERENCE FOR KEY PROJECT STAFF

TABLE OF CONTENTS

INTRODUCTION

This Annex forms part of the UNIDO Project Brief for the GEF-UNIDO project – Promoting Market Based Development of Small to Medium Scale Renewable Energy Systems in Cape Verde.

The document provides draft Terms of Reference for the key project staff foreseen as part of the technical assistance for the project. It is intended that UNIDO finalise the Terms of Reference prior to the selection process for the consultants.

Some of the Terms of Reference will be prepared by the National Project Manager during the project implementation and therefore are not included here.

OVERVIEW OF TECHNICAL ASSISTANCE FORESEEN

The following provides a summary of the international and national consultants required for the project. The right hand column indicates if the TOR is included here or if it will be prepared during the project implementation.

International staff

A summary of the international staff envisaged for the project is given in the following table.

Table 40: International consultants envisaged for the project

Position	Estimated person months	Tasks to be performed	TOR included
International RE expert	19	Overall project management, RE advice and project development of the pilot projects, training on RE	√
International RE policy expert	3	Consult and draft RE law, strategy and action plan	√
International energy regulation specialist	3	Consult and draft RE law, strategy and action plan	√
International project evaluator	6.5	Evaluation of the whole project	No
International RE finance expert	2	Prepare and consult on a detailed investment strategy and identify finance for RE in Cape Verde	√
Training expert	8	Preparation and execution of training in solar and wind project design, development and operation	√

These international experts will provide the specific technical expertise required to ensure the quality of the project activities. Therefore the areas of expertise will include international level training and capacity building as well as specific technical advice on the demonstration projects. At the beginning of the project the international RE expert will provide advice to ECREEE and the project management team to ensure a smooth start to the project. In addition international expertise is recommended to bring the level of knowledge required and international practice to the development of a new renewable energy law and tariff calculations. Finally it is recommended to use an international expert for the development of the investment strategy.

National staff

A summary of the input expected from national consultants and staff is included in the following table.

Table 41: National consultants envisaged for the project

Position	Estimated person months	Tasks to be performed	TOR included
Project manager	25	Project management, regular reporting, advice and training on RE	√
Project assistant	15	Project management, regular reporting, advice and training on RE	No
National RE trainers	17	Provide training on all aspects of RE from technical to commercial and social	No
National RE expert	19	Evaluation of demonstration and upscale projects	No
National evaluation expert	4	Ensuring contract terms and specifications are in line with national laws and regulations.	No
National policy expert	9	Preparation of draft RE law, strategy and action plan with international expert	√
National finance consultant	4	Provide local input into CV RE investment strategy	√

Technical Project components

National experts will be recruited to provide local technical expertise and services under the guidance of the international experts to develop and implement the renewable energy projects. These experts will primarily be professionals of local engineering consultancies, financing and legal experts. National experts will be recruited for helping the preparation of the RE and EE law as well as providing inputs to the investment strategy. Independent evaluation of the demonstration projects will be carried out by national experts. Finally the majority of the capacity building will be provided by national experts following training (under the train-the-trainers) programme.

Project management

The project management will be the responsibility of one key national consultant plus national consultants and staff at ECREEE. They will be trained by the international RE expert. The national project manager will be full time over the first three years, then part time in the final year and will not only be responsible for the overall project management but will also be providing RE advice and training. He/she will be responsible for liaison with UNIDO. One full time assistant will also be based at ECREEE supporting the project management team.

TERMS OF REFERENCE FOR INTERNATIONAL RENEWABLE ENERGY EXPERT

Post: International Renewable energy expert
Duration: 19 person months
Location: Cape Verde

Renewable energy training and project development in Cape Verde

Background

UNIDO is executing a GEF funded project to promote renewable energy in Cape Verde. The ultimate goal of the Project is to avoid greenhouse gas emissions by developing and promoting a market environment that will stimulate investments in small to medium scale renewable energy projects in Cape Verde which, in turn, will help drive economic growth, support rural electrification efforts in the country and contribute to poverty alleviation. The energy sector in Cape Verde, although with high electrification rates in all islands, is characterized by low levels of access to modern energy services and a high dependence on imported fossil fuels for electricity generation. The Government of Cape Verde's primary objective for the sector is the availability of a reliable system of energy supply that is efficient, affordable, sustainable and environmentally friendly. By demonstrating the technical feasibility and commercial viability of renewable energy projects; preparing an investment strategy for scaling up or replicating pilot projects and establishing a dedicated seed fund that will provide co-funding to support the development of small to medium scale renewable energy projects; strengthening the institutional capacity to effectively promote and support small to medium scale renewable energy development into economic and social sectors; and establishing a policy and legal environment that supports renewable energy market, market conditions will be created to foster the development of this type of projects.

The Project seeks to address some of the existing barriers to the development of small to medium scale renewable energy in Cape Verde through an integrated approach combining demonstration renewable energy projects with capacity building and technical assistance at the institutional, policy, market and project/investment level.

Primary target groups of the Project are government policy making and implementing institutions, the electricity utility, project developers, financial services providers, energy professionals, equipment suppliers, and energy consumers.

Project finance and technical assistance will be provided to support the development and implementation of a limited number of grid and off-grid small to medium scale renewable energy demonstration projects with high replication potential in various productive sectors (e.g. ice production, remote village electrification, tourism, hospitals and agriculture) and resulting in avoided GHG emissions.

A detailed investment plan and strategy for the dissemination of renewable energy in Cape Verde will be developed.

Technical assistance will be provided to ECREEE, MTIE, Cape Verde's Economic Regulatory Agency (ARE) and ELECTRA to develop and help establish a market oriented policy and regulatory instruments needed to support and stimulate the creation of a market for small to medium scale renewable energy.

The Project will build knowledge and in-depth technical capacity at ECREEE, and within ELECTRA, to allow ECREEE to become the focal point for renewable energy development in Cape Verde providing training and information to stimulate the market for small to medium scale renewable energy. In-house technical knowledge within ELECTRA will allow the utility to develop its own renewable energy projects to avoid further GHG emissions. Technical assistance and capacity building will also be provided for potential project developers, equipment suppliers and energy consumers as well as building up the capabilities at the University and the Employment and Vocational Training Institute to provide further training.

Objective

The objective of this consultancy is to provide support and training to the Project Management Office, to the MTIE and ECREEE so that their capacity is built to continue the project without assistance. In addition the work will include 'on-the-job' training including assistance in supervising the demonstration projects and providing technical assistance to the demonstration projects and investment scale-up projects.

Scope of Work

Consultancy services required consist of the following envisaged activities:

1) **Providing advice and training to ECREEE and the project management team to ensure a smooth start to the project.**
   This training is primarily aimed at the project management office for the project (MTIE and ECREEE) to ensure that MTIE has the capacity to not only undertake the project management but also for ECREEE to be a focal point for renewable energy within Cape Verde. The training will be on-the-job training as well as including some formal aspects of training on project management. The International RE expert will be based at ECREEE for a month at a time and will help MTIE to establish all the project reporting procedures required as well as identifying what is required and helping to develop ECREEE as a focal point.

   ECREEE should be able to provide awareness raising and capacity building, business development advice, market assessments, technology assessments, project identification and development, quality assurance for RE equipment, monitoring and evaluation of RE projects and also to hold a database of RE resources and projects.

2) **Technical advice for the demonstration projects**
   The International RE Expert will provide technical advice and some supervision of the demonstration projects in conjunction with the National Project Manager (NPM). The NPM has overall responsibility for the demonstration projects and will request assistance from the Expert where necessary.

Co-ordination

The Consultant will co-ordinate closely with the national project manager and other national and international experts.

Level of Effort and Schedule

The work is expected to take 19 person months. It is envisaged that the international consultant will visit Cape Verde four times during this period with the initial two visits being of at least one month duration each.

Qualification, required skills and experience

- Advanced degree in engineering or renewable energy with preference given to those with proven professional experience in the area of renewable energy in West Africa.
- Extensive knowledge of international project management, project commissioning and renewable energy project development.
- At least 10 years experience in the field.
- Demonstrated track record of relevant work in the mentioned area (publications, project documents, reports).
- Fluency in oral and written English is required.

TERMS OF REFERENCE FOR INTERNATIONAL RENEWABLE ENERGY TRAINER(S)

Post: International Renewable energy trainer(s)
Duration: 8 person months
Location: Home base plus travel to Cape Verde

Renewable Energy Training

Background
UNIDO is executing a GEF funded project to promote renewable energy in Cape Verde. The ultimate goal of the Project is to avoid greenhouse gas emissions by developing and promoting a market environment that will stimulate investments in small to medium scale renewable energy projects in Cape Verde which, in turn, will help drive economic growth, support rural electrification efforts in the country and contribute to poverty alleviation. The energy sector in Cape Verde, although with high electrification rates in all islands, is characterized by low levels of access to modern energy services and a high dependence on imported fossil fuels for electricity generation. The Government of Cape Verde's primary objective for the sector is the availability of a reliable system of energy supply that is efficient, affordable, sustainable and environmentally friendly. By demonstrating the technical feasibility and commercial viability of renewable energy projects; preparing an investment strategy for scaling up or replicating pilot projects and establishing a dedicated seed fund that will provide co-funding to support the development of small to medium scale renewable energy projects; strengthening the institutional capacity to effectively promote and support small to medium scale renewable energy development into economic and social sectors; and establishing a policy and legal environment that supports renewable energy market, market conditions will be created to foster the development of this type of projects.

The Project seeks to address some of the existing barriers to the development of small to medium scale renewable energy in Cape Verde through an integrated approach combining demonstration renewable energy projects with capacity building and technical assistance at the institutional, policy, market and project/investment level.

Primary target groups of the Project are government policy making and implementing institutions, the electricity utility, project developers, financial services providers, energy professionals, equipment suppliers, and energy consumers.

Project finance and technical assistance will be provided to support the development and implementation of a limited number of grid and off-grid small to medium scale renewable energy demonstration projects with high replication potential in various productive sectors (e.g. ice production, remote village electrification, tourism, hospitals and agriculture) and resulting in avoided GHG emissions.

A detailed investment plan and strategy for the dissemination of renewable energy in Cape Verde will be developed.

Technical assistance will be provided to ECREEE, MTIE, the Economic Regulatory Agency and ELECTRA to develop and help establish the market oriented policy and regulatory instruments needed to support and stimulate the creation of a market for small to medium scale renewable energy.

The Project will build knowledge and in-depth technical capacity at ECREEE, and within ELECTRA. This will allow ECREEE to become the focal point for renewable energy development in Cape Verde providing training and information to stimulate the market for small to medium scale renewable energy. In-house technical knowledge within ELECTRA will let the utility to develop its own renewable energy projects to avoid further GHG emissions. Technical assistance and capacity building will also be provided for potential project developers, equipment suppliers and energy consumers as well as building up the capabilities at the University and the Employment and Vocational Training Institute to provide further training.

Objective

The objective of this consultancy is to build and strengthen technical capacity with respect to renewable energy at the institutional, market and enterprises level through both a "train-the-trainers" approach and through direct training. The consultant (or consultants) will develop and execute relevant training programmes.

It is envisaged that the training will not only result in further RE project development but that it will also result in a number of experts who will be able to train others in the market beyond the GEF project. As a result, the training will include training targeted at the potential market participants as well as at organizations that will be able to provide training such as ECREEE, ELECTRA, the University of Cape Verde, the Employment and Vocational Training Institute (IEFP, from the Portuguese acronym for Instituto do Emprego e Formação Profissional) and the Business School. It is envisaged that some of the training developed will be able to be incorporated as modules in existing courses at the University of Cape Verde, IEFP and the Business School.

Scope of Work

The consultancy services required consist of the following tasks:

1) Development of a detailed working plan for the execution of the training programme (schedule, role and responsibilities, milestones, etc.)
2) Preparation of the training material and logistics including the training guides for the train-the-trainers course.

   The Consultants will prepare the training material for each of the envisaged modules or courses:
   - Renewable Energy opportunities and potential
   - Identification, development and management of RE projects
   - Design and development of RE projects (wind and solar specific)
   - Financing instruments for RE projects
   - Operation and maintenance of RE projects
   - Technical grid connection issues

   The Consultants will prepare minimum requirements for the Trainers to be trained. The National Project Manager will help in the selection of trainees, the identification of 1 or 2 demonstration projects for the practical training, securing approval for site visits, classroom logistics, etc.
3) Carry out the 1st training session – Train the trainers plus other trainees

The Consultants will provide training to national trainees in classroom and at demonstration projects in each of the modules/courses prepared in Step 1.
The training will be both in the classroom as well as at the demonstration projects for on-the-job training. So for each of the courses the Consultants will train national RE experts on use of the training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching and delivering the first training; co-teaching and delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback on the teaching and training techniques. Any future training will be delivered by the national experts alone.

4) Remote advice
Following the first training session it is envisaged that some of the trainees will apply the knowledge, skills and tools that have been provided to identify potential RE projects and to start on the design and development of these projects. During this period of time, trainees will have access to the trained trainers and limited access to Consultant's technical advice.

5) Assist and oversee the 2nd training period which will be carried out in conjunction with the trained trainers from the "Train-the-Trainers" course.

6) Oversee and evaluate the third training session carried out by trained trainers.

7) Assist in the development of modules and training materials for courses at the University of Cape Verde and Employment and Vocational Training Institute based on the "Train-the-Trainers" course.

BACKGROUND TO TRAINING AND PROPOSED COURSES

THE TRAIN THE TRAINERS – ENERGY EXPERT TRAINING

A group of approximately 20 professionals will be trained in a classroom, on-the-job and mentored by the international expert team and equipped with the expertise and the tools required for providing the following services:

- Providing technical assistance to enterprises and coaching on renewable energy implementation
- Conducting short (one-half day) awareness raising meetings for managers on the benefits and opportunities of renewable energy and showcasing the support available to participating companies (1/2 day meetings are included in Project Component 2)
- Conducting training sessions for stakeholders interested in developing their own renewable energy projects.

It is expected that the 20 persons will come from MTIE, ECREEE, ELECTRA, ARE, the University of Cape Verde, the Employment and Vocational Training Institute (IEFP, from the Portuguese acronym for Instituto de Emprego e Formação Profissional) and the Business School. Some of the trained professionals will subsequently assume roles as RE Experts and become a source of expertise and services for the GEF project as well as for the nascent renewable energy sector.

PROPOSED COURSES

IDENTIFICATION, DEVELOPMENT AND MANAGEMENT OF RENEWABLE ENERGY PROJECTS TRAINING

This two-day training is targeted to the management and technical people involved in developing RE projects. It is expected that the participants will be identified as part of the meetings in Project Component 2 who are looking to develop a project, possibly with support from the GEF project. The training will provide an overview of all the issues relating to renewable energy project development and will also act as an introduction to the more detailed design and operation training courses. The training will help to identify what sort of projects each participant could develop at their sites and will help them to identify the technical issues as well as to carry out a life cycle cost analysis of the project and provide an overview on software for RE potential analysis such as the RETScreen.

A series of 3 of these two-day trainings is envisaged with the target of training 40 managers/personnel.

The UNIDO international expert team will train national RE experts on the two-days training curriculum. The training will be introduced to the national experts in three stages: observing the international experts teaching and delivering the first training; co-teaching and delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback on the teaching and training techniques. Any future training will be delivered by the national experts alone.

DESIGN AND DEVELOPMENT OF RENEWABLE ENERGY PROJECTS

This two-day training is targeted to the technical person responsible for developing renewable energy projects and is designed as a follow-on from the Identification training. There will be one day that is technology generic and then the training programme will split into two separate sessions for solar and wind projects.

The course will ensure that the participants understand all the issues relating to the design and development of renewable energy projects from assessing the site specific resource available, to sizing and designing a system, commissioning specifications, planning and permitting and providing links to additional information resources. The training will include issues incorporated in tendering and how to oversee the project installation. The intention is that the training would be split with an initial two day training session and then the participants apply their knowledge before a final day of advanced training where issues that have come up are explored.

A series of 3 of these two-day trainings is envisaged with the target of training 40 managers/personnel.

The UNIDO international expert team will train national RE experts on use of the training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching and delivering the first training; co-teaching and delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback on the teaching and training techniques. Any future training will be delivered by the national experts alone.

FINANCING INSTRUMENTS FOR RE PROJECTS

This one-day course is targeted at developers and financial institutions which are interested in investing in RE projects and wish to understand better the issues involved. The training will guide participants through an analysis of the existing financing instruments, including carbon financing, available for renewable energy projects and on how to analyse the financial viability of these projects. The training is intended to be held in a classroom. A series of 3 of these one-day trainings is envisaged with the target of training 30 participants.

OPERATION AND MANAGEMENT OF RENEWABLE ENERGY PROJECTS

This two-day training is targeted at developers and technicians looking at developing a RE project who wish to understand better the issues associated with the operation and management of RE projects. The training will guide participants through operational and management issues of renewable energy projects including monitoring and quality control. This will include the maintenance requirements for different types of projects including daily checks and maintenance to unplanned overhauls as well as the resources needed and the spares required. The training is intended to be classroom and project based with visits and demonstrations at the pilot projects. A series of 3 of these two-day trainings is envisaged with the target of training 40 technicians.

The UNIDO international expert team will train national RE experts on use of the two-day training curriculum. This curriculum will be introduced to the national experts in three stages: observing the international experts teaching and delivering the first training; co-teaching and delivering the second training with the international experts; and delivering the third training with international experts observing and providing feedback on the teaching and training techniques. Any future meetings will be delivered by the national experts alone.

TECHNICAL GRID CONNECTION ISSUES FOR RENEWABLE ENERGY

This training is primarily targeted at ELECTRA and the project developers to ensure that there are no negative consequences either to the operation of the transmission and distribution network or to the smooth operation of renewable energy projects. The course will cover the distribution, stability, power grid quality concepts and the effects of renewable energy into the grid and how to minimise the effect of intermittent energy generation. It is envisaged that this training will be one week long at ELECTRA and will be provided by International Experts.

DEVELOPMENT OF MODULES FOR UNIVERSITY OF CAPE VERDE

The courses outlined above will be edited so that they become modules for insertion in technicians training courses and electrical engineering courses at the University of Cape Verde. In addition the modules will be offered as separate short courses for previously qualified technicians or engineers who wished to upgrade their skills to include renewable technologies.

DEVELOPMENT OF MODULES FOR THE EMPLOYMENT AND VOCATIONAL TRAINING INSTITUTE

The courses outlined above will be edited so that they become modules for insertion in RE related training courses at the Employment and Vocational Training Institute. In addition the modules will be offered as separate short courses for previously qualified technicians or engineers who wished to upgrade their skills to include renewable technologies.

DEVELOPMENT OF MODULES FOR BUSINESS SCHOOL

The courses outlined above will be edited so that they become modules for insertion in technicians training course and electrical engineering courses at the Business School. In

addition the modules will be offered as separate short courses for previously qualified technicians or engineers who wished to upgrade their skills to include renewable technologies.

Co-ordination

The Consultants will co-ordinate closely with National Project Manager, who is responsible for all the training as well as with University of Cape Verde, Employment and Vocational Training Institute (IEFP, Instituto do Emprego e Formação Profissional) and the Business School.

Level of Effort and Schedule

The work is expected to take 8 person months over an 18 month period. It is envisaged that the international consultants will visit Cape Verde six times during this period for the consultation periods and meeting.

Qualification, required skills and experience

- Advanced degree in engineering or renewable energy with preference given to those with proven professional experience in the area of renewable energy in West Africa
- Experienced trainer in renewable energy at a recognised institution
- Extensive knowledge of solar and wind technologies.
- At least 10 years experience in the field.
- Demonstrated track record of relevant work in the mentioned area (publications, project documents, reports).
- Fluency in oral and written English is required

TERMS OF REFERENCE FOR AN INTERNATIONAL POLICY AND RENEWABLE ENERGY REGULATION EXPERT

Post: Policy and Renewable Energy Regulation Expert
Duration: 6 person months
Location: Home base plus travel to Cape Verde

Renewable Energy Law, Policy and Action plan Preparation

Background

UNIDO is executing a GEF funded project to promote renewable energy in Cape Verde. The ultimate goal of the Project is to avoid greenhouse gas emissions by developing and promoting a market environment that will stimulate investments in small to medium scale renewable energy projects in Cape Verde which, in turn, will help drive economic growth, support rural electrification efforts in the country and contribute to poverty alleviation. The energy sector in Cape Verde, although with high electrification rates in all islands, is characterized by low levels of access to modern energy services and a high dependence on imported fossil fuels for electricity generation. The Government of Cape Verde's primary objective for the sector is the availability of a reliable system of energy supply that is efficient, affordable, sustainable and environmentally friendly. By demonstrating the technical feasibility and commercial viability of renewable energy projects; preparing an investment strategy for scaling up or replicating pilot projects and establishing a dedicated seed fund that will provide co-funding to support the development of small to medium scale renewable energy projects; strengthening the institutional capacity to effectively promote and support small to medium scale renewable energy development into economic and social sectors; and establishing a policy and legal environment that supports renewable energy market, market conditions will be created to foster the development of this type of projects.

The Project seeks to address some of the existing barriers to the development of small to medium scale renewable energy in Cape Verde through an integrated approach combining demonstration renewable energy projects with capacity building and technical assistance at the institutional, policy, market and project/investment level.

Primary target groups of the Project are government policy making and implementing institutions, the electricity utility, project developers, financial services providers, energy professionals, equipment suppliers, and energy consumers.

Project finance and technical assistance will be provided to support the development and implementation of a limited number of grid and off-grid small to medium scale renewable energy demonstration projects with high replication potential in various productive sectors (e.g. ice production, remote village electrification, tourism, hospitals and agriculture) and resulting in avoided GHG emissions.

A detailed investment plan and strategy for the dissemination of renewable energy in Cape Verde will be developed.

Technical assistance will be provided to ECREEE, the MTIE, the Economic Regulatory Agency (ARE, from the Portuguese acronym Agência de Regulação Económica) and ELECTRA to develop and help establish the market oriented policy and regulatory

instruments needed to support and stimulate the creation of a market for small to medium scale renewable energy.

The Project will build knowledge and in-depth technical capacity at ECREEE, and within ELECTRA, to allow ECREEE to become the focal point for renewable energy development in Cape Verde providing training and information to stimulate the market for small to medium scale renewable energy. In-house technical knowledge within ELECTRA will allow the utility to develop its own renewable energy projects to avoid further GHG emissions. Technical assistance and capacity building will also be provided for potential project developers, equipment suppliers and energy consumers as well as building up the capabilities at the University and the Employment and Vocational Training Institute to provide further training.

Objective
The objective of this consultancy is to develop strengthen the existing RE laws, regulations and associated strategies and action plans that will facilitate the development of a small to medium scale renewable energy market in Cape Verde.

The International Energy Regulation Specialist and RE Policy Expert will work with the National legal and policy experts and co-ordination with ARE.

Scope of Work
Consultancy services required consist of the following tasks:

1. **Review of current regulations related to small and medium scale renewable energy projects.**

To ensure that existing laws and regulations address current barriers to investment in small to medium scale renewable energy, a comprehensive review of current regulations in Cape Verde related to small and medium scale renewable energy projects will be undertaken.

2. **Stakeholder consultation**

A stakeholder consultation will be held with MTIE, ELECTRA, ARE, relevant government agencies and potential project developers. This consultation will to identify any regulatory barriers to the development of renewable energy projects and discuss how these could be overcomed through revisions or additions to the current legal and regulatory framework.

3. **Report detailing recommendations of revisions or additions needed to current policy and regulatory framework**

Using the results from the consultation a report will be produced with propositions for policy and regulations to enable the development of small to medium scale renewable energy into the economic and social sectors.

Following review by the MTIE and ARE the document will be revised to include comments provided and submitted to the Government of Cape Verde for consideration.

Co-ordination
In addition to the co-ordination with the dedicated working group the consultant will co-ordinate with the national project manager, ARE and also the national legal expert.

Level of Effort and Schedule

The work is expected to take 6 person months over an 8 month period. It is envisaged that the international consultant will visit Cape Verde three times during this period for the consultation periods and meeting.

Qualification, required skills and experience

- Advanced degree in economics, policy or renewable energy with preference given to those with proven professional experience in the area of renewable energy policy in West Africa.
- Extensive knowledge of renewable energy financial, policy and legal frameworks, renewable energy financing, renewable energy business development and policy formulation.
- At least 10 years experience in the RE policy
- Demonstrated track record of relevant work in the mentioned area (publications, project documents, reports).
- Fluency in oral and written English is required.

TERMS OF REFERENCE FOR INTERNATIONAL RENEWABLE ENERGY FINANCE EXPERT

Post: Renewable Energy Finance Expert
Duration: 2 person months
Location: Home base plus travel to Cape Verde

Detailed Renewable Energy Investment Strategy for Cape Verde

Background

UNIDO is executing a GEF funded project to promote renewable energy in Cape Verde. The ultimate goal of the Project is to avoid greenhouse gas emissions by developing and promoting a market environment that will stimulate investments in small to medium scale renewable energy projects in Cape Verde which, in turn, will help drive economic growth, support rural electrification efforts in the country and contribute to poverty alleviation. The energy sector in Cape Verde, although with high electrification rates in all islands, is characterized by low levels of access to modern energy services and a high dependence on imported fossil fuels for electricity generation. The Government of Cape Verde's primary objective for the sector is the availability of a reliable system of energy supply that is efficient, affordable, sustainable and environmentally friendly. By demonstrating the technical feasibility and commercial viability of renewable energy projects; preparing an investment strategy for scaling up or replicating pilot projects and establishing a dedicated seed fund that will provide co-funding to support the development of small to medium scale renewable energy projects; strengthening the institutional capacity to effectively promote and support small to medium scale renewable energy development into economic and social sectors; and establishing a policy and legal environment that supports renewable energy market, market conditions will be created to foster the development of this type of projects.

The Project seeks to address some of the existing barriers to the development of small to medium scale renewable energy in Cape Verde through an integrated approach combining demonstration renewable energy projects with capacity building and technical assistance at the institutional, policy, market and project/investment level.

Primary target groups of the Project are government policy making and implementing institutions, the electricity utility, project developers, financial services providers, energy professionals, equipment suppliers, and energy consumers.

Project finance and technical assistance will be provided to support the development and implementation of a limited number of grid and off-grid small to medium scale renewable energy demonstration projects with high replication potential in various productive sectors (e.g. ice production, remote village electrification, tourism, hospitals and agriculture) and resulting in avoided GHG emissions.

A detailed investment plan and strategy for the dissemination of renewable energy in Cape Verde will be developed.

Technical assistance will be provided to ECREEE, the MTIE, Cape Verde Regulatory Agency (ARE, from the Portuguese acronym Agência de Regulação Económica) and ELECTRA to develop and help establish the market oriented policy and regulatory instruments needed to support and stimulate the creation of a market for small to medium scale renewable energy.

The Project will build knowledge and in-depth technical capacity at ECREEE, and within ELECTRA, to allow ECREEE to become the focal point for renewable energy development in Cape Verde providing training and information to stimulate the market for small to medium scale renewable energy. In-house technical knowledge within ELECTRA will allow the utility to develop its own renewable energy projects to avoid further GHG emissions. Technical assistance and capacity building will also be provided for potential project developers, equipment suppliers and energy consumers as well as building up the capabilities at the University and the Employment and Vocational Training Institute to provide further training.

Objective

The objective of this consultancy is to prepare and consult on a detailed investment strategy for small to medium scale renewable energy in Cape Verde.

The output of this assignment will result in an investment plan that will identify where potential RE projects can be developed, the scale of capital expenditure required and, for each project, a scheduled activities timeline and potential returns.

The plan will also identify sources of funding including international donor agencies, international financial institutions and domestic institutions. This plan will differ from the recent study carried out by Martifer as it will focus in small to medium scale RE projects and not in large-scale electricity production.

The consultant will also provide support and guidance in the execution of the study of options to provide 100% RE electricity for Brava.

The International RE finance expert with work closely with the National Project Manager and a local financial expert. Close co-ordination will be required with the awareness raising activities.

Scope of Work

Consultancy services required consist of the following envisaged activities:

1. **Identification of potential renewable energy projects in each economic sector of Cape Verde**

   The Consultant will liaise with the National Project Manager on the planning of a number of meetings, targeted at different market participants, to identify additional RE projects that can be developed in short term, discuss the limitations to renewable energy investment and to brainstorm possible ways to access finance.

   This will identify both new projects and analyse the scope for replication from the demonstration projects already identified for submission for seed financing.

   Initial work has shown a number of projects that could form part of the investment strategy, namely projects identified whilst preparing this project. These include the wind power projects, hybrid systems for electrification of villages and to supply irrigation systems, solar water heating systems for hospitals and PV systems for electricity generation. It is expected that these types of projects can be replicated across all the Cape Verde islands.

2. **Consultation on opportunities and limitations of renewable energy investment in Cape Verde**
   Meetings with the market participants will be held to discuss the limitations to renewable energy investment and to brainstorm possible ways to access finance.

3. **Detailed cost plan prepared based on the projects identified**
   The financial commitment required against each of these projects will be identified to estimate the total investment needed and the potential returns for each project.

4. **Identify potential sources of funding**
   The RE finance expert will identify possible sources of funding for RE projects both internationally and nationally to feed into the investment plan. The Ministry of Environment, Rural Development and Marine Resources will be involved in this process as the Designated National Authority for CDM in Cape Verde to investigate potential financing through CDM.

5. **Prepare full investment plan**
   A full RE investment plan will be developed including the detailed cost plan for RE development and the identification of finance. This plan will be used by the Government of Cape Verde to help raise finance for small to medium scale RE projects. The plan will identify where potential renewable energy projects can be developed, the scale of capital expenditure required and for each project the potential return on investment. The plan will identify further sources of funding including international donor agencies, international financial institutions and domestic institutions.

6. **Provide support and advice on the Study of options to provide 100% RE electricity for Brava**
   The Government of Cape Verde set out within the Cape Verde National Energy Policy the requirement for one of the islands to have electricity provided by 100% RE. Being Brava the targeted island.

   The consultant will assess the RE resource of the island, and analysis the various options to provide the island with electricity 100% from RE. The work will review the different feasible renewable technologies and energy storage systems appropriate for the island and provide a report detailing the technical options to meet this 100% RE target along with an outline budget to implement these options.

Co-ordination
In addition to the co-ordination with the national counterparts the consultant will co-ordinate with the national project manager and a national finance consultant.

Level of Effort and Schedule
The work is expected to take 2 person months over a 6 month period. It is envisaged that the international consultant will visit Cape Verde two times during this period for the consultation periods and meeting.

Qualification, required skills and experience

- Advanced degree in renewable energy with preference given to those with proven professional experience in conducting similar studies in islands or remote locations.
- Extensive knowledge of renewable energy financing, renewable energy business development, investment plans and renewable energy funds.
- At least 10 years experience in the field.
- Demonstrated track record of relevant work in the mentioned area (publications, project documents, reports).
- Fluency in oral and written English is required.

TERMS OF REFERENCE FOR A NATIONAL PROJECT MANAGER

Post: National project manager
Duration: 25 months
Location: Cape Verde

Project management

Background
UNIDO is executing a GEF funded project to promote renewable energy in Cape Verde. The ultimate goal of the Project is to avoid greenhouse gas emissions by developing and promoting a market environment that will stimulate investments in small to medium scale renewable energy projects in Cape Verde which, in turn, will help drive economic growth, support rural electrification efforts in the country and contribute to poverty alleviation. The energy sector in Cape Verde, although with high electrification rates in all islands, is characterized by low levels of access to modern energy services and a high dependence on imported fossil fuels for electricity generation. The Government of Cape Verde's primary objective for the sector is the availability of a reliable system of energy supply that is efficient, affordable, sustainable and environmentally friendly. By demonstrating the technical feasibility and commercial viability of renewable energy projects; preparing an investment strategy for scaling up or replicating pilot projects and establishing a dedicated seed fund that will provide co-funding to support the development of small to medium scale renewable energy projects; strengthening the institutional capacity to effectively promote and support small to medium scale renewable energy development into economic and social sectors; and establishing a policy and legal environment that supports renewable energy market, market conditions will be created to foster the development of this type of projects.

The Project seeks to address some of the existing barriers to the development of small to medium scale renewable energy in Cape Verde through an integrated approach combining demonstration renewable energy projects with capacity building and technical assistance at the institutional, policy, market and project/investment level.

Primary target groups of the Project are government policy making and implementing institutions, the electricity utility, project developers, financial services providers, energy professionals, equipment suppliers, and energy consumers.

Project finance and technical assistance will be provided to support the development and implementation of a limited number of grid and off-grid small to medium scale renewable energy demonstration projects with high replication potential in various productive sectors (e.g. ice production, remote village electrification, tourism, hospitals and agriculture) and resulting in avoided GHG emissions.

A detailed investment plan and strategy for the dissemination of renewable energy in Cape Verde will be developed.

Technical assistance will be provided to ECREEE, the MTIE, Cape Verde Regulatory Agency (ARE, from the Portuguese acronym Agência de Regulação Económica) and ELECTRA to develop and help establish the market oriented policy and regulatory instruments needed to support and stimulate the creation of a market for small to medium scale renewable energy.

The Project will build knowledge and in-depth technical capacity at ECREEE, and within ELECTRA, to allow ECREEE to become the focal point for renewable energy development in Cape Verde providing training and information to stimulate the market for small to medium scale renewable energy. In-house technical knowledge within ELECTRA will allow the utility to develop its own renewable energy projects to avoid further GHG emissions. Technical assistance and capacity building will also be provided for potential project developers, equipment suppliers and energy consumers as well as building up the capabilities at the University and the Employment and Vocational Training Institute to provide further training.

Objective

The objective of this role is to provide the day-to-day management, monitoring and evaluation of project activities as in the agreed project work plan. The National Project Manager (NPM) will coordinate all project activities being carried out by project national experts and partners and will co-ordinate work with international consultants. The NPM will also be in charge of the organization of the various seminars and training to be carried out within the project. The NPM will provide technical advice and training on renewable energy to stakeholders in Cape Verde.

Proposed Project Management Arrangement

UNIDO holds the ultimate responsibility for the implementation of the project, the delivery of the planned outputs and the achievement of the expected outcomes. The project will be directly executed by UNIDO in collaboration with the MTIE, and ECREEE.

In UNIDO headquarters a senior project manager will be responsible for the general management and monitoring of the project, and reporting on the project performance to GEF. UNIDO will be in charge of procuring the international and national expertise, technologies and services needed to deliver the outputs planned under the four project components. It will manage, supervise and monitor the work of the international teams and ensure that deliverables are technically sound and consistent with the requirements of the project.

As agreed with the Government of Cape Verde, the MTIE will have overall project coordination responsibility. A Project Management Office (PMO) will be hosted at the Secretariat of ECREEE based in Praia, Cape Verde. The PMO-ECREEE set-up will consist of a National Project Manager (NPM) and a Project Administrative Assistant (PAA). Operating as an entity, the PMO will be responsible for the day-to-day management, monitoring and evaluation of project activities as in the agreed project work plan. The PMO will coordinate all project activities being carried out by project national experts and partners. It will also be in charge of the organisation of awareness raising seminars and training. During the whole implementation period of the project UNIDO will provide the PMO with the necessary management and monitoring support. The PMO will also be responsible for the communication and dissemination of the opportunities and results from this project which is important to the sustainable development of the renewable energy market in Cape Verde.

A Project Steering Committee (PSC) will be established for periodically reviewing and monitoring project implementation progress, facilitate co-ordination between project partners, provide transparency and guidance, and ensuring ownership, support and sustainability of the project results. The Steering Committee will have a balanced representation from key ministries, public institutions, private sector, NGOs, UNIDO and other international organizations partnering in the project or having relevant ongoing programmes. The final

composition of the Steering Committee will be defined during the project implementation start-up phase.

The PMO will also be responsible for the communication and dissemination of opportunities and resulting from this project. A programme of awareness raising of stakeholders will take place to ensure the project has lasting results. These stakeholders will include regional governments, investors, installers and local business which could benefit from RE.

Scope of Work
The National Project Manager will be required to carry out the following envisaged activities:

1) **Prepare a detailed working plan for the entire project**
   At the beginning of project implementation a detailed working plan for the entire duration of the project will be developed by UNIDO in collaboration with the PMO, ECREEE and the MTIE. The working plan will clearly define roles and responsibilities for the execution of project activities, including monitoring and evaluation; setting milestones for deliverables and outputs. The working plan will be used as a management and monitoring tool by the PMO and UNIDO and reviewed and updated as appropriate on a biannual basis.

2) **Prepare Terms of Reference and recruit a Project Assistant for the duration of the project**
   Following recruitment of the Project Assistant the NPM will responsible for the management of the Assistant.

3) **Day to day coordination, management and monitoring of all project activities**
   The NPM will be responsible for the day-to-day management, monitoring and evaluation of project activities as in the agreed project work plan. The format for reporting and monitoring will be established at the beginning of the project.

4) **Project Management Office Reporting**
   At the beginning of the project the Project Steering Committee and UNIDO should agree on the reporting format of the PMO.

5) **Responsible for coordinating work of renewable international energy consultants and the local consultants**
   The NPM will ensure that there is full co-ordination between all the international consultants and the local consultants as well as facilitating the visits and logistics of the international consultants and co-ordination with Government organisations.

6) **Managing the demonstration projects**
   Overseeing and reporting on all the demonstration projects. The NPM will be responsible for ensuring that the demonstration projects follow the required process related with the grant funding. Regular reporting on the progress of each demonstration project will be required. It is expected that the NPM will visit all the project sites to check progress and completion.

7) **Organisation of the awareness raising meetings for different sectors of the economy**
The NPM will be responsible for organising a series of meetings and training on renewable energy targeted to enterprises' top management, managers and engineers. Meetings and training will be mainly delivered by the national experts trained under this project. The NPM will be responsible for selecting the trainers and national experts. A detailed working plan for the execution of this task (schedule, venues, trainers, etc) will be developed prior to the execution of 10 to 12 half day meetings. The feedback from these meetings will be fed to the International and National RE Finance Consultants. Following the completion of the meetings the NPM will provide follow up information to the participants on the project.

8) **Organisation and management of the training components of the project**
This project component aims to build and strengthen technical capacity with respect to renewable energy at the institutional, market and enterprises level through both a "train-the-trainers" approach and direct training. The NPM will be responsible for liaising with the international training experts and the national experts to develop a detailed working plan for the execution of a training programme (including schedules, roles and responsibilities, milestones etc). The NPM will help in the selection of the 'train-the-trainers' participants and will be responsible for the logistics and identifying the demonstration projects for the training. The NPM will then check the progress and manage the preparation of the training material and will be responsible for the logistics of the training. The NPM will also ensure that the training is evaluated.

9) **Project website**
The NPM will be responsible for the design, development and maintenance of a website. It is envisaged that this would be sub-contracted but the content of the website will be prepared by the NPM in collaboration with the Steering Committee. The website should include, as a minimum, details of the Project and details on technologies, case studies from the demonstration projects. An on-line database of existing and potential renewable energy projects in Cape Verde should also be included in the website.

10) **Preparation of TORs & recruitment of evaluation consultants**
The evaluation of the demonstration projects will be carried out by an independent national consultant with the help of a local economist. Each project evaluation should follow the same reporting structure developed and established for this project.

11) **A dissemination programme will be designed**
The NPM will be responsible for designing a dissemination programme to raise awareness of the demonstration projects and of small to medium scale renewable energy in Cape Verde. It is possible that some of this task could be sub-contracted to others.

12) **Support on developing the Study of options to provide 100% RE electricity for Brava**
The Government of Cape Verde set out within the Cape Verde National Energy Policy the requirement for one of the islands to have electricity provided by 100% from RE. Being Brava the targeted island.

The NPM will provide support to the International RE finance experts in developing a study to assess the RE resource of the island, and analysis the various options to provide the island with electricity 100% from RE.

13) **Assist UNIDO staff in processing claims, selection of consultants and other contract related matters**

14) **Assist in reviewing, commenting on and editing, when necessary, reports prepared by national and international consultants in consultation with the PSC and UNIDO**

15) **The consultant will perform other tasks as reasonably requested by UNIDO and the Project management committee.**

16) **Assist UNIDO staff in conducting fact-finding and market consultation missions where necessary**

Level of Effort and Schedule

The work is expected to be developed in 36 months over three years. The NPM will be based at the Project Management Office in ECREEE.

Qualification, required skills and experience

- Advanced degree in economics, engineering or renewable energy.
- Extensive knowledge of renewable energy technologies, training, financing, renewable energy business development, and project management.
- At least 10 years experience in the field.
- Demonstrated track record of relevant work in the mentioned area (publications, project documents, reports).
- Fluency in oral and written English is required.

TERMS OF REFERENCE FOR NATIONAL POLICY EXPERTS

Posts: National Policy Expert
Duration: 9 person months
Location: Cape Verde

Background

UNIDO is executing a GEF funded project to promote renewable energy in Cape Verde. The ultimate goal of the Project is to avoid greenhouse gas emissions by developing and promoting a market environment that will stimulate investments in small to medium scale renewable energy projects in Cape Verde which, in turn, will help drive economic growth, support rural electrification efforts in the country and contribute to poverty alleviation. The energy sector in Cape Verde, although with high electrification rates in all islands, is characterized by low levels of access to modern energy services and a high dependence on imported fossil fuels for electricity generation. The Government of Cape Verde's primary objective for the sector is the availability of a reliable system of energy supply that is efficient, affordable, sustainable and environmentally friendly. By demonstrating the technical feasibility and commercial viability of renewable energy projects; preparing an investment strategy for scaling up or replicating pilot projects and establishing a dedicated seed fund that will provide co-funding to support the development of small to medium scale renewable energy projects; strengthening the institutional capacity to effectively promote and support small to medium scale renewable energy development into economic and social sectors; and establishing a policy and legal environment that supports renewable energy market, market conditions will be created to foster the development of this type of projects.

The Project seeks to address some of the existing barriers to the development of small to medium scale renewable energy in Cape Verde through an integrated approach combining demonstration renewable energy projects with capacity building and technical assistance at the institutional, policy, market and project/investment level.

Primary target groups of the Project are government policy making and implementing institutions, the electricity utility, project developers, financial services providers, energy professionals, equipment suppliers, and energy consumers.

Project finance and technical assistance will be provided to support the development and implementation of a limited number of grid and off-grid small to medium scale renewable energy demonstration projects with high replication potential in various productive sectors (e.g. ice production, remote village electrification, tourism, hospitals and agriculture) and resulting in avoided GHG emissions.

A detailed investment plan and strategy for the dissemination of renewable energy in Cape Verde will be developed.

Technical assistance will be provided to ECREEE, the MTIE, Cape Verde Regulatory Agency (ARE, from the Portuguese acronym Agência de Regulação Económica) and ELECTRA to develop and help establish the market oriented policy and regulatory instruments needed to support and stimulate the creation of a market for small to medium scale renewable energy.

The Project will build knowledge and in-depth technical capacity at ECREEE, and within ELECTRA, to allow ECREEE to become the focal point for renewable energy development in Cape Verde providing training and information to stimulate the market for small to medium

scale renewable energy. In-house technical knowledge within ELECTRA will allow the utility to develop its own renewable energy projects to avoid further GHG emissions. Technical assistance and capacity building will also be provided for potential project developers, equipment suppliers and energy consumers as well as building up the capabilities at the University and the Employment and Vocational Training Institute to provide further training.

Objective
The objective of this consultancy is to strengthen the existing RE laws, regulations and associated strategies and action plans to facilitate the development of a small to medium scale renewable energy market in Cape Verde.

In particular the national consultants will help the International Consultant to become familiar with their tasks by researching and compiling all relevant government policies, regulations, and procedures adopted.

The national consultants will work closely with the International Consultant, National Project Manager and the Project Management Office.

Scope of Work
Consultancy services required consist of the following three tasks:

1. **Review of current regulations related to small and medium scale renewable energy projects.**
   The national consultant will provide support to the Policy and Regulation RE International Consultant to ensure that current laws and regulations address the current barriers to investment in small to medium scale renewable energy

2. **Stakeholder consultation**
   A stakeholder consultation will be held with MTIE, ELECTRA, ARE, relevant government agencies and potential project developers. This consultation is intended to identify any regulatory barriers to the development of renewable energy projects and discuss how these could be overcome through revisions or additions to the current legal and regulatory framework.

   In National Consultant will be responsible for setting up the meetings required for the consultation.

3. **Report detailing recommendations of revisions or additions needed to current policy and regulatory framework**
   Using the results from the the consultation a report will be produced with propositions for policy and regulations to enable the development of small to medium scale renewable energy into economic and social sectors.

   Following review by the MTIE and ARE the document will be revised to include comments provided and submitted to the Government of Cape Verde for consideration.

Co-ordination
In addition to the co-ordination with the national counterparts the consultant will co-ordinate with the project manager, and the International Legal expert.

Level of Effort and Schedule

The work is expected to total of 12 person months over a 6 month period.

Qualification, required skills and experience

- Advanced degree in law, economics, policy or renewable energy.
- Extensive knowledge of renewable energy financial, policy and legal frameworks, renewable energy financing, renewable energy business development and tariff setting
- At least 5 years experience in the field.
- Demonstrated track record of relevant work in the mentioned area (publications, project documents, reports).
- Fluency in oral and written English is required.

TERMS OF REFERENCE FOR A NATIONAL FINANCE EXPERT

Post: National Finance Expert
Duration: 2 person months
Location: Cape Verde

Detailed Renewable Energy Investment Strategy for Cape Verde

Background

UNIDO is executing a GEF funded project to promote renewable energy in Cape Verde. The ultimate goal of the Project is to avoid greenhouse gas emissions by developing and promoting a market environment that will stimulate investments in small to medium scale renewable energy projects in Cape Verde which, in turn, will help drive economic growth, support rural electrification efforts in the country and contribute to poverty alleviation. The energy sector in Cape Verde, although with high electrification rates in all islands, is characterized by low levels of access to modern energy services and a high dependence on imported fossil fuels for electricity generation. The Government of Cape Verde's primary objective for the sector is the availability of a reliable system of energy supply that is efficient, affordable, sustainable and environmentally friendly. By demonstrating the technical feasibility and commercial viability of renewable energy projects; preparing an investment strategy for scaling up or replicating pilot projects and establishing a dedicated seed fund that will provide co-funding to support the development of small to medium scale renewable energy projects; strengthening the institutional capacity to effectively promote and support small to medium scale renewable energy development into economic and social sectors; and establishing a policy and legal environment that supports renewable energy market, market conditions will be created to foster the development of this type of projects.

The Project seeks to address some of the existing barriers to the development of small to medium scale renewable energy in Cape Verde through an integrated approach combining demonstration renewable energy projects with capacity building and technical assistance at the institutional, policy, market and project/investment level.

Primary target groups of the Project are government policy making and implementing institutions, the electricity utility, project developers, financial services providers, energy professionals, equipment suppliers, and energy consumers.

Project finance and technical assistance will be provided to support the development and implementation of a limited number of grid and off-grid small to medium scale renewable energy demonstration projects with high replication potential in various productive sectors (e.g. ice production, remote village electrification, tourism, hospitals and agriculture) and resulting in avoided GHG emissions.

A detailed investment plan and strategy for the dissemination of renewable energy in Cape Verde will be developed.

Technical assistance will be provided to ECREEE, the MTIE, the Economic Regulatory Agency (ARE, from the Portuguese acronym Agência de Regulação Económica) and ELECTRA to develop and help establish the market oriented policy and regulatory instruments needed to support and stimulate the creation of a market for small to medium scale renewable energy.

The Project will build knowledge and in-depth technical capacity at ECREEE, and within ELECTRA, to allow ECREEE to become the focal point for renewable energy development in Cape Verde providing training and information to stimulate the market for small to medium scale renewable energy. In-house technical knowledge within ELECTRA will allow the utility to develop its own renewable energy projects to avoid further GHG emissions. Technical assistance and capacity building will also be provided for potential project developers, equipment suppliers and energy consumers as well as building up the capabilities at the University and the Employment and Vocational Training Institute to provide further training.

Objective

The objective of this consultancy is to provide assistance to the International Consultant in preparing and consulting on a detailed investment strategy for small to medium scale renewable energy projects in Cape Verde.

The output of this assignment will result in an investment plan that will identify where potential RE projects can be developed, the scale of capital expenditure required and, for each project, a scheduled activities timeline and potential returns.

The plan will also identify sources of funding including international donor agencies, international financial institutions and domestic institutions. This plan will differ from the recent study carried out by Martifer as it will focus in small to medium scale RE projects and not in large-scale electricity production.

In particular the national consultant will help the International Consultant to become familiar with their tasks by researching and compiling all relevant government policies, regulations, and procedures adopted.

The national consultant will work closely with the International Consultant, National Project Manager and the Project Management Office.

Scope of Work

Consultancy services required consist of the following envisaged activities:

1. **Identification of potential renewable energy projects in each economic sector of Cape Verde.**

   The national consultant will liaise with the National Project Manager and the international finance expert on the planning of a number of meetings, targeted at different market participants, to identify additional RE projects that can be developed in short term, discuss the limitations to renewable energy investment and to brainstorm possible ways to access finance.

   This will identify both new projects and analyse the scope for replication from the demonstration projects already identified for submission for seed financing.

   Initial work has shown a number of projects that could form part of the investment strategy, namely projects identified whilst preparing this project. These include the wind power projects, hybrid systems for electrification of villages and to supply irrigation systems, solar water heating systems for hospitals and PV systems for electricity

generation. It is expected that these types of projects can be replicated across all the Cape Verde islands.

The Consultant will assist the International Consultant to identify the market for small to medium scale renewable energy project development. This will include estimating the magnitude of the current and potential market for small to medium scale renewable energy projects, in terms of sectors, locations, employment and sales and/or assets, technology use, current energy use and captive power.

2. **Consultation on opportunities and limitations of renewable energy investment in Cape Verde**
   Meetings with market participants will be held to discuss the limitations to renewable energy investment and to brainstorm possible ways to access finance. The National Consultant will be responsible for organising the meetings.

3. **Detailed cost plan prepared based on the projects identified**
   The financial commitment required against each of these projects will be identified to estimate the total investment needed and the possible returns available for each project. The National Consultant will provide local finance information to the plan.

4. **Identify potential sources of funding**
   The consultant will identify possible sources of funding for RE projects both internationally and nationally to feed into the investment plan. At a national level the Consultant shall consult with local financial institutions to assess what is needed to make them invest in the RE market and to identify projects that they may be interested int. The Ministry of Environment, Rural Development and Marine Resources will be involved in this process as the Designated National Authority for CDM in Cape Verde to assess the potential financing through the CDM.

5. **Prepare full investment plan**
   The national consultant will assist the international consultant in developing a full RE investment plan including the detailed cost plan for RE development and the identification of finance. This plan will be used by the Government of Cape Verde to help raise finance for small to medium scale RE projects. The plan will identify where potential renewable energy projects can be developed, the scale of capital expenditure required and for each project show the possible returns available. The plan will identify further sources of funding including international donor agencies, international financial institutions and domestic institutions.

Co-ordination

In addition to the co-ordination with the national counterparts the consultant will co-ordinate with the national project manager and the International finance consultant.

Level of Effort and Schedule

The work is expected to take 2 person months over a 12 month period.

Qualification, required skills and experience

- Advanced degree in economics, finance, banking or renewable energy.

- Extensive knowledge of renewable energy financing, renewable energy business development, investment plans and renewable energy funds.
- At least 5 years experience in the field.
- Demonstrated track record of relevant work in the mentioned area (publications, project documents, reports).
- Fluency in oral and written English is required.