CAPE VERDE : ENERGY ANALYSIS AND RECOMMENDATION

UNDERTAKEN BY UNIDO AND ECREEE

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LIST OF ABBREVIATIONS

ADC	Austrian Development Cooperation
ADB	African Development Bank
ADF	African Development Bank
AECID	Spanish Agency for International Development Cooperation
ARE	Economic Regulatory Agency
Art.	Article
CABNAV	Cape Verde Shipyards
CDM	Clean Development Mechanism
CEDIPRE	Centre for Public Law and Regulation of Coimbra's University
CEIF	Clean Energy Investment Framework
CRMA	Climate Risk Management and Adaptation Strategy
CSP	Country Strategy Paper
CV	Cape Verde
DGA	Directorate General of Environment
DGASP	Directorate General of Agriculture Forestry and Livestock
DGE	Directorate General of Energy
DGIC	Directorate General of Industry and Commerce
DGPOG	Directorate of Conception and Management Services
DGT	Directorate General of Tourism
DL	Decree-Law
DSM	Demand Side Management
EB	Executive Board
EBID	ECOWAS Bank For Investment and Development
ECOWAS	Economic Community Of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EE	Energy Efficiency
EIA	Environmental Impact Assessment
ELECTRA	National Electricity and Water Company
EROTS	Instruments for Territory Planning
ETS	Economic Transformation Strategy
FAO	Food and Agriculture Organization

FIC	Commercial Free Zone of Cape Verde
FNC	First national Communication
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIS	Geographic Information system
HFO	Heavy Fuel Oil
HV	High Voltage
IPC	Indicative Cooperation Programme
IPP	Independent Power Producer
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
koe	kilogram oil equivalent
LPG	Liquefied Petroleum Gas
LV	Low Voltage
MAA	Ministry of Environment, Agriculture and Fisheries
MDG	Millennium Development Goal
MTIE	Ministry of Tourism, Industry and Energy
MV	Medium Voltage
NER	Renewable Energy Research Group
NGO	Non-Governmental Organisation
O&M	Operation and Maintenance
PAIS	Inter-Sectoral Environmental Plans
PANA	Plan of Action for the Environment
PDM	Municipal Director Plan
PESER	Sectoral Renewable Energy Plan
PIs	Interconnection Points
PRSP	Poverty Reduction and Strategy Paper
PV	Photovoltaic
RE	Renewable Energy
RES	Renewable Energy Sources
SDTIBM	Society of Tourism and Integrated Development of Boavista and Maio
SMEs	Small and Medium Enterprises
TC	Technical Committee

TOE	Tonne of Oil Equivalent
TOR	Terms of Reference
UN	United Nations
UNCT	United Nations Country Team
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNFPA	UN Population Fund
UNICEF	UN Children's Fund
UNFCCC	United Nations Framework Convention on Climate Chnage
UNIDO	United National Industrial Development Organisation
ZDE	Zones Development of Wind Energy
ZSER	Areas for the Development of Renewable Energy

1 INTRODUCTION

Cape Verde is small country consisting of 10 small islands and 13 islets, located in the Atlantic Ocean, 400 kilometres from the westernmost point of Africa. It has a total area of 4033 square kilometres and a total population of 542.000 inhabitants, with population growth rates of about 1.8%.

Cape Verde has few natural resources and suffers from poor rainfall and limited fresh water. Only 4 of the 10 main islands (Santiago, Santo Antão, Fogo, and Brava) normally support significant agricultural production, and over 90% of all food consumed in Cape Verde is imported. Mineral resources include salt and pozzolana (a volcanic rock used in cement production).

The economy of Cape Verde is service-oriented, with commerce, transport, and public services accounting for more than 70% of GDP. Although nearly 70% of the population lives in rural areas, agriculture and fishing contribute only about 9% of GDP. Light manufacturing accounts for most of the remainder. An amount estimated at about 20% of GDP is contributed to the domestic economy through remittances from expatriate Cape Verdeans.

Since 1991, the government has pursued market-oriented economic policies, including an open welcome to foreign investors and a far-reaching privatization program. It established as top development priorities the promotion of market economy and of the private sector; the development of tourism, light manufacturing industries, and fisheries; and the development of transport, communications, and energy facilities. From 1994 to 2000 there was a total of about $407 million in foreign investments made or planned, of which 58% were in tourism, 17% in industry, 4% in infrastructure, and 21% in fisheries and services.

Fish and shellfish are plentiful, and small quantities are exported. Cape Verde has cold storage and freezing facilities and fish processing plants in Mindelo, Praia, and Sal.

Cape Verde's strategic location at the crossroads of mid-Atlantic air and sea lanes has been enhanced by significant improvements at Mindelo's harbour (Porto Grande) and Praia’s harbour, and at Sal's and Praia's international airports. New international airports were opened in Boa Vista (December 2007) and Sao Vicente (December 2009). Ship repair facilities at Mindelo opened in 1983. The major ports are Mindelo and Praia, but all other islands have smaller port facilities. In addition to the international airport on Sal, airports have been built on all of the inhabited islands, although the airports on Brava and Santo Antão are now closed. All other airports enjoy scheduled air service.

The positive change in affluence amongst the population in parallel with the growth in the tourism sector have contributed to a correspondent increase in demand for petroleum products, electricity and desalinated water. Therefore, Cape Verde is faced with increasing power deficit that is already hampering economic and social development. Although considerable investments have been made in the last few years, they have largely failed to address ever widening power supply shortage. Beside this, the high electricity tariffs that the country experiences (about 0.25 euro per KWh) affects the development of the economy.

The Government of Cape Verde has launched an ambitious 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.

This document presents a background review of the electricity sector, and includes recommendations to facilitate a growth in the renewable energy market in Cape Verde.

2 REVIEW OF ELECTRICITY SECTOR IN CAPE VERDE

2.1 Overview

The Cape Verde's energy supplies come from four main sources – petroleum products, butane gas, firewood and wind. The use of firewood for cooking especially in the rural areas is deeming to be fuelling the evident deforestation in the country, being the most affected the islands that are traditionally more rural (S. Antão, S. Vicente, S. Nicolau, Santiago, Fogo e Brava).

As an archipelago, each island of Cape Verde has its own local power station running on petroleum products (renewable energy production represented only 3% of the generation capacity in 2009) and its own electrical grid. The electricity power system has faced a very important growth in the last years, achieving coverage of 90 % of the country in 2010. An important Rural Electrification Programme has been implemented since the 90's, extending the electrical grid to the most remote rural areas. The coverage of the urban areas is almost 100%.

The National Electricity and Water Company (ELECTRA) is responsible for supplying electricity and desalinated water in Cape Verde. ELECTRA is a company held by Cape Verde Government (85%) and Cape Verde Municipalities (15%), which, under a concession contract signed in 2000 is credited with the monopoly of distribution (and by now also in production) of electricity throughout the country.

The main power station is located in the country's capital (City of Praia) with an installed capacity of 38.5 MW, followed by Mindelo (18.3 MW) and Sal (9 MW).

Like many other countries Cape Verde is heavily dependent on imported petroleum products, including the HFO and diesel for power generation.

Despite the efforts invested by the government in recent years, the electricity production remains deficient in the country, affecting in large-scale its development. The situation should improve significantly in the near future, since several projects are under implementation.

2.2 Sector objectives

The Cape Verde Government's primary objective for the sector is the availability of a reliable system of energy supply that is efficient, affordable, sustainable and environmentally friendly.

To achieve this objective, the government has defined a strategic plan (Cape Verde Energy Policy) for the sector to be implemented in the next years with the following overall objectives:

- Improve and expand efficiently, existing energy supply systems to:
    - Meet growing energy demand induced by both economic activities and desalination needs for production of drinking water. This is expected to be achieved by increasing the electricity generation installed capacity from 85.08 MW in 2009 to 100 MW in 2010 and 140 MW in 2012. This production is expected to come from fossil fuel thermal plants and from the development of renewable energy (25% of production by 2011 and 50% of production by 2020).
    - Centralize the power generation in each island (one power station for each island), by increasing the power capacity of the machines and consequently the efficiency of the system;
    - Reinforce the electrical grid and cut technical and non-technical losses from 30% in 2008 to 24% in 2010 and 20% in 2012;
    - Promote the private sector participation in electricity generation;
    - Restructure the National Electricity and Water Company (ELECTRA) to become technically and financially viable to be able to meet shareholder obligations.
- Create a Fuel Logistics Company, to reduce the internal logistic costs of petroleum products;
- Promote the development of renewable energy projects in Cape Verde, to achieve 25% renewable energy penetration in 2011 and 50% and for one island (Brava) 100% penetration in 2020;
- Promote a domestic fuel sub-sector, which clearly focuses on sustainable management of forest resources;
- Widen the population's access to modern forms of energy so as to stimulate development and reduce poverty;
- Strengthen institutional and human resource capacity and enhance Research and Development (R&D) in energy development; and
- Provide adequate security of energy supply.

In summary, the national strategy for the energy sector in Cape Verde is based on the development of more efficient electrical production and distribution systems, where the renewable energy should have an important role as well as a more efficient management of internal logistic costs of petroleum products.

2.3 Generation Capacity

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%). ELECTRA operates all over the country, 18 diesel power stations of different capacities (with a total capacity of 85.08 MW) and 3 wind farms (with a total capacity of 2.4 MW).

Table 1: Cape Verde Generation Capacity 2009 (ELECTRA)

Island	Power Plant	P.P. Installed Capacity (MW)	No of Engines (No x MW)	Wind Firm Installed Capacity (MW)	No of Engines	Available Capacity (MW)	Commissioning date/Notes
S. Antão	Ribeira Grande	3.80	0.4+0.6+2x0.8+1.2			3.80	1994 / 2001
	Porto Novo	1.80	2x0.4+1			1.80	1995/2008
S. Vicente	Matiota	10.90	2.2+2.36+2x3.17			10.90	1978/1994
	Lazareto	7.44	2x4.72			7.44	2002
	Monte Montona			0.900	3x0.300	0.90	1994
S. Nicolau	Ribeira Brava	0.58	2x0.16+0.256				1998/1994 (deactivated)
	Tarrafal SN	2.22	0.62+2x0.8			2.22	1991/2008
Sal	Palmeira	9.04	2x0.8+2x3.72			9.04	2001/2002
	Palmeira			0.600	2x0.300	0.30	1994
Boavista	Sal-Rei	2.14	0.4+0.648+1.088			2.14	1999/2007
Maio	Porto Ingles	1.38	2x0.2+0.688			1.38	1999/2008
Santiago	Gamboa (Praia)	7.42	2.36+2x2.532			5.00	1987/1992
	Palamrejo (Praia)	26.04	2x5.58+2x7.44			26.04	2002/2008
	Assomada	3.92	0.4+2x0.56+3x0.8			3.92	1998/2006
	Tarrafal ST	1.36	0.16+0.4+0.8			1.36	1995/2000
	S. Cruz	2.18	2x1.09			2.18	
	Monte S. Filipe			0.900	3x0.300		
Fogo	S.Filipe	3.00	0.4+2x0.8+1			3.00	1994/2008
	Mosteiros	0.80	2x0.2+0.4			0.80	2003
Brava	Favetal	1.06	0.256+0.4+0.4			1.06	1998/2009
TOTAL ELECTRA		85.08		2.400		83.28	

The power plants at S.Vicente, Sal and Praia (Gamboa and Palmarejo) run on heavy fuel. For the rest of the country the power plants run on diesel, with a very high production cost.

The maximum peak power for 2009 at Cape Verde power stations was registered at City of Praia (24 MW). The following table shows the evolution from 2006 to 2009 of the peak load in the Cape Verde electrical system.

Table 2: Peak Load Evolution 2006 – 2009 (ELECTRA)

Island	Power System	Installed Capacity (MW)	Peak Load - 2006 (MW)	Peak Load 2007 (MW)	Peak Load 2008 (MW)	Peak Load 2009 (MW)
S. Antão	Ribeira Grande	3.80	1.52	1.60	1.71	1.75
	Porto Novo	1.80	0.83	0.95	0.96	0.96
S.Vicente	S.Vicente	18.34	10.10	10.10	10.00	10.90
S.Nicolau	São Nicolau	2.22	0.96	10.07	1.01	1.02
Sal	Sal	9.04	6.64	6.40	6.70	6.42
Boavista	Baovista	2.14	0.68	0.96	1.22	1.30
Maio	Maio	1.38	0.45	0.52	0.52	0.58
Santiago	City of Praia	33.46	18.70	20.55	21.70	24.00
	Assomada	3.92	1.71	1.83	1.97	2.25
	Tarrafal ST	1.36	1.02	1.00	1.24	1.09
	S. Cruz	2.18	0.92	1.25	1.49	1.58
Fogo	S.Filipe	3.00	1.13	1.33	1.46	1.49
	Mosteiros	0.80	0.36	0.38	0.41	0.40
Brava	Brava	1.06	0.47	0.51	0.58	0.57

According to data provided by ELECTRA, the peak load at each power station is lower than the installed capacity, as shown in Figure 1.

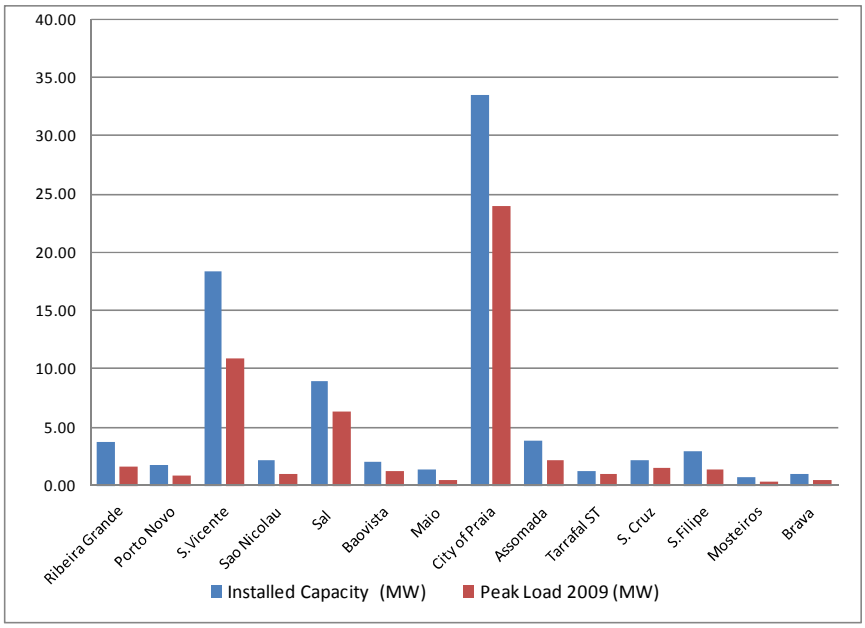


Figure 1: Peak Load vs. Installed Capacity at Cape Verde Power Stations

Although the peak load is lower than the installed capacity the Service Quality of the Electrical Systems (measured by the number and duration of black-outs) remains very low, as shown in the table below.

Table 3: Quality of service measured by number and duration of black outs (ELECTRA)

Island	Power System	Black-Out (2008)		Black-Out (2009)	
		Quantity	Duration (min)	Quantity	Duration (min)
S. Antão	Ribeira Grande	9	1,620	14	1,830
	Porto Novo	62	6,502	30	3,127
S.Vicente	S.Vicente	18	337	11	197
S.Nicolau	São Nicolau	16	424	33	923
Sal	Sal	14	1,541	30	1,716
Boavista	Baovista	12	808	20	511
Maio	Maio	19	887	37	2,456
Santiago	City of Praia	31	1,290	31	1,467
	Assomada	77	23,605	72	21,640
	Tarrafal ST	37	13,295	23	3,313
	S. Cruz	208	89,414	168	37,523
Fogo	S.Filipe	12	453	49	1,644

Island	Power System	Black-Out (2008)		Black-Out (2009)	
		Quantity	Duration (min)	Quantity	Duration (min)
	Mosteiros	23	3,492	27	1,322
Brava	Brava	52	5,844	24	1,184

During 2009 ELECTRA registered a consumption of 8,838,142 litres of heavy fuel 380, 41,280,339 litres of heavy fuel 180 and 19,306,960 litters of diesel for electricity production. Figure 2 shows the evolution of fuel consumption in the last five years.

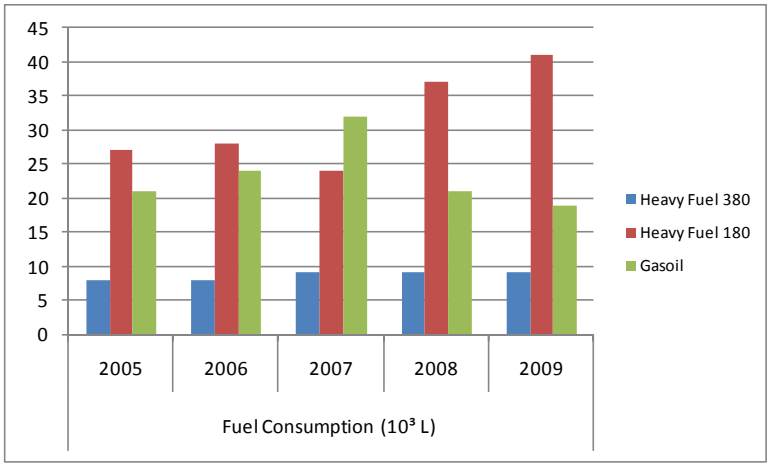


Figure 2: Fuel Consumption 2005 – 2009 (ELECTRA)

As it can be seen since 2007 there has been a reduction in the consumption of diesel, resulting from a greater utilisation of the generator sets that use heavy fuel oil.

Additional to the main power plants of ELECTRA, there are several small diesel electrical systems that provide electricity to disperse and remote rural populations which are under the responsibility of the municipalities. Having into account data from ELECTRA's Account Report 2009 the electricity coverage rate of Cape Verde in 2009 was of 87%, leaving 13% of the population without access to the grid. The S. Vicente, Sal, Boavista, Maio and Brava islands can be considered to be totally electrified. S. Antão, S. Nicolau and Fogo have localities still to electrify, being served at the moment by small diesel generator micro-systems (Figueiras, Ribeira Alta, Pico da Cruz, Tarrafal and Monte Trigo in St. Antão; Morro Brás, Juncalinho and Carrical in S. Nicolau; and Chã das Caldeiras in Fogo). These populations without access to electricity are dispersed and located in remote areas and it is not predicted to be connected to the grid.

The Rural Electrification Programme has focused in 2010 on Santiago island that showed in 2009 one of the lowest coverage rates in the rural areas. It is expected that with the implementation of this programme, with 10% of the population left to electrify (being these the more disperse and remote population).

Moreover, it is important to refer that for Tarrafal and Monte trigo localities (Porto Novo – St. Antão) there is a EU programme running for the installation of a solar system (Monte Trigo) and a mini-hydro system (Tarrafal) which will supply the correspondent localities. For Chã das Caldeiras (Fogo) the government as already launched a public bidding process for its electrification through a photovoltaic systems.

According to ELECTRA's Account Report 2009, there are several investments planned for 2010, in terms of increasing electricity generation in Cape Verde:

- Subcontract a company to supply and install 2 generator sets of 11MW, for reinforcement of the Palmarejo Power Station;
- Subcontract a company to supply and install the equipments and necessary materials for electricity capacity and distribution reinforcement to the Santo Antão, S. Nicolau, Fogo and Boavista islands;
- Increase energy production capacity in Porto Novo from 1,056kVA to 1,320kVA;
- Increase energy production capacity in Santa Cruz from 1,200kVA to 1,500kVA;
- Increase energy production capacity in Santa Catarina from 2x1,056kVA to 2x1,320kVA;
- Major maintenance of generator sets

2.4 Transmission and distribution

The transmission at medium voltage for Cape Verde was standardized at 20 kV.

At Santiago Island (the largest electrical system in the country) the first high voltage transmission line of 60 kV (43 km of overhead line), that will connect Palmarejo power station to Calheta Substation, is under construction. After finishing the construction of the high voltage line Santiago Island electricity production will be concentrated at one single power station at Palmarejo (Palmarejo power plant installed capacity is also under reinforcement – see above investments planned for 2010).

The table bellow gives indications about the medium voltage electrical grid in the country.

Table 4: Cape Verde medium voltage grid (ELECTRA)

Island	Medium Voltage Grid	
	Overhead Line (Km)	Underground Line (Km)
S. Antão	53.10	124.90
S. Vicente	28.80	101.80
S. Nicolau	24.80	25.20
Sal		119.10
Boavista	11.50	3.50
Maio		
Santiago	131.90	141.70
Fogo	29.50	17.10
Brava	18.00	5.40

Total	**297.60**	**538.70**

2.5 Energy balance – demand and supply

Electricity generation

Table 5 shows the electricity production in Cape Verde from 2005 to 2009.

The electricity production has registered an average annual increase of about 6% during the last five years.

The production at Gamboa and Palmarejo power stations located in City of Praia represents about 48% of the total electricity production, while Santiago Island covers more than 50% of the total national production.

Due to maintenance problems, the wind energy production capacity has been decreasing annually. Sal wind energy production capacity has been reduced to less than 50% in 2009 when compared with the wind energy production capacity from 2005. Santiago's wind farm is practically out of operation.

Table 5: Cape Verde Electricity Production 2005 – 2009 (ELECTRA)

Island	Power Plant	P.P. Installed Capacity (MW)	Production 2005		Production 2006		Production 2007		Production 2008		Production 2009	
			Diesel Prod. (MWh)	Wind Energy Prod. (MWh)	Diesel Prod. (MWh)	Wind Energy Prod. (MWh)	Diesel Prod. (MWh)	Wind Energy Prod. (MWh)	Diesel Prod. (MWh)	Wind Energy Prod. (MWh)	Diesel Prod. (MWh)	Wind Energy Prod. (MWh)
S. Antão	Ribeira Grande	3.80	6,334.408		6,851.113		7,164.030		7,547.257		7,903.209	
	Porto Novo	1.80	3,336.279		3,559.583		3,806.789		3,945.542		4,088.465	
S. Vicente	Matiota	10.90	15,027.600		20,053.971		13,902.500		16,008.300		19,128.700	
	Lazareto	7.44	37,621.095		33,253.998		38,707.399		39,192.580		38,850.065	
	Monte Montona			3,549.737		4,491.840		4,734.942		4,407.061		3,656.019
S. Nicolau	Ribeira Brava	0.58	562.711									
	Tarrafal SN	2.22	3,373.241		4,326.757		4,386.339		4,743.813		4,773.927	
Sal	Palmeira	9.04	32,597.521		37,156.781		37,900.532		38,405.202		37,135.880	
	Palmeira			600.730		566.617		637.500		462.500		293.300
Boavista	Sal-Rei	2.14	3,648.480		4,008.851		4,743.298		5,953.466		6,565.442	
Maio	Porto Ingles	1.38	2,127.659		1,834.868		2,198.627		2,318.881		2,579.016	
Santiago	Gamboa (Praia)	7.42	17,802.523		28,287.361		35,618.519		12,193.785		5,178.000	
	Palamrejo (Praia)	26.04	81,780.047		77,499.904		84,080.835		118,998.128		131,230.170	
	Assomada	3.92	6,595.673		7,182.579		7,776.529		8,719.637		9,319.341	
	Tarrafal ST	1.36	4,061.063		4,346.401		4,605.899		5,004.894		5,150.906	
	S. Cruz	2.18	3,161.620		3,422.600		4,545.040		5,397.670		6,556.699	

Island	Power Plant	P.P. Installed Capacity (MW)	Production 2005		Production 2006		Production 2007		Production 2008		Production 2009	
			Diesel Prod. (MWh)	Wind Energy Prod. (MWh)	Diesel Prod. (MWh)	Wind Energy Prod. (MWh)	Diesel Prod. (MWh)	Wind Energy Prod. (MWh)	Diesel Prod. (MWh)	Wind Energy Prod. (MWh)	Diesel Prod. (MWh)	Wind Energy Prod. (MWh)
	Calheta S.Miguel		1,343.101		1,460.607		457.167					
	Monte S. Filipe			2,299.239		2,382.194		1,496.367		640.132		711.542
Fogo	S.Filipe	3.00	5,607.924		6,294.292		6,672.404		7,186.141		7,477.350	
	Mosteiros	0.80	1,175.931		1,226.446		1,318.526		1,442.378		1,505.558	
Brava	Favetal	1.06	2,023.163		2,097.499		2,035.345		2,089.634		2,295.601	
Total		**85.08**	**228,180.039**	**6.449,706**	**242,863.611**	**7,440.651**	**259,919.778**	**6,868.809**	**279,147.308**	**5,509.693**	**289,738.329**	**4,660.861**

Electricity Consumption

Table 6 shows ELECTRA electricity sales for the period 2005 – 2009.

Table 6: ELECTRA electricity sales 2005 – 2009 (ELECTRA)

Island	Sales 2005 (MWh)	Sales 2006 (MWh)	Sales 2007 (MWh)	Sales 2008 (MWh)	Sales 2009 (MWh)
S. Antão	7,382.865	8,324.800	8,165.273	8,271.676	9,195.800
S. Vicente	39,151.558	38,425.754	37,625.874	39,346.865	41,278.531
S. Nicolau	3,616.876	3,756.472	3,741.252	4,022.590	4,036.274
Sal	21,822.109	26,474.948	28,070.277	29,916.251	29,379.600
Boavista	2,750.422	2,701.811	3,238.581	4,107.659	4,330.340
Maio	2,009.624	1,652.116	1,590.858	1,730.097	1,733.433
Santiago (Praia)	68,161.047	67,706.856	70,300.059	73,426.738	77,644.011
Santiago (Interior)	8,107.764	8,178.894	8,188.940	7,989.083	9,179.330
Fogo	5,554.660	5,797.817	5,962.385	5,996.769	6,551.289
Brava	1,995.193	1,754.795	1,588.090	1,544.994	1,761.084
Total	**160,552.118**	**164,774.263**	**168,471.589**	**176,352.722**	**185,089.692**

The electricity sales have registered an average annual increase of about 3.6% during the last five years, having registered in the last two years an annual increase of about 4.9%. This is the result of rural electrification programs and grid extension projects in urban areas.

The City of Praia represents around 41% of the total electricity sales in the country, and the Santiago Island, more than 46%.

Table 7 shows the electricity annual sales distribution by sectors of activities during the last five years as well as ELECTRA internal energy consumption.

Table 7: ELECTRA annual sales by sectors of activities (ELECTRA)

Consumers	Sales 2005 (MWh)	Sales 2006 (MWh)	Sales 2007 (MWh)	Sales 2008 (MWh)	Sales 2009 (MWh)
Central Government	7,486.533	8,081.655	9,678.089	10,216.311	11,730.731
Municipalities	9,061.484	8,595.762	8,567.822	8,331.846	8,778.124
Intitutions/Social Organisations	2,779.665	2,896.522	3,075.622	3,255.539	3,793.510
Commerce/ Industry /Agriculture	61,371.084	62,868.601	65,852.465	69,315.007	70,052.697

Consumers	Sales 2005	Sales 2006	Sales 2007	Sales 2008	Sales 2009
Domestic	80,977.089	82,331.723	81,297.593	85,234.018	90,754.629
Total Sales	**161,675.855**	**164,774.263**	**168,471.591**	**176,352.721**	**185,109.691**

Internal Energy Consumption	**33,498.797**	**32,077.890**	**32,285.887**	**32,883.083**	**32,759.771**

*- *Internal consumption - includes electricity consumption for water desalination*

Almost 50% of the electricity demand is from the domestic sector, while the commercial, industrial and agriculturial sectors are responsible for about 38% of the demand. ELECTRA internal energy consumption which includes energy consumption for the desalination plants at Praia, Mindelo, Sal and Boavista, represents about 18% of the total sales.

Power Load Shedding

As illustrated in the Figure 1 and Table 8, the installed capacities at the power stations are higher than the registered peak load, meaning that at normal situation (with all the generators available), the power station can support the electrical load.

Table 8: Peak load vs installed capacity in Cape Verde power stations (ELECTRA)

Power System	Installed Capacity 2009 (MW)	Peak Load 2009 (MW)
Ribeira Grande	3.80	1.747
Porto Novo	1.80	0.956
S.Vicente	18.34	10.9
São Nicolau	2.22	1.02
Sal	9.04	6.42
Baovista	2.14	1.296
Maio	1.38	0.578
City of Praia	33.46	24
Assomada	3.92	2.246
Tarrafal ST	1.36	1.092
S. Cruz	2.18	1.575
S.Filipe	3.00	1.49
Mosteiros	0.80	0.402
Brava	1.06	0.568

The main reasons for load shedding in the different electrical systems are then:

1. Technical problems with available generator due to lack of maintenance or spare parts availability;
2. Shutdown of main generators for scheduled maintenance;

3. Delay in implementation of new projects for reinforcement of the installed capacity and consequently, lack of capacity to supply the total power demand.

The main urban centres are practically all connected to the grid. The Cape Verde coverage rate in the end of 2010 is expected to be 90%, the other 10% corresponding to the rural disperse and remote populations, which have a corresponding, lower demand. Thus the extension of the grid to rural areas would represent just a very small increase in energy demand. However there is a retraction in the consumption in the main urban areas mainly due to grid expansion problems and limited installed capacity. The sector may also experience difficulties in answering to new big consumers, such as plants, hotels etc, due to the reasons already appointed.

Losses

Table 9 and Table 10 show the total losses of each ELECTRA system, during the last five years (2005-2009). As it can be seen in these tables the system registered an increase in electricity losses (technical and non-technical losses) during the last five years, from 17% (2005) to 26% (2008), with a very small reduction in 2009 (on the figures after the point).

At the largest electrical system in Praia (Santiago island) the losses are extremely high, registering an increase from 24% (2005) to 36% (2008). In 2009, the system in Praia produced 143,676 MWh but only 88,666 MWh was consumed / sold. This means that more 51,000 MWh was lost (technical and non-technical losses) during the year. Fraud and electricity theft is one of the problems that occur in Santiago Island. According to ELECTRA's Accounts Report 2009, ELECTRA is developing actions to control these losses.

The reduction in losses is one of the main objectives to be achieved in the next future, according to ELECTRA's Accounts Report 2009.

Table 9: ELECTRA annual losses at Cape Verde electrical system 2005-2007 (ELECTRA)

Island	2005					2006					2007				
	Production (MWh)	Internal Consumption (MWh)	Sales (MWh)	Losses (MWH)	Losses (%)	Production (MWh)	Internal Consumption (MWh)	Sales (MWh)	Losses (MWH)	Losses (%)	Production (MWh)	Internal Consumption (MWh)	Sales (MWh)	Losses (MWH)	Losses (%)
S. Antão	9,671	13	7,383	2,275	24%	10,411	13	8,325	2,073	20%	10,971	14	8,165	2,791	25%
S. Vicente	56,198	10,934	39,152	6,113	11%	57,800	9,601	38,426	9,773	17%	57,345	9,672	37,626	10,047	18%
S. Nicolau	3,936	19	3,617	300	8%	4,327	10	3,756	561	13%	4,386	11	3,741	634	14%
Sal	33,198	8,508	21,822	2,868	9%	37,723	8,916	26,475	2,332	6%	38,538	8,754	28,070	1,713	4%
Boavista	3,648	1,320	2,750	-422	-12%	4,009	1,224	2,702	83	2%	4,743	1,289	3,239	216	5%
Maio	2,128	15	2,010	103	5%	1,835	14	1,652	169	9%	2,199	12	1,591	596	27%
Santiago (Praia)	106,387	12,638	68,161	25,587	24%	113,053	12,254	67,707	33,092	29%	126,198	12,476	70,300	43,421	34%
Santiago (Interior)	10,657	18	8,108	2,531	24%	11,529	17	8,179	3,333	29%	12,382	25	8,189	4,169	34%
Fogo	6,784	15	5,555	1,214	18%	7,521	14	5,798	1,709	23%	7,991	17	5,962	2,011	25%
Brava	2,023	16	1,995	12	1%	2,097	14	1,755	328	16%	2,035	14	1,588	434	21%
Total	234,630	33,496	160,552	40,581	17%	250,304	32,077	164,774	53,453	21%	266,789	32,285	168,472	66,032	25%

Table 10: ELECTRA annual losses at Cape Verde electrical system 2008-2009 (ELECTRA)

Island	2008					2009				
	Production (MWh)	Internal Consumption (MWh)	Sales (MWh)	Losses (MWH)	Losses (%)	Production (MWh)	Internal Consumption (MWh)	Sales (MWh)	Losses (MWH)	Losses (%)
S. Antão	11,493	17	8,272	3,204	28%	11,992	18	9,196	2,778	23%
S. Vicente	59,608	9,588	39,347	10,673	18%	61,635	9,205	41,279	11,152	18%
S. Nicolau	4,744	13	4,023	708	15%	4,774	14	4,036	723	15%
Sal	38,868	7,377	29,916	1,574	4%	37,429	7,016	29,380	1,034	3%
Boavista	5,953	1,232	4,108	614	10%	6,565	1,421	4,330	814	12%
Maio	2,319	10	1,730	578	25%	2,579	10	1,733	836	32%
Santiago (PRAIA)	137,230	14,594	73,427	49,209	36%	143,676	15,023	77,644	51,010	36%
Santiago (Interior)	13,725	24	7,989	5,711	42%	14,470	22	9,179	5,269	36%
Fogo	8,629	15	5,997	2,617	30%	8,983	15	6,551	2,417	27%
Brava	2,090	12	1,545	533	26%	2,296	17	1,761	517	23%
Total	284,657	32,882	176,353	75,422	26%	294,399	32,760	185,090	76,550	26%

2.6 Electricity consumers

In Cape Verde the national electricity coverage in 2009 was 87%, an increase of about 7% when compared to 2008 coverage figures. The main reason for this increase has been the Rural Electrification Program that continues during 2010, with the objective to attain a national electricity supply coverage of about 95% at the end of 2010. The per capita consumption at the domestic sector registered a negative growth from 162.2 to 159.8KWh/inhabitant/year (-5%). This is the result of the connection of new rural consumers which in the beginning, normally, register low consumption of electricity.

ELECTRA divide the consumers into three main groups:

1. Low Voltage Consumers (includes domestic consumers and small industry, commerce and service);
2. Special Low Voltage Consumers (includes medium commerce, industry and service);
3. Medium Voltage Consumers (industries connected to the medium voltage grid).

The evolution of the number of consumers per island and per ELECTRA's voltage category between 2005 and 2009 is shown in Table 11 and Table 12, respectively.

Table 11: Evolution of ELECTRA's consumers per islands (ELECTRA)

Island	2005	2006	2007	2008	2009
S. Antão	8,015	8,310	8,624	9,249	9,677
S. Vicente	17,757	18,919	19,955	21,152	22,706
S. Nicolau	2,841	3,048	3,304	3,464	3,588
Sal	4,799	5,352	5,959	6,922	8,236
Boavista	1,265	1,323	1,616	1,832	2,167
Maio	1,442	1,623	1,731	1,739	2,086
Santiago (Praia)	28,887	31,497	31,755	34,005	38,421
Santiago (Interior)	6,483	7,005	8,999	9,408	10,276
Fogo	3,849	4,089	4,441	4,840	5,335
Brava	1,557	1,714	1,785	1,850	1,906
Total	**76,895**	**82,880**	**88,169**	**94,461**	**104,398**

Table 12: Evolution of ELECTRA's consumers per category (ELECTRA)

Consumers Category	2005	2006	2007	2008	2009
Low Voltage	76,309	82,261	87,519	93,770	103,677
Special low Voltage	477	508	535	568	596
Medium Voltage	109	111	115	123	125
Total	**76,895**	**82,880**	**88,169**	**94,461**	**104,398**

Over the last five years the number of consumers increased 7.9% per year. As a result of the Rural Electrification Program implemented by the government the number of consumers has increased 10.5% from 2008 to 2009.

2.7 Cost of energy provision

The cost of energy provision differ from island to island, depending on the dimension of the equipment, the type of fuel used (heavy fuel or diesel) and the specific consumption of each generator set. The biggest power plants of Praia, São Vicente and Sal are running on heavy fuel, while for the other island, the power plants are running on diesel.

Fuel consumption represents over 60% of ELECTRA's cost structure being the dominant component of the electricity production cost. To reduce the electricity production cost there are three main targets that ELECTRA has to achieve:

1. Unification of the power plants in each island (one power plant for each island), allowing the installation of bigger and more efficient generator sets;
2. Make heavy fuel oil available in all the islands;
3. Install generator sets running on heavy fuel in all the islands instead of the diesel generators already installed.

Naturally the substitution of the existing diesel generators by generators running on heavy fuel oil will be done gradually. These heavy fuel oil generators will become the base units for electricity production in the systems. The diesel generator will nevertheless remain operational (while there is a justification for it) for emergency situations or to cover peak load.

Due to lack of an organized cost accounting at the company, it is not possible to define with certainty the electricity production cost in Cape Verde. The government presents a estimated cost of electricity production of 13.3 CVE/KWh while ELECTRA has an estimation of 15 CVE/KWh, with a range cost from 13 CVE/KWh at S.Vicente and 22 CVE/KWh at S. Antão, S.Nicolau, Fogo and Brava.

2.8 Electricity tariffs

The electricity tariffs in Cape Verde are defined by the Regulatory Agency (ARE), based on data provided by ELECTRA and confirmed by ARE. The following table indicates the actual electricity tariff.

Table 13: Electricity tariff 2010 (ARE)

		Base tariff (T) (CVE)	VAT (15% x 30%T) (CVE)	Total (T+VAT) (CVE)
Low Voltage	**<=60kWh**	21.79	0.98	22.77
	>60kWh	28.65	1.29	29.94
	Public lightening	20.04	0.9	20.95

		Base tariff (T) (CVE)	VAT (15% x 30%T) (CVE)	Total (T+VAT) (CVE)
Special low Voltage	**Energy Cons. (kWh)**	24.81	1.12	25.93
	Power Tax (1)	303.96	13.68	317.64
Medium Voltage	**Energy Cons. (kWh)**	20.48	0.92	21.4
	Power Tax (1)	279.96	12.6	292.55
Rental counter	**Single phase (up to 10 A)**	41.4	1.86	43.26
	Single phase (=>15A)	100.55	4.52	105.07
	Three Phase (up to 10A)	265.09	11.93	277.02
	Three Pase (=>15 A)	369.89	16.65	386.54

3 FUTURE DEMAND PROJECTIONS

Electricity production has registered an average annual increase of about 6% during the last five years. However, part of the electricity demand was not met due to production capacity and grid connection limitation. Meeting this additional demand would represent a significant increase in electricity production.

The Government has developed a study[1] on the energy demand for Santiago, S. Vicente, Sal and Boavista, which represents 90% of the national energy production. Two scenarios were considered:

1. Probable Scenario – considering that part of the planned touristic investments is not performed.
2. Optimistic Scenario – considering all the planned touristic investment performed;

The following tables summarise the demand projections for Santiago, S. Vicente, Sal and Boavista from 2012 to 2027.

Table 14: Demand Projection: Probable Scenario (Simonsen Associados,2008)

		2012	2017	2022	2027
Santiago	Average Load (MW)	36	49	62	78
	Peak Load (MW)	51	70	89	112
	Installed Capacity (MW)	72	98	125	157
	Annual Production (GWh)	315	426	545	686
S. Vicente	Average Load (MW)	12	16	20	24
	Peak Load (MW)	17	24	31	38
	Installed Capacity (MW)	24	34	43	53
	Annual Production (GWh)	102	139	174	214
Sal	Average Load (MW)	14	19	24	30
	Peak Load (MW)	29	40	48	59
	Installed Capacity (MW)	41	56	68	83
	Annual Production (GWh)	124	171	211	266
Boavista	Average Load (MW)	4	8	14	18
	Peak Load (MW)	9	17	28	36
	Installed Capacity (MW)	12	24	40	50
	Annual Production (GWh)	37	73	121	159
Total (4 Islands)	Average Load (MW)	66	92	120	150
	Peak Load (MW)	106	151	196	245
	Installed Capacity (MW)	149	212	276	343
	Annual Production (GWh)	578	809	1,051	1,325
Other Datas (4 Islands)	Population	428,426	480,251	540,322	610,764
	Bed capacity	49,261	76,470	98,830	114,572
	Tourist / year	1,536,938	2,385,885	3,083,509	3,574,632
	Per capita consumption (KWh/inhab/h)	0.154	0.192	0.222	0.248

[1] "Estudo de Demanda de Energia", Simonsen Associados, 2008

Table 15: Demand Projection: Optimistic Scenario (Simonsen Associados, 2008)

		2012	2017	2022	2027
Santiago	Average Load (MW)	49	69	89	107
	Peak Load (MW)	67	95	123	146
	Installed Capacity (MW)	93	134	172	204
	Annual Production (GWh)	437	609	782	933
S. Vicente	Average Load (MW)	27	30	33	37
	Peak Load (MW)	38	42	47	52
	Installed Capacity (MW)	53	59	65	73
	Annual Production (GWh)	237	235	293	327
Sal	Average Load (MW)	25	34	38	42
	Peak Load (MW)	36	49	54	59
	Installed Capacity (MW)	51	69	76	83
	Annual Production (GWh)	221	300	334	366
Boavista	Average Load (MW)	7	12	20	25
	Peak Load (MW)	10	17	28	36
	Installed Capacity (MW)	14	24	40	50
	Annual Production (GWh)	61	105	175	221
Total (4 Islands)	Average Load (MW)	108	145	180	211
	Peak Load (MW)	151	203	252	293
	Installed Capacity (MW)	211	286	353	410
	Annual Production (GWh)	956	1,249	1,584	1,847
Other Datas (4 Islands)	Population	428,426	480,251	540,322	610,764
	Bed capacity	90,615	116,890	126,490	128,490
	Tourist / year	2,827,188	3,646,968	4,008,888	4,008,888
	Per capita consumption (KWh/inhab/h)	0.252	0.304	0.334	0.345

4 ELECTRIFICATION / IMPROVEMENT PROJECTS

4.1 Service improvements in CV

Power Supply, Transmission and Distribution Lines Project in Santiago Island [23]

Description of project	The African Development Bank has been supporting the energy sector through the Santiago Production Capacity and Distribution Network Strengthening Project co-financed with the Japan Bank for International Cooperation (JBIC) that will help double the installed capacity from 22 MW in 2008 to 44 MW in 2010. The sector goal of the project is to contribute to improving the living conditions of the Cape Verdean population and competitiveness of the national economy through the energy needs. The specific objectives are to contribute to improving the access rate to electricity and secure power supply on the island of Santiago. These objectives will be achieved by creating a network of transmission and distribution only, the realization of new connections and increased production capacity by more efficient technologies. Centralizing the production of electricity on the island of Santiago on a site can reduce production costs and operating constraints while providing a better quality of service. The construction of a high voltage line that will transport energy is the best option to promote the penetration of electricity in rural areas. The shutdown of small plants and the use of heavy fuel oil instead of diesel will reduce the negative environmental impacts associated with the production of electricity. The negative impacts of extending the central Palmarejo and electric lines are limited or minor. The project will not implicate displacement of people and will not affect the cultural heritage or protected sites. It will have a significant economic and social impact for people in the project area estimated at 27,000 or 6% of the total population. The electrification rate in the project area will increase from 29 to 50%.
Funding	African Development Bank, Cape Verde Government,
Loan Agreement	Cape verde Government: 2,75 Milhões de UC ADF: 4,82 Milhões de UC Japan International Cooperation Agency (JICA)/Japan Bank for International Cooperation (JBIC): 25,07 Milhões de UC ECOWAS Bank For Investment and Development (EBID): 6,06 Milhões de UC Total: 38,7 Milhões de UC
Scope of project	The project includes the following components: a) Central - this component is to increase the capacity of 20 MW Power Plant Palmarejo by installing two groups

[2] African Development Bank Website, consulted in October 2010 at: http://www.afdb.org/en/projects-operations/project-portfolio/project/p-cv-fa0-001/

[3] African Development Bank, *BAD e Cabo Verde " Construindo juntos uma África melhor"*, consulted in October 2010 at: http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Cap%20Vert%20Yol%20portugais%20ok.pdf

	(Groups No. G5 and G6) of 10 MW each. The work to be done include: extending the power plant building, and the establishment of command/control equipment, the equipment room and the installation of auxiliary wafer, and the setting up additional fuel storage capacity. b) Transport network - this component includes: construction of a double circuit HT (high tension) line nominal voltage 60 kV along 40 km linking the Palmarejo Plant (located in the town of Praia in Calheta) to the North of the island of Santiago; the construction of a transformer station 20/60 kV and a 20 MVA transformer with two HV/MV 10 MVA in Praia; and the construction of a transformer station of 60/20 kV, equipped with two transformers MT / HT 10 MVA of 10MVA each c) Distribution network – this component provides for the extension of Medium Voltage (MV) and Low Voltage (LV), rehabilitation, extension and reconfiguration of the network of Praia, and the realization of connections and public lighting. The main achievements include the construction of 73 km of MV lines along the 35 km of main lines of Tarafal and Assomada; 48 km of LV lines, 14 new MV/LV; replacing the obsolete 4 transformer stations, rehabilitation and extension of 6 main stations, modernization of 11 transformer stations, and the installation of 1,040 public lightings for achieving 5770 power connections. The completion of the distribution network will help increase the electrification rate in Santiago in 2009 to 85% and 95% in 2012. d) Support Directorate General of Energy (DGE) – this component aims to strengthen the capacity of DGE in the development of sectoral policy, preparation of program development and maintenance of statistics and monitoring the energy sector. To this end DGE will have computer equipment and receive technical assistance. In addition staff will be trained in the areas of demand forecasting, preparation of budgets and sector programming. e) Monitoring and supervision of works – this component consists on checking and approving the studies of work execution, control of work and validation of tests for various works to be constructed under the project. f) Training and Awareness – the operating staff of the works will be trained on the operation and maintenance of lines and High Voltage (HV) that will be built for the first time in Cape Verde. People will be made aware of potential dangers of high voltage lines through a public awareness campaign. g) Compensation – the HV and MV lines will result in the alienation of land belonging to private owners who will be compensated in accordance with laws and regulations of Cape Verde. h) Project Management – this component includes:(i) the audit of projects; (ii) the control and supervision of work; (iii) environmental monitoring; and (iv) the activities of the Project Implementation Unit.
Project Implementation	Project started in: 12/12/2008 until 21/12/2011

Status	On-going

Project for Energy Production Centralization on 4 islands: St. Antão, Fogo, São Nicolau and Boavista

Description of project	The objectives of this project are: • Satisfy electricity demand in the 4 islands (having into account the actual situation and the expected evolution in the years to come); • Improve the efficiency and security of electricity supply, with the reduction of the time between electricity supply cuts; • Reduce the cost of electricity productions, and consequently contribute to the improvement of ELECTRA financial situation; • Deactivation of the actual electricity production plants that are located within the residential areas and that impact negatively the populations due to the sound and the emissions of GHGs. • Deactivation of the micro-power plant units that are operating in these islands, conducting to savings in the cost of electricity production and contributing to improve the quality of the supply systems to the consumers. This project aims at: • Construction of 4 new power plants in St. Antão, Fogo, São Nicolau and Boavista • Installation of four 180 fuel generators sets of 1,500kW each: 2 for St. Antão and 2 for Fogo • Installation of two diesel generators sets of 1,000kW each: 1 for São Nicolau and 1 for Boavista • 20KV Grid extension in a total of 164km, being 55km in St. Antão, 32km in Fogo, 54km in São Nicolau and 23km in Boavista.
Funding	Dutch Government, Cape Verde Government and ELECTRA
Loan Agreement	Donation from the Dutch Government within the ORET programme of 50% of the equipment and installation cost, estimated in 11.19M€ Cape Verde Government contribution: 50% of the equipment and installation cost, estimated in 11.19M€ ELECTRA: financing the studies, technical supervision and land acquisition, estimated in 2.13M€ Estimated Total of the projects: 24,51M€ shared between the 4 islands as follow: • St. Antão: 9.99M€ • Fogo: 8.60M€ • São Nicolau: 4.03M€ • Boavista: 1.80M€
Scope of project	Cutting current energy generation and distribution deficits; Cutting costs through the interconnection through centralising the

	production of electricity within the islands; Cutting technical and non-technical; Improve the quality of electricity supply; Improve population quality of life The ultimate goal is to improve Electra's financial situation and reduce the amount of Government transfers for electricity production.
Project Implementation	18 months after the projects have been attributed
Status	Yet to start. This project is delayed and there are no visible signs of when the project will start.

Programme to support the implementation of the Poverty Reduction Strategy Paper II (PRSP 2008-2011)

Description of project	The objectives of this project are: contribute to Poverty Reduction; Stimulate economic growth and transformation of the economy; strengthen the building of public financial management; and improving the business environment. The beneficiaries of this project are: companies and private Cape Verdean People. Thus with this project Cape Verdean population will benefit from: Improvement in management and sustainability of energy sector and ELECTRA; Enhancement of the effectiveness of monitoring and evaluation of budget execution and external control; Broaden the tax base, Business climate improvement, Improvement of the capacity and efficiency in the production and distribution of electricity,
Funding	African Development Bank
Loan Agreement	African Development Fund (ADF): UAC 5,000,000 Co-financier UAC 51,400,000 Total UAC 56,400,000
Scope of project	Improvement in management and sustainability of energy sector and ELECTRA; Enhancement of the effectiveness of monitoring and evaluation of budget execution and external control; Broaden the tax base, Business climate improvement, Improvement of the capacity and efficiency in the production and distribution of electricity
Project Implementation	On-going
Status	On-going

4.2 Rural Electrification

Rural Electrification Programme

Description of project	The Rural Electrification Programme began in the 90's, supported by the Luxemburg cooperation, started in 1994 in Santo Antão and was then extended to S. Nicolau. This project was undertaken in these two islands until 2001, corresponding to the period where electrification rates were above 80% in both islands. Within the 2007 to 2010 the Rural Electrification Programme 6000 connections to the grid are to be carried out. In 2010 the programme has focused in Santiago Island which in 2009 showed the lowest cover rate in the rural areas. With this programme electrification projects are to be implemented so that the countries coverage rate increases to 90%. This will leave 10% of the populations to be connected to the grid (corresponding these populations to the ones to which grid connection is very difficult and access to electricity may be provided by alternative technologies). The following localities are to be electrified: • Praia: Palmarejo Grande, Trindade, Matão, São Tomé, Portete Cima e Portete Baixo • Ribeira Grande Santiago: Santana, Bota Rama, Porto Mosquito, João Varela, São João Baptista, Chã de Igreja e Gouveia • São Domingos: Fontes de Almeida, Baia, Moia-Moia, Castelo Grande, Rema-Rema, Pedra Galinha, Água de Gato, Gudim, Achada Lama, Achada Baleia, Portal, Capela, Chã de Coqueiro, Dobe, Tinca e Cancelo • São Lourenço dos Órgãos: Pico de Antónia, Órgãos Pequeno, Levada, Barragem de Poilão, Achada Costa, Bom Pó, Chã de Vaca, Gigae, Covada, Ribeirão Galinha e João Gotô • São Salvador do Mundo: Picos Acima, Leitão Grande, Leitãozinho, Covão Grande, Jalalo Ramos, Purgueira, Babosa, Faveta, Mato Forte, Mato Limão e Rebelo • São Miguel: Tagarra, Monte Pousada, Hortelã, Chã de Horta, Ribeira São Miguel e Ribeira dos Flamengos; • Santa Catarina de Santiago: Serra Malagueta, João Dias, Pingo Chuva, Entre Picos de Reda, Entre Picos Boa Entrada, Chã de Tanque, Achada Falcão, Mato Baixo, Achada Tossa, Arribada, Furna, Palha Carga dos Engenhos, Mato Sancho, Chã de Cana, Gil Bispo, Poilão dos Engenhos, Banana dos Engenhos, Boa Entrada, Fundura, Junco, João Dias, 4 Caminhos, Fonteana, Banana Semedo, Japluma, Viúva, Cruz Grande, Saltos Acima, Ribeirão Isabel, Furna Baixo, Mato Real, Vassoura e Achada Grande; • Santa Cruz: Achada Ponta, Macati, Ribeira Seca, Renque Purga, Porto Madeira, Achada Monte Negro, Ribeirão Boi, Serelho, Boaventura, Ribeirão Égua, Cova Barro e Monte Rabelado; • Tarrafal de Santiago: Curral Velho, Serra Malagueta, Mato Brasil, Guindão, Fazenda e Achada Meio • São Felipe: Cutelo Lacacã, Jardim, Saltos, Monte Largo e Fonte Aleixo

	• Mosteiros: Corvo, Achada Grande e Relvas • Santa Catarina do Fogo: Monte Vermelho, Figueira Pavão, Maria da Cruz, Cova Figueira, Roçadas, Tinteira, Mãe Joana, Estância Roque e Baluarte; • Maio: interligação de linha AMT Mourrinho/Cascabulho/Pilão Cão/Alcatraz • São Nicolau: Palhal, Belém, Morrebraz,e Hortelã e interligação de linha AMT Praia Branca/Central Eléctrica. Brava: Lomba Tantum, Palhal Ferreiros, Baleia e Garça
Funding	State Treasury
Loan Agreement	For the time being 1.155.154.706 + 25 000 000 ECV have already been spent
Scope of project	Grid extension and increase country's grid coverage percentage to 90% by the end of 2010. Electricity supply
Project Implementation	2007-2010
Status	On-going

Promoting market based development of small to medium scale renewable energy systems in Cape Verde

Description of project	This project is being developed within a bigger project: A national level project in Cape Verde under the GEF Programmatic Approach on Access to Energy in West Africa, under the GEF4 Strategic Programme: SP3 Promoting market approaches for renewable energy The project objective is to create market conditions conductive to the development of small to medium scale renewable energy systems in Cape Verde. This project based on the analysis of the GHG emissions from power generation in Cape Verde and its expected growth provides a systematic approach to address barriers to the development of small to medium scale renewable energy based systems, either grid connected and stand alone. This project will identify a total of 2MW pilot projects to be installed which will save approximately 5,850tCO2.
Funding	UNIDO (GEF) Executing agencies: Ministry of Industry and Energy, ELECTRA, ECOWAS Centre for Renewable Energy and Energy Efficiency
Loan Agreement	Co-financing: • Project Government Contribution: : 1.7M$ (in-kind =0.5M$ and cash=0.7M$) • GEF Agency (UNIDO): 0.29 M$ (Grant) • Multilateral Agency(ies): 1.9M$ (Soft Loan) • Private Sector: 2.06M$ (Hard loan) • Total co-financing= 5.95M$

	Financing plan: • GEF Grant: 1.72 M$ • Co-financing: 5.95M$ • Total: 7.67M$
Scope of project	The GHG emission reductions will be realised through the following interventions: 1. Demonstrating the technical and economical viability of small to medium scale renewable energy systems with combined capacity of 2MW, either grid connected and stand alone format and developing a national investment strategy for the replication of pilot projects to the rest of the country; 2. Establishing and operationalising policy, legal and regulatory framework conductive to the development of small to medium scale renewable energy projects; 1. Strengthening capacities of support institutions, market players and market enablers and awareness raising
Project Implementation	March 2010 – December 2015
Status	On-going

MARTIFER Project: Renewable Energy Plan

Description of project	This project includes the formulation of the renewable energy plan for Cape Verde. It is being financed by the Portuguese line of credit to Cape Verde.
Funding	Portuguese Government
Loan Agreement	Portuguese line of credit to Mozambique
Scope of project	The project includes: • The definition of the energy plan for Cape Verde • Resource Analysis • Pilot project installations • Grid rehabilitation • Analysis of the policies and place and recomendations & capacity building. At the moment resource analysis are being carried out to identify Cape Verde's potential and 2 PV pilot projects are being constructed in Sal (2.5MW) and Santiago (5MW) Islands. The legislation in place has already been revised and a new decree law on Promotion and Incentive for the Use of Renewable Energy has been proposed by the project.
Project Implementation	The project has started implementation in January 2010 and is supposed to be finished in December 2011
Status	On-going

Cabeólica Wind Farm projects in Santiago, Sal, São Vicente and Boavista

Description of project	The Cabeólica Project involves the construction, operation and decommissioning of four wind farms on the islands of Santiago, São Vicente, Sal and Boa Vista in the Republic of Cape Verde. The wind farms will comprise of between 30 to 32 – 850kW wind turbines creating a total installed capacity of about 28 MW. The wind farms will be connected to the existing electrical network on each island. Construction of the entire project on all four islands will take up to approximately 18 months. The wind farms will be designed to operate for a total lifetime of at least twenty years, after which they will either be decommissioned and the site restored, or a new planning application submitted to re-power the site with either rehabilitated or new equipment. The Cabeólica Project proposes to install a total capacity of between 25.5 to 28 MW which comprises 20-25% of current energy demand in Cape Verde. This level of renewable energy penetration is rare and Cape Verde will be the first country in Africa to achieve such ratios.
Funding	Searching for funding with ADB
Loan Agreement	60million euros
Scope of project	Increase renewable energy wind power generation in Cape Verde Face 20-25% of current energy demand in Cape Verde.
Project Implementation	Started December 2010. Expected to finish in the end of 2011
Status	On-going

4.3 Cooperation Projects Related with Renewable Energy

Indicative Programme of Cooperation Luxemburg-Cape Verde 2005-2010

Description of project	In October 2005, on the sidelines of the 7th Partnership Commission, a Second Indicative Cooperation Programme for the period 2006-2010 was signed. IPC 2006-2010 maintained the same sectors priority than the previous one: the IPC 2002-2005. IPC 2002 – 2005 aimed at providing greater coherence, flexibility and durability in the relations of cooperation, while ensuring continuity of Luxembourg priorities by focusing on three areas: (i) education, (ii) health, (iii) water and sanitation as well as food assistance. The IPC 2002-2005 was mainly concentrated in the islands of Santo Antão, Santiago and São Nicolau. The IPC 2006-2010 abandoned the geographic concentration to cover the whole of Cape Verde, this in order to move towards a programmatic support to national programmes. The main objective remained the fight against poverty by supporting Cape Verde's efforts to achieve the Millennium Development Goals and to facilitate the gradual transition out of the Least Developed Countries (LDC) category 1 "'January 2008.
Funding	Luxemburg Government
Loan Agreement	45 million Euros
Scope of project	Education, Health, Water and sanitation as well as food assistance.

Project Implementation	2006-2010
Status	On-going (finishing in the end 2010)

Indicative Programme of Cooperation Luxemburg-Cape Verde 2011-2015[4]

Description of project	The IPC 2011-2015 arise from the perspective of continuity and strengthening the cooperative relations between Luxembourg and Cape Verde. It is the result of a dialogue between the two countries to work on a common platform for creating improved conditions for the implementation of a cooperation program consistent with the last one on implementation at the moment (IPC 2005-2010). The overall objective is to support efforts by the Government of Cape Verde for the reduction of poverty in a sustainable manner through sustained growth and distributed equitably, good governance and gradual integration into the global economy. The interventions in the IPC aim at strengthening institutional capacity in Cape Verde in economic, social and financial sectors. Both countries are committed to reduce national disparities in economic and social domains as well as to reduce Cape Verde's economic vulnerability. Strengthening human resources capacity, better use of natural resources and of the environmental and good governance are prerequisites for achieving the programme goal. This programme focus of 4 areas of intervention: 1. Education, professional training and social professional integration; 2. Water and sanitation coupled with renewable energy and use of alternative techniques: The intervention of Luxemburg cooperation will be in line with the Action Plan for Integrated Management of Water Resources (APIMWR) approved by the Cape Verde authorities. Thus within APIMWR and its program of works, concrete actions will be determined. 3. Health and school feeding support; 4. Food aid.
Funding	Luxemburg Government
Loan Agreement	The implementation of the program is based on an indicative amount of EUR 60 million over 5 years. This budget will fund all the actions decided by mutual Agreement within the IPC and therefore in keeping with the priorities of the Growth Strategy and Poverty Reduction Plan and sectoral development in Cape Verde. The commitments and disbursements of budget will be spread in a balanced manner on the 5 years of duration of IPC. Percentage of funding within the 4 areas of intervention: 1. Education, professional training and social professional integration: 47,49% 2. Water and sanitation coupled with renewable energy and use of alternative techniques: 23,54% 3. Health and school feeding support: 13,15% 4. Food aid:8,33%

[4] Programme Indicatif de Cooperation Luxembourg – Cap Vert 2011-2015

	Funds for studies and technical assistance: 7,49%
Scope of project	1. Education, professional training and social professional integration 2. Water and sanitation coupled with renewable energy and use of alternative techniques 3. Health and school feeding support 4. Food aid
Project Implementation	2011-2015
Status	To start in 2011

5 INSTITUTIONAL AND REGULATORY FRAMEWORK

This section includes an assessment of the institutional set-up and the existing regulatory framework in Cape Verde, relating to the energy sector and in particular the renewable energy sector. It includes an outline of the responsibilities and roles of the different organisations operating in the sector and provides an assessment of resource and capacity constraints with the aim to offer recommendations in terms of institutional set-ups, capacity building, supportive policy measures and possible legislative and regulatory changes for further development of the renewable energy sector.

5.1 Existing legal and regulatory frameworks

The key legislation and supporting documents affecting the renewable energy sector are:

- Cape Verde National Energy Policy, 2008
- Decree-law nº14/2006, of 20 of February, revises the Decree-law nº54/99, of 30 of August that established the bases of the Electric System in Cape Verde. This revision better evidences the principle of freedom of establishing the production of electricity in Cape Verde.
- Decree-law nº30/2006 of 12 June, on Independent Producer licensing
- Decree-law nº41/2006 of 31 July, defining the Electric Energy Crisis and respective corrective measures
- Ordinance nº18/2006 of 24 July, on Power Producers Guarantees
- Ordinance nº21/2006 of 28 August, on tariff and payment procedure of the fees for Independent Producers
- Art. 54 of Law nº4/VII/2007 of 11 January, Free customs duties on renewable energy imports of equipment and accessories
- Decree-Law n.1/2011 of 3rd of January, on Promotion and Incentive for the Use of Renewable Energy,
- ECOWAS Treaty
- Decree-Law nº 26/2003, of 25 August, creating the Economic Regulatory Agency (ARE)

The Decree-Law (DL) n.14/2006 of 20th of February, revises the Decree-law nº54/99, of 30 of August that established the bases of the Electric System in Cape Verde. DLs n. nº30/2006 of 12 June, Ordinance nº18/2006 of 24 July and Ordinance nº21/2006 of 28 August, set out the licence, guarantees and tariffs for independent power production activities, in which renewable energy may be included at.

Each of these is detailed further below.

Besides these regulations, renewable energy is also referenced directly and indirectly in:

- Economic Transformation Strategy (ETS) which is a long term vision adopted in 2003 to transform Cape Verde from a least developed country (LDC) into an emerging country.

- Poverty Reduction and Strategy Paper II- 2008-2011 (PRSP-II 2008-2011), which supports the principles of the ETS as well as those of Government's Programme under the VIIth Legislature (2006-2011). The goal is to achieve double-digit economic growth, and bring unemployment down to below 10%. It hinges on five pillars: (i) promoting the Government reform; (ii) human resource development; (iii) promoting competitiveness by reconciling the challenges of sustainable development with globalization; (iv) strengthening economic infrastructure; and (v) strengthening social cohesion

Cape Verde Country Strategy Paper (CSP) 2009-2012 – This strategy, developed by ADB, it is set within the dual framework of the Economic Transformation Strategy (STE) in Cape-Verde (a long-term structuring vision) and the Poverty Reduction Strategy Paper II (PRSP 2008-2011). This strategy focus on: (i) good governance to enable the country consolidate its gains; and (ii) infrastructure that will drive tourism as the engine of growth and increase the competitiveness of the economy. Within Pillar II ADB will target transport, energy and water resource mobilization in light of the country's vulnerability to climate change. Within the energy sector will contribute to cutting energy production deficit and cost, the increasing demand for which is induced by rising economic activities and drinking water production through desalination. In terms of renewable energy The Bank will contribute to the promotion of renewable energy through dialogue with the Government and the donor community, while providing technical assistance through its Climate Risk Management and Adaptation Strategy (CRMA) and the Clean Energy Investment Framework (CEIF).

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 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

The specific political options for this sector include:

- Increase renewable and alternative energy penetration;
- Promotion of energy conservation and energy efficiency within the energy sector;
- Expansion of electric energy production capacity;
- Expansion of electricity supply coverage and ensure energy access
- Strengthening of institutional capacity and legal frameworks

- Creation of a Energy Security Fund;
- Promote research and adoption of new technologies

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. For the electricity coverage the Council of Ministers fixed a target of 95% and 100% of coverage at the national level by 2011 and 2015, respectivelly..

The aim for the Renewable Energy sub-sector is to ensure increase of renewable and alternative energy penetration (wind, solar, geothermal, ocean thermal energy conversion, wave energy, waste energy and biofuels) in the following years and consequently reduce fossil fuel dependency. The specific objectives are:

- Diversification of energy sources;
- Cover electricity demand necessities by 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 a first phase, give priority to wind energy development. The Government will reserve Zones for the Development of Wind Energy (called in Portuguese: "*Zonas de Desenvolvimento de Energia Eólica"*, ZDE)
- At the same time, the Government will monitor the technological evolutions in terms of incineration and will analyse the environmental impact of the eventual introduction of micro nuclear plants.
- Create the National Renewable Energy Company as a public/private company, which will facilitate business planning, and will guide national efforts and facilitate investment in renewable and alternative energy.

Decree-law nº14/2006, of 20 of February and Decree-Law nº54/99, of 30 of August and

The DL n. 14/2006, of 20th of November[5], which revises the DL n. 54/99 of 30th of August, establishes the bases for the Electricity System in Cape Verde with the aims of: promoting national economic and social development; environmental preservation; ensuring a safe and reliable supply at a reasonable price (fair and not discriminatory); encouraging the use of renewable resources; and attracting private investment and stimulating competition. The principles through which the DL n. 14/2006, of 20th of November aims at the national social and economic development are the following:

- Ensure a safe and reliable supply of electricity as well as increase the coverage of service to all consumers at a reasonable price, fair and not discriminatory in its use
- Increase the use of renewable energy sources and cogeneration to produce electricity;
- Promote efficiency and technological innovation in generation, transmission, distribution and use of electricity in the country;

[5] DL 14/2006 DL n. 14/2006, of 20th of November, consulted in October 2010 at: http://www.are.cv

- Attract private national and foreign investment for the Electricity System, including auto-producers and independent power producers, through the definition of stable, equitable, transparent and favourable conditions for investment;
- Encouraging healthy competition and competitiveness in the Electricity System.

In this DL the Electricity System is defined as including the activities of generation, transport, distribution and sale of electricity, thus enclosing independent power production and self-generation of electricity when adequate and necessary for the implementation of the objectives of this DL. It also states that the Electricity System can also include electricity distribution and sales activities when integrates in small and remote localities.

The implementation of this DL, through regulations, codes and technical norms is of the competency of the public services of the sector as well as of the Regulating Agency acting in the energy sector (in Cape Verde ARE, Economic Regulatory Agency).

In terms of licenses, this diploma states that:

- Production and distribution services, when delivered in an autonomous isolated area, need to obtain previous to developing its activities, a license from the Government, after previous consultation with the Regulatory Agency;
- Independent power production and auto-production, need a specific license from the Government, after consultation with the Regulatory Agency;
- The operation of independent power production activities and auto-production are subjected to specific regulations, that need to be attained;
- The licenses to be supplied to energy generation installations that use innovative technologies and technical solutions, may benefit of a special regime in accessing to a connection to the grid, having being hear the project proponent and the Regulatory Agency, besides the other benefits that the Law provides.

Decree-Law No. 30/2006 of 12 June[6]

This decree-law on Independent Power Licensing regulates the activity of independent power production, regardless of the source of energy. It establishes the rules on access, licensing and exploration of production activities related to electric energy, including independent production and self-production. Special attention is devoted to public expropriations and licensing procedures and to the connection to the electric network for energy self-producers. Moreover, the decree-law sets technical requirements for safety and security of the plants as well as of energy production and distribution processes. Finally, it provides sanctions for non-compliance and related control procedures.

In terms of renewable energy it sets some specific benefits:

- Special regime for the operation of autonomous production of energy and cogeneration;
- Obligation of the National Grid Operator of purchasing the electricity generated from renewable energies;

[6] DL 30/2006 of 12 June, consulted in October 2010 at: http://faolex.fao.org/docs/pdf/cvi67373.pdf

- The remuneration for the renewable energy delivered to the National Grid: the remuneration does not have to be negotiated between the project developer and the national grid operator, it is set by ARE.

Ordinance nº18/2006 of 24 July[7]

This Ordinance further regulates the Decree-Law No. 30/2006 on electric energy production activities. In particular, it establishes the rules on the guarantees related to energy production activities. The Ordinance defines the value, validity and beneficiaries of the afore-mentioned guarantees.

In terms of the values of the guarantee:

- Guarantee of 1,000,000CVE per MW or fraction of power connection, established in the respective Establishment Licence (Number 2 of Article 15 of of the DL n. 30/2006 of 12 June);
- Guarantee of 500,000CVE per MW of fraction of attributed power connection, established according to the Number 1 of Article 29th of the DL n. 30/2006 of 12 June.

Ordinance nº21/2006 of 28 August

The Ordinance n. 21/2006 of 28th of August sets the tariff and payment procedure for Independent Producers. This DL is in line with the DL 30/2006 of 12 June on Power Producers Licensing.

In terms of tariffs to be paid this DL sets the following:

- Operation Licence Tax: 75,000CVE/MW or fraction of attributed power connection, being at the maximum 1,000,000 CVE. The Independent Power Producer should do the payment before the operation licence is delivered.
- Establishment Licence Tax: 10,000CVE/MW or fraction of attributed power connection, being at the maximum 150,000 CVE.
- Exploration Licence Tax: 20,000CVE/MW or fraction of attributed power connection, being at the maximum 300,000 CVE.

In terms of payment procedure, the DL states:

- DGE is the entity that charges the supra-referred taxes, and this institutions is responsible for emitting a guide for tax charging.
- The independent power producer (the proponent) needs to demonstrate by presenting an appropriated document that has carried out the payment of these taxes.
- The charged taxes go to DGE.

[7] Ordinance n.18/2006, of 24th July, consulted in October 2010 at: http://faolex.fao.org/docs/pdf/cvi67374.pdf

Decree-law nº41/2006 of 31 July[8]

This law defines provisions related to electric energy crisis and exceptional intervention measures to be adopted by the State. The Decree-Law identifies the authorities in charge for managing energy crises. Special attention is devoted to compensation plans.

Art. 54 of Law nº4/VII/2007 of 11 January

This law frees imports of new and modern renewable energy production equipment and accessories from customs duties.

This is an article of the Cape Verde State Budget, which is revised every year so that it stays valid. This article has been included in the Cape Verde State Budget since 2007.

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

This decree law establishes the rules concerning the promotion, incentives 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 (EIA) 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.

[8] DL 41/2006 of 31 July, consulted in October 2010 at: http://faolex.fao.org/docs/pdf/cvi67372.pdf

In terms of environmental licensing, this DL reviews the Environmental Impact Assessment procedure so that it becomes similar to some European Countries, in which only some large scale renewable energy projects are subjected to Environmental Impact Assessment and not all. It also exempts of AIA the renewable energy projects developed in Sensitive Areas, creating a system of Assessment of Environmental Effects, similar to what happens at the European level for smaller projects in areas with tacit approval deadlines that ensures adequate mitigation of environmental impacts.

Also, taking into to account the existing limitations of the electricity systems and the possible existence of multiple counter-parties interested in developing renewable projects, this law creates a open simplified bidding scheme for the allocation reception capacity previewed under the Renewable Energy Master Plan, whose selection criterion will be the discount rate. In order to avoid speculation and postponement of projects, this law establishes fees and interim deadlines until the start of project operation.

The licensing procedure begins with the allocation of the reception capacity, being the main technical requirements and information necessary, stated in earlier legislation (DL 30/2006, of 12 June).

In terms of micro-generation the new Decree-Law creates a simplified authorisation scheme facilitated by prior registration. The installation of micro-generation systems only requires a prior registration with the Energy Directorate General and a subsequent inspection to validate their compliance with the requirements of applicable law. In terms of decentralised rural energy production this DL also creates a simplified licensing scheme for the area or region rather than per installation.

Decree-Law nº 26/2003, of 25 August[9]

The Economic Regulator Agency was created by the DL n. 26/2003 of 25th of August, having beginning its activities on 12 February 2004.

The Agency was created within the reforms of the financial and infrastructure sector, associated with the Constitution of the Republic, revised in 1992, in which the State regulates the market and the economic and financial activities, by creating or not Independent Administrative Authorities.

ARE is an Independent Administrative Authority that regulates the water, energy, transport sectors. Its mission is to provide economic efficiency and the financial balance of the regulated sectors to ensure that services of public interest and with benefits for the society are offered. Thus it has the function of economic regulator, supervision and sanctioning of breaches in the sectors in which it acts.

[9] ARE website, DL n. 26/2003 of 25th of August, extracted in October 2010 at: http://www.are.cv/Downloads/DL_n_26_03_Criacao_da_ARE.pdf

ECOWAS Treaty[10]

The Economic Community of West African States (ECOWAS) Treaty was established in 1975 to be the sole economic community in the region for the purpose of economic integration and the realisation of the objectives of the African Economic Community. This treaty was established between the following West African Member States: Benin, Burkina Faso, Cape Verde, Cote D'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togolese Republic. This treaty has been revised in 1993.

This treaty aims at promoting co-operation and integration, leading to the establishment of an economic union in West Africa in order to raise the living standards of its peoples, and to maintain and enhance economic stability, foster relations among Member States and contribute to the progress and development of the African Continent.

ECOWAS has several departments; being the Department of Energy part of the Office of the Community Infrastructure. ECOWAS Department of Energy is responsible within the ECOWAS Commission for providing the technical expertise in Energy and for the design and implementation of technical projects for the region decided by the ECOWAS President.

The department's functions as stated in Article 28, Item 1 & 2 of the Revised ECOWAS Treaty is to ensure coordination and harmonization of Member States policies and programmes in the field of energy, and, to this end:

i) Ensure the effective development of the regions energy resources;

ii) Establish appropriate cooperation mechanisms with a view to ensuring a regular supply of hydrocarbons;

iii) Promote the development of new and renewable energy, particularly solar energy, in the framework of the policy of diversification of sources of energy;

iv) Harmonise national energy development plans by ensuring particularly, the interconnection of electricity networks;

v) Articulate a common energy policy, particularly, in the field of research, exploitation, production and distribution

vi) Establish an adequate mechanism for the collective solution of the energy development problems within the Community, particularly those relating to:

   a) Energy Exchanges among Member States

   b) Shortages of skilled technicians, and

   c) Financial resources for the implementation of energy projects of Member States

ECOWAS has also an Energy Protocol[11] that establishes a legal framework in order to promote long-term co-operation in the energy field, based on complementarities and mutual benefits, with a view to achieving increased investment in the energy sector, and increased energy trade in the West Africa region. This protocol regulates commerce, investment promotion and protection and states other provision in terms of energy in the Member States.

[10] ECOWAS Treaty, extracted in October 2010 at: http://www.comm.ecowas.int/sec/index.php?id=treaty&lang=en

[11] ECOWAS Energy Protocol A/P4/1/03

The One Programme in Cape Verde / UNDAF

The Cape Verde's One Programme objective is to maximise and make efficient use of the joint contributions of participating Agencies to better support Cape Verde national policies in accelerating economic growth, promoting competiveness, creating productive employment and fighting poverty.

Following the recommendations in his 2006 High-Level Panel Report on Systems-Wide Coherence, one of the UN Secretary-General was to pilot reform in which all UN agencies Deliver as One, in the attempt to become more effective, strategic and relevant. At the heart of this is the idea that each UN Country Team (UNCT) works together in unity while recognizing eacg agency's unique contribution and diversity.

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, signed in 1st July 2008, aims to help Cape Verde's Government implement national priorities, such as those proposed at the Forum that assembled the Government, the United Nations System and Civil Society together at Praia on the 22nd of October, 2007 concerning:

(i) The achievement of international development goals, including the Millennium Development Goals (MDG) ;

(ii) Successful management of the period following graduation and

(iii) Support during the phase of post- accession to the World Trade Organisation (WTO).

The One Programme, running from 2008 to 2011, pays special attention and addresses the following cross-cutting issues: capacity development, the fight against HIV/AIDS, gender, communication for development and human rights.

While only six resident Agencies, Funds and Programmes (UNDP, UNICEF, UNFPA, WFP, FAO, WHO) have participated in the UNDAF, there are currently twenty Agencies (both resident and non-resident), Funds and Programmes taking part in the One UN Programme.

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 next steps in this joint programming exercise include notably the definition of "Outputs" to be produced by UN agencies and implementing partners. The UNDAP 2012-2016 is expected to be finalized and signed by December 2011/January 2012.

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.

5.2 Institutional Framework

Stakeholders in the renewable energy sector include government bodies and para-statal organisations, non-government organisations and associations as well as the private sector. In summary the key stakeholders are:

- The Ministry of Tourism, Industry and Energy (MTIE);
- The Ministry of Environment, Agriculture and Fisheries (MAA);
- The Ministry of Finance;
- The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)
- Economic Regulatory Agency (ARE);
- The National Water and Electricity Company (ELECTRA, SARL herein called ELECTRA);
- Renewable Energy Research Group (NER.)

Also, within the energy sector, the following organisations are operating:

- LPG companies – Shell and Enacol
- Oil companies – Shell and Enacol
- Private renewable energy companies: Electroaris, Electric, Martifer, Movitrom
- Non-governmental associations: NER (Renewable Energy Research Group)

Further detail is provided below for the key players in the electricity market: MTIE, MAA, Ministry of Finance; ECREEE, ARE and ELECTRA, and NER.

Ministry of Tourism, Industry and Energy (MTIE)

The Ministry of Tourism, Industry and Energy (MTIE), is tasked with the responsibility for establishing, implementing and monitoring innovative economic policies that aim Cape Verde sustainable growth and the competitiveness of the country in the world.

MTIE supervises the following institutions: ELECTRA S.A, the Society of Tourism and Integrated Development of Boavista and Maio (SDTIBM), Commercial Free Zone of Cape Verde (FIC) Cape Verde Shipyards (CABNAV).

MTIE comprises the following central services for strategy design, regulation and implementation coordination:

- The Directorate General for Energy; (DGE);
- The Directorate General of Industry and Commerce (DGIC) and;
- The Directorate General of Tourism (DGT).

In terms of services in the energy sector, MTIE is responsible for the attribution of interconnection point's (PIs) licenses for independent power producers.

Directorate General of Energy (DGE)

DGE is the service responsible for the definition, conception, execution and evaluation of the energy and desalination policy, as well as for the presentation of new proposals for growth, improvement and increased productivity and competitiveness of the energy sector.

DGE integrates the following services:

a) Conventional energy and desalinisation service;

b) Renewable energy and energy efficiency service;

c) Special Services Management Unit.

DGE also has the important role of approving energy related projects. Specifically for this project DGE is the national counterpart.

Ministry of Finance

The Ministry of finance has been working together with the Ministries of Environment and Energy to mobilise financial resources to implement projects, thus it is an important institution that can help renewable energy projects to get financing. The Ministry of Finance only starts to search for project financing, after the projects have been approved by DGE.

Ministry of Environment, Agriculture and Fisheries (MAA)[12]

The central services of the Ministry are organised in Directorates Generals and divided in two groups: 1) technical support services- administrative and planning; and 2) conception and management services.

The Directorate of Planning, Budget and Management is the only service that is part of the Technical Support - administrative and planning. Its main functions are: administrative management of the Ministry global equity, human resources management, general planning

[12] Ministry of Environment, Agriculture and Fisheries, DLn.56/2005 of 22 of August, consulted in October 2010 at: http://www.ambiente-territorio-cplp.org/pages/caboverde/caboverde.pdf

of programs and monitoring of projects, organization and implementation of a data collection system to allow sector development monitoring, integrated financial and operation monitoring of projects, and monitoring of cooperation among the partners in consultation with national authorities responsible for this area

The Directorate of Conception and Management Services (DGPOG) are part of the: Directorate General of Environment (DGA); Directorate General of Agriculture Forestry and Livestock (DGASP) and Fisheries Directorate. Its general functions are: conception of development programs and implementation and monitoring of projects at national, regional and local level; development of decree-law proposals, monitoring and enforcement of policies for the sector.

MTIE is also responsible for the National Communication to the UNFCCC on Cape Verde GHG emissions, mitigation and adaptation

Directorate of Environment (DGA)

The specific functions of DGA are:

- Implement the Environmental Policy, coordinate and supervise the actions necessary to its execution, by other words, implement the PANA II (Second Plan of Action for the Environment 2004-2014)[13];
- Propose a share and disseminate laws, regulations and administrative provisions relating to the sector and ensure its effective implementation;
- Prepare and implement the nature conservation national strategy;
- Collaborate in formulating policy to protect the built heritage
- Promote participation of citizens and institutions in environmental protection, helping to raise awareness of economic and social groups to environmental issues;
- Protect endangered specimens, stocks and fragile habitats in order to preserve natural resources;
- Promote and support the adoption of solutions in the field of solid waste and liquid waste by encouraging waste reduction, treatment and recycling;

Activities of the DGA:

- Supports the definition, implementation and evaluation of environmental policy, by diagnosis and studies on the state of the environment;
- Supports the definition of a policy for managing air quality and for controlling emissions to the atmosphere, with special focus on urban areas and implement measures under the regime of prevention and control of the air quality inside buildings;
- Study and propose legislative measures for the protection and improvement of environment, notably on environmental liability regime;
- Adopt measures for the protection of terrestrial and aquatic ecosystems threatened with destruction;

[13] PANA II, consulted in October 2010 at: http://www.sia.cv/documentos/pana_sintese.pdf

- Collaborate with public bodies in respect of treaties and conventions signed and / or ratified by Cape Verde, on the environment, particularly in its implementation;
- Promotes and supports the adoption of solutions in the field of solid waste and liquid waste, encouraging the reduction, treatment and recycling;
- Promote strategies for action on the application of prevention and control of noise pollution, with particular attention with regard to urban areas;
- Organise a national system of surveillance and control of environmental quality;
- Show, every three years, a preliminary draft White Paper on the state of environment in Cape Verde;
- Study and propose the adoption of forms of technical and financial support to environmental protection associations;
- Encourages the development of alternative technologies for low-polluting nature, including the value and use of non-conventional energy;
- Promote, support and follow the strategy to integrate environment into sectoral policies;
- Promote and monitor initiatives within an integrated policy for the sector of environment and natural resources.

Within PANA II, renewable energies are referred to as one of the Cape Verde environmental potentials that should be exploited in a sustainable way, especially: wind, ocean and solar resources.

Moreover PANA II defines nine Inter-Sectoral Environmental Plans (PAIS) were prepared. The following table shows the orientation lines of each of these Plans.

Table 16: Inter-Sectoral Environmental Plans (PAIS) and their orientation (PANA II, 2004)

PAIS	Global orientation
Environment and Sustainable Management for Hydro Resources	The highest priority is to mobilize resources, building hydraulic infrastructure that will allowing access of the population to water in sanitary and hygienic conditions and reduction of water losses in agriculture. Water resources protection against pollution is also a priority.
Environment and Public Health	Priority is given to preventive measures to combat parasites and infectious diseases – such as diarrheal, malaria, tuberculosis among others - and management of hospital waste. In terms of municipal waste management, the National Plan for Waste Management, has diagnosis the problem of waste management. Within the specific interventions for waste management the following stand out: residue reduction, legislation, location and good management of waste dumps, as well as the implementation of feasibility studies for reusing and recycling
Environment and Biodiversity	The priority goes to improving the knowledge on maritime and terrestrial biodiversity connected to in situ biodiversity valorisation and conservation. Biodiversity management is linked to hydro resource management,

PAIS	Global orientation
	agriculture modernization, livestock, promotion of the activities that provide income and consequent reduction of bad agriculture practices, uncontrolled exploration of national resources and mineral resources. In terms of the maritime biodiversity the priorities are concentrating on improving the knowledge on the maritime species in general, with emphasis in the endanger and endemic species and in the rational management of coastal areas.
Environment and Territory Planning	The priorities are concentrated in developing priority programmes: territory planning plans, Municipal Territory Plans, compile a National Registry, creation of a Territorial Information System, production of digital cartography, rehabilitation and modernisation of geodetic national grid and capacity building. Having into account the study on Alternative Methods of Construction to Reduce the use of Sand, it is consider essential to carry out a feasibility study on the imported sand supply market from the Africa Continent and a environmental impact study on the extraction of sand from the sea floor.
Environment and Education, Capacity Building, Information and Awareness	This sector has a big environmental education programme to all education levels and to the public in general with the objective of providing a sense of responsibility and action on the problems related to environment. All the PAIS and PAMs (Municipal Environmental Plans) include an education, capacity building and environmental communication component.
Environment and Tourism	The Government aims at developing sustainable tourism in Cape Verde using the local available potential, guaranteeing a positive impact on the sustainable socio-economic development. Several programmes are consider for this sector, such as: diversification of the national touristic products available (eco-tourism, beach and mountain tourism); development of a system to supervise touristic areas; integration of environmental concerns in the educational tourism programmes; and reduction of the impact of the touristic activities (such as waste generation, treatment of waste water etc..)
Environment and Agriculture, Forestry and Livestock	In agriculture, particularly in rural areas, the short, medium and long term priorities are associates with integrated interventions in investigation and adoption of better agriculture practices and the use of affordable technology to solve a multitude of problems that affect rural populations. In this sector the search for alternatives of using wood and other biomass resources is also a priority.
Environment and Fisheries	Priorities are orientated towards a rational management of the fishing resources and promotion of the quality of products. Capacity building on fishing and related activities.
Environment and Industries, Energy and Commerce	In the energy sector, the priorities are centralised in rural electrification through the adoption of renewable energy technologies (wind and solar) and the programme for domestic energies to reduce the consumption of fuel wood. In the industry sector the priority is on the development studies on the impact of the national industries in the environment.

PAIS	Global orientation
	In the commerce sector, the problem is centralised on the production of solid waste, due to the unlimited importation of non-degradable packages and non- refundable. Priority orientations are: revision of the legislation and enforcement of the supervising activities, the integration in the World Trade Organisation (WTO), revision and definition of control mechanisms for package imports; commercial cooperation and participation in the ECOWAS[14] activities.

As it can be seen the development of renewable energies are a priority considered in the PAIS, especially in the Environment and Industries, Energy and Commerce.

The DGA integrates three specific services:

1. Directorate of Legal Affairs, Inspection and Environmental Impact Assessment,
2. Directorate of Environmental Information & Environmental Quality Monitoring,
3. Directorate of the Natural Resources Management Services;

Within the Directorate of Legal Affairs, Inspection and Environmental Impact Assessment, DGA is also responsible for the AIA process in Cape Verde. This process is defined by the Law n. 29/2006 of 6 of March[15], and this law stipulates which projects are subjected to AIA. In terms of renewable energy projects the following are subjected to AIA according to this law:

- Dams;
- Energy production plants (wind, wave energy, geothermal).

However if the new DL on Promotion and Incentive for the Use of Renewable Energy is approved, there is a possibility that these type of projects are exempt from AIA.

ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)

ECREEE is a specialized ECOWAS Agency which acts as an independent body but within the legal, administrative and financial framework of ECOWAS rules and regulations. It was founded in 2008 with the Regulation C/REG.23/11/08 of the 61st Session of ECOWAS Council of Ministers in Ouagadougou, Burkina Faso, on November 23. In November 2009, ECREEE was established by the ECOWAS Commission with support from the Austrian Development Cooperation (ADC), the United Nations Industrial Development Organisation (UNIDO) and the Government of Cape Verde. The Spanish Agency for International Development Cooperation (AECID) joined the initiative and provides support to the ECREEE project activities.

[14] ECOWAS, *Economic Community of West African States*

[15] Official Boletim, DL Law n. 29/2006 of 6 of March, extracted in October 2010 at: http://www.sia.cv/docs/DL.pdf

The establishment of ECREEE is a necessary response to ECOWAS Member States specific needs as highlighted in their national and regional policies as well as a response to international energy and climate change decisions.

ECREEE aims to contribute to the achievement of the MDGs in West Africa by providing at least half of the people with access to modern energy services using renewable energy and energy efficient technologies and services. For that ECREEE goals are to:

- Lead and coordinate activities in the plan of action of the ECOWAS/UEMOA white paper on energy access that focus on RE and EE technologies and services;
- Improve energy security by promoting energy efficient technologies in ECOWAS member states;
- Contribute to achievement of the MDGs in West Africa by making available to at least half of the people in the region, access to modern energy services using RE&EE technologies;
- Enable the ECOWAS energy sectors to take advantage of Carbon Finance and the Clean Development Mechanism (CDM).

The ECREEE Secretariat is based in Cape Verde, city of Praia. It is headed by the Executive Director, Mr. Mahama Kappiah, former Head of the ECOWAS Energy Division for Energy Access and Renewable Energy. Cape Verde's Government provides office space and infrastructure, including training facilities for capacity building programs facilitated by the Centre. The Centre opened in the 6 July 2010.

The Centre is governed by an Executive Board (EB) and a Technical Committee (TC), which are responsible for the high decisions making and technical guidance, respectively. The following table shows the committees stakeholders.

Table 17: ECREEE Governance Structure: Executive Board and Technical Committee[16]

	Objective/Functions	Stakeholders
Executive Board (EB)	Highest decision making body. Meets on a yearly basis to provide strategic guidance and approve the work plan and progress reports. The EB will also oversee the management and operations of ECREEE. The EB is chaired by a representative from the ECOWAS Commission.	Representative of the ECOWAS Commission (Chair) Executive Director of ECREEE Rotating representative of the ECOWAS Energy Ministers UNIDO representative Expert from each contributing donor Renewable Energy/Energy Efficiency expert from the ECOWAS region
Technical Committee (TC)	Responsible for providing the technical guidance for ECREEE. The TC has the role of reviewing major technical documents and reports for submission to the EB. The TC is also responsible for technical review of projects to be	Executive Director of ECREEE (Chair) Representative of the ECOWAS Commission Rotating technical expert from ECOWAS

[16] ECREEE webpage, consulted in October 2010 at: http://www.ecreee.org/

	Objective/Functions	Stakeholders
	be funded by ECREEE resources and is recommending their approval by the EB. The TC meets twice a year.	Member States Representative from each contributing donor Professional staff of the Centre Expert of energy associations or enterprises in the region Representative of energy related civil society

In terms of activities, ECREEE support activities and tries to mobilize funds for the creation of regional renewable energy and energy efficiency markets. To address the challenges and barriers to market penetration of RE and EE technologies, five thematic programmes are proposed to be carried out by the Centre:

- Tailored Policy Frameworks and Quality Standards
- Facilitate Capacity building
- Advocacy, Awareness Raising, Knowledge Management and Networking
- Implementation of Renewable Energy Programs and Projects
- Implementation of Energy Efficiency Programs and Projects

The actions of each one of the referred programmes are highlighted in the table below.

Table 18: ECREEE Thematic programmes: objectives and actions

ECREEE Thematic Programme	Objectives/Actions
Tailored Policy Frameworks and Quality Standards	Providing support for national bodies that are responsible for prioritizing, planning and establishing appropriate policy and regulatory frameworks to ensure affordable access to energy, energy efficiency and renewable energy technologies and services. Stimulate private sector in development and implementation of RE&EE technologies and services projects in ECOWAS region. Set up a firm and realistic RE&EE portfolio standards both for the member states and the ECOWAS region. There is the need to put in place national and regional policies that require certain percentages of annual electricity and thermal energy use to be covered by renewable energy sources. The introduction of regional and national RE&EE quality technology standards will be facilitated by the Centre.
Facilitate Capacity building	Develop technical skills for the introduction of RE&EE technologies. There remains a continuing shortage of qualified personnel in the RE&EE markets of the ECOWAS region, in both the public and private sectors. Technical knowledge is needed to build a critical mass of policy analysts, economic managers and engineers who will be able to manage all aspects of RE&EE technologies and services development in the region. Human, institutional and corporate capacity building in RE&EE is therefore required for the realization and sustenance of the goals and objectives of the Centre. This is also required to sustain the scientific, engineering and technical skills relevant for the design, development, fabrication, installation and maintenance of RE&EE technologies.

ECREEE Thematic Programme	Objectives/Actions
Advocacy, Awareness Raising, Knowledge Management and Networking	Information dissemination on RE&EE resources, technology availability, benefits and opportunities to the general public – directed to users as well as investors. The Centre will make use of advocacy and public awareness strategies in this regard.
Implementation of Renewable Energy Programs and Projects	Develop and implement concrete RE programs and projects that seek to create the necessary policy, regulatory and investment environment at national and regional levels. These activities will take into account the different energy needs and realities of urban and rural areas in West Africa. The Centre, in collaboration with private companies will identify ways of financing renewable energy projects in urban and rural areas. Tailored financing schemes, models (e.g. feed in tariffs) and tools (e.g. for project appraisal) will be developed to ensure that RE technologies and services are provided to the consumer (including the very poor) at affordable prices and that the nascent renewable industry continues to grow and remain sustainable. In this regard the Centre will also facilitate the development and implementation of innovative commercial and non-commercial RE demonstration projects with good potential for up-scaling. For such projects ECREEE will try to mobilize additional carbon funds (e.g. CDM) and co-funding (grants and loans) from bilateral and multilateral donors.
Implementation of Energy Efficiency Programs and Projects	Develop and implement programs and projects to stimulate and promote the use of energy-efficient appliances and practices: energy-saving technology in industries, urban and rural households, commercial and public buildings and energy efficient transport systems and paths - in order to reduce energy consumption, reduce the emission of green house gases and reduce energy costs for consumers. Products under this program shall include application of compact fluorescent lamps, and the development of standards for refrigerators and air conditioners. Other activities that will be implemented include: • Develop pilot projects in selected locations in ECOWAS Member States to demonstrate the savings and benefits from the use of energy efficient equipment in urban and rural areas; • Create a platform for knowledge exchange and sharing of experiences among Member States and develop a capacity building and training program for representatives of the region in the field of EE and Demand Side Management (DSM); • Develop regional appliance efficiency standards and equipment labelling

The main target groups of ECREEE activities, programmes and projects are: policy makers in energy and related sectors; energy service companies; policy makers; the private sector such as small and medium enterprises (SMEs), entrepreneurs, equipment manufacturers, project developers financing institutions; national institutions charged with promoting renewable energy and energy efficiency; research institutions, universities, private sector, civil society organizations; national standards organizations and import control outfits; and ultimately, the greater population of the ECOWAS region.

In terms of programmes, ECREEE will be the main implementing agency of the UNIDO USD 150 million programme that will focus on the energy access agenda and energy efficiency in key sectors of the economy.

Economic Regulatory Agency (ARE)

ARE was constituted by the DL n. 26/2003 of 25th of August[17] and began its activities on 12 February 2004. The Agency was created within the reforms of the finance and infrastructure sectors, associated with the Constitution of the Republic (reviewed in 1992), according to which is the competence of the State to regulate the market, the finance and economic activity, and that it may create Independent Administrative Authorities to help to do that.

Since its creation, a ARE has had an active role within Cape Verde, not only by regulating the sectors under its jurisdiction but as well by promoting lectures on Consumer Rights, international conferences and by signing cooperation memorandums with similar institutions, such as CEDIPRE - Centre for Public Law and Regulation of Coimbra's University, the Graduate Course in Public Regulation and Competition, with the participation of experts from other national regulatory agencies.

ARE's main goal is to promote economic efficiency and maintain the financing balance within the sectors for which it is responsible for (energy -electricity and fuels-, water and wastewater, Urban collective transports and maritime collective transports), thus to assure the offer of public interest services that will benefit the society.

This body is also responsible for setting up the prices at which electricity from renewable energy projects is bough by the national grid as well as for regulating electricity tariffs. The DL n.27/2003 of 23rd of August[18] states the responsibilities and competencies of ARE.

Responsibilities:

- Regulate the access to the activities in the sectors in which it acts: energy (electricity and fuels), water and wastewater, urban collective transports and maritime collective transports;
- Ensure the existence of conditions that meet efficiently, the demand of services in the regulated sectors;
- Protect the financial-economic balance of service providers regulated by it;
- Provide the holders of concessions, operating licenses or other agreements the existence of conditions enabling them to fulfill their obligations under those instruments;
- Ensure, on regulated activities serving the public interest, the relevant public service obligations and universal service obligations;
- Protect the rights and interests of consumers in terms of tariffs and quality of service;
- Ensure the impartiality of regulation and transparency of commercial relations between the operators of regulated sectors and between them and the consumers;
- Ensure the implementation and enforcement of laws and regulations applicable to regulated sectors, as well as compliance by the operators of the provisions of their securities for conducting activities or contracts;

[17] ARE website, DL n. 26/2003 of 25th of August, extracted in October 2010 at: http://www.are.cv/Downloads/DL_n_26_03_Criacao_da_ARE.pdf

[18] ARE website, DL n.27/2003 of 23rd of August, extracted in October 2010 at: http://www.are.cv/Downloads/DL_n_27_03_Estatuto_da_ARE.pdf

- Coordinating with the competent authority the application of the law of competition in regulated sectors;
- Contribute to the gradual improvement in economic conditions in the regulated sectors, including fostering, adoption of practices that promote the efficient use of assets;
- Promote consumer information and clarification, in coordination with the relevant authorities

Competencies:

- Competencies in relation to public service concessions: It's ARE competency prior to Government approval, the emission of an opinion, in:
- Granting of concessions in the sectors in which it acts and draft terms of reference and the respective concession contracts;
- Authorization of sale, disposal or encumbrance of concessions;
- The termination or modification of the concession contracts, and the possible seizure or surrender of the concession.
- Competencies on tariff prices: It's ARE competency in terms of tariff prices:
- Define tariffs and prices consistent with the laws and regulations;
- Ensure compliance with pricing rules established in the concession contracts and licenses;
- Set the analytical cost accounting rules appropriated to the accounting separation of regulated activities;
- Proceed with the adoption and revision of the tariff.
- Competencies on the operators' business relationship
- The business relationship between regulated entities and consumers, is processed in accordance with the laws applicable to regulated sectors, as well as the bases of their contracts and concessions and licenses.
- In the framework of the preceding paragraph, it is ARE responsibility to approve the regulation of commercial relations as well as by its reviews.
- Regulated entities may submit proposals to the ARE for revision of the regulation.
- Regulatory competencies: for a proper exercise of its activities its ARE competence to:
- Make regulations deemed necessary for the enforcement of laws relating to the sectors that regulates;
- Approve regulations relating to its internal organization and functioning.
- Its are competency to:
    - Prosecute and punish violations of the laws and administrative regulations which ARE is responsible for implementation and supervision, as well as those resulting from compliance with its own determinations;
    - Propose to the Government to implement the sanctions provided in the concession contracts or licenses in, as well as the puncture of violations of laws and regulations whose implementation or supervision not fit them;

- Aware the competent organizations the infringements of rules that ARE became aware in performing their duties;
- Aware the competent authorities of other offenses that it became aware in performing their duties.
- The sanction procedures respect the principle of hearing of interested parties, the adversarial and other principles of law on administrative procedure and, where appropriate, the system of contraindications.

- Advisory competency:
  - Without prejudice of ARE's competencies in relation to public service concessions, ARE should emit opinions on all matters within its sphere of specific assignments that are submitted by the National Assembly or the Government.
  - AER is also responsible for formulating suggestions for the creation or revision of regulatory framework in the sectors under its jurisdiction.

ELECTRA, SARL

ELECTRA, SARL (herein called ELECTRA), created in 17 of April of 1982, by the DL nº 37/82, is a company which aims at the production and distribution of electricity throughout the territory of Cape Verde. ELECTRA is owned by the Government of Cape Verde (63% of the social capital), the Municipalities (9% of the social capital) and by the INSP (Social Security National Institute) (with 27%).

ELECTRA's mission is to provide electricity and water related services, which add value and comfort, contributing to the development of Cape Verde. Nowadays it has a current electricity coverage rate of 75%, as well as the responsibilities of producing and distributing drinking water in S. Vicente, Sal, city of Praia in Santiago, Vila Sal-Rei in Boavista, with a coverage rate of 50%, and for the collection, treatment and reuse of wastewater in the city of Praia.

With Headquarters and Service Centres in the city of Mindelo, located on St. Vicente island, and about 695 employees, the company carries on business through nine operating units of production and distribution: two on the island of Santiago and one in each of the other islands (having in some islands more than one production plan and distribution services).

ELECTRA, as part of its privatization process is active, managing five autonomous business:

Three businesses are managed on the basis of a concession contract signed between the company and the Government, which has the starting date of 18.01.2000, valid for a period of thirty-six years. In this three business Electra acts as concessionaire of public services, are, namely in:

- Transport and distribution of electricity throughout the national territory, on an exclusive basis;
- Transport and distribution of water in S. Vicente, Sal, Boavista and in Praia, on an exclusive basis;
- Wastewater collection and treatment for reuse in Praia, on an exclusive basis.
- Two businesses are subject to licensing by the Government, which is valid for thirty years, starting in 18.01.2000, namely:

- Production of electricity throughout the country;
- Production of desalinated water, in S. Vicente, Sal, Boavista and Praia.

ELECTRA's energy production is based in fossil fuel and diesel thermal generation and wind power. As already referred above, in the end of 2009 ELECTRA was operating 18 diesel power plants of different capacities and three wind farms.

Renewable Energy Research Group (NER, Núcleo de Investigação em Energias Renováveis)

NER is a non-profit association which aims to develop and promote the use and benefits of renewable and non-conventional energy in Cape Verde, through the optimization of its performance and reduction of costs.

To achieve this aim NER is studying all these systems and adapting those to the reality in the country. NER also promotes the efficient use of energy resources, contributing to sustainable development and the environmental protection.

NER intends to become a meeting point structure of people in general, but mainly of technicians from different fields (lawyers, architects, biologists, political scientists, economists, engineers, physicists, administrators, mathematicians, physicians, psychologists, sociologists, etc.) in the country that are worried about energy and environmental issues, particularly with reducing dependence on fossil fuels. Thus this Association shall developed any activity that contributes to achieve the stated objectives, including[19]:

- Investigate the adaptability to Cape Verde of the technologies available that allow the use of renewable energy in housing, industrial and tourist facilities, networks of electricity and other energy users;
- Develop and disseminate pilot projects, which could be used in similar facilities;
- Raise awareness among the general public, particularly schools, on renewable energy technologies with economic benefits in Cape Verde as well in the conventional technology solutions that best fit, for its economic advantages, the reality of Cape Verde, and on the set technologies that allow energy networks stability;
- Contribute to the definition, and eventually to the implementation of a sustainable energy policy;
- To stimulate programs and projects in renewable energy and energy efficiency, to contribute to sustainable development and environmental protection;
- Base interventions, taking into account the need for a functioning network that promotes the collaboration of all stakeholders in the energy sector (especially the Government and its agencies on energy and environmental area, the regulator of the energy sector, universities, industry and other non-governmental organizations and civil society in general), considering the complex interrelationship between energy and environment and also the technological, economic, social and renewable energy development and utilization;
- Streamline processes for improving the energy saving in buildings;

[19] NER website, consulted in October 2010 at: http://www.ner.org.cv

- Promote the development of energy-using equipment quality benchmarks in the market;
- compile information and conduct studies on the development of applicable technologies;
- Disseminate the results of studies and analysis, and all information likely to develop the analytical capacity in renewable energy, energy efficiency and environmental protection;
- Promote, with their associates and colleagues, meetings, sectoral meetings, seminars and other activities as appropriate , as well as cooperate in activities helpful to the improvement of access to energy, water and waste treatment, which are likely to contribute to improving the quality of life in communities and to protect the environment;
- Provide advisory services in energy and environment;
- Perform any other duty that comes in line with NER objectives and is allowed by law.

6 BASELINE PROJECTION OF GREEN HOUSE GASES

The First National Communication to the UNFCCC[20] provides a baseline for greenhouse gases (GHG) in Cape Verde as well as potential mitigation scenarios. The Second National Communication is currently being prepared and is not yet available; thus the detail on GHG emissions presented in this section reflects the results of the Cape Verde First National Communication to the UNFCCC (base year 1995).

According to the First National Communication (FNC), in 1995 Cape Verde emitted 330,901 liquid tonnes of CO_2 equivalent (tCO_2e) of which carbon dioxide emissions (CO_2) accounted for approximately 74% of this total. The following table shows the Greenhouse Gas (GHG) emissions per sector in 1995.

Table 19: GHG emissions per sector - 1995[21]

Emissions (Gg)	CO_2	CH_4	CO	N_2O	NO_x	tCO_2e	%
Fossil fuels	217.730	0.009	0.574	0.006	0.723	219.871	66.45
Biomass*	47.383	0.391	4.107	0.003	0.076	37.992	11.46
Agriculture		1.817		0.004		39.419	11.91
Solid residues and wastewater		1.465		0.010		33.689	10.18
Emissions Total	**245.103**	**3.682**	**4.681**	**0.023**	**0.799**	**330.901**	**100**

**Liquid emissions= biomass burning- CO_2 capture*

[20] First National Communication of Cape Verde to the United Nations Framework Convention on Climate Change, extracted in October 2010 at: www.unfccc.com

[21] Ibid

The emissions from fossil fuels were responsible for 66.45% of the total emissions in Cape Verde, while agriculture, biomass and solid residues & wastewater were responsible, respectively, for 11.91%, 11.46% and 10.18%. The origin of CH_4 was mainly from the agricultural sector and livestock, while the origin of N_2O emissions is from solid waste and wastewater.

The origin of emissions from energy sources in 1995 is mainly from fossil fuels (65%) and fuel wood and biomass (35%). The origin of CH_4 results from the consumption of fuelwood and biomass (98%), while the origin of N_2O emissions lies in the consumption of fossil fuels (67%) (Table 20)

Table 20: GHG emissions from energy sources in Cape Verde (1995) [22]

Emissions	*CO_2	*CH_4	CO	*N_2O	NO_x	CO_2e	%
Fossil fuels (Gg)	217.73	0.009	0.574	0.006	0.723	219.871	65
Biomass (Gg)	106.87	0.391	4.107	0.003	0.076	117.412	35
Emissions Total (Gg)	**324.60**	**0.4**	**4.681**	**0.009**	**0.799**	**337.283**	**100**
Emissions per inhabitant (kg/hab)	840.54	1.036	12.12	0.023	2.07	873.37	

** $CO_2e = CO_2+24.5CH_4+320N_2O$ for an integration time of 100 years (IPCC 1994)*
Cape Verde population in 1995 was evaluated in 386,185 inhabitants.

The analysis of emissions originated from the consumption of fossil fuels except CO_2 shows that the transport sector contributed 74% of CH_4 emissions and 91% of N_2O emissions.

Table 21: GHG emissions from fossil fuel consumption (except CO_2): 1995[23]

Activity	CO		CH4		N2O		NOx	
	Ton	%	Ton	%	Ton	%	Ton	%
Thermal Power Plants & Desalination Plants	14.12 NA	2.5 NA	0.028 NA	0.3 NA	0.565 NA	9.3 NA	64.01 NA	8.85
Transport	553.762	96.5	6.369	73.65	5.528	90.7	635.75	88
Agriculture/ Residential	5.852	1	2.251	26			22.96	3.15
Total	**573.73**	**100**	**8.648**	**100**	**6.093**	**100**	**722.72**	**100**

For the reduction of GHG the FNC indicates the following general policies and measures to be adopted:

[22] Ibid

[23] Ibid

- Strengthening international cooperation in setting common goals to improve the environment at the global level, both in respect information exchange, as in science and in the transference of technology.
- For sustainable development:
    - Strengthen the institutional capacity to ensure continuity of operations implementation and transference of technology and "know how".
    - Increase public awareness, by training programs and information.
- The general sustainable development policy should have two components for which financial resources should be made available:
    - support for the definition of policies and strategies;
    - support and facilitation of national technical capacity.
- For the energy sector the FNC indicates the necessity to strengthening actions in the following four main areas: energy and environmental policy and planning; rural and suburban electrification; rational use and management of energy; and energy efficiency in the use of firewood and biomass.
- In terms of energy policy, FNC highlights the necessity of re-orientating the energy policy to achieve a more efficient energy system. To this effect Cape Verde should ensure the technical and financial support necessary to achieve the following main goals:
- The development of a strategy of energy management and the establishment of an institution for promoting energy framed in an open economy;
- A more thorough study of the National Mitigation in Energy and Environment components;
- Legislation and regulation of a financing plan for the conservation of energy;
- The implementation of the Framework Law for the Power Sector and its regulation;
- The implementation of the Framework Law for Oil Sector and its regulation, and
- Establishment of favourable conditions for development and donor investment awareness.
- In terms of projection scenarios the FNC considered two for the energy sector: a baseline scenario (business as usual: zero penetration of RE) and an alternative scenario with a strong participation of renewable energy within the energy economy (30% of renewable energy penetration from 1995-2010 and from 2010 -2020). The following tables summarise the results of the projections for the two scenarios considered (Table 23) as well as the assumptions under each scenario (Table 22).

Table 22: Assumptions considered in the Cape Verde FNC emission projections[24]

FNC Scenarios	Assumptions
BAU Scenario	• 0% increase in the penetration of renewable energy in the electricity

[24] Ibid

FNC Scenarios	Assumptions
	production • Continued consumption of the specific fuel per kWh for 1995; • During the period 1995-2010: the production of electricity based in fossil fuels increases 4.6 times thus corresponding to an increase in emissions of CO2 and other pollutants; • During the period 2010-2020: the production of electricity based in fossil fuels increases 2.29 times with serious consequences for the global environment at regional and local levels.
Alternative Scenario	• 30% penetration of renewable in the power generation system during 1995-2010 (24% wind and 6% solar power); • 30% penetration of renewable energy (23.2%+5.8% solar wind) with corresponding reduction of emissions and power plant effluents. • Strong response in the field of energy conservation, especially in the use of exhaust gas for production of desalinated water for cold production. • Introduction of an economic policy for energy management in the industrial and domestic sectors aiming at more rational use of energy and more efficient equipment. • Reduction of the fuel consumption for electricity production will be a key objective for a saving and power management campaign. One of the goals will be to pass a specific consumption between 225 and 247 grams of fuel per kWh to about 210 grams / kWh. • Considers a mixed solution energy renewable (photovoltaic panels and small wind turbines) for lighting, door-radio and television, the rational use of butane gas (refrigerators + kitchen) and firewood for efficient furnaces, for the small and isolated communities (about 15% of the population of Cape Verde), that remain outside the conventional system of production, transmission and distribution of electricity.

Table 23: Emission projections FNC[25]

tCO2e	BAU scenario			Alternative scenario		
	1995	2010	2020	1995	2010	2020
Electricity production	67,213	308,359	705,149	67,213	93,505	205,149
Domestic Sector (oil products)	33,048	71,940	138,299	33,048	71,940	138,299
Domestic Sector (fuelwood & biomass)	93,232	107,987	107,987	93,2321	107,9871	107,9871
Transports	130,584	838,013	4,224,543	130,5842	838,0132	4,224,5432
Desalinization	19,916	19,916	19,916	19,916	19,916	19,916
Total Emissions	343,933	1,439.328	5,665,875	343,993	1,252,523	4,990,327

[25] Ibid

tCO2e	BAU scenario			Alternative scenario		
	1995	2010	2020	1995	2010	2020
Emission Reductions				0	186,805	675,518

Notes:

1 *With the introduction of more efficient homes, it is expected a decrease in consumption of about 20% of firewood. However, increasing population and corresponding increase in demand can offset this decline.*

2 *A 10% decrease in consumption of fossil fuels in the transport sector is expected for the period 2000-2020 with the implementation of a program to improve energy efficiency in maritime and land transport fleets, rationalization of urban and interurban transport and the introduction of low power consumption mini-bus in urban circuits.*

Under the BAU scenario, the continued consumption of fossil fuels as per 1995 will cause the emission of 1439ktonCO_{2e} in 2010, corresponding to an increase of 4.2 times compared to the base year (344 ktonCO_{2e}). For 2020, the total emission in tones of CO_2 equivalent would be 3.94 times that of the year 2010.

In the alternative scenario, reductions of approximately 30% of GHG emissions from the electricity generation sector power together with 10% in the transport sector, leads to a decrease of 13% on the global emissions in 2010 in this scenario, compared to the same year of the BAU. In the year 2020 of the alternative scenario global emissions are expected to be 12% lower than those of base scenario.

7 OPPORTUNITIES FOR RENEWABLE ENERGY

It is clear that neither conventional energy sources nor RE can solve the problems of rural and urban energy development on their own in Cape Verde. For the foreseeable future, it will not be possible to supply the rural areas with oil or grid power in large enough quantities to support the desired economic growth. This means an increased reliance on local energy sources and therefore renewable energy sources. Also, in the longer term, RE can be seen as a promising and, indeed, necessary compliment in the national energy mix.

Cape Verde has a good renewable energy resource endowment with ample sunshine and good and reliable wind resource. At the moment there are is no study of the Renewable Energy Resource Potential in Cape Verde. Specific studies and analysis were mainly carried out on wind and solar. MARTIFER is conducting a study on the renewable energy potential in 5 islands of Cape Verde, namely: Santiago, São Vicente, Sal, Santo Antão and Fogo, of which some of the results were used in the following sections. Within its studies besides the wind and solar potential, MARTIFER is also analysing the hydro, geothermal and ocean potential.

7.1 Biomass resource and opportunity

Due to the existing climatic conditions, the status and future potential of biomass energy in Cape Verde is very low. 40% of the food in Cape Verde is imported. However some opportunities may exist using municipal solid waste and for biodiesel production.

Municipal Solid waste

The main municipal wastes in Cape Verde are various solids and liquids from household and human waste. Municipal solid waste can be incinerated to produce energy or anaerobically digested

Biodiesel

Jatropha Curkas has been in second half of 19th and first half of 20th centuries an important basis of the economy of Cape Verde and it has been widely used in Africa and Asia for biodiesel production.

In the last two years external financing for the expansion of Jatropha Curkas cultivation has been provided and some companies have already been created to export the seeds, and other are foreseeing to export the oil extracted from seeds. However up until now, no project has been announced to produce biodiesel in Cape Verde. Biodiesel production in Cape Verde will help to reduce imported diesel oil, in the middle term (according to NER it can help to reduce at least in 5%, the 80 000 tones/year[26]).

7.2 Wind resource and opportunity

Cape Verde has a huge wind power potential, even in Sotavento islands were the average wind speeds are lower than in Barlavento islands. Wind power utilisation is an obvious

[26] NER

option for the Cape Verde islands, situated in the North-West Passage belt with excellent wind resources and with high dependency of imported diesel fuel for power generation. The average wind speed in Cape Verde is more than 6m/s, and it has been one of the rare ECOWAS countries with an annual high and interesting potential for wind energy.

The most significant example of the country's wind energy potential is S. Vicente, were the installed 3 x 300kW wind turbines have generated an annual average electricity of 3,912,071 kWh between 1995 and 2008 (Figure 3), meaning that the utilisation of the installed capacity is of 4,340h/yearin 1997, rising to 5500 h/year. Moreover, the dominant wind direction is almost constant

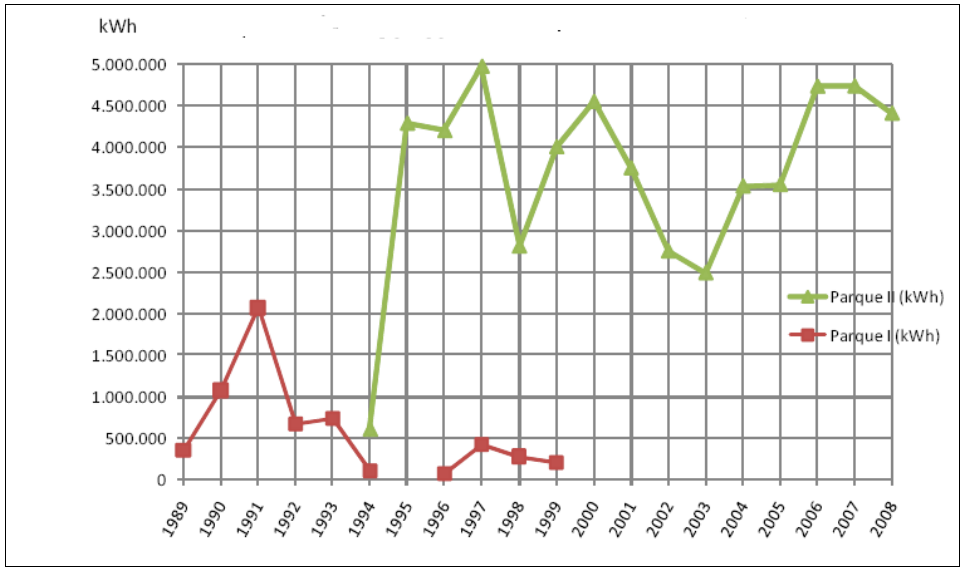


Figure 3: Energy produced in São Vicente[27]

Within the Wind Power Extension Project II, wind conditions have been thoroughly measured and logged during the period 2001 to 2004 at the three existing wind farm sites – S. Filipe at Santiago, S. Pedro at São Vicente and Palmeira at Sal, and in addition at a proposed new site located in Flamengo at São Vicente. The following figure shows the monthly variation of wind speed at 31m in Flamengo, Filipe and Palmeira collected between November 2001 and October 2002. As it can be seen a high wind period is registered from January to June and a relative low wind period from July to December.

[27] NER, xxx presentation 6

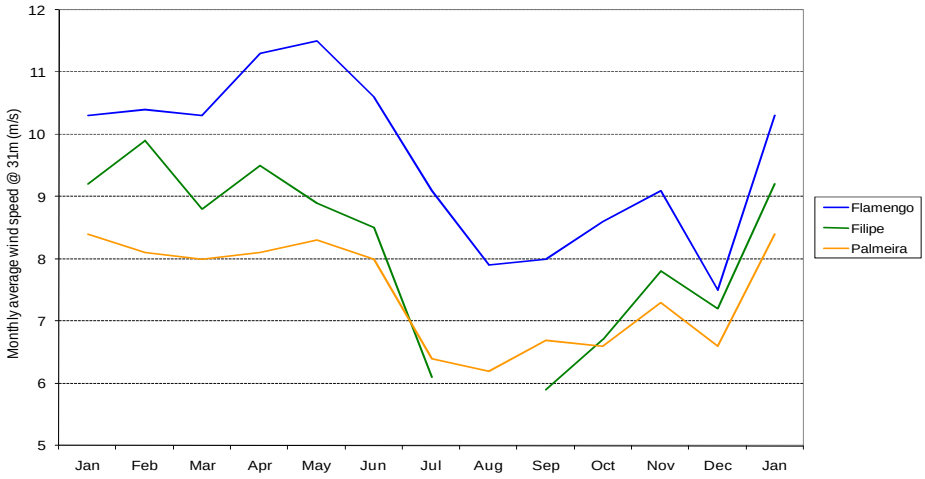


Figure 4: Monthly variation of wind speed at 31m[28]

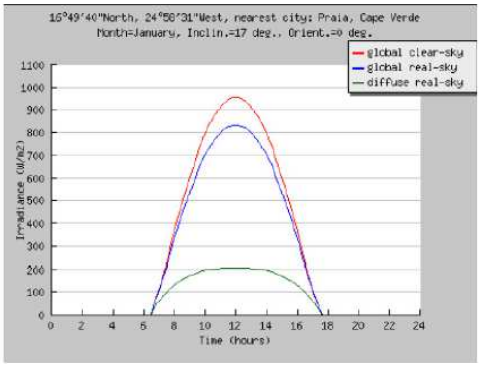
This study has conducted to the development by Cabeólica S.A. for four wind farm projects in Santiago, Sal, São Vicente and Boavista. This project requested in March 2010 for development support to ADB (specification of this project can be found in Section 4 and in Section 8).

Cape Verde has been exploiting wind energy mainly for electricity production and desalination since 1995. This proves that the economic potential for this resource is substantial.

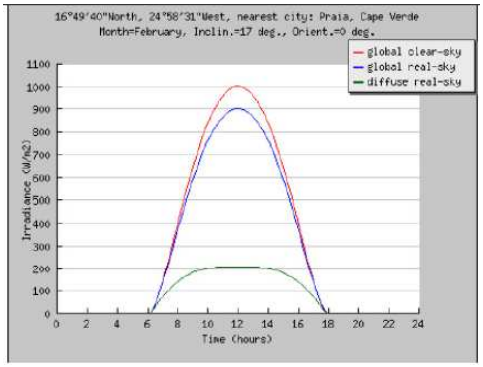
7.3 Solar resource and opportunity

Like the wind resource potential, solar energy potential in Cape Verde is very high. Cape Verde has one of the highest solar irradiation of the ECOWAS countries; of 6kWh/m^2/day. The following graphs shown in Figure 5, taken from EU/Joint Research Centre/Institute for Energy/Renewable Energy Unit site, give us the global real-sky irradiance, the diffuse irradiance and the global clear-sky irradiance in W/m^2 in a fixed plan oriented to an azimuth of 0º and an inclination to horizontal of 16 degrees in S. Vicente.

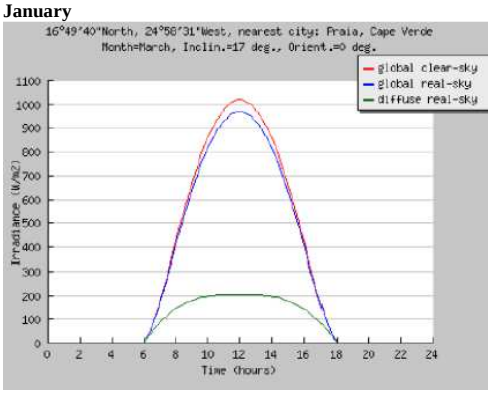
[28] Riso DTU, Simple wind-diesel concept with high wind penetration in Cape Verde, 2009



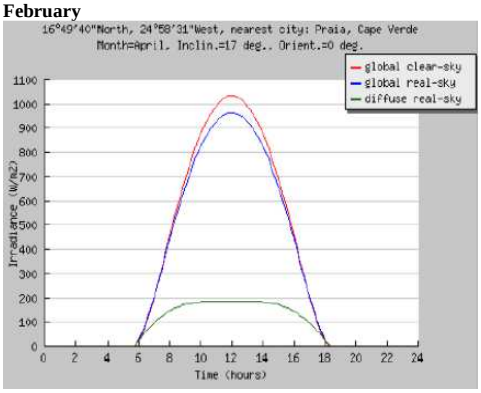
January



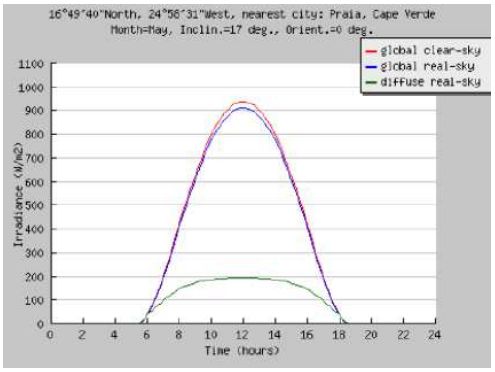
February



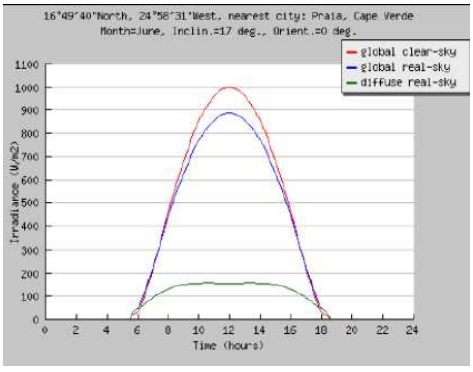
March



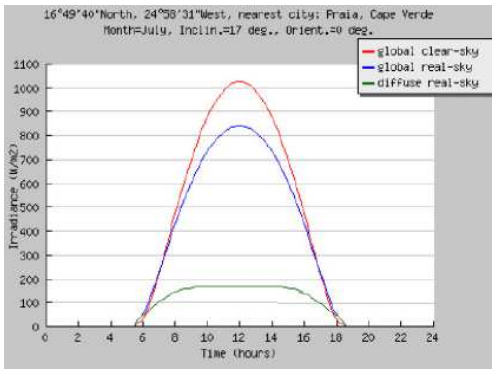
April



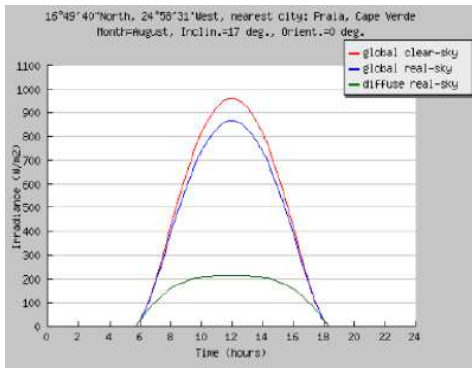
May



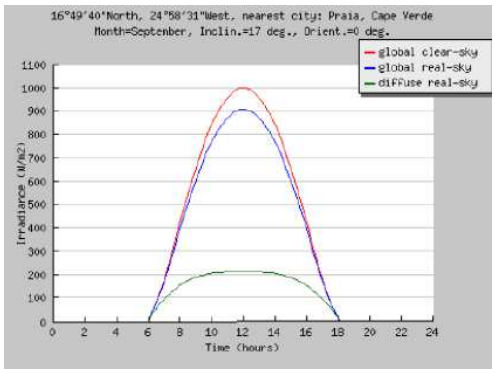
June



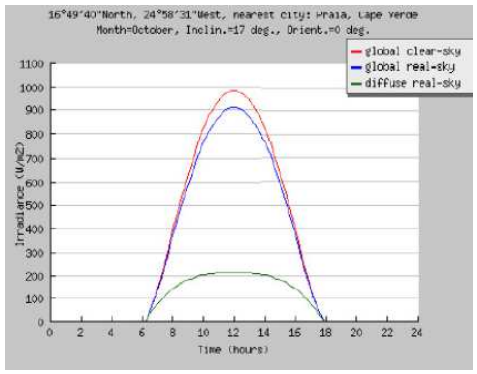
July



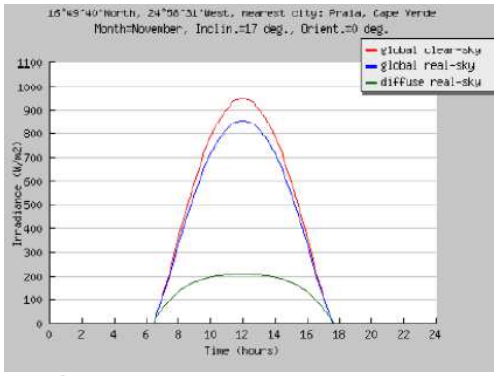
August



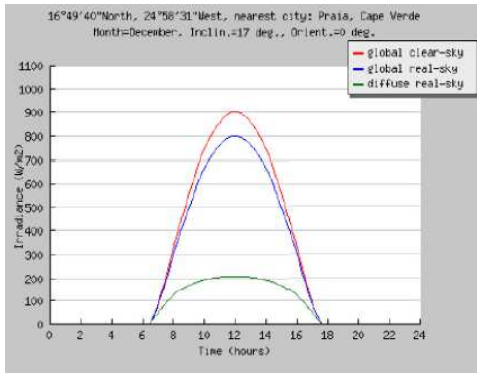
September



October



November



December

Figure 5: Graphs on the global real-sky irradiance, the diffuse irradiance and the global clear-sky irradiance in São Vicente[29]

[29] NER, Presentation on the International Simposyum of Renewable Energy and Economic Competitivity, Mindelo May 2010, consulted in October 2010 at: http://www.ner.org.cv/root/simpo/3.%20RuiP-Apresenta%C3%A7%C3%A3o%20Symposium%203.pdf

The graphics were taken for the twelve months of the year and it can be seen that, at noon, the real-sky irradiance (blue curve) never drops below 800 W/m^2.

MARTIFER is conducting a study on the renewable energy potential in five islands of Cape Verde, namely: Santiago, São Vicente, Sal, Santo Antão and Fogo. In this study the solar power potential shown in Table 24 was identified. This estimative was carried out taking into consideration: topography (areas with slopes lower than 3% + areas bigger than 1ha), planning constraints (EROTs/PDM); proximity to the electricity grid (maximum distance considered =1000m) and accessibility (roads).

Table 24: PV solar potential in Santiago, São Vicente, Sal, Santo Antão and Fogo[30]

Island	Number of Areas Identified	PV solar potential (MW)
Santiago	160	620.15
São Vicente	90	726.31
Sal	53	660.50
Santo Antão	12	10.40
Fogo	3	9.45

In this study the PV potential associated with off-grid power systems for isolated populations was not considered, and thus there is still a huge PV potential to be realised with this type of smaller systems. Due to the high solar energy potential, according to the NER presentation at the International Symposium of May 2010, it is intended to provide 2% of the total energy consumption by 2010. There is a huge solar potential, and thus a good opportunity in Cape Verde to use solar resource for: grid connected; off grid solar energy generation, solar thermal and microgeneration.

In terms of micro-generation using solar renewable energy technologies, MARTIFER has already listed thirty buildings in Cape Verde in which PV systems can be installed. Also micro-generation in the tourism sector (for example, installation of solar water heaters and PV systems in hotels) shows a potential good opportunity due to Cape Verde's bet on the expansion of this sector.

Photovoltaics

PV can be utilised anywhere in Cape Verde. The opportunities include large PV plants (>MW), to diesel – PV hybrid systems to solar home systems and small systems for social uses. Where PV is used on a grid it can offset significant quantities of fossil fuel and for off-grid areas it can provide electricity where it is not economic to extend the grid or to build mini-grids. PV can be used for health centres, schools, community centres and telecommunications as well as for homes (solar home systems). A good opportunity for the use of PV exists for the isolated grids run by ELECTRA which currently run on diesel. These grids currently do not run 24 hours because of the high costs of fuel, installing PV power

[30] MARTIFER, July 2010 Progress Report: Cape Verde Solar PV projects

plants at these locations could reduce the running costs of these grids, and allow expansion of the system to run for 24 hours a day.

Up to now there are several successful PV-based applications for water pumping, lighting and telecommunication systems and big PV projects are being developed by MARTIFER in Sal (2.5MW) and Santiago (5MW) Islands.

Solar Water Heating.

The opportunity for solar water heating is at every location where there is a need for hot water. In particular this includes the hotel sector where they currently either use electricity or fuel oil boilers to produce hot water. Household systems can be used where there is a domestic demand and solar water heating could also be used as pre-heating for more industrial processes that require hot water.

7.4 Hydro Power

MARTIFIER plans to carry out a study of the hydro resource potential in Cape Verde. This study will study the hydro (fluvial and marine) potential for pump storage and mini-hydro potential in the country.

The studies carried out at the moment by MARTIFER[31] in to hydro pump storage have revealed that most of the islands do not have fluvial hydro potential. However Santiago and São Vicente islands revealed a lot of potential associated with hydro pump storage, which are the island with higher energy consumption:

- São Vicente – the potential in this island can be only achieved through marine water pumping, due to the uncertainties of natural filling of the dam for hydro electric and pump storage generation;
- Santiago – this island shows fluvial and ocean pump potential.

Within the MARTIFER study the hydro pumping projects showed on the following table have been identified:

Table 25: Hydro pump projects[32]

Island	Location	Type of pump project	Capacity (MW)	Autonomy (hours)
Santiago	São Gonçalo	Fluvial pump	Scenario I: 25 Scenario II: 50	Scenario I: 19 Scenario II: 14
	Mato Grosso	Fluvial pump	Scenario I: 25 Scenario II: 50	Scenario I: 20 Scenario II: 10
São Vicente	Monte de Goa	Marine pump	Scenario I: 8 Scenario II: 15	Scenario I: 22 Scenario II: 20

[31] MARTIFER, Renewable Energy Plan for Cape Verde: Hydropower and the Hydro Potential in Cape Verde, June 2010

[32] MARTIFER, Pump projects – Preliminary Document for Discussion, July 2010

MARTIFER is also going to study the potential in Santo Antão that although it does not have an energy consumption that will make a hydro pump storage solution economically viable, due to its proximately to São Vicente, it can become a viable solution if the Santo Antão and São Vicente electric system become connected through submarine cables. Santo Antão has fluvial potential.

Mini-hydro resource analysis was supposed to start in July this year. Up until now there are no results of this. However several studies do confirm local climates on some areas such as Brava and Fogo are responsible by significant resources of hydropower as well.

7.5 Geothermal Power

A study is planned to be carried out by MARTIFER on the geothermal potential in the São Vicente, Santo Antão and Fogo Islands. These were the islands analysed due to recent volcanic activity registered there.

7.6 Ocean Power

Due to its geographical position Cape Verde is deemed to have a high ocean power potential still to be exploited. The energy carried by the Atlantic Ocean waves is very large; typical mean values are between 20 – 70 kW/m of wave front. A shoreline of 1km would thus receive 20 – 70 MW which, converted to electric power with an efficiency of 50%, would produce 10 – 35 MW. Wave energy resources are, however, unevenly distributed. At the moment there are no studies available on the ocean energy potential in Cape Verde. MARTIFER as part of its Energy Plan for Cape Verde is studying this potential.

7.7 Other Opportunities

Passive Cooling

Buildings can be designed so that the heat of the sun induces convection currents which draws cool air into the building and so reduce the inside temperature. In Cape Verde, radiative cooling could be incorporated into buildings by using “no heat” aluminium sheet roofing. This special type of aluminium sheet reflects most of its heat into the atmosphere and not into the building. During the rainy season of the year, desiccant cooling could be useful. Moisture absorbing materials such as salt, coconut husk or charcoal are used. The growing and watering of plants, trees, grasses, etc. will also assist in the cooling of nearby buildings. This will help to reduce the huge electricity demand of air conditioners in the country.

8 EXPERIENCE OF RENEWABLE ENERGY TECHNOLOGY IN CV

8.1 Biomass

There is no experience in Cape Verde on biomass technologies.

8.2 Wind

Cape Verde has a long relationship with wind power. Wind power production has been under analysis since 1995. More recently wind pumps for water capture were, and still are, used and these are very important in agriculture, mainly in Barlavento islands. In S. Vicente, Vale do Calhau provided a significant example: ten years after the electrification of the area, the existing wind pumps are still operating and some of them were recently rehabilitated.

Recently wind energy for electricity generation was introduced. Wind Power projects have some successful cases (ELECTRA, Step 1 (10 x 30 kW) and Step 2 projects (8 x300 kW)), however some small projects that have been installed have failed after a short time, mainly due to the insufficient support to projects after erection, but also because of the increase of population due to the existence of electricity that made the generation capacity installed insufficient to face demand. Matão (15 kW), Assomada (125 kW) (55kW), Chão Bom (90 kW), Ponta de Água (60 kW) in Santiago island, Brava (150kW) and Maio (160 kW) are some examples of failed projects.

ELECTRA, Step 1 (10 x 30 kW) and Step 2 projects (8 x300 kW)

This two projects has referred to above constitute a good example of the wind power potential in Cape Verde.

Cabeólica Wind Farm projects in Santiago, Sal, São Vicente and Boavista

The Cabeólica Project involves the construction, operation and decommissioning of four wind farms on the islands of Santiago, São Vicente, Sal and Boa Vista in the Republic of Cape Verde. The wind farms will comprise of between 30 to 32 – 850kW wind turbines creating a total installed capacity of about 28 MW.

The wind farms will be connected to the existing electrical network on each island. Construction of the entire project on all four islands will take up to approximately 18 months. The wind farms will be designed to operate for a total lifetime of at least twenty years, after which they will either be decommissioned and the site restored, or a new planning application submitted to re-power the site with either rehabilitated or new equipment.

The Cabeólica Project proposes to install a total capacity of between 25.5 to 28 MW which comprises 20-25% of current energy demand in Cape Verde. This level of renewable energy penetration is rare and Cape Verde will be the first country in Africa to achieve such ratios.

This project requested in March 2010 for development support to ADB.

8.3 Solar Projects

Solar renewable power potential has been used moderately in Cape Verde. Photovoltaic systems have been used in isolated areas for lighting and water pumping, and also as power supply sources for antennas. Solar thermal systems for water heating purposes are very few

but it is increasing. Between 2005 and 2008, 722 units of both system types were imported in whole country and some local makers have also installed some panels, basically in residential sector. Almost all hotels use electric water heaters in the rooms with a daily energy consuming heating/cooling cycle very expensive for the guests and for the country.

MARTIFER has already identified 30 public building on were to install micro-generation systems under the Portuguese Line of Credit to Cape Verde. In addition MARTIFER is building 2 solar PV parks in Sal (2.5MW) and Santiago Islands (5MW). These two projects are in the construction phase and are planned to be finished this year.

9 BARRIERS TO RENEWABLE ENERGY DEVELOPMENT IN CV

It is quite clear that selected appropriately RE technologies have significant impacts on improving several people's lives and providing them with means of livelihood and much needed income. Despite the opportunities for RE in Cape Verde, dissemination of RE technologies has been marginal. Significant barriers still remain to their uptake and these need to be clearly identified and understood if they are to be addressed and overcome. The following provides a summary of some of the barriers that need to be addressed in Cape Verde.

9.1 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 RE technologies and inadequate financing mechanisms. Some financial institutions also perceive RE technologies as unreliable and lacking long-time viability. For smaller projects it is particularly difficult to mobilise risk capital for its 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).

Comment [Lugm1]: What changed the new RE law??

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 RE in Cape Verde, however it is 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. feasibility studies, measurements) is expected to continue.

Comment [Lugm2]: What changed the new RE law??

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.

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 big projects faces a lot of difficulties and hence takes much longer 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. 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. In particular, there is need to buy down capital costs of potential projects and assist in the development of bankable projects and loan negotiations between project developers and financial services providers.

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 RE 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 RE systems and spread the payment.

In addition the currently small and dispersed size of the Cape Verdean renewable energy market does not facilitate benefits such as economies of scale.

High transaction costs

Renewable energy projects are typically smaller 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 is no dedicated financing for renewable energy activities within financial institutions. In addition the capacity within financial institutions and power utilities to appraise renewable energy proposals is limited or non-existing. The cost of borrowing capital in Cape Verde is expensive and the longer pay-back periods required for renewable energy projects are difficult to finance. The bank's interest rates on loans in Cape Verde are 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– foreign exchange risk.

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.

9.2 Institutional and Regulatory Barriers

Insufficient support for RE 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 incentivise 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 put it in place and make it operational. Moreover more needs to be done if renewable energy is to be actively incentivised and encouraged. Within the Cape Verde National Energy Policy is stated Cape Verde's goals in terms of renewable energy as well as indicating 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 with significant contributions by Martifer, a private Portuguese company, with local support from Cape Verde Government Officials.

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 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 sized RE projects. All these players need to strength their capacity and competencies on renewable energy projects, their benefits as well as in the importance of their active role on that.

9.3 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 no capacity to be able to develop and implement any renewable energy project. ELECTRA, which is the obvious entity to develop electricity generation projects, has a low capacity for managing as well as meeting 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, wind and small hydropower in particular.

Bulk procurement of renewable energy technologies is limited due to the current small market for renewable energy based modern energy services. Hence the (technical) infrastructure to support renewable energy development does not exist or is very limited.

Local manufacturing and/or assembly of renewable energy technology components is currently lacking, along with knowledge, skills, expertise and facilities.

Finally there is a need to ensure that installers/contractors are suitably qualified to ensure that renewable energy systems do not fail because of unsatisfactory installation. There is 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 RE systems in to the grid

Regarding grid-connected RE one of the biggest 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.;

9.4 Information and Awareness Barriers

Lack of information on renewable energy technology and opportunities

There is poor awareness of renewable energy technologies and the opportunities they can offer beyond the solar water pumping systems and big wind farms. Therefore there is limited knowledge of the 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 RE 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.

This information is also lacking within the energy market players, some of them do not know benefits that can be yielded from renewable energy and their role. There is a need to increase awareness and disseminate information to raise the capacity of the different energy market players:

- Institutions need capacity building to set up as to effectively support the development of renewable energy projects;
- Market enablers such as policy makers and regulators need capacity building to ensure that they can develop and implement policies and regulations that are conductive to the development of renewable energy projects;
- Entrepreneurs, project developers, financing institutions need capacity building on how to successful develop and manage investments in renewable energy;
- All stakeholders: increase awareness on the benefits of using renewable energy systems so as to increase market potential.

10 RECOMMENDATIONS

The findings and recommendations for increasing the role of renewable energy within Cape Verde are based on the analysis of the sector and also take into account work already carried out within this sector.

The key to developing a market environment for renewable energy is to address the barriers to its development within the context of the energy sector in the country.

Therefore the recommendations fall into a number of broad categories:

- Addressing the legal and regulatory barriers;
- Addressing the lack of technical and institutional capacity to develop the market;
- Addressing the lack of information and demonstration of commercial RE projects;
- Addressing the financial barriers.

10.1 Addressing the legal and regulatory barriers

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 instrument to incentivise 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 to make it operational. More needs to be done if renewable energy is to be actively incentivised and encouraged. Within the Cape Verde National Energy Policy is stated Cape Verde's goals in terms of renewable energy as well as indicating 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 with significant contributions by Martifer, a private Portuguese company, with local support from Cape Verde Government Officials.

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 there is a need to establish a standard PPA for renewable energy.

Renewable Energy

As already referred there is a new Decree-Law on the Promotion and Incentives for the Use of Renewable Energy. The following table highlights what should be included in a renewable energy law and what is contemplated in recent enacted Decree-Law on the Promotion and Incentives for the Use of Renewable Energy at the moment in Cape Verde.

Table 26: Items of the Decree-Law on the Promotion and Incentives for the Use of Renewable Energy

Items to be included on a renewable energy law	Items included in the Decree-Law on the Promotion and Incentives for the Use of Renewable Energy
Definition of Renewable Energy technologies	Defines what are the renewable energy technologies to which the decree law is applicable: hydro, wind, solar, biomass, biogas or industrial, agricultural and urban residues
Eligible technologies and objectives for each technology	Defines the eligible technologies and states that for each of the islands a Sectoral Strategic Plan for Renewable Energies (PESER) as well as Zones for the Development of Renewable Energies (ZDER) will be defined. The plan and the zone will specify the technologies that can be then installed.
Clear targets for renewable energy development	The targets for the production of renewable energy are not defined within this DL, but those are defined at a higher (more generic) level within the Cape Verde National Energy Policy.
Establish bodies responsible for promoting renewable energy and their roles and responsibilities	Yes.
Define licensing and authorisation systems of facilities using renewable energy	Yes. There are three regimes for the production of electricity from renewable energy: • General regime • Micro-production regime; • Simplified regime for decentralised rural electrification. The DL defines the licensing and authorisation systems.
Duration of licences	The DLl stipulates the duration of the licences
Clarify the rules for electricity network access	The DL clarifies the rules for accessing the grid as well as clarifies the economic incentive for renewable energy reception.
Define the support available for renewable energy technologies: • Guarantees offered by the	Defines the following support for renewable energy technologies: • Electricity production from renewable energy is always considered a National Interest;

Items to be included on a renewable energy law	Items included in the Decree-Law on the Promotion and Incentives for the Use of Renewable Energy
State • Establishment of any tax incentives • State subsidies • Tariff systems and indexing methods	• Fiscal incentives • Import incentives • Tariff system and indexing methods • City council compensations • Economic inceptions for reception of energy produced from renewables
Define types of contracts to purchase energy	There are three regimes for the production of electricity from renewable energy: • General regime • Micro-production regime; • Simplified regime for decentralised rural electrification. For each one of these regimes the DL defines the type of contracts that should be carried out for purchasing energy.
Tendering systems	Chapter VI of the DL highlights the tendering systems that will be put in place.
Minimum technical standards	Annex I of the DL identifies the technical and Security requisites
No discrimination of investors	Yes
Procedures for granting the land	Yes
Application of technical and financial control systems to sector	Yes.
Systems of arbitration in case of need	Yes

As it can be seen the new decree law on the Promotion and Incentives for the Use of Renewable Energy includes everything that a renewable energy law should contain.

Support for renewable energy

Potential support mechanisms include[33]:

- Setting explicit targets for the share of renewables in the electricity generation mix;
- Establishing "standard" power purchase agreements (PPAs);
- Ensuring long-term electricity generation licences and PPAs;
- Developing a favourable tariff setting and adjustment formula;
- "Light-handed" regulation.

[33] Regulatory and policy options to encourage the use of renewable energy, Module 9, UNIDO

- Enacting explicit regulations that encourage local private participation in renewable energy development;
- Providing subsidies to renewable energy-based power systems especially those located in rural areas (e.g. tapping into rural electrification funds).
- Feed-in tariffs
- Quota systems
- Tendering

The package of support mechanisms for renewable energy that has recently been put together in Cape Verde, as highlighted in the table above, seems to be quite complete. However there is still room for improvement. Improvements can be made in terms of establishing specific targets for renewable energy technologies and establishing a standard PPA for renewable energy

Explicit targets for the share of electricity generation from proven renewable energy technologies such as hydro, wind, solar PV and biomass-based cogeneration could be set for Cape Verde. The targets should be set based on the identified resource and the real potential for its development. These targets are going to be set up within the PESERs, which will be developed under the new Decree Law n.1/2011, of 3 of January. The targets can be set as capacity targets (kW), generation targets (MWh/yr) or as a % of annual generation.

Although there are regulations on the establishment of PPAs in Cape Verde, a **standard PPA for renewable energy** generation would provide clear rules and commitment to the project developer and investors that their (excess) power will be bought at a pre-agreed tariff.

10.2 Addressing the lack of technical and institutional capacity to develop the market

Building up the capacity of the renewable energy stakeholders is one of the most important factors to ensure that renewable energy is promoted within Cape Verde. Strengthening the capacity should build up a critical mass of expertise. Capacity building programmes are required on renewable energy for: ECREEE, Ministry of Tourism, Industry and Energy (MTIE), Directorate General of Energy (DGE), ARE, ELECTRA, Ministry of Finance, Financial Institutions, Ministry of Environment, Agriculture and Fisheries (MAA), Associations, Municipalities, educational institutes, electricians etc.

The following matrix shows the training needs of each of the stakeholder groups. In addition the table shows that in some cases the capacity building should be targeted at the whole sector and for others it will be targeted at those who show interest in entering the RE market or developing a RE project.

Table 27: Training requirements for different stakeholder groups

	Renewable energy law issues and implementation	Calculating tariffs and negotiation	Identification, development and management of renewable energy projects - overview	Design and development of renewable energy projects (wind, solar, biomass)	Operation and management of renewable energy projects (wind, solar, biomass)	Opportunities available from renewable energy, outline costs and operational issues
Ministry of Energy (MTIE)	√	√	√	√	√	√
Directorate General of Energy (DGE)	√	√	√	√	√	√
ARE	√	√				
ECREEE			√	√	√	√
Renewable Energy National Company			√	√	√	√
ELECTRA			√	√	√	√
Financial Institutions/ Ministry of Finance						√
Min. of Environment, Agriculture and Fisheries (MAA)						√
Associations*			√	√	√	√
Municipalities*			√	√	√	√
Technical Training Institute + University+ IFP + Business School			√	√	√	√
Cape Verde Portugal Chamber of Commerce, Industry and Tourism*			√	√	√	√
Other private sector participants*			√	√	√	√
Rural NGOs*			√	√	√	√

* to include various private sector companies and sectors, technicians etc.

√ Training targeted for these stakeholders

√ Training targeted to those who show interest to develop a RE project

Key to any capacity building is that it should be self perpetuating beyond any external assistance. Therefore 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 it is recommended that 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, the future focal point of renewable energy, ELECTRA, the Cape Verde University, Professional Educational Institute (IFP, Instituto de Formação Profissional) and Business School.

Training should include practical training, training on-the-job, management training as well as seminars abroad. In the longer term courses should be offered by Cape Verde University, IFP and Business School in renewable energy and the skills needed to develop the market. Also in the longer term training could extend down to schools so that all Cape Verdeans understand the role that renewable energy can play in service provision and in avoiding GHG emissions.

The Ministry of Tourism, Industry and Energy has some knowledge of renewable energy but further capacity building on RE policy formulation and an understanding of the more practical issues would be useful.

In addition to the technical and commercial training outlined there is also a need for more general capacity building and institutional strengthening at ECREEE. If ECREEE is to fulfil its tasks and to play an important role in the future of renewable energy in Cape Verde the following is required for:

- Identification and employment of new staff
- Training of existing staff member and new staff
- Make ECREEE a site for demonstration of RE technologies
- Training courses for new market entrants on renewable energy technologies – train the trainer needed for ECREEE.
- Training facilities should be established at ECREEE. Some additional tools may be required to allow for successful training – this could include demonstration tools, models.

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.

The Renewable Energy National Company that will be established for facilitating RE business planning should build its capacity on identification, development and management of RE projects, on opportunities available from RE projects, on the risks and opportunities that renewable energy can deliver.

As the provider of electricity ELECTRA should build up its knowledge of renewable energy, ideally with a department or group within ELECTRA who focus on this area. As well as receiving training ELECTRA employees should seek to pass that knowledge on within the company. Where possible ELECTRA should be involved either alone or in partnership with private operators to develop RE projects to get practical experience.

Other government ministries and departments as well as the municipalities could benefit from a better understanding of the role that renewable energy could play in the delivery of services, particularly in rural areas.

Financial institutions need to understand better the risks and opportunities that renewable energy can deliver so that they lend to the sector.

The inclusion of private sector stakeholders and companies is important to ensure that there is a sustainable renewable energy sector in Cape Verde. This should include not only potential companies to import, assemble, install and maintain renewable energy systems but also potential customers.

Training for potential customers would involve an understanding of the opportunities available with renewable energy, the advantages and challenges and how to take a project forward in Cape Verde. This would be carried out by the trained ECREEE staff who would also be available for providing follow-up advice and further information. Initial workshops could invite in international experts but the intention is that follow on training would all be provided by ECREEE staff, University of Cape Verde, IFP and Business School.

All training activities should be evaluated separately to ensure that any feedback is used to improve future training. Feedback should be received from the participants and trainers and assessed by ECREEE.

10.3 Addressing the lack of information and demonstration of commercial RE projects

There is a lack of appreciation of the technical feasibility and commercial viability of renewable energy projects due to the lack of experience in Cape Verde of developing small to medium scale renewable energy projects. Demonstration projects need to be implemented to provide the confidence to the national decision makers, ELECTRA, potential project developers and consumers that there is a positive role for small to medium scale renewable energy systems and to increase the understanding of their practical operation.

Demonstration projects should cover a wide number of sectors and should all have significant potential for replication.

- Grid connected renewable energy can provide competitive and stable electricity prices (compared to expensive and fluctuating HFO/diesel based power) and can reduce energy costs for the host company, thereby encouraging further productive activities. It can also provide power at more rural points on the grid where the current voltage levels are low, and will offset associated GHG. The quality of the service provided by ELECTRA (measured by the number and duration of blackouts is quite low. The cost of the electricity makes energy one of their highest costs and end-users would like to see ways to reduce these costs.
- Small to medium scale mini-grid renewable energy will offset expensive LFO/diesel based electricity and will also allow the rural mini-grids to provide power for more hours a day. This is likely to allow more connections, both domestic and commercial, to fix populations in remote areas where currently there is a limited supply of electricity and to encourage greater income generation uses since they need more reliable electricity than currently available. This will also contribute positively to alleviate the current financial burden of the Municipalities that maintain and operate current mini-grid diesel generators systems.

- Off-grid renewable energy allows for small scale income generation activities that otherwise cannot go forward, or must rely on diesel generating sets and ongoing fuel costs. The scattered population and its low domestic needs are favourable factors for this decentralized energy supply modality. In rural areas, solar (and wind) energy could meet the socio-economic needs related to water supplies (including desalinisation), basic lighting, medical drug conservation (refrigeration), communication and audio-visual equipment as well as providing power for the income generation activities. Renewable energy thus constitutes a real alternative to solutions currently used, if any, to meet those needs (e.g. kerosene lamps, manual pumping and small diesel gensets).

It is recommended that the projects should include some on-grid projects, some mini-grid projects and some stand-alone projects. Each of these has potential for scale up and replication in Cape Verde and all together will help develop a market environment for renewable energy. For commercial viability projects must have a guaranteed income and therefore where the projects are not on the grid it is important that there are income generation activities.

It is also recommended that the initial demonstration projects are provided with significant technical and financial support to ensure that they proceed. Following the successful implementation of these projects further RE projects should be identified to help the market develop. These projects would receive some technical and financial support to help them get off the ground. Following this second round of projects there should then be sufficient experience and expertise that further projects are identified and proceed without the need for external support.

Dissemination programmes should be carried out to address the lack of information. The dissemination programmes should include radio and poster campaigns, the establishment of a central website and the strengthening of ECREEE to allow it to become a source of information.

As recommended in the Cape Verde National Energy Policy Cape Verde should enter into co-operation agreements with other ECOWAS countries that have the know-how on the development of renewable energy technologies such as solar, wind and hydro energy, through sub-regional, regional or international collaboration

10.4 Addressing the financial barriers

Some of the financial barriers will be addressed by the already mentioned actions – for example training of the financial institutions, training in and need to carry out life cycle analyses, demonstration of commercial viability and preparation of a standardised PPA. However there is still an issue with access to sufficient finance for renewable energy projects.

ECREEE, as the renewable energy focal point, should be able to provide a comprehensive list of potential funders and source of finance for renewable energy projects in Cape Verde. In addition they should be able to provide advice on business plans to help access the finance.

Consideration should be given to establishing a seed fund or guarantee mechanism so that financial institutions are encouraged into the sector offering longer term loans at reasonable interest rates.

Consideration should also be given to creating a mechanism for providing interest-free loans for the acquisition of PV systems (as practised in some countries), as one option for increasing the adoption rate.

10.5 Actively pursue/speed up on-going activities

Cape Verde has high targets to be met in terms of energy generated by renewable energy sources. For that, and has highlighted in the Cape Verde National Energy Policy, rehabilitation of the transmission and distribution network is a pre-requisite for renewable energy grid-connected projects as well as it is a national priority to reduce losses on the system and to ensure that when renewable energy is connected to the grids the losses are at a minimum.

Regular and effective maintenance of existing facilities and services (generating sets and the T& D network) is absolutely necessary to ensure utilisation of available potential to the fullest extent.

The establishment of a cross-sectoral round table on renewable energy will allow lessons learned to be easily circulated between sectors but could also form a focal point for information exchange and applications for funding.