United Nations Development Programme

Country: Republic of Sao Tome and Principe

PROJECT DOCUMENT

Project Title: Promotion of environmentally sustainable and climate-resilient grid/isolated grid-based hydroelectric electricity through an integrated approach in Sao Tome and Principe.
UNDAF Outcome(s): #4 – By 2016, the Government and districts, as well as the population, adopt techniques and behaviour that promote a sustainable environment and ensure better prevention and management of risks and natural disasters.

UNDP Strategic Plan Focus Area: Environment and Sustainable Development: Promoting the use of renewable energy and alternative sustainable habitats.
Mainstreaming environment and energy.
Executing Entity/Implementing Partner: Ministry of Public Works, Infrastructure, Natural Resources and Environment (MPWINRE).

Other Implementing Partners: Empresa da Agua e Electricidade (EMAE – Water and Electricity Company), Ministry of Agriculture, Fisheries and Rural Development.

Implementing Entity/Responsible Partners: United Nations Development Programme.

Brief Description: The objective of the project is to introduce an integrated energy and ecosystems-based approach to grid/isolated-grid-based mini/small hydro-electricity generation in Sao Tome and Principe by leveraging $ 20.7 million in multilateral and private sector financing over its five-year implementation period. This, in turn, is expected to generate direct global benefits of 137,200 tons of CO_2 over the same period and 36,850 tons CO_2/yr thereafter in avoided greenhouse gas (GHG) emissions. When one looks at the 25 year lifetime of the hydropower stations earmarked for development during the 5-year project period, the power station would have generated 365,000 MWh, with a combined amount of CO2 reduced of 874,200 (737,000 + 137,200) tons, including the CO2 reduction related to sustainable land and forest management; this is equivalent to $ 6 of GEF funds per tCO_2. The project will achieve this target by introducing a conducive regulatory framework and by establishing a financial support mechanism that together will facilitate private sector participation in increasing the share of hydropower electricity generation in the country.

In addition, in order to ensure the availability of hydro resources for electricity generation (and irrigation for job creation), the project will implement an integrated watershed management approach. It aims at integrating natural resource management with community livelihoods improvement in a sustainable way and within a landscape approach. The project will introduce innovative participative methods of natural resource management, conservation farming and agro-ecology. This will be achieved through watershed level land use planning and implementation of community forests over 6,000 ha, sustainable agricultural land management practices over 10,000 ha, and income generating activities (such as mushrooms, medicinal plants, ecotourism, etc.) for rural communities. This landscape approach will be sustained by a financial mechanism between the private hydroelectricity producers and the upstream communities, based on the maintenance of environmental services (water supply regulation).

Programme Period:	2011-2015
Atlas Award ID:	00087589
Project ID:	00094537
PIMS #	4602
Start date:	January 2016
End Date:	December 2020
Management Arrangements:	NIM
PAC Meeting Date:	TBD

Total resources required (total project fund)	**$25,980,248**
- Regular (UNDP)	$1,000,000
- GEF	$5,274,544
Other (partner managed sources)	
•	
• Government	$15,382,704
• Private sector (banks)	$800,000
• Private sector (IPPs)	$3,400,000
• NGO	$123,000
•	

Agreed by (Government):

Date/Month/Year

Agreed by (Executing Entity/Implementing Partner):

Date/Month/Year

Agreed by (UNDP):

Date/Month/Year

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LIST OF ACRONYMS

APR	Annual Project Review
A/R	Afforestation/ reforestation
BD	Biodiversity
CBNRM	Community-based natural resources management
CF	Community Forest
CO	UNDP Country Office
CO_2	Carbon dioxide
ECOFAC	Ecosystèmes Forestiers d'Afrique Centrale
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMAE	Empresa de Agua e Electricidade
EP	Ecological Perimeter
EU	European Union
FAO	Food and Agriculture Organisation of United Nations
FRA	Forest Resources Assessment
FSM	Financial Support Mechanism
GEF	Global Environment Facility
GHG	Greenhouse Gas
IBA	Important Bird Area
IPP	Independent Power Producer
IUCN	International Union for the Conservation of Nature and Natural Resources
IWM	Integrated Watershed Management
IWMP	Integrated Watershed Management Plan
kW	Kilowatt
kWh	Kilowatt-hour
LD	Land Degradation
LUCF	Land use change and forestry
LULUCF	Land use, land use change and forestry
M&E	Monitoring and Evaluation
MAFRD	Ministry of Agriculture, Fisheries and Rural Development
MPWINRE	Ministry of Public Works, Infrastructure, Natural Resources and Environment
Mtoe	Million tons of oil equivalent
MW	Megawatt
MWh	Megawatt-hour
NBSAP	National Biodiversity Strategy and Action Plan

NGO	Non-Governmental Organization
NIM	National Institute of Meteorology
NRM	Natural resource management
QPR	Quarterly Progress Report
PES	Payment for Environmental Services
PIF	Project Identification Form
PIR	Project Implementation Review
PMU	Project Management Unit
PA	Protected Area
PPA	Power Purchase Agreement
PPG	Project Preparation Grant
PRSP	Poverty Reduction Strategy Paper
PV	Photovoltaic
RCU	UNDP Regional Coordination Unit
REDD	Reducing Emissions from Deforestation and forest Degradation
RTA	UNDP Regional Technical Adviser
SFM	Sustainable Forest Management
SLFM	Sustainable Land and Forest Management
SIDS	Small Islands Developing States
STP	Sao Tomé and Principe
toe	Tons of oil equivalent
TPR	Tripartite Review
TTR	Terminal Tripartite Review
UNCCD	United Nations Convention to Combat Desertification
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar
VOA	Voice of America

1. SITUATION ANALYSIS

Context and Global significance

The Democratic Republic of Sao Tome and Principe is located in the Gulf of Guinea, off the north-western coast of Gabon. It consists of the two main islands of Sao Tome and Principe located about 140 km apart. It has a population of 187,356 inhabitants (2012 Census) and the country's economy revolves around agriculture and fishing, sectors which are highly vulnerable to climate change.

With a per capita GDP of US$ 1,486 (World Bank, 2012), Sao Tome and Principe (STP) is considered a lower middle income country; however, almost half of the population lives in poverty. It is heavily dependent on resources from the IMF, via its Extended Credit Facility, and other donors. Like several other SIDS (Small Island Development States) with small populations, the country is exposed to the enduring challenges that arise from lack of economies of scale, high oil prices, high transportation and communication costs, expensive public administration and infrastructure, and lack of skilled human capital. As per the African Economic Outlook (2011), growth of the São Tomé and Príncipe economy was expected to be 5.2% in 2013 compared to 4.9% in 2011. This growth was to be driven by the service, transport, construction and retail sectors. In 2012 the government reported a slight decrease in the growth rate to 4.0%, the result of a reduction in foreign direct investment (FDI) and private and public consumption. Real gross domestic product (GDP) growth was projected to be 5.8% in 2014, thanks to an increase in FDI, an oil exploration signature bonus and the inception of the country's major infrastructure projects, notably the deep-water seaport.

Electricity generation

In the power sector, the bulk of electricity generation is based on imported diesel, despite the fact that the country possesses several rivers that can be tapped to generate electricity from hydropower. Electricity generation in the country has been steadily increasing over the years (Table 1) to meet the growing needs of the economy and, unfortunately, this increase in demand has been systematically met by increasing the thermal generation capacity, despite the availability of an extensive network of rivers. For example, for the latest electricity generation figures available (2013), the share of hydro in the generation mix constituted only 8 % of the total electricity produced.

Table 1: Electricity Generation 2003 – 2013

Year	Hydro Generation (kWh)	Thermal Generation (kWh)	Total (kWh)
2003	7,858,894	26,649,854	34,508,748
2004	6,172,604	31,098,320	37,270,924
2005	4,247,586	37,196,606	41,444,192
2006	3,767,757	39,058,192	42,825949
2007	7,629,989	41,415,508	49,045,497
2008	7,668,107	43,040,443	50,708,550
2009	7,260,660	41,658,785	48,919,445
2010	4,788,615	52,416,117	57,204,732
2011	6,001,697	61,224,620	67,226,317
2012	6,386,000	70,470,869	76,856,869
2013	5,890,472	64,862,759	70,753,261

Source: EMAE

The need to shift electricity generation from utilising less imported fuel to relying more on locally-available resources (mainly mini (100 kW to 1 MW) and small hydropower (≤ 10 MW)) has recently become a cornerstone of the country's domestic and foreign policy; consequently, its energy policy is being developed in such a manner so as to help support it in moving in this direction. Thus, the transformation of the energy sector to an economically viable and environmentally friendly system requires a comprehensive and multi-faceted approach in the design of the appropriate policy and planning frameworks, and incentives to fully integrate renewable energy technologies in a way that is climate resilient and minimizes negative impacts on ecosystems that supply its rivers.

Empresa de Agua e Electricidade (EMAE)

Electrical power in the country is provided by the Empresa de Agua e Electricidade (EMAE), a public-private company that is 51% owned by the Government of Sao Tome and Principe, and the remaining 41% is jointly owned by the private sector, with Sonangol holding 40% and a local anonymous enterprise owning the remaining 9%. As per Decree nº 40/2008 of 31 October 2008, the Government approved the new legal status of EMAE, empowering it with the objective to render public services related to the generation, transmission and distribution of electricity (and similar services related to potable water supply). EMAE's total installed generation capacity (Table 2) on the islands of Sao Tome and Principe is 22.5 MW, consisting of 20.6 MW from diesel plants and 1.92 MW from hydro plants.

Table 2: Installed and available generating capacities in Sao Tome and Principe, January 2014

Type / Ownership	Location	Installed Capacity (kW)	Available Capacity (Jan 2014, kW)	Present Status (Jan 2014)
Diesel/EMAE	Sao Tome	9,680 (grid-connected)	7,430	2 generators (1,000 and 1,250 kW) under maintenance.
Diesel/EMAE	Santo Amaro	8,505 (grid connected)	6,804	1 generator (1,701 kW) under maintenance.
Diesel/Private	Bobo Forro	7,000 (grid-connected)	7,000	Operational.
Hydro/EMAE	Contador (Rio Contador)	1,920 (grid-connected)	1,920	Operational
Hydro/Private	Guegue (Rio Manuel Jorge)	320 (grid-connected)	0	Stopped operation in early 2012. New turbine and generator required.
Diesel/EMAE	Porto Alegre	80 (isolated grid)	80	Operational
Diesel/EMAE	Angolares	216 (isolated grid)	216	Operational
Diesel/EMAE	Santa Catarina	108, isolated grid	108	Operational
Diesel/EMAE	Santa Luzia	64 (isolated grid)	64	Operational
Diesel/EMAE	Various locations, Principe	1,944 (mini-grids)	1,120	2 generators (328 and 496 kW) not in operation and are scheduled for replacement.
Hydro/Private	Rio Papagayo, Principe	80 (mini-grid)	0	Operated for only 2 weeks in 1999 due to over-dimensioned 400 kW turbine-generator set. Replaced by an 80 kW unit and operated for a few weeks when the transformer was relocated to a diesel power station on Principe Island.
Total	Diesel/EMAE	20,597	15,822	
	Diesel/Private	7,000	7,000	
	Hydro/EMAE	1,920	1,920	
	Hydro/Private	400	0	

Source: EMAE

In January 2014, the available EMAE diesel generating capacity was 15.8 MW, with the remaining approx. 5 MW of installed capacity either under maintenance or awaiting replacement. The private diesel generating capacity of 7 MW owned by Renergia Ltd. at Bobo Forro operates at approx. 50% capacity because of outstanding payments from EMAE; under this scenario, the power station operator manages to cover its costs in terms of equipment wear and

tear, lubricants, spare parts, maintenance costs, etc. Under its leasing agreement with Renergia (Bobo Forro), EMAE supplies the fuel and reimburses the former for the energy supplied to the grid.

EMAE's main distribution system includes the 30 kV and 6 kV lines over the north-western section of Sao Tome Island from near Neves to Ribeira Afonso. It also operates isolated diesel-powered mini-grids in Angolares, Santa Catarina and Santa Luzia on Sao Tome Island and diesel-based mini-grids on Principe (Table 2). It has a client base that comprises 26,000 households and 5,000 industrial/commercial users. It has sole responsibility for transmitting electricity and its distribution to consumers. However, the private sector is permitted to generate and supply the EMAE grid. Also, the private sector is allowed to generate electricity for its own consumption, but not for operating a mini-grid, for example, to supply customers. In this connection, discussions will be held with the Government to further liberalise the electricity market by allowing IPPs to also have the option of setting up hydropower-based mini-grids to supply the "captive consumers" who may otherwise wait a long time before EMAE builds its own mini-grid to service them. These "captive consumers" can be for example agro-industries, small factories, hotels, etc. Finally, to generate electricity and supply the EMAE grid, the private sector needs a license from the Government to build a hydropower station and operate as an IPP, as well as a PPA with EMAE to supply the grid in accordance with the regulations spelled out in the grid code.

Table 2 a: Electricity Tariff Structure (December 2013)

Consumer Type	Tariff (US Cents/kWh)
Domestic ≤ 100 kWh	8.3
Domestic 100 kWh - ≤ 300 kWh	12.3
Domestic ≥ 300 kWh	19.2
Commercial and Industrial	19.2
Public Administration	49.3
State Enterprises and Institutions	30.1
EMAE Employees ≤ 100 kWh	2.5*
EMAE Employees 100 kWh - ≤ 300 kWh	3.7*
EMAE Employees ≥ 300 kWh	5.8*
Embassies and International Organisations	35.1
State Autonomous Regions	49.3
Financial Institutions	35.1
Telecom Enterprises	35.1
Travel Agencies	35.1

*The 215 EMAE Employees benefit from a very low subsidised tariff.

As of December 2013, EMAE had a client base of 30,781 customers (comprising 25,971 households and 4,810 in other categories) sub-divided into 14 different tariff categories (Table 2 a), ranging from a subsidized rate of 8.3 US Cents/kWh (social tariff for those consuming ≤ 100 kWh/month) to 19.2 US Cents/kWh (also subsidised) for commercial services and industries to the highest tariff of 49.3 US Cents/kWh for the 463 customers labelled as "Public Administration" and 80 customers labelled as "State Autonomous Regions". The cost of thermal generation at the busbars of EMAE power stations was 23 US Cents/kWh in 2013 (the cost of delivery to consumer premises was not available), while the cost of generation at the 1.92 MW Contador hydropower station that was refurbished in 2006 was estimated at 2 - 3 US Cents/kWh by EMAE. In summary, the tariffs are subsidized for certain categories of consumers, while others pay full price. With regard to losses, technical losses are estimated to have come down to 10 % after rehabilitation and reinforcement of the distribution system by the African Development Bank/African Development Fund in 2002, while non-technical losses remain high at 16%, thus providing insights into the capacity of certain consumers to pay their electricity bills.

In addition, The Voice of America (VOA) operates a radio broadcasting station that relays programmes produced in Washington, D.C. in several languages, including English, French and Portuguese at Pinheira some 5 km from Sao Tome. VOA utilises a dedicated (and isolated from the EMAE grid) 5 MW diesel power station to meet its needs for electricity. In addition, there is a hydropower station on Rio d'Ouro at Agustino Neto that was originally built during the colonial days to provide electricity associated with cocoa production; it was later refurbished with 1x307 kW and 1x 37 kW turbine-generator sets. Both these sets experienced electro-mechanical problems around 2006/2007, were dismantled and the power station has not been in operation since. The civil engineering works are in still in very good condition, including the machine room and the penstock. The power station infrastructure is owned by the Government, but a private company (Rio Douro Investment Management Company) has a lease with the Ministry of Finance to operate it; however, the management company has not exercised any management functions since 2007.

Electricity from renewable sources of energy, including hydro, photovoltaics and wind, represent even today a tiny less than 10% fraction of the total energy supplied in the country; the share of hydropower, as computed from Table 1, was 8% in 2013. Just over half the population (57%, World Bank, 2012) of Sao Tome and Principe have access to electricity; even then, the country has to resort to occasional load shedding. Those without electricity rely on candlelight and kerosene for lighting, and on biomass (firewood and charcoal) for cooking. The issue of connecting new households to the grid remains a great challenge for EMAE due to insufficient generating capacity. Hence, the Government's interest to create the necessary environment to enable the private sector, both local and foreign, to invest in the hydropower electricity generation sector.

Table 3: Imported diesel/lubricants used for thermal electricity generation

Diesel/Lubricants	2009	2010	2011	2012	2013
Diesel (litres)	11,743,334	9,473,229	13,315,861	18,101,521	19,095,025
Lubricants (litres)	51,558	35,761	34,541	46,617	59,428
Total Cost (x 10^3 Dobras)	137,176,456	113,291,764	193,367,754	267,024,011	289,494,914
Total Cost ($)	7,838,655	6,473,815	11,049,586	15,258,515	16,542,567

Source: EMAE

The country's use of imported diesel fuel for electricity generation and the associated expenditures in terms of foreign currency have been on an increasing trend over the few years. For example (Table 3), in 2009, the expenditures related diesel for electricity generation were approx. $ 8 million and increased to over $ 16 million in 2013, representing an increase of 100% over a period of 5 years.

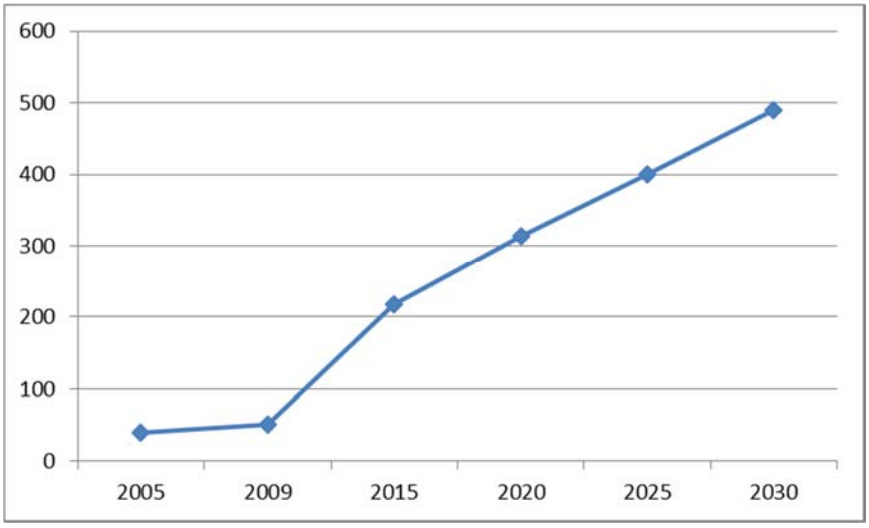
Electricity produced from hydropower constitutes at the present time approx. 8% of the total generated in the country, with the balance produced by diesel generators. As per a study undertaken by CECI Consultants of Taiwan in 2008 (Report entitled "Master Plan for the Development of Water Resources in the Democratic Republic of Sao Tome and Principe, December 2008), electrical energy demand in the country would increase from 39,000 MWh in 2005 to 490,000 MWh by 2030 (Fig. 1). In 2013, the demand was projected to be approx. 175,000 MWh; however, EMAE was able to supply only 77,000 MWh, representing only 44% of what the country was reasonably expected to need as per the projection. This is an indication that electricity demand in the country is highly suppressed due to EMAE's inability to build additional capacity to meet the increasing demand. It also points to the private sector's

reluctance to enter the electricity generation market due to the absence of a proper policy framework, and a secure and conducive environment for private investment.

Moreover, as per the same study by the Taiwanese consultants, it was expected that, in order to meet the needs of the country in terms of economic growth, investments in hydropower would increase the country's hydrogenation capacity to 39.7 MW in the short term (5-7 years) and reaching a total of 63.6 MW in the long term (15 years). Unfortunately, no investment in hydropower has been made since 1999. The hydrological data for the rivers determined by the CECI consultants in 2008 were validated 2 years later when the Ministry of Public Works undertook formulation of the country's Water Resources Master Plan. Regarding the emission reduction potential through the harnessing of hydropower, a UNEP RISO (June 2013) study entitled "Emission Reduction Profile – Sao Tome and Principe" indicates that the country "has an overall abatement potential of 111,630 tCO_2" per year, 78% of which could be provided by mini/small hydropower stations.

Hidroelectrica STP, Ltd. - a Spanish company, did propose the development of a 4 MW, 280-m head, run-of-the-river project at Bombaim on Rio Abade under the CDM modality and financing for the project was secured from a Netherlands-based Bank. Hidroelectrica, which was later purchased by Soares da Costa of Portugal, commenced construction on some components of the power station in 2008, viz. it installed 1 km of pressure conduit (out of a required 1.8 km) and partially built and strung the 12 km, 30 KV line from Bombaim to Agua Ize to connect the power station to the existing EMAE grid. It was reported that it had also ordered the 2 turbine-generator sets that were to be installed at the power station. However, when Hidroeléctrica/Soares da Costa was unable to conclude a firm power purchase agreement (PPA) with EMAE, the Bank stopped further disbursements in 2009. Since then, construction has stopped and vegetation has taken over whatever land had been cleared for building the machine hall. This example underscores the types of policy barriers facing potential investors in the hydropower sector in the country and which the present project will work with the Government to address within the context of the "Lei de Bases do Sector Electrico".

Fig. 1: Projected electricity demand until 2030 (103 MWh)



Source: CECI Engineering Consultants, Taiwan

Sao Tome and Principe's First National Communication submitted to UNFCCC in December 2004 estimated that the hydropower could theoretically provide 247 GWh of electricity per year, 70% of which could be tapped to annually produce 170 GWh. However, electricity generation from hydropower provided only 6 GWh in 2013. The energy sector development plan prepared in 2004 estimated that the country's hydropower potential could be tapped to

provide 170 GWh/year, i.e. up to 70% of the theoretical potential. For comparison purposes (Table 1), hydropower provided only 6 GWh in 2013, while the total EMAE electricity generation for the same year was 71 GWh. Hence, if hydropower in the country were developed to the extent of even 30% of its available potential, it would have met the totality of EMAE's electricity generation in 2013. However, it is recognised that it would not be possible for the country to rely solely on hydropower generation for its total electricity supply; the variance in river flows during the dry season (June-August) and wet season can be substantial. Hence, diesel power generation will always remain part of the electricity supply equation, but its annual share can be substantially reduced.

The Economics of Electricity Generation from Mini/Small Hydropower in Sao Tome and Principe

As per Table 4 below, most of the identified sites, if developed, would have individual installed capacities under 4 MW, except for the site at Dona Eugénia on Ió Grande which is planned to have a 9.6 MW installed capacity. Mini (100 kW to 1 MW) and small (≤ 10 MW) hydropower plants have higher specific costs (per kW installed); therefore, investment costs (civil engineering, electro-mechanical costs, connection to existing grid, etc.) can be quite high. Preliminary costs provided by CECI Engineering Consultants, Inc., Taiwan in December 2008 indicate a range from $ 3,000 to 5,000/kW, while the Brazilian company TECNIC proposed a cost of $ 3,865/kW in March 2013 for the construction of a 11.5 MW hydro plant on Rio Grande. These cost figures are similar to data available in a wide range of capacities for mini/small hydropower stations that have been built in other developing countries in the region and throughout the world. Furthermore, they are in line with cost figures per kW installed provided in the June 2012 report on "Hydropower" published by the International Renewable Energy Agency (IRENA).

The cost of electricity generated by hydropower is very site-specific. For the 16 mini/small hydropower sites investigated by the CECI consultants, the levelised cost (the price at which electricity must be generated from a specific source to break even over the lifetime of the installation, typically 25 years) varies between 2 and 10 US Cents/kWh. Compared to this low cost of electricity generation from mini/small hydropower, the cost of thermal generation at the busbars of EMAE power stations, excluding costs related to spare parts, salaries and wages, was 23 US Cents/kWh in 2013 (Total Cost of $ 16,542,567 (from Table 3)/Total Thermal Generation of 70,753,261 kWh (from Table 1). Again, as indicated earlier, the cost of generation at 1.92 MW Contador hydropower station that was refurbished in 2006 was estimated at 2 - 3 US Cents/kWh by EMAE.

Table 4: Potential Sites for Hydropower Development

No.	Site	River	Installed Capacity (MW)	Head (m)	Estimated Annual Generation (MWh)*
1	Cruz Grande	D'Ouro	0.88	100	3,461
2	Agustino Neto	D'Ouro	0.34	60	1340
3	Almeirim	Agua Grande	0.44	50	1,731
4	Santa Luzia	Manuel Jorge	1.15	380	4,746
5	Santa Clara	Manuel Jorge	0.89	190	3,667
6	Mato Cana	Abade	2.0	60	5,599
7	Claudino Faro	Abade	2.0	100	5,348
8	Bombaim	Abade	4.0	280	9,685
9	Dona Eugénia	Ió Grande	9.6	80	30,448
10	Meteus Sampaio	Umbugu	0.5	28	1,519
11	Neves	Provoz	2.0	95	7,287
12	San João	Contador	0.9	200	1,382
13	Santa Irene	Lemba	3.0	100	9,229
14	Monte Verde	Xufexufe	0.80	60	2,935
15	Monte Rosa	Quija	3.75	260	10,427

16	Caldeiras	Carvao	0.02	50	100

Source: CECI Engineering Consultants, Taiwan

*Hydropower capacity (kW or MW) is directly proportional to the Head (in metres) and flow rate (in m^3/s), while the annual electricity production (kWh/MWh) depends on the available water supply, i.e. the flow rate. Hence, it is normal to have somewhat similar installed capacities and heads with different amounts of energy produced on an annual basis because the flow rate is site-specific. As indicated earlier, the variance in river flows from river to river and depending on the dry season (June-August) and wet season can be substantial. These hydrological differences were taken into account by the CECI consultants in determining the annual electricity production at different sites.

Ecosystems, land use and forest management

STP's ecosystems are rich and diverse and capable of providing multiple services and resources but they are also being significantly degraded. Ecosystem functions, especially water resources regulation, are threatened across the country due to land conversion for agriculture, forests degradation, over-exploitation of wildlife and other natural resources, erosion and bushfires, exacerbated by climate change and droughts. As stated by the Government and highlighted by several technical reports[1], the country's water resources are highly vulnerable to climate change, and water flows in the watersheds depend on a sustainable forest cover and on proper agricultural practices. Therefore, the development of new hydropower plants must be integrated with an approach to land-use planning and sustainable land and forestry management practices. Such an integrated landscape approach does not exist yet in STP, although it has been strongly recommended by the program for Conservation and Rational Utilization of Forest Ecosystems in Central Africa (ECOFAC).

The latest FAO Forest Resources Assessment (FRA 2010) estimates that the lands under trees cover is approximately 90% (90,900 ha), with high heterogeneity in quality and with various land uses:

- 40% of the country is natural forest, called "Ôbô". The Ôbo Natural Park covers 29,500 ha, and its management plan was validated in 2010 through the EU funded programme ECOFAC. Although the higher lands are not under pressure because of their difficult access, pressure is growing in the lowland forests in the buffer zone (which is not yet well defined) of the national park, as human penetration for natural resources extraction are more and more frequently observed.
- 21% of the country is secondary forest, called "Capoeira". These lands are abandoned cocoa and coffee plantations. There are no management plans of these lands. These forests are place for illegal wood extraction, agricultural conversion and land use conflicts. Growing crops in these sloping lands, without application of measures against erosion, lead to soil degradation.
- 29% of the country is shade forest. These are productive lands (cacao and coffee) under trees cover. Many of them need to be rehabilitated with high quality trees plantation to have a better production.

Six broad ecosystem and land use categories (encompassing terrestrial and aquatic habitats) were identified for STP : (i) Cloud & montane forests, (ii) Lowlands forests, (iii) Secondary forests, (iv) Shade forests, (v) Savana & dry forest, (vi) Mangrove.

[1] Such as the Global Water Partnership (2010), Taiwanese cooperation (2012), National Ecological Management Plan for STP (2009) and National Report on Biodiversity in STP (2007).

Table 5. Main eco-geographic zones for STP

ECO-GEOGRAPHIC ZONES	KEY CHARACTERISTICS AND GLOBAL ENVIRONMENTAL SIGNIFICANCE
The cloud & montane forests Ecosystem	The cloud forests site comprises the highest parts of the island and includes three peaks, Pico de São Tomé (2,024 m), Calvario (1,594 m) and Pico Ana Chaves (1,630 m), as well as Lagoa Amelia, an old crater-lake and the surrounding marshy area. The area holds most of the montane and cloud-forests in the centre of the island above 1,000 m, around the Pico de São Tomé massif. Montane forests extend to 1,400 m, above which they give way to cloud-forest. The cloud forest Ecosystem belongs to the Ôbo National Park. Montane forests are located between the agricultural lands and the clouds forests. This is a transition zone. The area that held forest between 800 m and 1,000 m on the northern edge of the massif is excluded, as it has been cleared for cultivation. The climate of the area is characterized by strong rains, fog patches, and low temperature. Trees are dominated by epiphytes. Typical tree species of both forest-types include *Tabernaemontana stenosiphon*, *Homalium henriquesii*, *Croton stelluliferus*, *Polyscias quintasii*, *Craterispermum montanum*, *Podocarpus mannii*, all of which are endemic to the Gulf of Guinea islands, and the more widespread *Olea capensis*, *Syzygium guineense* and *Pauridiantha floribunda*. *Podocarpus mannii* is a gymnosperm endemic in Sao Tomé. *Phylippia thomensis* et *Lobelia barnsii* are located only in the Pico de São Tomé massif.
The lowlands forests Ecosystem	This ecosystem extends from the coast to the about 800 m high. It is mainly located in the south-west and extends from the Binda and Quija rivers, on the west coast, to the confluence of the Ana Chaves and Io Grande rivers and the right bank of the Io Grande. The area comprises most of the lowland primary evergreen forests of the island as well as, in the centre, montane forest on the Cabumbe peak (1,403 m). The southern slopes of the Pico de São Tomé massif define the northern boundary of the site. Old secondary forest occurs near the coast, in the valleys of the Binda, São Miguel and Quija rivers, resulting from the regrowth of plantations abandoned in the late 1970s. Further inland the terrain is rugged and the ground broken and stoney, making walking difficult. The forests have not been fully surveyed botanically, but large trees include *Uapaca* sp. The understorey is generally open under a closed canopy, with few shrubs.
The secondary forest Ecosystems	This ecosystem is old primary forest that was cleared for cacao plantations. They were later abandoned and turn into secondary forest. The floristic composition is mainly characterized by exotic and cultivated species with rapid growth, such as *Bambusa vulgaris*, *Cecropia peltata*, *Maesa lanceolata*, *Dracaena arborea*, *Ficus sp* and *Cestrum leavigatum*. Fruit trees are also part of this ecosystem: *Pycnanthus angolensis*, *Pentaclethra macrophylla*, *Artocarpus altilis*, *Artocarpus heterophyllus*, *African Treculia*.
The shade forest Ecosystems	This ecosystem results from intensification and modernization operations, since the 60's, of cacao plantations (Theobroma cacao) and coffee (Coffea sp.). It is composed of both spontaneous and introduced species for the purpose of shade species: *Milicia excelsa*, *Cedrela odorata*, *Fagara macrophylla*, *Carapa procera*. Also, *Eritrina*

ECO-GEOGRAPHIC ZONES	KEY CHARACTERISTICS AND GLOBAL ENVIRONMENTAL SIGNIFICANCE
	species were introduced for nitrogen fixation.
The savana & dry forests Ecosystems	The site is situated on the northern coast, between Lagoa Azul and Diogo Nunes, and includes a succession of grasslands, coconut plantations and herbaceous swamps. Around the coastal lagoon of Lagoa Azul there are also thickets and dry lowland forest along narrow gullies The northen savana is one of STP's most degraded and threatened ecosystems due to human encroachment and activities, compounded by droughts. In the top North, the vegetation is grassland and shrub steppe. Rainy season precipitation is very variable in time and space and has decreased significantly and become more irregular in recent decades. This savanna represents about 1,000 ha. There is a protected area in Praia das Conchas (belonging to the Ôbo National Park) which is very threatened.
The mangrove Ecosystems	The mangrove ecosystem is located in the lagoons, separated from the mainland by rivers. The vegetation is dominated by two species: *Rhizophora mangle* (Rhizophoraceae) and *Avicennia germinans* (Avicenniaceae). In the intertidal zone, an association of several species of algae covers mangrove roots. These surfaces also host invertebrates such as oysters (Isognom) and the mangrove crab (Aratus). The ornithological fauna consists of species such as *Gallinula chloropus*, *Bubulcus ibis*, or *striatus virescens*.

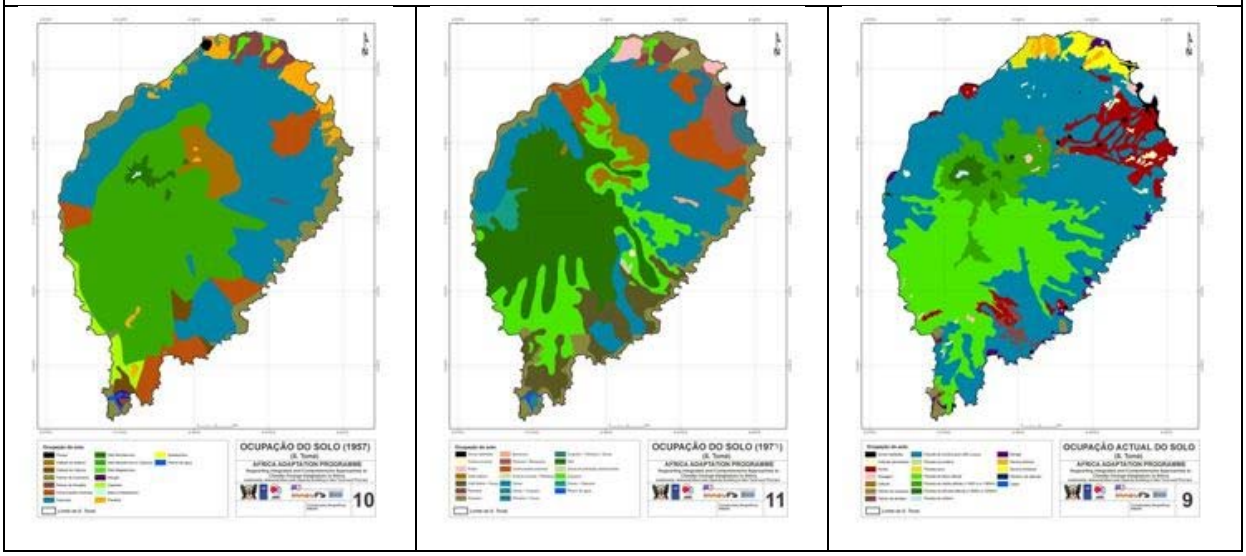
Poorly managed shifting agriculture and the absence of forests management plan degrade soils and ecosystems. Major pressures on the ecosystems are driven by demand for wood and for charcoal as a domestic fuel in the capital, and by illegal trees cutting.

The forest degradation rate at the national level has not been estimated yet because of the absence of a complete forestry inventory. However, data consulted and analysed during the PPG implementation shows that some forests in STP (a sample of about 46,000 ha outside the protected areas) are threatened by degradation at an annual rate of 1.27%. This is very high compared to the regional mean[2] and then highlights the need for sustainable forest management implementation in STP.

Although no official data exist in STP to quantify soil erosion and no research process are in place, all stakeholders agreed that soil loss is amongst the most serious environmental problem threatening the fragile ecological balance of the country. Recent mapping shows important land uses changes in the country (table 6).

[2] Net deforestation in Central Africa is 0.16% per year. Net degradation for the same region is 0,09% per year (Duveiller at al. 2008).

Table 6. Evolution of the land occupation in STP in 1957, 1975 and 2013 (from left to right).



Water resources

Forests in STP bring however major ecosystem services (such as provisioning food and fuel, regulating erosion and climate, supporting soil formation and protection, and regulating water flows and quality), which are threatened by land and forest degradation. Although the water resources potential in the country is not well defined (due to notably the very recent adoption of the water resource Master Plan which is not yet implemented), several studies range the total volume of water flows from 2.1 billion m3 per year (DRNE, 2010) to 6.4 billion m3 per year, which are high rates per inhabitant compared to the mean in other parts of the world[3]. There are 12 main watersheds in STP, which are divided in 116 sub river basins. Water flow is coming from rainfall, and then regulated by the vegetation cover, which supports the rivers supply in quantity and quality, but also the soil humidity and the underground water refill. The National Institute of Meteorology (NIM) states that the precipitations have already severely decreased from an annual mean of 913 mm between 1951 and 1976, to an annual mean of 816 mm between 1977 and 2000. Projections from the NIM show another decrease in precipitation of 85 mm until 2040. Recent scientific research highlights the impact of land use and land cover changes on west and central African monsoon[4]. Moreover, there are huge spatial differences in rainfall in the country: the south-eastern watersheds have significantly higher flow rates than the north-western watersheds. For instance, Rio Xufexufe watershed, which represents 1,741 ha, has a total annual volume equal to 282 million m3 of water, whereas Agua Grande watershed (1,572 ha) has a total of 57 million m3 of water. The threat on water availability due to land degradation, and that affects hydropower plant investment[5], and the spatial heterogeneity of water resources in the country call for an integrated watershed planning and management. This landscape approach needs to include ecosystems protection measures, land uses planning and forests management, and involve the commitment of several stakeholders (different governmental institutions, water users, farmers and communities, hydro-electricity producers, etc.).

[3] Global Water Partnership (2010), Development of a financial strategy for the water sector in Central Africa, National report for Sao Tomé and Principe.

[4] Past and present biogeophysical impacts of land use and land cover changes on West African monsoon, Sy and al., 2013, European Geosciences Union General Assembly.

[5] The CECI Consultants report indicates an average plant load factor of 33% - a low figure related to the variance in river flow.

Other environmental services generated by the STP's ecosystems: Energy supply, GHG sink and Biodiversity conservation

50% of the population still doesn't have access to a modern source of energy. Firewood and charcoal remains the main source of energy (in addition to oil lamp used by households). The charcoal consumption is growing very fast: according to estimation of the draft Forestry Development Plan, 10.5 tons of charcoal (about 15 m3) were consumed in 1988 whereas 210 tons (300 m3) were consumed in 2000. The firewood consumption, after a decrease in the 80's (108,500 tons per year), has had been growing up to 136,600 tons per year since 2000. These trends show the growing needs of biomass for energy, as well as the need for renewable energy development.

National GHG (greenhouse gas) inventories for STP carried out in connection with communications to the UNFCCC show that 'Land-Use Change and Forestry' (LUCF) are actually removing GHG from the atmosphere at a ratio of ~600% of total GHG emissions. STP is then a net sink of global emissions, of about 530,200 tons of CO2 equivalent each year. Achieving carbon sequestration at the watershed level depends on a number of conditions: e.g. the watershed's climatic, edaphic and floristic characteristics, but also the size of the watershed, population, the size of the livestock herds (if any) and access to the national grid. The implementation of the Project strategy, both with sustainable land and forest management, at significant scale (about 23,000 ha in total) can generate global environmental benefits by strengthening carbon capture capacities and mitigating climate change uncertainties.

Due to the remoteness and the small dimension of the country, STP has a very diverse and specific biodiversity, which is directly linked to the quality of natural habitats. The country is rich in endemic fauna and flora including 28 birds species, 81 butterflies species, 60 snails species, 3 mammals species, 15 reptiles species and 148 plants species (14% of the country's flora).

As regards the flora, there is a total of 1,260 vegetal species in the country (933 indigenous and 297 introduced), out of them 148 are endemics[6]. Bridges (2013) estimates that 14.9% of endemic species in STP are vulnerable, and 12.2% are near threatened. The variety of Orchids is notably high (Vaz & Oliveira, 2007).
As regards the fauna, there is a total of 10 species of small mammals, 49 species of birds, 89 species of butterflies, 14 of reptiles, and 5 amphibians. The level of bird endemism is globally unique: STP houses 28 species of endemic land birds, a very high concentration for a country of 1,001 sq km. For example, the famous Galapagos Islands house 22 endemic species in 8,000 sq km (13 islands). The country was recently added to the Important Bird Area (IBA) in Africa.

The gradual degradation and loss of natural habitats inevitably result in declines in habitat quality and extent as well as numbers and distribution of wildlife, both within Obo National Park and in the wider landscape. Despite their importance, the species on the islands are at risk. Four are listed in the IUCN red list as Critically Endangered, one is Endangered, eight are Vulnerable and a further three Near Threatened. Recently, BirdLife alerted the governement about 3 key flagship endemic birds which are critically endangered: Neospiza concolor, Lanius newtoni and Bostrychia bocagei[7].

Threats to lands & forests, root causes and impacts

The principal underlying causes of land and forest degradation and deforestation can be organized in three categories:

- Illegal cutting of trees for wood construction (house, furniture, pirogue, pontoon, etc.) and for firewood and charcoal production:

[6] Report on the state of biodiversity in Sao Tomé and Principe, 2014.

[7] BirdLife International (2014) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 22/03/2014.

Although the law states that no tree in STP can be cut without the authorisation the Ministry, the Department of Forests estimates that about 80% of the wood exploitation in the country is illegal. Some species are particularly threatened: *Milicia excelsa, Carapa procera, Fagara macrophylla, Manilkara multinervis,* etc. As there is no management plan of forests (except for the protected area), forests are largely overharvested in some parts of the country. This unsustainable practice led to a depletion of timber stock in the forests of STP (between 1989 and 1999, the forestry inventory shows a decrease of 6% of the volume of wood of the commercial species).
The North and North East of the country (savannah ecosystem) have been dramatically deforested from charcoal production, even in the protected area Praia das Conchas. This has a severe impact on the agro-ecological production system in this area. For instance, cacao cannot be produced any more because of more frequent and dramatic droughts.

- Extension of agricultural lands and land uses changes, especially in or close to the buffer zone of Obo National Park:
  Following the land reform initiated in 1993, extraction of high yielding timber trees for wood has been very widespread by those who have been assigned land under reforma fundiaria (land reform). This land reform has had an important effect on the forest cover in the country. Moreover, many of the landholding remains unused and unoccupied, with the preference of many people to live in larger towns or at least adjoining main roads.
  Today, land privatization is leading to an increase in the number of small farms and the clearance of trees. This mainly affects secondary forests and areas surrounding the Obo National Park. This does not currently affect primary forest but may be a threat in the future. Signs of palm-wine harvesting, hunting and other extractive activities are now becoming evident in the core of the Monte Carmo area (Olmos and Turshak 2010). Penetrations of poor families in the buffer zone and in the national park are more and more common. They collect wood and non-forest products, which increase pressure on the ecosystems.
  Several large-scale agribusinesses are also likely to result in the loss of forest and its flows of ecosystem services if no measures are taken. Road developments along the east and west coasts are increasing access to previously remote areas (A. Gascoigne in litt. 2000).

- Non-adequate agricultural practices such as slash and burn farming, very little crops rotation, non-adapted techniques in sloping fields:
  The main cause of soil loss is to be found also in the shift in agriculture policies and land use over the past couple of decades, and from the land reform. Persistent inadequate soil management practices such as land burning and coal production and significantly reducing the fertility of agriculture soil.
  Every year in June, smallholder farmers are clearing lands with fire before seeding maize. This practice seriously affects land ecosystems and causes soil erosion. According to the Ministry of Agriculture, about 1,000 ha are burned each year for that purpose, mostly in the Lobata district. Besides, many crop fields are located in steep areas in the country. Interviews carried out during the PPG revealed that farmers noticed a decreased of yield year after year but didn't know of any solution to stabilize yield. Soil erosion is observed, as farmers usually don't use adequate techniques cultivation such as terrace and trees plantation.
  In production areas, there is an excessive and non-appropriate use of chemical fertilizers, which contribute to the impoverishment of the country's arable lands. In a general case, farmers do not use basic agroecology techniques such as compost in order to manage the fertility of their soil.

In a context of extreme poverty and economic degradation in the rural areas of STP, many communities tend to rely on natural resources for their subsistence. Unsustainable activities in the rural areas includes logging, charcoal burning, wildlife hunting and poaching, palm wine farming, collection of medicinal plants, intensive vegetable growing under slaw and burn deforestation process[8].

[8] Report of the Monte Pico Association prepared in 2007 for the FFEM (French Fund for Global Environment).

Box 1. Bombaim Village – Competing land uses in Bombain landscape

How the Bombaim landscape is a place of competing land uses?

Located in the Rio Abade watershed, the community of Bombaim (34 inhabitants) is an old annexe of the "Roça Milagrosa" and lives mainly from agriculture (cacao, coffee, palm oil), livestock and ecotourism.

Recently, the company SATOCAO has started forests clearance for cacao plantation rehabilitation. However, this creates land uses conflicts, as the community doesn't want that specific lands to be cleared on the hill close to their village. Indeed, they argue that tourists often climb this hill because of its beauty and diversity. If the forest is cleared, tourists will not appreciate and may not come any more.

Moreover, the engineers from the ministry alerts on the fact that some of the lands of Bombaim areas need to be kept as secondary forests, especially those on the top of the hills and on high slopes, in order to protect the ecological integrity of the watershed.

Besides, Bombaim is a high potential site for hydro production, and has been selected as a priority investment under the GEF project. Water supply is another uses of the land's ecosystems services.

This situation illustrates clearly the land uses conflict that happens in watersheds in STP. It shows the need for more clarity in land planning, and the need of a participatory approach, shared by all the users of resources of the watershed. This approach needs to facilitate the emergence of shared challenges and to define the rules of uses of natural resources in the watershed.

Long-term solution and barriers to achieving the integrated energy and ecosystems-based solution

While there are many challenges facing STP with respect to energy and management of natural resources, the long-term solution involves two inter-related axes of action. First, it implies STP embracing a renewable hydropower development path that supports the country to become much more self-sufficient in energy, and preferably cleaner energy, while also supporting human and economic development. This is bound to have a positive impact on forests that are currently suffering from unsustainable and inefficient use of biomass. This is possible through the promotion of renewable energy production. Increasing the locally available energy will undoubtedly contribute to the country's development, while having a very positive impact on people's livelihoods. Together with an intensification of agricultural practices, this will open up a number of possibilities for income generation and improved quality of life. Secondly, these same local communities are to be empowered as key agents of change with respect to the good stewardship of land, water and biodiversity. This is possible, if people are given a stake in conserving forests and associated resources, and if people derive benefits from it. The Integrated Watershed Management model embraces these two axes of action, while also catering for the social aspects that permeate community relations.

Long-term solution: the integrated landscape approach at the watershed level

The concept of Integrated Watershed Management (IWM) in STP provides a framework to integrate natural resource management with community livelihoods improvement and hydro-energy production in a sustainable way. The watershed-based approach is a relevant strategy in STP to develop a landscape approach integrating conservation of ecosystems and local development of communities. The highest and steepest sub-catchments support cloud forest and dense primary forest ecosystems, while those less steep are used for agroforestry and food crops. IPPs will establish the hydroelectricity plants in watershed so that upstream land use changes might affect their energy production.

Downstream fishermen observed a significant decrease in fish population in the coast waters due to soil erosion upstream[9].

Through the IWM, the project will address the issues of degradation of natural resources, soil erosion, landslides, floods, frequent droughts and desertification, low agricultural productivity, poor water quantity and quality and poor access to land. This will be achieved through watershed level land use planning and implementation of Community-based natural resources management (CBNRM) methods and innovative agroecological techniques. IWM involves better coordination of land, water and energy management and a watershed-scale approach to achieving sustainable development of communities, land and forest conservation, low carbon development and adaptation to climate change. Watershed stakeholders will use and manage their available land to maximize production from hydroenergy, agriculture, livestock and forestry on land allocated for these purposes. This IWM approach will be sustained through a sharing benefit mechanism.

A key tool to achieve effective IWM in STP will be the Integrated Watershed Management Plan (IWMP) which is a document developed cooperatively by government and stakeholders (communities, IPPs, agribusiness, tourism operators, etc.). It states suitable strategy for ecosystems conservation and local communities' development, and shared goal and outlines actions to manage land, forest and water on the watershed basis. It will be developed for each watershed at the beginning of the project with the support of consultants. The IWMP will detail the solutions for improving lands management through implementation of the following concepts in the appropriate areas of each watershed:

- An innovative participative method of forest management will be implemented for upstream lands (output 3.1). Owned by the State, secondary forests have no management plans yet and are not controlled due to the weak institutional capacity. The project will introduce Community Forests (CFs) concept in the country (at least over 6,000 ha). As this community-based approach of natural resource management is new in the country, an appropriate legal text and framework will be drafted by a consultant and validated by the government. Management rights and responsibilities are transferred to the communities and CFs are managed by and for the benefit of communities, with advice from administrations (MAFRD) and local authorities (namely the "Camara").
  An initial mapping of the project zones will be carried out by a team of local experts. A detailed assessment for each area will include: a clear delimitation of the upstream forests, identification of the biodiversity and the ecosystems services, identification of the uses and the users and the stakeholders to the natural resources (forest dweller communities but also private sector, civil society, institutions and decision-makers), and an assessment of potential income generating activities. The data collected will support the design of participatory management plans. As a constitutive part of the IWMP, the CF management plans will be developed for each forest with operational guidance for sustainable forest management. They will include (i) the situation description (reference assessment), (ii) the measures required to conserve lands and to sustainably manage natural resource, (iii) the responsibilities of each stakeholders, (iv) a detailed work plan and budget. Each plan will be validated by stakeholders during meetings, before its official approval by authorities. Together with this process, a co-management convention will be negotiated at the local level, and agreed upon and signed by each local authority ("Camara") and Community Committee to clarify roles, responsibilities and benefits in relation to management of the forests.
  Community Forests establishment also includes organisational support and capacity building for communities. A committee will be established in each village in order to manage the forest. It will be formed by community leaders during the development of the participatory plans. The committee will benefit from a learning and capacity building process including environmental, development, organizational and economic topics. It is expected that each community leader will act as a multiplier of knowledge within his own community, disseminating the principles for the sustainable management of productive landscapes and the maintenance of the ecosystems services in each watershed.

[9] Source: NGO MARAPA, interview with Manuel Jorge Carvalho Do Rio, March 2014.

CFs will contribute to maintain ecosystem services through sustainable management of forests (for example, reducing the frequency and impact of bushfire by creation and maintenance of firebreaks and fire management systems - surveillance and fire-fighting teams), to reduce erosion in the watershed, and to improve communities' livelihoods on a sustainable basis.

- In order to address soil erosion in the watershed, the project will support the introduction of sustainable Agricultural Land Management (SALM) practices among the farmers through a capacity building process including pilot land plots, training, technical assistance to the farmers and investments for the adoption and dissemination of sustainable farming techniques (output 3.2). These measures will be described and illustrated in the IWMP.
  With the support of international expertise, a training programme will be organized for at least 4,000 farmers in SALM practices for reducing soil erosion. The training plan will be developed in collaboration with the CIAT, farmer's organisation and the international expertise. It will go into depth the efficient SALM techniques adapted in the context of each watershed: (i) Agronomic practices (crop rotation, cover crops and green manure), (ii) soil fertility management (mulching, improved fallows and composting), (iii) water management (river bank protection) and (iv) mechanical land management (terraces, stone lines and anti-erosion small dams). The learning cycle will be sustain by monitoring in the field both by local agent of the MAFRD and by a local NGO that will be also trained by the international expertise.
  The learning cycle in agro-ecology seeks to improve the capacity of participants to promote agro-ecological practices, by reinforcing both their knowledge (technical aspect) and their skills (methodological aspect). It will consist of both theoretical and practical sessions, in planetary and working groups' sessions. Efforts will be made to organize participative and dynamic training sessions. Very comprehensive documents (with illustration and simple texts) will be given to the participants for dissemination in the communities.
  Pilot demonstrative land plots will be established for two purpose: (i) organising practical training in field and (ii) producing scientific knowledge for capitalisation on SALM techniques in the country.
  Based on first results of these pilot plots, investments for material and equipment for the implementation of soil management techniques at large scale will be done on plots of group of farmers. Criteria for selection of farmers will include: motivation to take a leadership role in the process of dissemination of SALM techniques in his community, availability of time, geographic and social representation, focus on the weakest segments of the population (women, unemployed groups).

- In order to reduce pressure on the natural resources, activities will be developed in communities to meet their needs for food, wood and other natural resources, harvested sustainably, and to provide alternative income-generation (output 3.3).
  These income-generating activities include (i) new agricultural products such as mushrooms, medicinal plants and vanilla/spices grown on cocoa trees, (ii) non timber forest products, (iii) production of organic compost, (iv) eco-tourism.
  The project proposes to organise the implementation of these income-generating activities around the Ecological Perimeters (EP) concept. EPs are established on about 2 to 5 hectares in each communities and provide food (vegetables, fruits), wood (fuel wood and other purposes), non-wood products, fruits, medicinal plants, vegetables and orchards, mushrooms production, water supply, saplings for replanting degraded CFs, fishes in basins, etc. A pilot experimentation of aquaculture in the watershed will be performed and recommendations for dissemination will be formulated in case of promising results.

- A financial mechanism will be set up by the project in order to sustain the Integrated Management of the Watershed (outputs 3.4 and 3.5). This mechanism will be based on Payment for Environmental Services (PES) – payment from the IPPs based on sharing benefit scheme of the energy proceeds. A Community Trust (CT) is fuelled by IPPs and will finance every year micro-projects which contribute to sustainable land and forest management in the watershed. The full mechanism is described below in the following paragraph (Financing Support Mechanism).

The PES scheme must include a monitoring system which (i) assess the link between sustainable activities implemented in the upstream lands and the environmental services (namely water flows and quality) and (ii) measure the maintenance or improvement of water availability in the watershed. There is thus an obvious need for: (i) qualitative and quantitative data on the water resource in each watershed, (ii) an information tool where such information and data on water resource (but also on land use, forestry and agriculture data) can be fed, and that can be available to all concerned stakeholders (communities, IPPs, agribusiness, scientists, agribusiness, NGO, decision-makers, etc.). This water monitoring scheme will provide information on the water flows upstream the hydropower installation, and it is expected that it will support the water users to progressively include to the CTs mechanism more criteria based on additional water flow that the SLFM will bring.

The barriers to achieving the integrated solution

The Project will address the following specific barriers and groups of barriers which currently constrain positive changes towards the development of an integrated, sustainable and widely replicated IWM model in STP:

Barrier 1) Policy and legal instruments relating to community management and benefit-sharing in secondary forest ("Capoeira") are inexistent. An appropriate policy and legal framework is required to support effective implementation of the IWM model.

At national level, a Forestry Master Plan was designed in 2002 with the support of ECOFAC, AGRECO and CIRAD. It describes the situation in the forestry sector and defines main priorities and actions plan for the sector. The Forestry Master Plan gives the following orientations:

- To develop information and knowledge about the forestry sector (mapping, database, capacities building, etc.)
- To support farmers and private sector for sustainable management of forests and agroforestry systems (support for trees plantation, improve the productivity of forests, promote the valorisation of trees, etc.)
- To promote a better planning, management and valorisation of forests (promote the participation of local population for the management of secondary forests, reduce illegal exploitation of forests, increase incomes from forests and improve livelihoods of local population).

However the GoSTP has never validated it because of lack of advocacy capacities in the MAFRD. During the last 12 years, the situation and main policy priorities has been evolving. Whereas the natural forests ("Obo") are under a protection area management plan ("Obo Natural Park"), the secondary forests have been the poor relation that has been ignored. One of the main recommendations of the past projects is to introduce and develop Community Forest Management for the secondary forest in STP (about 21,000 ha). Thus the Forestry Master Plan needs to be updated with both recent data and strategic priorities for the forestry sector in STP.
Besides, some legal codes and texts relating to natural resource management (forestry, environment, conservation of fauna, flora and protected areas,) include incentive for community involvement, but no specific law does exist for community management of the secondary forest. Then the legal framework needs to be designed in order to clarify and facilitate community management and benefit sharing of the secondary forests as part of the IWM model.

Barrier 2) Poor understanding of the natural resource base, ecosystems and ecosystems services flows and the impacts of land management, natural resource and energy use inhibit development of integrated and sustainable management at the watershed level.

Traditional approaches to forest management, sustainable farming and energy projects are compartmentalized and fail to understand the overall needs of populations at the scale of a village, its community lands and the

landscape level (watershed). Also, rural communities have little awareness about the impacts of their activities on natural resources and ecosystems, and in particular how their management of land and resources affect GHG emissions and carbon sequestration. A few ad hoc successful approaches exist, but the emergence of a more visionary approach to generating global benefits with focus on the watershed level will meet constraints linked to rural poverty, low levels of education, significant gender imbalance and run-down or inexistent social infrastructure (access roads, rural clinics, grid connectivity, etc.).

The main purpose of IWM is to integrate natural resource management (and the related ecosystems services flows) and hydropower production with community livelihoods improvement through a landscape conservation approach.
However, information on water and carbon in watershed is very limited and there are very few examples of systematic collection of natural resources and water flows information on which to base management. Communities need simple, repeatable survey and monitoring methods to obtain baseline information and to monitor trends in natural resources (habitats and species) to ensure that community management achieves sustainable management objectives and that natural resource exploitation is carried out sustainably. Adaptive management requires this information to allow for changes in management if conservation or other objectives are not being met. Moreover, the sustainable financing of IWM through the Community Trust (see full explanation below in Financial Support Mechanism chapter) needs information on ecosystems services maintenance and improvement in the long term.

Barrier 3) Poverty, cultural habits and lack of alternatives, innovation and investment (private sector and public finance) at village level make it hard for communities to break out of a cycle of unsustainable land, resource and energy use and rural exodus.

As evidenced by several previous development interventions at the village level, the principles of participative land uses planning and management can be introduced. However, bringing about lasting change will depend on communities having a positive stake in it. Poverty, tradition and lack of alternatives drive communities and individuals to continue to carry out unsustainable practices of resource exploitation both legal and illegal (e.g. cutting trees without permits from the MARFRD). The lack of jobs and alternative options for income generation drive the rural exodus – many villages lose young people who emigrate either seasonally/ temporarily to look for work or permanently to find work in the capital or other countries. During village interviews at the PPG stage, all communities expressed the need for social benefits in villages (health, education, income-generating activities and employment) as well as improved natural resource management, sustainable use and more efficient energy use.

Farming practices are among the hardest to change and this creates a barrier to the introduction of Sustainable Agricultural Land Management (SALM) alternatives (e.g. mulching, improved fallows, agroforestry and tree planting). Lack of knowledge of the environmental impacts of their practices and the inability of farmers to invest in equipment over the medium to long term are barriers to implement alternative techniques (typically intercropping, river banks protection, anti-erosion dams, terraces, etc.). There are challenges in term of appropriate economic incentives to make these technologies accessible, popular and progressively systematic in rural areas. The Community Trust (CT) will be a long-term solution to finance these innovation upstream the watershed.

Examples of alternative income-generating activities (IGAs) exist in rural villages in STP but these are limited and usually initiated under the umbrella of donor-funded development projects. Village activities with linked social / financial and environmental benefits seen at the PPG research stage include ecotourism, mushroom production, medicinal plants and revolving credit funds providing social benefits (start-up funds for household and community enterprises) and a percentage of profits to environmental funds to support management of

Community Forests. Similar approaches need to be widely replicated as part of the IMW model, to lead to sustainable and lasting village level development.

Barrier 4) Poor understanding of the IWM model and of conservation farming, ecosystems and potential carbon benefits, coupled with poor communication and working relationships and limited capacity of national administrations and local communities inhibit the development, promotion and widespread replication of an effective and sustainable IWM model

Through the UNDP UNEP GEF project "Integrated Management of the Rio Provaz Hydrographic Basin", a river basin management plan is under implementation with the objective to enabling equitable water resources allocation and protection. This is a first step toward the IWM approach proposed in the present project, which also included participative land uses planning, Community Forest Management, Conservation Farming, Afforestation, etc. Yet, the idea of IWM is very new and not well understood in rural STP.
The MAFRD lacks the necessary working relationships with other administrations at both national and local levels. It has limited experience and human resources (appropriately trained staff) for the coordination and management of a national programme.
At local level, some farmers structures has been recently supported by projects (PAPAFPA for example) but there is a need for more training, better networking so that ideas can be shared, and more resources to finance activities and to ensure replication of an effective IWM model across STP.
At the community level, there is a perception of decrease in crops yield[10]; but there is no understanding of their real causes, of the link with the current un-adapted agricultural practices (crops in sloppy field without soil management techniques such as terraces or anti-erosion dams). There is a need to promote effective community involvement in improving their agricultural practices, and also in management, decision-making and benefit sharing from CF.

The capacity of institutions at the local and district levels is limited due to high levels of staff turnover, low salaries and poor motivation. Capacity at the level of districts ("camara") and villages is also weak in terms of human and financial resources. Communities lack adequate skills and training for land management and forest management (e.g. financial management, habitat improvement, ecoguards and ecoguides training). The needs include transport, materials for habitat management, fire control and replanting, mechanisms and training for ensuring longer-term sustainable funding for environmental management.

Financial Support Mechanism

The Financial Support Mechanism (FSM) proposed in the project will have two distinct components:

1. A guarantee fund, related to the energy component of the project, which aims at providing more security to the IPPs as it protects them against the risk of payment default by EMAE;
2. A community development fund, called Community Trust (CT), which aims at financing sustainable forestry and conservation agriculture in the long term through a Payment for Environmental Services (PES) mechanism between the IPPs and the communities living within the watershed.

When IPPs will negotiate with the government for the PPA, they will sign for both the guarantee fund and the community development fund, according to the modalities explained below.

[10] During the PPG, some farmers testify a loss of half of their yield within only 5 years.

The energy component of the FSM

Investment in renewable energy projects often requires to be supported with financial incentives, at least initially, because such projects are not only typically more expensive on a cost per installed capacity basis than the traditional methods of electricity generation, but that they are also, in some cases, considered to be riskier investments due to technology or resource uncertainties. The degree to which cost and risk factors apply varies according to technology and geographical location and investors expect to get a higher return on their investment to compensate them for taking on additional financial risks, or the financial risks need to be reduced through providing more revenue certainty.

Hydropower has historically been more expensive to harness for a number of reasons, including the fact that hydro resources may often be located in remote areas that require costly infrastructure to access the market (grid). This additional cost varies significantly across geographical locations and means that the level of support required to incentivise investment varies also.

In the case of STP, financial support to mini/small hydropower development can take the form of either an upfront grant or a buy-down in the level of certainty that project developers will get paid for electrical energy supplied to EMAE. In the WB/IFC "Doing Business 2014" data, STP ranks 157 out of 189 economies on protecting investors and 183 out of 189 on enforcing contracts. In discussions with private project developers, it was clear that this concern is very much present in their minds. In their view, as mini/small hydropower development is fairly well-known among lending institutions throughout the world, securing loans in the international finance market for investment in this area does not pose much of a problem. However, of real concern is the potential that investors may not get paid for the energy they supply to the EMAE grid. Investments in mini/small hydropower are made for a minimum of 25 years and any doubt in the minds of developers regarding the business climate in a particular country will make them reluctant to invest. Specifically in the case of STP, there has been a precedent, as mentioned above, when Hidroelectrica, the developer of the Bombaim hydro power station had to stop work in the absence of a Power Purchase Agreement. It is not clear why it decided to even initiate investment in the project in the absence of a signed PPA.

Hence, private sector developers would like to see a signed PPA before they make any investment. In addition, they would like to see in place a financial support mechanism that would "protect" them in case of payment default by EMAE for energy already supplied. Consequently, in order to mitigate any investor payment-default risk, the project will establish a Financial Support Mechanism (FSM - referred to as Renewable Energy Guarantee Scheme in the PIF) and allocate a joint GEF-UNDP risk-sharing capital of $ 1,200,000, viz. $ 1,000,000 from GEF funds and $ 200,000 from UNDP. This amount will fully cover one year of electricity generation from 5.51 MW of installed capacity (generation of almost 16,000 MWh/year at an average feed-in tariff of 7.5 US Cents/kWh) in the unlikely circumstance that EMAE does not reimburse the private developers anything at all for electricity supplied to the grid during that whole year.

What is the basis for assuming an average feed-in tariff of 7.5 US Cents/kWh? As indicated above, the CECI consultants determined that the levelised cost of electricity generation for the 16 mini/small hydropower sites they investigated varied between 2 and 10 US Cents/kWh. In addition, in March 2013, a private investor made a proposal to the Government to develop 3 "cascading" hydropower sites totalling 11.51 MW and sell electricity to the grid, subject to negotiations, at 9 US Cents/kWh; hence, it is safe to assume an average feed-in tariff of 7.5 US Cents/kWh for electricity sale to EMAE.

The probability that the total amount of the FSM will get depleted in just 1 year is very low, as remedial measures will kick-in as soon as EMAE starts falling behind on payments to IPPs. Still, in addition to the FSM, IPPs will be encouraged to develop their own financial instruments with private insurance providers and in case of default of payment by EMAE, the FSM will step in as "subordinate insurance" to reimburse that portion of default not covered by the IPPs' own insurance companies. Still, the situation may arise when capital markets, after evaluating EMAE's financial reports, may not willing to finance a developer's project at a reasonable cost without State support. To

minimise this from arising, the project will, during its initial stages of implementation, discuss with the Government the option of providing a sovereign guarantee that will serve as an added financial incentive for the capital market to provide debt financing to the developer at a reasonable cost.

The purpose of this guarantee scheme will be two-fold:

- First, to support the request of project developers vis-à-vis their potential lending institutions. A commitment from the Government that the chances of a payment default on the part of EMAE for energy already supplied to the grid is minimised would reduce the overall risk profile of the investment, making it easier and less expensive for the developer to raise the necessary debt financing. In addition and aimed at providing further assurance to the capital market, the project will solicit the support of other donors to increase the volume of FSM funds that will allow, if need be, to partially cover the debt portion of a developer.
- Second, it will provide assurance to project developers that there is a mechanism in place to shield them from default on the part of EMAE, should it happen.

There is, of course, a fundamental question of sustainability of resources available under the FSM for this financial support to grid-connected mini/small hydropower to continue beyond the projects' lifetime of 5 years. Neither the project nor the Government wants such an important modality for reducing the country's import of diesel fuel through substitution with locally available hydropower resources not to be sustainable. In fact, the project expects that the experience gained through the operation of the FSM will act as a magnet to other donors (and the Government) to further capitalise it beyond the initial $ 1.2 million, so that the country can benefit from investment in the hydropower sector for capacities exceeding the 4 MW planned to be constructed during the project lifetime; in fact, during the project's lifetime, the installed capacity will be 5.1 MW. Hence, for all practical purposes, the FSM is not expected to be a short-lived mechanism; in fact, it will have to be operational for at least 20 years, equivalent to the duration of the PPAs signed by the IPPs. The FSM is meant to be in operation until such time that investors gain sufficient confidence that the risk of EMAE in defaulting on its payments has been minimised through the project.

It has been clarified above that the purpose of the FSM is to reduce the overall risk profile of the private investment and to shield investors from default on the part of EMAE. In discussions with project developers, this issue will be highlighted and the website will also make clear the purpose for setting up the FSM. This, it is hoped, will sensitise project developers to the fact that the FSM is expected to decrease gradually over time and eventually be phased out when private sector has developed sufficient confidence that the risk of EMAE defaulting on payments for energy supplied has been considerably minimised. Still, during implementation of the project, discussions will be held with the Government to consider the options for putting in place its own FSM, in unlikely circumstance that it should still be necessary beyond the project time-frame to support project developers.

Operationalising the FSM

The FSM will be a non-grant mechanism that will be operational, as indicated above, for at least 20 years, equivalent to the duration of the PPAs signed by the IPPs. The funds will be deposited with the Central Bank; its concurrence was secured during implementation of the PPG. The funds themselves will be under the joint management of the Ministry of Finance and UNDP and will cover IPPs against the risk of EMAE not fulfilling its financial obligations, as outlined in the Power Purchase Agreements, towards developers for electricity already supplied to the EMAE grid. The FSM will not be used for investment.

Under the circumstance that EMAE does not credit the IPP for energy already provided, the latter solicits the support of Ministry of Finance (MoF) with a view to resolving the issue with EMAE. Hopefully, a satisfactory resolution of the issue will be found through an acceptable payment schedule. If, however, EMAE is unable to pay the IPP, then the latter solicits the fund managers to step in and make payment under the FSM, based on the non-performance of contractual obligations under the PPA. In order not to deplete the funds under the FSM, its management will enter into an agreement with EMAE on a repayment schedule. Only when all avenues for reaching a payment schedule acceptable to the concerned parties (developer and EMAE) cannot be reached, the fund managers (Ministry of Finance

and UNDP) will determine the amount of payment that needs to be made to the developer and request the Central Bank, in writing, to release the funds.

Upon completion of the project, management of the FSM will continue with the Ministry of Finance acting as fund manager. Prior to the expiry of the last PPA, the Ministry of Finance will hold discussions with the donors to determine how the remaining funds would be disposed of; for example, whether these funds should revert back to the donors or, with their concurrence, be utilised for other development projects or a combination thereof.

Box A below provides a snapshot of how the energy component of the FSM will be set up and operate:

Box A: FSM Snapshot

Financial Support Mechanism

Purpose: (1) To support project developers vis-à-vis lending institutions by minimising financial risks.

(2) Provide assurance of payment to developers for energy supplied in case of default by EMAE.

Initial Capitalisation: $ 1.2 million ($ 1 million from GEF and $ 0.2 million from UNDP). Additional capitalisation will be sought from donors to expand the programme and to, if required, partially cover the debt portion of a developer.

Funds Host: Central Bank of Sao Tome and Principe.

Funds Managers: Ministry of Finance and UNDP.

Lifetime: Minimum duration of 20 years, equivalent to duration of PPAs signed between EMAE and IPPs.

Disbursements, whenever required: Initial contribution ratio to be maintained, i.e. 83% from GEF and 17% from UNDP.

Operationalising FSM: Recruitment of a consultant with financial engineering background and experience towards the beginning of Year 2 of project to draft regulations.

Worst case scenario: Initial capitalisation can cover one full year of default by EMAE; however, this is highly unlikely to happen, as EMAE is a Government-owned Utility and its failure by going bankrupt will prove disastrous to the national economy. In addition, the probability that the total amount of the FSM will get depleted in just 1 year is very low, as remedial measures will kick-in as soon as EMAE starts falling behind on payments to IPPs. In addition to the FSM, IPPs will be encouraged to develop their own financial instruments with private insurance providers and in case of default of payment by EMAE, the FSM will step in to reimburse that portion of default not covered by the IPPs' own insurance companies. Finally, during initial implementation of the project, discussions will be held with the Government regarding the option of providing a sovereign guarantee that will serve as an added financial incentive for the capital market to provide debt financing to the developer at a reasonable cost.

Generating capacity to be installed under project: 5.51 MW (Table 4)

Expected annual generation: 16,000 MWh

Average feed-in-tariff: 7.5 US Cents/kWh (the levelised cost of mini/small hydropower generation for the 16 sites investigated by the CECI consultants varies between 2 and 10 US Cents/kWh).

Cost of default for 1 full year of energy supply from IPPs: 16,000,000 kWh x 7.5 US Cents/kWh = $ 1.2 million.

The Community Trust of the FSM

Community-based natural resources management (CBNRM) often requires to be supported with external financial incentives, in order to introduce new techniques and management methods, to design streamlined legal framework, and to accompany behaviour changes in the communities. Many CBNRM projects have been funded by donor agencies in several African countries. These efforts can produce tangible benefits for the communities while maintaining the flow of environmental services from the ecosystems on which they depend. However, in many projects, a long-term financial mechanism is needed in order to guarantee the sustainability of CBNRM[11].
In STP, the Ministry of Agriculture, Fisheries and Rural Development (MAFRD) is largely dependent of external funding to implement its sustainable resources management policy, and thus the farmers are involved only on a "short term dynamic" for the duration of a project. The director of forestry department states that the lack of recurrent funding is one of the main obstacles that the administration faces for sustainable forest management.

In line with the integrated approach promoted by the project, the financial support mechanism to sustain CBNRM in STP will be a Payment for Environmental Services (PES) scheme at the watershed level based on the water regulation services provided by the upstream ecosystems. The IPPs, who are downstream users of the water resource, will finance the communities upstream who are maintaining water availability and quality thanks to the implementation of CBNRM.

Several options of PES scheme were discussed during the PPG. On one hand, the payment can be done directly to the communities in cash or in kind. Whereas this option is experimented in several Latin American countries, it is often limited to one micro-watershed, and an experienced NGO is needed to actively manage this scheme. Moreover, transaction costs might be high is case of individual payments.

In STP the objective is to replicate the PES scheme to all hydroelectricity production sites. Moreover there is no stakeholder, neither private project developers nor NGO, with large PES experience in the country. Besides, the PES scheme must include a control system to assess whether providers and users are complying the agreement.
Thus the other option discussed during the PPG is more effective and preferred in the case of STP. The IPPs will contribute to a specific fund, called Community Trust (CT), each year at a rate of 10% of their income received from EMAE. The rate of 10% is acceptable for the private projects developers (it is equivalent of other PES initiatives in the world) and it generates an appropriate sum of 120,000 USD per year[12]. The aim of the CT is to co-finance concrete actions (micro-projects proposed by the communities) that would participate to the watershed management (sustainable land and forest management): reforestation, equipment for fire protection, income generating activities, etc. Actions collectively proposed by at least 3 actors could be 70% co-financed and individual actions could be 50% co-financed. Thus, every year, total budget of the implemented thanks to this mechanism will range from 170,000 to 238,000 USD. This amount will sustain the management of forests (annual operations[13] such as trees plantation, firebreaks maintenance, training, etc.) and the investments in Income Generating Activities and reforestation activities. Local agents of the MAFRD will support the communities to formulate the micro-projects. Local NGOs can also support communities to propose innovative projects. The FSM board will manage the CT, and will organise once a year a call for micro-projects. A committee, composed by the Ministry of Finance, EMAE, MAFRD, UNDP, local

[11] Roe D., Nelson F., Sandbrook C., 2009. Community management of natural resources in Africa: Impacts, experiences and future directions. Natural Issues No 18, International Institute for Environment and Development, London, UK.

[12] The project targets the installation of hydroelectricity plants, which will produce 15,871 MWh per year. Assumption is made for a kWh price at 0,075 USD (as a conservative price – see Box 1). IPPs will generate 1,190,325 USD of income. Hence, if the IPPs re-invest 10% of their energy proceeds, the CT will be fuelled each year by 119,033 USD.

[13] According to Financial instruments for the implementation of regional forestry strategies (February 2013), ECO estimates the minimum costs of maintenance of the Sambandé Community Forest (1,000 ha) at 3,000 USD per year. Thus, to maintain the protection of 6,000 ha of Community Forests, a minimum amount of 18,000 USD is needed every year.

authorities, FONG and communities representatives, will meet once a year in order to select the most appropriate to be financed by the CT.

The micro-project will be checked against the following criteria: (i) location within the watershed concerned by the PES scheme, (ii) actions that can be carried out in a sustainable way and without causing any environmental degradation or biodiversity loss, (iii) actions in line with the Integrated Watershed Management Plan (assessment performed at the initial stage of the project) and the related Community Forest management plan, (iv) income-generating activities that are viable and environmental friendly. Social actions can be proposed if they have a positive impact on the environment (ex: environmental education support for children).
The international part-time Technical Adviser will draft a specific manual of procedures of the disbursement of the CT for micro-projects before the launching of this activity.

Stakeholders analysis

The Project, with its broad vision of integrated action at the level of watershed, will need to bring together a wide array of stakeholders for both planning and implementation. The objective will be to engage all stakeholders at the relevant stage to employ their expertise and the resources they can bring to assist in achieving Project objectives. The following stakeholders are expected to play important roles, as outlined below:

Table 7. Stakeholder Matrix

Stakeholder	Stakes, roles and responsibilities in the project
The Ministry of Public Works, Infrastructures, Natural Resources and Energy of (PWINRE)	The Ministry of PWINRE is the project's executing agency. It has financial and management autonomy that enables it to implement the project, adopting good administrative practices and in line with the national execution modality. It will work closely with EMAE which reports to the Ministry of Public Works and involve both the environmental direction and the CCD committee in order to successfully build an inter-sectoral framework for land uses management at the watershed scale.
The Ministry of Agriculture, Fisheries and Rural Development (AFRD)	The Ministry of AFRD is responsible for component 3 implementation. It has significant experience in the development of rural projects. Besides the direction of Agricultura and the direction of Forests, the project will also work with two entities entities of the Ministry : CIAT and CATAP. - **The CIAT** (Center of Research on Agronomy and Technology) : it provides experimental supports for farmers and agrobusiness. With 57 staff, 32 ha of experimental plots and well equiped labs, it has the capacity to bring sugnificant contribution to the project implementation. - **The CATAP** (Center of Technical Training for Agriculture and Livestock) : it has weak capacities to provide specific training support to staff and farmers. The MAFRD shows important interests and motivation to the Project implementation. This will provide a guarantee of sustainability and replication of the project's pilot actions.
Local populations : farmers and their families	Especially social groups such as women and youth are most often active in the implementation of development activities at the local community level. At the same time, they may often be those causing the degradation of ecosystems, namely through the unsustainable & illegal harvest of forestry and wood products or extensive agriculture. Thus, raising their awareness (to promote a change of behaviour) and ensuring their effective inclusion in the project design, choice of activities and implementation of activities are a prerequisite for achieving conservation of natural resources at the watershed scale.

Stakeholder	Stakes, roles and responsibilities in the project
Farmers associations	Producers are grouped into one main farmer umbrella organizations, the FENAPA. This organization is active in the representation of rural people, negotiation and professionalization of producers in the fields of agriculture, livestock, fisheries, natural resource management, processing and marketing. Because of the communism past of STP, community based organisation such as farmers cooperative are not usual. However, some projects (such as the food security project supported by the taïwanese cooperation, or the PAPAFPA) have recently succeed in organising farmers in associations. These young associations will be key partners of the projects. These associations can make a significant contribution to the project in the implementation of certain project activities, such as training and adopting new sustainable agricultural techniques and in the dissemination of project results.
The decentralized state technical structures : CADR	Centre d'Appui au Développement Rural (CADR) is also key partners, as they are the delegation in the field of the State Minitry AFRD. They have an overall authority to organise, monitor and coordinate development activities within their respective scope of expertise (mainly agriculture, but also forestry). They are also responsible for overseeing and ensuring continuity of the various support projects within their remit. Thus, these structures (with appropriated reinforcement capacity) must be fully involved in the operational process : implementation, monitoring and evaluation of the project to take advantage of their technical skills and to ensure continuity.
Local Authorities : the CAMARA	There are 6 « Camara » (Municipalities) and one autonomous region in STP. These local authorities are responsible mainly for social aspects but also for environmental & natural resources issues at the local level. For instance, they are facing the problem of competing land uses within their disctrict. **The Camara** has the mandate to promote development at the district level. It is involved in the natural resources management (for example, controls of illegal logging) and land management plans, but with very weak capacities. It can coordinate land uses plans and community based NR management. It can act as local focal point in the coordination of development activities.
Non-Governmental Organisations	There ar a few NGOs active in the field of NRM and can thus provide additional support to the project, especially since they are often directly involved at the community level and can make a significant contribution in raising awareness. They are also involved in support to social activities (health, education, literacy, water, etc.) and can therefore provide additional support to the project that meets real needs and is often an important source of motivation, or a condition for the population's participation in conservation activities. The following NGO can be involved in the projects activities implementation : ADAPA, League of Nature Conservation in Sao Tomé & Principe, ZATONA, ALIZEE, AgriSud International, etc.
Private Sector in agribusiness : SATOCAO, etc.	The private sector consists of companies or economic interest groups that are more or less well established and which intervene in the sectors of production, processing and marketing. They include cacao & oilpalm producers and exporters, hydro energy producers, loggers, industries that sell goods and services and service providers, among others. They play an important role in input supply, production, processing or marketing of products derived from the local population's activities (such as cacao). They are thus an essential link between local populations and their economic environment for the exploitation of local resources and sustainability of activities initiated in the Project. Some private actors like illegal charcoal producers or game poachers may have to lose with the present project; this will need to be addressed, for example through incentive schemes developing alternative revenues streams for them.
Projects (e.g : PAPAFPA, etc.).	Various partner projects intervene in the Project areas, supporting the same populations and in some cases carrying out similar activities. They have relatively large financial, human and

Stakeholder	Stakes, roles and responsibilities in the project
	technical resources that may benefit the Project directly (co-financing) or indirectly (associated financing). These include: **The Food Crops Development Project**, supported by the taïwanese cooperation, is a strategic partner given its important contribution to the establishment of producers associations in some areas, which create a local dynamic for rural development. The Project will based its activities on these producers associations, in order to integrate conservation practices farming, sustainable lands uses and natural resources protection. **PAPAFPA** is another strategic partner, as they are working with communities in the buffer zones of the Ôbo National Park. A cooperation MoU should be signed in order to seek synergies in sustainable forestry and land management. Harmonization of interventions between PAPAFPA and the Project should improve the performance of the two projects to the benefit of local populations.
The financial partners	Co-financiers are expected to provide support in the form of opportunities between the project and other projects and programs implemented in similar geographic and sectoral areas, with complementary objectives. This should be facilitated by the few number of Donors in the country and the major position of UNDP.

Introduction to project sites

The project aims to pioneer an integrated energy and ecosystems-based approach to grid-based hydroelectric electricity generation in the country via interrelated components related to both energy and SLM/SFM activities. It develops activities for sustainable lands & forests management in order to secure the ecosystem services flows (in particular water supply) generated by the forests. Thus, many of the activities of the project are directly interlinked on a geographic level, namely the watershed.

However some of the SLM activities will be piloted over a much larger geographic area than just the hydro sites since the SLM/SFM components seek to alleviate pressures on natural resources from competing land uses and hydro energy development across a broad portion of the country's inland watersheds and this necessitates taking a landscape approach.

Then, for the preparatory phase of this project, the PPG consultants' team conducted research and interviews in a few communities in order to select potential project sites. The preliminary selection of the communities visited was made according to the criteria of relevance and feasibility developed jointly with the energy experts (see Box 2).

The PPG team discussed the project sites list during preparation of the Prodoc and it was finally refined down to 7 proposed sites (see Table below). The PPG team however alerts on the fact that private investors will decide the final location of their mini-hydro investment installation. Then the Project management team needs to be flexible as regards the sites of the project implementation.