Sao Tome and Principe

Country Profile

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Contents

Sao Tome and Principe – Brief Profile

Full name: The Democratic Republic of Sao Tome and Principe
Population: 187,356[1]
Capital: Sao Tome
Area: 1,001 sq km (386 sq miles)
Major language: Portuguese
Major religion: Christianity
Life expectancy: 65 years (men), 69 years (women) (UN)
Monetary unit: 1 dobra = 100 centimos
Main exports: Cocoa

Map of Sao Tome and Principe[2]

Economy, Growth and Emissions

Saõ Tomé & Príncipe is a former Portuguese colony located in the Gulf of Guinea and the island nation is the second-smallest country in Africa. The economy of Saõ Tomé & Príncipe is dominated by cocoa export, which in value represents 95% of the country's export. The plantations, which were nationalized at independence, have since been re-privatised as part of economic reforms introduced in the late 1980s. The cocoa production has been declining in recent years because of drought and mismanagement, which has resulted in a persistent balance-of-payments problem. All fuels are imported and domestic food-crop production is inadequate to meet local consumption, so the country also imports a significant amount of its food products.[3]

A key factor in Saõ Tomé & Príncipe's economic development has been the discovery of commercially exploitable off-shore oil reserves. This is bound to create major risks and challenges for the country's socio-economic development and stability, given the inadequacy of the nation's legal

[1] INE, 2012
[2] http://www.aefjn.org/tl_files/aefjn-images/im_Africa/im_afr_maps/saotome_principe-map.gif
[3] https://www.cia.gov/library/publications/the-world-factbook/geos/tp.html

and regulatory environment and weak capacity in both the public and private sectors. Investment in the oil sector is expected to increase in the coming years.

Saõ Tomé & Príncipe is highly dependent on Official Donor Assistance and in 2011, aid accounted for 12.9% of the GDP. Nevertheless, the country has managed to gradually adopt more prudent fiscal and monetary policies that are promoting economic growth. The service sector is the driving force of the economy accounting for nearly 50% of GDP in 2011.[4]

Approximately 60% of households have access to electricity, though close to 85% of households use firewood or charcoal for cooking.[5] The energy sector is largest GHG emitting sector in Saõ Tomé & Príncipe, contributing to more than 80% of the country's total emissions. The agriculture sector accounts for 10%, excluding land use change and forestry.[6]

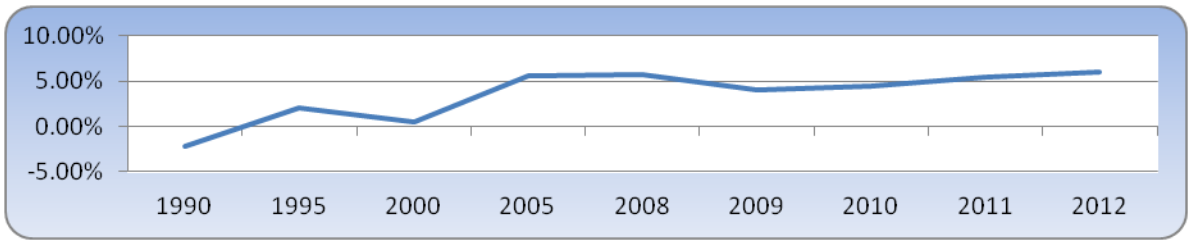

Figure 1. Economic growth since 1990 (GDP percent change)

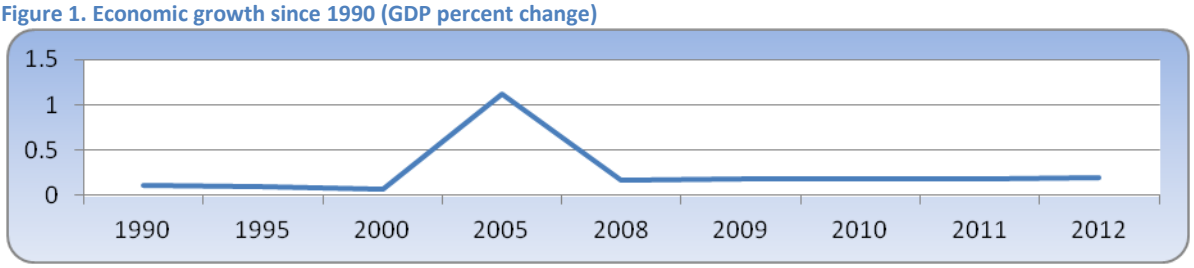

Figure 2. Economic growth since 1990 (GDP USD billions)

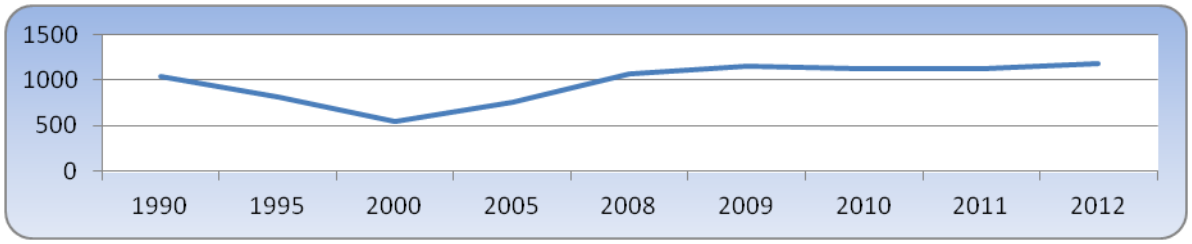

Figure 3. Economic growth since 1990 (GDP per capita)

[4] http://www.africaneconomicoutlook.org/fileadmin/uploads/aeo/PDF/Sao%20Tom%C3%A9%20and%20Principe%20Full%20PDF%20Country%20Note.pdf

[5] http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST#sources

[6] http://unfccc.int/files/ghg_data/ghg_data_unfccc/ghg_profiles/application/pdf/stp_ghg_profile.pdf

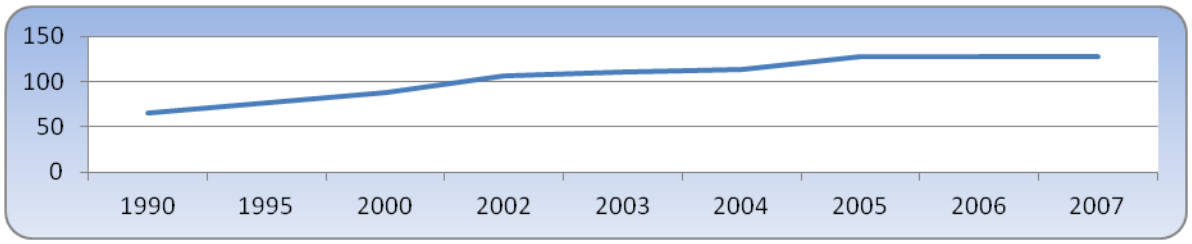

Figure 4. CO2 emissions growth, ktCO2

Status of CDM Development and Capacity Building in Sao Tome and Principe

Sao Tome and Principe has established a DNA and a number of capacity building activities for CDM have taken place in the country. Sao Tome and Principe is one of the countries taking part of the ACP-CD4CDM Project, covering 12 countries. The project is part of the European Commission Programme for Capacity Building related to Multilateral Environmental Agreements (MEAs) in African, Caribbean and Pacific (ACP) Countries. It aims at enabling the participating ACP countries to fully participate in the carbon market through capacity building.

To date three National Workshops have been held, and as a result a CDM project "Bombaim Small Hydropower Project" from Sao Tome and Principe was submitted for prior consideration on 14th of August 2012. A number of additional potential activities for CDM have also been identified in the energy sector.

Sao Tome has also been included in the Programme activities 'International water purification programme' which aims at reducing 12,488 tonnes of CO2 annually through efficient water purification systems. A CPA for Sao Tome is yet to be included in the PoA.

Overview of CDM Opportunities in Sao Tome and Principe

Agriculture and Forests

According to recent FAO estimates, Saõ Tomé & Príncipe's forests cover an area of 27,000 ha, which translate into approximately 28% of the country's total surface land area.[7] 41% of Saõ Tomé & Príncipe's forests are classified as primary forests, the most biodiverse and carbon-dense type of forest, while the remaining 59% consists of naturally regenerated forests[8].

Afforestation and reforestation of degraded forest lands and mangrove restoration do present potential for climate change mitigation in Saõ Tomé & Príncipe while generating financial flows from forest carbon activities under the CDM. A/R CDM activities though, have generally remained underdeveloped compared to other CDM sectors mainly as a result of the complexity of the A/R

[7] http://faostat.fao.org/site/377/DesktopDefault.aspx?PageID=377#ancor
[8] http://rainforests.mongabay.com/deforestation/2000/Sao_Tome_and_Principe.htm

CDM procedure and the limited market demand for A/R CDM credits. Moreover, CERs from these projects are not eligible in the European Emission Trading System and only tCERs are issued to A/R CDM projects. Nonetheless, Africa holds a significant share in the global CDM forestry sector by hosting 30% of all A/R CDM activities, which represent 8% of CDM activities in Africa[9], altogether reflecting Africa's potential for abatement in the LULUCF sector. While there are currently no A/R CDM activities in Saõ Tomé & Príncipe, the islands have potential for generating additional income from forest carbon activities under the CDM.

REDD+ also presents an opportunity for creating financial flows for Saõ Tomé & Príncipe's efforts to mitigate GHG emissions the forest carbon activities. However, in order for the islands to prepare and become 'ready for REDD+' Saõ Tomé & Príncipe will have clearly define rules on land tenure and carbon rights and set up institutions for REDD+ governance. Altogether, for REDD+ to become successful, outcome will have to secure clear, tangible benefits and access to land for forest dwellers and local communities while conserving Saõ Tomé & Príncipe's forests and biodiversity.

Woodfuel

Wood-based biomass is the dominant source of energy for Sub-Saharan Africa and woodfuel consumption per capita in Africa is higher than any other continent. In Saõ Tomé & Príncipe, the domestic energy consumption is almost entirely based on woodfuel. However the demand for wood is a driver of forest degradation and subsequently the release of GHG emissions.

Firewood

Biomass consumption (wood-energy and agricultural residues) remains the main source of domestic energy and energy in small scale commercial sectors. Reducing the demand for firewood is therefore a strategy to reduce drivers of deforestation and an exhaustion of Saõ Tomé & Príncipe's natural resources. Such include improved fuel-efficient cook stoves and alternative-fuels and techniques for cooking and baking which altogether might have significant impact on GHG emissions.

Charcoal

Charcoal constitutes the primary urban fuel in most of Africa and is a major source of income and environmental degradation in rural areas. The production, transport and combustion of charcoal constitute a critical energy and economic cycle in the economies of many developing nations.

Charcoal production is releasing methane – especially in the traditional open pits process. There are three phases in the carbonization process: ignition, carbonization and cooling. CDM projects are implemented in two different processes: 1) improvements in kiln design for better temperature control and greater control of carbonization variables which reduce methane emissions, or 2) capturing methane released from the charcoaling plant and combusting it to generate electricity (e.g. in a gas engine).

Since charcoal production involves tree removal from forests, sustainable wood supply is an important concern and aspect of charcoal production. Any introduction of efficient charcoal production technologies should therefore only be approved if facilities have allocated dedicated woodlots for sustainable fuelwood plantations. If charcoal is sustainably produced through

[9] UNEP Risoe CDM/JI Pipeline Analysis and Database, June 1st 2012

plantations and methane project emissions are zero, charcoal production becomes carbon neutral since all emitted carbon would subsequently be sequestered in replanted trees.

The annual charcoal production in Saõ Tomé & Príncipe for 2011 was estimated to 8,836 t.[10] According to a recently registered CDM project, using renewable charcoal from forest plantations shifting from traditional open kilns to efficient kilns employing methodology AM0041[11], the anticipated methane emissions reduction per ton of produced charcoal is 0.037 tons[12]. This corresponds to 0.777 tons of carbon emissions reduced per ton produced charcoal, based on the global warming factor of 21. Assuming that project emissions are zero and if fuelwood is supplied from sustainable plantations, transforming the islands' entire charcoal production, from a 100% open kiln production in the baseline would potentially result in emissions reduction of 6,866 tCO_2e/year. Such a project might be viable, but significant uncertainties are associated to this calculation, if not on the actual emissions reduction potential and project emission then on the current production methods as well as the outlook for including the entire charcoal production under one CDM activity.

Type of Technology	**Emission Reduction Potential per year (tCO_2e)**	**Baseline Methodologies**
Charcoal production	6,866	AMS-I.C., AMS-III.K., ACM00021, AM0041

Waste

Waste management has a great GHG emissions reduction potential. The potential for reductions lies in two different areas of waste handling, namely either proper disposal of organic matter, that would otherwise emit primarily methane (CH4) and waste incineration, that can serve to replace energy (both thermal and electric) that would have been produced from fossil fuels.

Organic matter, for instance in the form of waste, emits great quantities of greenhouse gasses, primarily methane (CH4), if not disposed of properly. The potential for the reduction of these emissions lies in various different sectors.

Both waste in the domestic sector, e.g. from small household livestock units, and in industrial and municipalities, waste is most often left unutilized, to decay or only rarely used for purposes as fertilizer or for burning in open pits. The waste is therefore both harmful to the surrounding environment and often also a health issue and hence a waste management project will greatly benefit to the local sustainable development.

Waste management projects can be implemented in various different sectors in Sao Tome. The challenge of mitigating these emissions is present as the incentive for securing that the waste in

[10] http://siteresources.worldbank.org/INTCARFINASS/Resources/MainReportLowCarbonEnergyprojectsforDevelopmentofSubSaharanAfrica8.18.08.pdf

[11] http://cdm.unfccc.int/filestorage/A/P/Q/APQY8M2DU796JH10G3SKEW5ZR4TBXN/05072010_PDD_Charcole.pdf?t=V298bTZrcmtxfDCc85eDOxwk3EIdOherlYZR

[12] http://www.fao.org/docrep/x2740E/x2740e60.pdf

question does not emit GHG, rarely exist. This is because the proper handling of the waste does not present an opportunity to generated revenue for the stakeholder responsible for handling the waste.

Agricultural Waste

Agricultural production leaves considerable amounts of agricultural waste, in the form of biomass and animal waste. Some of it is recycled into the agricultural production as fertilizer, while large amounts remain unutilized – and in many instances pose a disposal problem. Uncontrolled burning in the fields is not only a hazardous disposal solution - it is also wasting potential energy source. With efficient collection systems in place, waste from agricultural production can be utilized as fuel for power and heat production. In sugar industry, significant amounts of bagasse – the waste after extraction of sugar – is an equally excellent fuel. Rice production may also be industrialized to such an extent that rice husks are available in amounts sufficient for incineration in a boiler, thereby securing a basis for power and heat production. In the forest industry, large concentrations of biomass waste can be utilized for power and heat production, e.g. at sawmills. The forest industry also supplies raw material for briquettes production, where sawdust, charcoal dust, degradable waste paper and dust from agricultural production may constitute a final utilization of waste materials from agriculture related production.

Due to the very sparse agricultural production in Sao Tome and Principe the potential for reducing emissions in the sector is therefore very little and insignificant. Of the total CO2 emission from the country, the agricultural sector only contributes with 10% and of these 10%, half comes from enteric fermentation, which is very difficult to avoid.

Waste Water and landfill gas

The local authorities in Sao Tome and Principe do not have the sufficient technical or organizational capacity to implement and handle a proper waste management system and there is therefore a lack of infrastructure in this sector[13]. The waste is therefore deposited in inappropriate places and under aerobic conditions or burned in open air. As a result, there are no present obvious emissions reducing project potential.

Conventional Power Production

The installed grid-connected power production capacity in Sao Tome was around 28.5 MW in 2011. 26MW of this was thermal power and the remaining 2.5 MW was hydroelectric power production. Additional 10 MW of diesel power were generated in isolated grids and auto production[14].

Sao Tome has no local sources of fossil fuels; therefore most sources of thermal power generation are being imported. The grid coverage does not extent to all of the population, and only around 60% has access to grid electricity[15].

[13] "*São Tomé and Principe National Assessment Report*" 2009
[14] Panorama Energetico Nacional, Ministerio das Obras Publicas e Recursos Naturais, 2011, http://saotomeeprincipe.acp-cd4cdm.org/media/319842/panorama-energetico-nacional.pdf
[15] REEGLE, 2012, http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST

Since all thermal generation is based on diesel generators, emission reductions potential within the current conventional power generation is limited. Better options exist in covering the supply-demand gap through use of renewable energy, such as hydropower. A number of potential hydro project development sites have been identified. The emissions reductions potential using hydro will be discussed in chapter on renewable energies.

Renewable Energy

Hydro

There are considerable potential in further development of hydropower resources in Sao Tome and Principe. The current installed hydro capacity is just 2.5 MW, with additional 31.4 MW of identified potential. The identified sites include 14 sites with capacities between 0.044 MW and 3.75 MW[16]. All of the micro-scale CDM activities are automatically additional. The demand for electricity is expected to be between 25 MW **and 40 MW by 2019 therefore there is strong need to increase the share of renewable energy in the power production mix and move away from fossil fuel dependency.**

In addition to the 14 small-scale hydropower sites identified, a PDD for a 6.3 MW hydro power plant is in preparation. The calculated emissions reductions for this project are 12,810 tonnes of CO2[17].

Combined these hydro projects could potentially deliver emissions reductions of 86,764 tonnes of CO2 (calculated using Sao Tome's grid emission factor of 0.7137 tCO2/MWh and 3300 annual working hours[18]).

Wind

The wind measurements in the country indicate that wind power development has relatively low potential; however some options for utilization of wind power do exist. A 2 MW wind power scheme was launched in the district of Caue in 2007, with the technical support of German companies[19]. There is however no information on additional projects planned in future, and no estimates of the exact wind power potential.

Solar

The average daily insolation in Sao Tome and Principe is 5.2 kWh/m2[20] and there are no significant changes in the number of hours of sun per day throughout the year. This presents good opportunities for utilization of solar power. To date there are however no official studies of the exact solar power potential, therefore further calculations of the emissions reduction potential cannot be made within the scope of this report.

Technology type	Emission Reduction	Baseline Methodologies

[16] http://saotomeeprincipe.acp-cd4cdm.org/media/319842/panorama-energetico-nacional.pdf
[17] PDD for " Projecto MDL de mini-hidrica do Iô Grande – S.Tomé e Principe"
[18] Based on "Projecto MDL de mini-hidrica do Iô Grande – S.Tomé e Principe"
[19] REEGLE, 2012, http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST
[20] REEGLE, 2012, http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST

	Potential per year (tCO_2e)	
Hydro	86,764	ACM2, AMS-I.D., AM26, AMS-I.A., AM5, AM26, AMS-II.B., ACM11, ACM12, AM52

Energy Consumption

Greater efficiency in the consumption of energy is commonly an attractive option for emissions reduction due to its dual benefit of reducing both emissions and the size of the energy bill. It is, however, despite many years of promotion also the most overlooked option. In CDM, for instance, demand side energy efficiency projects only make up 1% of the CER generation. Among many reasons for this is the fact that most developing countries focus on energy access rather than energy saving. Approximately just over half the population of Sao Tome and Principe have access to electricity, which means that many more households are without electricity and have to rely on candlelight and kerosene lighting, as well as on biomass (firewood and charcoal) for cooking purposes. The cost of connecting new households to the grid remains a great challenge for Empresa de Agua e Electricidade (EMAE).[21]

The number of households in Sao Tome & Principe is estimated to be about 40,000. If 20,000 households have access to electricity these could potentially be a target for energy efficiency initiatives, but these would – despite the relatively high emission factor or about 0.8 tCO_2e/MWh – have limited effect. If two CFLs are distributed to each grid connected household, these 40,000 CFLs could generate approximately 2,000 tCO_2e/year depending on the wattages of the bulbs exchanged.

Similarly, an efficient cook stoves programme for the entire country would yield limited emissions reduction. 80% of the country uses fuel wood for cooking[22], or estimated 32,000 households. If every household would have the option and actually shift from an inefficient to an efficient cook stove, assuming an average annual emissions reduction per cook stove of 2 tCO2e, the total emissions reduction would be 64,000 tCO_2e/year. A 25% penetration rate would reduce this to 16,000 tCO_2e.

Technology type	Emission Reduction Potential per year (tCO_2e)	Baseline Methodologies
CFL distribution	2,000	AMS-II.E. AMS-II.J.
Efficient stoves	16,000	AMS-I.E. AMS-II.G. AMS-I.C.

[21] http://www.mbendi.com/indy/powr/af/sp/p0005.htm
[22] http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST

Industrial Production Processes

Industrial activities cover several industry sectors and reduction options related to energy efficiency as well as change of processes and substitution of materials. In developing countries many industries are cottage industries, such as small scale brick production, or even household based production like textiles, which in most cases are not captured and do not represent noteworthy emissions reduction options.

Sao Tomé and Principe has practically no industry except the cocoa production, which has been described under agriculture and forests and/or agricultural residues. Prospective emissions in the country will stem from oil exploration if and when the oil reserves in its waters are exploited. Currently, however, no immediate reduction options exist in industrial activities.

Transportation

There is 320 km of road in Sao Tome & Principe and no railways. There are 180,000 inhabitants in the country and about 50,000 travellers passing through the airport annually. Emissions in 2008 from combustion of liquid fuels were 128,000 tCO_2e.[23] A small part, about 8000 tCO_2e, of these emissions is from 30 GWh of diesel based electricity generation from 8 MW of installed capacity.[24] There are few, generally old and fuel inefficient cars (like Land Rovers) on the islands. The largest emitter is probably the flight services to and between the two islands 140 km apart for which there is little alternative. Only in 2009 a vessel for passenger transport was ordered[25]. Emissions reduction in transport is therefore regarded as not relevant.

Summary

Saõ Tomé & Príncipe feature an overall abatement potential of 111,630 tCO_2e. The total investments needed to achieve these reductions can only be roughly assessed as a sizeable share of the reductions relate to technologies for which still no data exists in terms of their investment to CER-revenue ratio.

Technology type	Emission Reduction Potential per year (tCO_2e)
Charcoal production	6,866
Hydro	86,764
CFL distribution	2,000

[23] http://data.worldbank.org/indicator/EN.ATM.CO2E.LF.KT
[24] http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST
[25] http://www.afrol.com/articles/33842

Efficient stoves	16,000
TOTAL	**111,630**

These estimates should not be regarded as anything near precise. Rather, they represent a form of calculation that allows comparison among economies and their relative attractiveness as destination for carbon finance.

It should be emphasized that while attempting to be exhaustive the estimates here do not claim to be all-inclusive. There may be unidentified sources of reductions not included in the technology overview and not represented by existing methodologies, but in all likelihood these would be minor compared to the potentials identified.