EMISSIONS REDUCTION PROFILE

Sao Tome and Principe

UNEP RISØ
JUNE 2013

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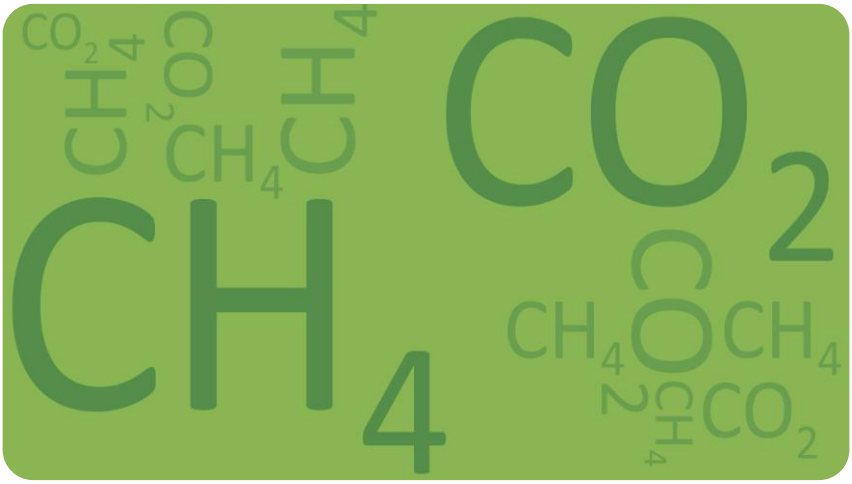

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Acknowledgements

The country emission profiles have been long underway. Keeping it on track would not have been possible without the initiation, the continuous support and the encouragement of Miriam Hinostroza, head of the Low Carbon Development team at UNEP Risø and the financing and continuous support from the EU ACP MEA programme and UNFCCC Secretariat, in particular Fatima-Zahra Taibi and Miguel Alejandro Naranjo Gonzalez, who have provided essential guidance and revisions.

We also wish to thank the Designated National Authorities of the countries for which the emissions reduction potentials have been assessed. The countries have commented on the reports in two iterations and valuable comments have been incorporated in the texts.

The profiles have benefited from shifting, but dedicated teams of research assistance. We wish to acknowledge the significant contributions from Maija Bertule, Jacob Ipsen Hansen, Maryna Karavai, Sunniva Sandbukt, Frederik Staun and Emilie Wieben, as well as Søren E. Lütken, senior adviser and contributing editor of the profiles and the summary report.

Contents

Brief Profile

Full name:	The Democratic Republic of São Tomé and Principe	Major religion:	Christianity,
Population:	165,400 (UN, 2010)	Life expectancy:	65 years (men), 69 years (women) (UN)
Capital:	São Tomé	Monetary unit:	1 dobra = 100 centimos
Area:	1,001 sq km (386 sq miles)	Main exports	Cocoa
Major languages:	Portuguese		

Map of Sao Tome and Principe[1]

[1] http://www.aefjn.org/tl_files/aefjn-images/im_Africa/im_afr_maps/saotome_principe-map.gif

Economy, Growth and Emissions

São 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 São 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, therefore, the country also imports a significant amount of its food products.[2]

A key factor in São Tomé & Príncipe's economic development has been the discovery of commercially exploitable offshore 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 and regulatory environment, and its weak capacity in both the public and private sectors. Investment in the oil sector is expected to increase in the coming years.

São 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 the GDP in 2011.[3]

Approximately 60% of households have access to electricity, though close to 85% use firewood or charcoal for cooking.[4] The energy sector is the largest GHG emitting sector in São Tomé & Príncipe, contributing to more than 80% of the country's total emissions. The agricultural sector accounts for 10%, excluding land-use change and forestry.[5]

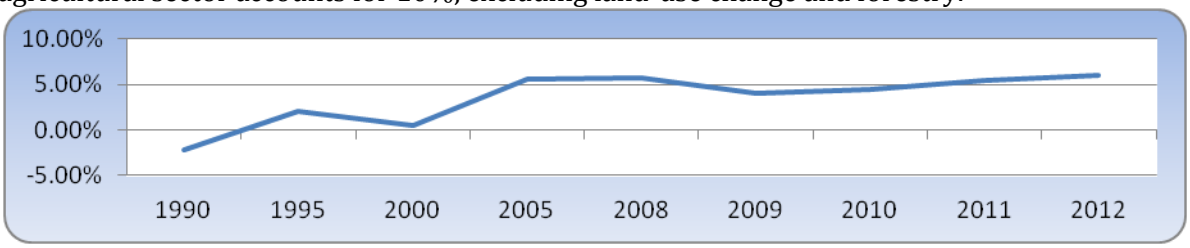

Figure 1. Economic growth since 1990 (GDP percent change)

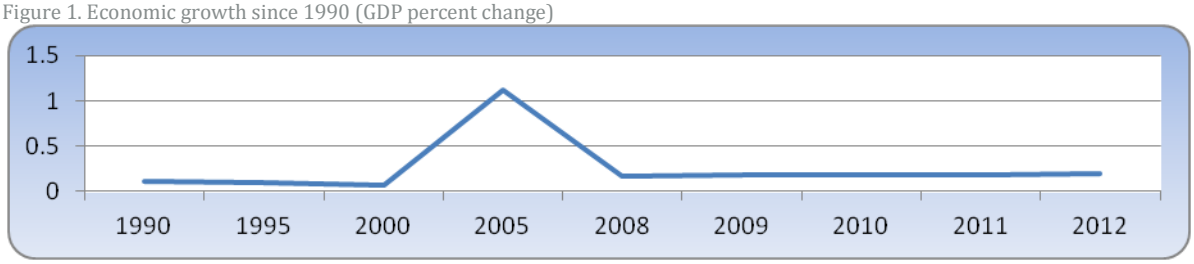

Figure 2. Economic growth since 1990 (GDP USD billions)

[2] *https://www.cia.gov/library/publications/the-world-factbook/geos/tp.html*

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

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

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

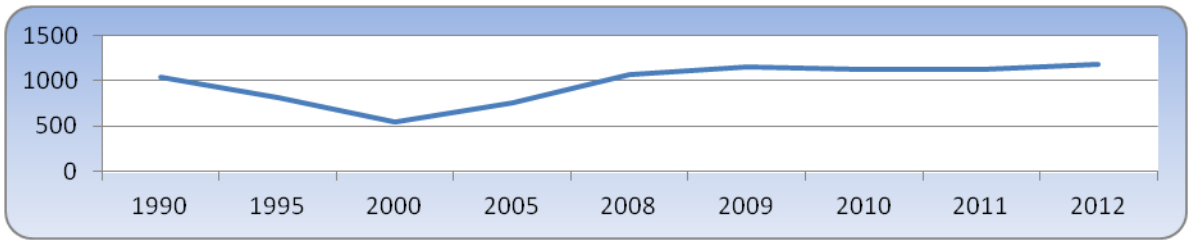

Figure 3. Economic growth since 1990 (GDP per capita)

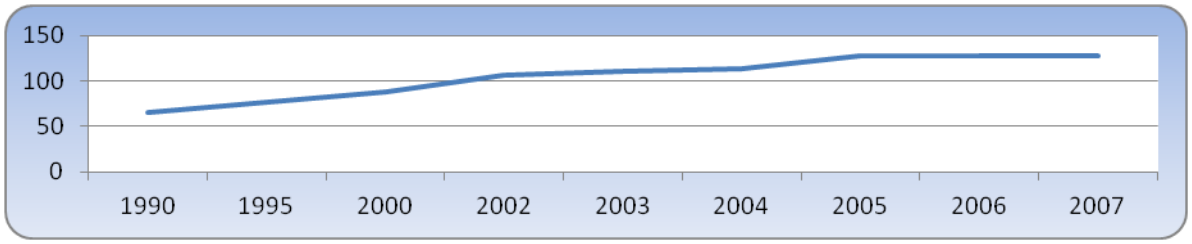

Figure 4. CO_2 emissions growth, $ktCO_2$

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

São Tomé and Principe has established a DNA, and a number of capacity building activities for CDM have already taken place in the country. São Tomé and Principe is one of the countries taking part in 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 take part in the carbon market, through capacity building.

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

São Tomé has also been included in the 'International water purification programme', which aims at reducing 12,488 tons of CO_2 annually, through efficient water purification systems. A CPA for São Tomé 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, São Tomé & Príncipe's forests cover an area of 27,000 ha, which translates into approximately 28% of the country's total surface land area.[6] About

[6] *http://faostat.fao.org/site/377/DesktopDefault.aspx?PageID=377#ancor*

41% of São Tomé & Príncipe's forests are classified as primary forest, the most biodiverse and carbon-dense type, while the remaining 59% consist of naturally regenerated forest[7].
Afforestation and reforestation of degraded forest lands, and mangrove restoration, present a potential for climate change mitigation in São Tomé & Príncipe, while generating financial flows from forest carbon activities under the CDM. However, A/R CDM activities have generally remained underdeveloped, compared to other CDM sectors, mainly as a result of the complexity of the A/R 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[8], altogether reflecting Africa's potential for abatement in the LULUCF sector. While there are currently no A/R CDM activities in São 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 São Tomé & Príncipe's efforts to mitigate GHG emissions, through forest carbon activities. However, in order for the islands to prepare and become 'ready for REDD+', São Tomé & Príncipe will have to clearly define rules on land tenure and carbon rights, and set up institutions for REDD+ governance. Altogether, for REDD+ to become successful, the outcome will have to secure clear, tangible benefits, and access to land for forest dwellers and local communities, while conserving São Tomé & Príncipe's forests and biodiversity.

Fuelwood

Wood-based biomass is the dominant source of energy for sub-Saharan Africa, and fuelwood consumption per capita in Africa is higher than any other continent. In São Tomé & Príncipe, the domestic energy consumption is almost entirely based on fuelwood. 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 São Tomé & Príncipe's natural resources. Such strategies include improved fuel-efficient cook stoves, and alternative fuels and techniques for cooking and baking, which altogether might have a significant impact on GHG emissions.

Charcoal

Charcoal constitutes the primary urban fuel in most of Africa, and is a major source of income as well as 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 releases methane – especially in the traditional open pits process. There are three phases in the carbonization process: 1) ignition, 2) carbonization, and 3) cooling. CDM projects are implemented in two different processes: 1) improving the kiln design for better temperature control and greater control of carbonization variables, which reduce methane emissions, or 2) capturing the 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. Therefore, any introduction of efficient charcoal production technologies should only be approved if facilities have allocated dedicated woodlots for sustainable fuelwood plantations. If charcoal is sustainably produced through plantations,

[7] *http://rainforests.mongabay.com/deforestation/2000/Sao_Tome_and_Principe.htm*

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

and methane emissions are eliminated, charcoal production becomes carbon neutral, since all emitted carbon would subsequently be sequestered in replanted trees.
The annual charcoal production in São Tomé & Príncipe for 2011 was estimated to be 8,836 t.[9] According to a recently registered CDM project, using renewable charcoal from forest plantations, shifting from traditional open kilns to efficient kilns employing methodology AM0041[10], the anticipated methane emissions reduction per ton of produced charcoal is 0.037 tons[11]. This corresponds to 0.777 tons of carbon emissions reduced per ton of produced charcoal, based on the global warming factor of 21. Assuming that project emissions are zero, and that 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 an emissions reduction of 6,866 tCO_2e/year. Such a project might be viable, but significant uncertainties are associated with this calculation, if not on the actual emissions reduction potential and project emissions, then on the current production methods and the outlook for including the entire charcoal production under one CDM activity.

Technology type	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: proper disposal of organic matter that would otherwise emit methane (CH_4), or 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 large quantities of greenhouse gasses, primarily methane (CH_4), if not disposed of properly. The potential for the reduction of these emissions lies in various sectors.

Waste in the domestic sector, e.g. from small household livestock units, as well as in the industrial sector and municipalities, is most often left unutilized, to decay, or rarely used for the purposes of fertilizer or for burning in open pits. The waste is, therefore, both harmful to the surrounding environment, and often a health hazard. Consequently, a waste management project will be greatly beneficial to local sustainable development.

Waste management projects can be implemented in various sectors in São Tomé. The challenge of mitigating GHG emissions from waste lies in the lack of existing incentives, as the proper handling of waste does not present an opportunity to generate revenue for the stakeholders.

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

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

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

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

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 a waste of a potential energy source. With efficient collection systems in place, waste from agricultural production can be utilized as fuel for power and heat production. In the sugar industry, significant amounts of bagasse – the waste after extraction of sugar – is an excellent fuel. Rice production may also be industrialized, to the 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 sparse agricultural production in São Tomé and Principe, the potential for reducing emissions in the sector are very little and insignificant. The agricultural sector only constitutes 10% of the total CO_2 emissions from the country, and of this 10%, half comes from enteric fermentation, which is very difficult to avoid.

Wastewater and Landfill Gas

The local authorities in São Tomé and Principe do not have sufficient technical or organizational capacity to implement and handle a proper waste management system, resulting in a lack of infrastructure in this sector[12]. Consequently, waste is deposited in inappropriate places, and under aerobic conditions, or burned in open air. As a result, there are presently no obvious emissions reducing project potentials.

Conventional Power Production

The installed grid-connected power production capacity in São Tomé was around 28.5 MW, in 2011; 26 MW of this was thermal power, and the remaining 2.5 MW was hydroelectric power production. An additional 10 MW of diesel power was generated in isolated grids and auto production[13].
As São Tomé has no local sources of fossil fuels, most sources of thermal power generation are imported. The grid coverage does not extend to the entire population, and only about 60% have access to grid electricity[14].
Since all thermal generation is based on diesel generators, emissions reduction 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 reduction potential using hydro will be discussed in the chapter on renewable energy.

Renewable Energy

Hydro

There is considerable potential in the further development of hydropower resources in São Tomé and Principe. In addition to the currently installed 2.5 MW hydro capacity, 31.4 MW of potential has been identified in 14 sites, with capacities between 0.044 MW and 3.75 MW[15].

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[12] *"São Tomé and Principe National Assessment Report" 2009.*

[13] *Panorama Energetico Nacional, Ministerio das Obras Publicas e Recursos Naturais, 2011, http://saotomeeprincipe.acp-cd4cdm.org/media/319842/panorama-energetico-nacional.pdf*

[14] *REEGLE, 2012, http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST*

[15] *http://saotomeeprincipe.acp-cd4cdm.org/media/319842/panorama-energetico-nacional.pdf*

The demand for electricity is expected to require up to 40 MW of additional generation capacity depending on choice of technology ready by 2019, thus potentially calling for exploitation of the full hydro potential.
In addition to the 14 small-scale hydropower sites identified, a PDD for a 6.3 MW hydropower plant is in preparation. The calculated emission reductions for this project are 12,810 tons of CO_2[16].
Combined, these hydro projects could potentially deliver emission reductions of 86,764 tons of CO_2 (calculated using São Tomé's grid emission factor of 0.7137 tCO_2/MWh, and 3,300 annual working hours[17]).

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 technical support from German companies[18]. There is, however, no information on additional projects planned in the future, and no estimates of the exact wind power potential.

Solar

The average daily insolation in São Tomé and Principe is 5.2 kWh/m2,[19] and there are no significant changes in the number of hours of sunlight per day, throughout the year. This presents good opportunities for utilization of solar power. However, to date, there are no official studies on 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 Potential per year (tCO_2e)	Baseline Methodologies
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. However, despite many years of promotion, it is also the most overlooked option. In CDMs, for instance, demand-side energy efficiency projects only make up 1% of the CER generation. Among the many reasons for this is the fact that most developing countries focus on energy access, rather than energy saving. Approximately over half the population of São Tomé and Principe have access to electricity, which means that many households are without electricity, and must 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).[20]

[16] *PDD for "Projecto MDL de mini-hidrica do Iô Grande – S.Tomé e Principe"*

[17] *Based on "Projecto MDL de mini-hidrica do Iô Grande – S.Tomé e Principe"*

[18] *REEGLE, 2012, http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST*

[19] *REEGLE, 2012, http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST*

[20] *http://www.mbendi.com/indy/powr/af/sp/p0005.htm*

The total number of households in São Tomé & Principe is estimated to be about 40,000. If 20,000 households have access to electricity, they could potentially be targets for energy efficiency initiatives. Despite the relatively high emission factor of about 0.8 tCO_2e/MWh, these initiatives would have a limited effect. If 2 CFLs are distributed to each grid-connected household, these 40,000 CFLs could generate approximately 2,000 tCO_2e/year, depending on the wattage of the bulbs exchanged.
Similarly, an efficient cook stoves programme for the entire country would yield limited emissions reduction. About 80% of the country, or an estimated 32,000 households, uses fuelwood for cooking[21]. If every household would have the option and actually switched from an inefficient to an efficient cook stove, assuming an average annual emissions reduction of 2 tCO_2e per cook stove, 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.

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 there are many cottage industries, such as small-scale brick production or even household-based production, like textiles, which in most cases are not represented and do not constitute noteworthy emissions reduction options.

São Tomé and Principe has practically no industrial activity except for 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, no immediate reduction options exist in industrial activities.

Transportation

There is 320 km of road in São Tomé & Principe, and no railways. There are 180,000 inhabitants in the country, with about 50,000 travellers passing through the airport annually. In 2008, emissions from combustion of liquid fuels were 128,000 tCO_2e.[22] A small part, about 8,000 tCO_2e, of these emissions was from 30 GWh of diesel-based electricity generation, from 8 MW of installed capacity.[23] There are few, generally old and fuel-inefficient cars (like Land Rovers) on the islands. The largest emitter is likely the flight services to, and between, the two islands -- 140 km apart, for which there is little alternative. It was only in 2009 that a vessel for passenger transport was ordered[24]. Emissions reduction in transport is, therefore, regarded as not relevant.

[21] *http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST*

[22] *http://data.worldbank.org/indicator/EN.ATM.CO2E.LF.KT*

[23] *http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST*

[24] *http://www.afrol.com/articles/33842*

Summary

São Tomé & Príncipe has 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 no data currently 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
Efficient stoves	16,000

These estimates should not be regarded as being precise. Rather, they represent a form of calculation that allows comparison among economies, and their relative attractiveness as destinations 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.

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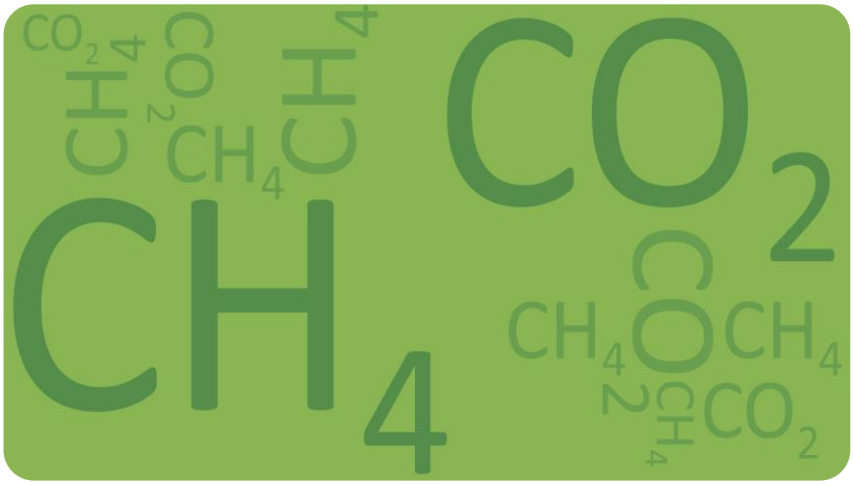

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