

GRID EMISSION FACTOR

Of



São Tomé and Príncipe

2012-2014

UNEP RISØ Centre

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ABBREVIATIONS

ACP African, Caribbean and Pacific states

BM Build Margin

CDM Clean Development Mechanism

CER Certified Emission Reduction

CM Combined Margin

CO2 Carbon Dioxide equivalent

DNA Designated National Authority

DOE Designated Operational Entity

EMAE Empresa de Água e Electricidade de São Tomé e Príncipe (State Electricity and Water Company)

GEF CO2 Grid Emission Factor

IPCC Intergovernmental Panel on Climate Change

IPP Independent Power Producer

MEAs Multilateral Environmental Agreements

NCV Net Calorific Value

OM Operating Margin

PDD Project Design Document

UNFCCC United Nations Framework Convention on Climate Change

INTRODUCTION

This report covers the Grid Emission Factor (GEF) for the main electricity system of the Island of Sao Tome in the Democratic Republic of Sao Tome and Principe, and serves as support to the submission of the respective Standardized Baseline by the Designated National Authority (DNA) of the Democratic Republic of Sao Tome and Principe.

The methodology applied is described in the "Tool to calculate the emission factor for an electricity system – version 4.0", officially published by the United Nations Framework Convention on Climate Change (UNFCCC) – hereafter, referred to as the *Tool*.

Data on net electricity generation and fossil fuel consumption for the calendar years 2010 to 2014 is provided by the state's Water and Electricity Company, EMAE.

BASELINE METHODOLOGY

STEP 1. Identify the relevant electricity system

A *grid/project electricity system* is defined by the "spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity" (UNFCCC, 2013). Table 1 in Annex 1 shows all the power units/plants connected to the electricity system under analysis in this report.

Isolated grids and private power units (auto-consumers), supply electricity in places not connected to the chosen electricity system or serve as backup power during grid shortages, in the case of the latter. There are no imports or exports with any other electricity system. Thus, no **connected electricity system** is considered in the calculation.

STEP 2. Choose whether to include off-grid power plants in the project electricity system

Project participants may choose between the two options to calculate the operating margin and build margin emission factor:

- Option 1: Only grid power plants are included in the calculation; or
- Option 2: Both grid power plants and off-grid power plants are included in the calculation.

A study by the World Bank (World Bank, 2010) estimated an off-grid¹ capacity of around 8 MW of diesel-based power units in Sao Tome and Principe – the most part in the *tourism sector* in the country.

The lack of grid reliability and stability has led some enterprises to invest in their own generation units to balance the common grid shortages and blackouts, in order to keep a steady supply to their customers.

Despite their presence in the electricity generation sector, to simplify the calculation, off-grid power plants won't be considered and, therefore, Option 1 is chosen.

STEP 3. Select a method to determine the operating margin (OM)

The *tool* offers four different methods to calculate the OM emission factor:

- a) Simple OM
- b) Simple adjusted OM

¹ The classification as *off-grid power plant* is based on the requirements set under Annex 2 of the *Tool*. Hence, off-grid in this context excludes all isolated systems not connected to the electricity system defined in Step 1.

- c) Dispatch data analysis OM
- d) Average OM

The available data provided by EMAE is on a yearly basis, both on electricity generation and fossil fuel consumption of the power plants connected to the electricity system. This means that method b) can be excluded from further consideration, as it requires hourly data. In addition, in the context of establishing a standardized baseline, method c) can also be excluded, as it requires *ex-post* annual monitoring of data.

In order to use method a), it is compulsory to demonstrate that low-cost/must run resources² constitute less than 50% of the total grid generation in one of the following two cases:

1. In the average of the five most recent years; or
2. Based on long-term averages for hydroelectricity production.

For the chosen electricity system, low-cost/must-run refers solely to hydro resources. Table 2 presents an average of the five most recent years of grid generation. The values are relative to the period 2010-2014, and are taken from EMAE's Annual Reports (EMAE, 2011, EMAE, 2012; EMAE, 2013, 2014).

As it can be noticed, hydroelectricity production is below 50% of the total grid generation in all the years considered (an average of around 8.8%), which means that method a) can be used to calculate the OM emission factor.

In order to justify the choice between method a) and method d), it is relevant to dwell on the concept of *Operating Margin*. In brief, the operating margin refers to the group of power units/plants whose operation is affected by the implementation of a new project that starts supplying electricity to the grid or reduces consumption of grid electricity.

Now, the only difference between the Simple OM and Average OM methods is the inclusion of low-cost/must-run power units/plants in the calculation (as in the case of the latter). In systems where the generation mix is dominated by low-cost/must-run resources (higher than 50%), it makes sense to assume that their operation would be affected by the implementation of a new project even though they have low operational costs. On the other hand, in systems where the share of low-cost/must-run resources in the generation mix is not high (less than 50%), it is reasonable to assume that their operation won't be affected by the implementation of a new project and, in consequence, all these power units/plants can be excluded from the calculation of the *Operating Margin emission factor*.

In the particular case of the grid under analysis, low-cost/must-run resources constitute, in a 5-year average, around 8.8% of the generation mix and, therefore, we can assume that their operation will not be affected. Hence, the Simple OM method is chosen.

² Low-cost/must-run resources are defined as "power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants." (UNFCCC, 2013).

The Simple OM is calculated for the calendar years 2012, 2013 and 2014 – the most recent years to which data is available at the time of preparation of this report.

STEP 4. Calculate the operating margin emission factor according to the selected method

The *tool* presents two options to carry out the calculation. As the net electricity generation and a CO2 emission factor of each power plant are available, **option A** in the *tool* will (and must) be used.

The OM emission factor, **EF_{grid,OMsimple,y}**, is calculated using Equation 1:

$$EF_{grid,OMsimple,y} = \frac{\sum_m (EG_{m,y} \times EF_{EL,m,y})}{\sum_m EG_{m,y}} \quad (1)$$

where:

- **EF_{grid,OMsimple,y}**: Simple operating margin CO2 emission factor in year *y* (in tCO2/MWh);
- **EG_{m,y}**: Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (in MWh);
- **EF_{EL,m,y}**: CO2 emission factor of power unit *m* in year *y* (in tCO2/MWh)
- **m**: All power units serving the grid in year *y* (except low-cost/must-run power units if the Simple OM method is used);
- **y**: The relevant year as per that data vintage chosen in **Step 3** (in this case the *ex ante* option was chosen).

The emission factor of each power unit *m* is calculated using **Option A1** (as per the *tool*), using Equation 2, except for one particular instance:

$$EF_{EL,m,y} = \frac{\sum_i (FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y})}{EG_{m,y}} \quad (2)$$

where:

- **EF_{EL,m,y}**: CO2 emission factor of power unit *m* in year *y* (in tCO2/MWh);
- **FC_{i,m,y}**: Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (in mass or volume unit);
- **NCV_{i,y}**: Net calorific value (energy content) of fossil fuel type *i* in year *y* (in GJ/mass or volume unit);
- **EF_{CO2,i,y}**: CO2 emission factor of fossil fuel type *i* in year *y* (in tCO2/GJ);
- **EG_{m,y}**: Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (in MWh);

- **m**: All power units serving the grid in year *y* (except low-cost/must-run power units if the Simple OM method is used);
- **i**: All fossil fuel types combusted in power unit *m* in year *y*;
- **y**: The relevant year as per that data vintage chosen in **Step 3** (in this case the *ex ante* option was chosen).

The IPCC default values for the **NCV_{i,y}**, at the lower limit of the uncertainty at a 95% confidence interval, are used. The latter can be found in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the IPCC Guidelines on National GHG Inventories (IPCC, 1996). In this particular case, diesel is the only fossil fuel type to be considered and the condition of Equation 3 is applied.

$$NCV_{Diesel,y} = 41.4 \text{ GJ per ton}, \forall y \quad (3)$$

As data on fuel consumption is given in litres, in order to convert the values to tones, a density value for diesel is set by Equation 4. The information is extracted from from OECD/IEA, Energy Statistics Manual, 2004

$$\rho_{Diesel} = 0.84 \text{ ton per m}^3 \quad (4)$$

The IPCC default values for **EF_{CO₂,i,y}**, at the lower limit of the uncertainty at a 95% confidence interval, are used. The latter can be found in Table 1.4 of Chapter 1 of Vol.2 (Energy) of the IPCC Guidelines on National GHG Inventories (IPCC, 1996). The value used for diesel is set by Equation 5.

$$EF_{Diesel,y} = 72.6 \text{ tCO}_2 \text{ per TJ}, \forall y \quad (5)$$

Table 3 presents the results of applying Equation 2 for all power plants serving the grid, while Table 4 presents the results of applying Equation 1 for method a).

The 3-year generation-weighted average Simple OM is **0.6462 tCO₂/MWh**, as it can be observed in Table 4.

STEP 5. Calculate the build margin (BM) emission factor

To calculate the BM emission factor, the *tool* presents two options (differentiated in terms of data vintage).

Option 1 is chosen in this report. The BM emission factor is calculated *ex ante* "based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation (...)" (UNFCCC, 2013), for the first crediting period. In the context of this report, the BM emission factor is calculated based on the most

recent information available on units already built for sample group m at the time of submission of this standardized baseline.

Capacity additions from retrofits of power plants are not included in the calculation of the BM emission factor.

A sample group of power units to be used in the calculation is determined as per the guidance given by the *Tool*, and according to the data vintage selected. Table 5 presents the results of this process.

The latest information available is relative to 2014, where a total of 85,267 MWh was supplied to the grid. As it can be observed, the 2 most recent power units constitute 68.8% of the total electricity generation in 2014.

The BM emissions factor is "the generation-weighted average emission factor of all power units m during the most recent year y for which electricity data is available (...)" (UNFCCC, 2013). It is calculated using Equation 5

$$EF_{grid,BM,y} = \frac{\sum_m (EG_{m,y} \times EF_{EL,m,y})}{\sum_m EG_{m,y}} \quad (6)$$

where:

- $EF_{grid,BM,y}$: Simple operating margin CO₂ emission factor in year y (in tCO₂/MWh);
- $EG_{m,y}$: Net quantity of electricity generated and delivered to the grid by power unit m in year y (in MWh);
- $EF_{EL,m,y}$: CO₂ emission factor of power unit m in year y (in tCO₂/MWh);
- m : Power units included in the build margin (Sample group);
- y : Most recent historical year for which electricity generation data is available (calendar year 2014, in this case)

Table 6 shows the results from Equation 6. A Build Margin (BM) emission factor, $EF_{grid,BM}$, of **0.7016 tCO₂/MWh** was calculated.

STEP 6. Calculate the combined margin (CM) emission factor

The calculation of the CM emission factor, $EF_{grid,CM,y}$, is based on the 'Weighted average CM' methodology, since one of the conditions⁶ to apply the 'Simplified CM' option is not met – the data requirements to apply the build margin methodology are available.

Equation 7 is used to calculate the Weighted Average CM.

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (7)$$

where the new variables refer to:

- **w_{OM}**: Weighting of operating margin emission factor (%);
- **w_{BM}**: Weighting of build margin emission factor (%).

Equation 8 sets the boundary condition to apply these weights, which can balance differently according to the type of CDM project.

$$w_{OM} + w_{BM} = 100\% \quad (8)$$

The weights of wind and solar power project activities, due to their intermittent and non-dispatchable nature, can be set as in Equations 9a and 9b.

$$w_{OM} = 75\% \quad (9a)$$

$$w_{BM} = 25\% \quad (9b)$$

All other project activities should use weights as set by Equations 10a and 10b.

$$w_{OM} = 50\% \quad (10a)$$

$$w_{BM} = 50\% \quad (10b)$$

Table 7 shows the final results, using the two sets of weights above.

CONCLUSION

The present work calculated the CO₂ emission factor for Sao Tome and Principe's main electricity system (in the Island of Sao Tome). Table 7 is repeated below, with the values found:

Parameter	SI Unit	w_{OM}	w_{BM}	Description	Value
$EF_{grid,CM,y}$	tCO ₂ /MWh	0.5	0.5	Combined margin CO ₂ emission factor for the project electricity system applicable to all project activities other than wind and solar	0.6739
$EF_{grid,CM,y}$	tCO ₂ /MWh	0.75	0.25	Combined margin CO ₂ emission factor for the project electricity system applicable to wind and solar power generation	0.6601
$EF_{grid,BM,y}$	tCO ₂ /MWh	n.a.	n.a.	Build margin CO ₂ emission factor for the project electricity system	0.7016
$EF_{grid,OM,y}$	tCO ₂ /MWh	n.a.	n.a.	Operating margin CO ₂ emission factor for the project electricity system	0.6462

BIBLIOGRAPHY

1. Empresa de Água e Electricidade, Government of Sao Tome and Principe, *Relatório e Contas – Exercício de 2010*, 2011
2. Empresa de Água e Electricidade, Government of Sao Tome and Principe, *Relatório e Contas – Exercício de 2011*, 2012
3. Empresa de Água e Electricidade, Government of Sao Tome and Principe, *Relatório e Contas – Exercício de 2012*, 2013
4. Empresa de Água e Electricidade, Government of Sao Tome and Principe, *Relatório e Contas – Exercício de 2013*, 2014
5. Empresa de Água e Electricidade, Government of Sao Tome and Principe, *Relatório e Contas – Exercício de 2014*, 2015
6. IPCC, *2006 IPCC Guidelines on National GHG Inventories*, 2006. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
7. OECD/IEA, *Energy Statistics Manual*, 2004. Available at: http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/NRG-2004/EN/NRG-2004-EN.PDF
8. UNFCCC, *Guidelines for quality assurance and quality control of data used in the establishment of standardized baselines, Version 02.0*. Available at: <http://cdm.unfccc.int/Reference/Guidclarif/index.html>
9. UNFCCC, *Tool to calculate the emission factor for an electricity system – Version 4.0*. Available at: <http://cdm.unfccc.int/Reference/tools/index.html>
10. World Bank, *Estudo sobre a Revitalização do Sector Eléctrico e Participação do Sector Privado em São Tomé e Príncipe – Relatório Preliminar*, 2010

ANNEX 1 – TABLES

Table 1. List of power plants connected to the main electricity system of the Island of Sao Tome.

unit_number	station_name	unit_name	installed_capacity	commissioning_date	fuel_type	Connected		
						2012	2013	2014
				dd/mm/yy	i			
			kW			Y/N	Y/N	Y/N
1	S. Tomé	ABC 1	1,000	1990	Diesel	Y	Y	Y
2	S. Tomé	ABC 2	1,250	1993	Diesel	Y	Y	Y
3	S. Tomé	ABC 3	1,280	1996	Diesel	Y	Y	Y
4	S. Tomé	Deutz 1	1,450	2001	Diesel	Y	Y	Y
5	S. Tomé	Deutz 2	1,450	2001	Diesel	Y	Y	Y
6	S. Tomé	Deutz 3	1,450	2001	Diesel	Y	Y	Y
7	S. Tomé	Cater3516B (or Caterpillar)	1,800	2009	Diesel	Y	Y	Y
9	Santo Amaro	HIMSEN # 1	1,701	2010	Diesel	Y	Y	Y
10	Santo Amaro	HIMSEN # 2	1,701	2010	Diesel	Y	Y	Y
11	Santo Amaro	HIMSEN # 3	1,701	2010	Diesel	Y	Y	Y
12	Santo Amaro	HIMSEN # 4	1,701	2010	Diesel	Y	Y	Y
13	Santo Amaro	HIMSEN # 5	1,701	2010	Diesel	Y	Y	Y
14	Bobô-Fôrro 2 (Private)	Group 1 - Group 5	7,458	2010	Diesel	Y	Y	Y
15	Contador	Turbine 1	960	1967	Hydro	Y	Y	Y
16	Contador	Turbine 2	960	1967	Hydro	Y	Y	Y
17	Guegue (Private)	Turbine 1 (Guegue)	320	1994	Hydro	Y	Y	Y
18	Bobô-Fôrro 1	Group 1	1,000	2011	Diesel	Y	Y	Y
19	Bobô-Fôrro 1	Group 2	1,000	2011	Diesel	Y	Y	Y
20	Bobô-Fôrro 1	Group 3	1,000	2011	Diesel	Y	Y	Y

21	Bobô-Fôrro 1	Group 4	1,000	2011	Diesel	Y	Y	Y
22	Bobô-Fôrro 1	Group 5	1,000	2011	Diesel	Y	Y	Y
23	Bobô-Fôrro 1	Group 6	1,000	2011	Diesel	Y	Y	Y
24	Bobô-Fôrro 1	Group 7	1,000	2011	Diesel	Y	Y	Y
25	Bobô-Fôrro 1	Group 8	1,000	2011	Diesel	Y	Y	Y
26	Porto Alegre	Hemoinsa	80	2007	Diesel	N	N	N
27	Ribeira Peixe	Perkins 1	80	n.a	Diesel	N	N	N
28	Angolares	Hemoinsa 1	128	1995	Diesel	N	N	N
29	Angolares	Perkins 1	88	1995	Diesel	N	N	N
30	Santa Catarina	G1	108	n.a	Diesel	N	N	N
31	santa Luzia	G1	64	n.a	Diesel	N	N	N

Table 2. Average share of the total grid generation of low-cost/must-run for the five most recent years.

Resource Type	Net electricity generation (kWh)					
	2010	2011	2012	2013	2014	5-year average
Thermal	50,354,914	58,734,255	67,620,211	72,729,068	77,530,788	65,393,847
Hydro	4,788,615	6,001,697	6,386,000	6,390,000	7,696,197	6,252,502
Total	55,143,529	64,735,952	74,006,211	79,119,068	85,226,985	71,646,349
Percentage of low-cost/must run	8.68%	9.27%	8.63%	8.08%	9.03%	8.73%

Table 3. Emission Factor (tCO₂/MWh) and CO₂ emissions of each power plant

year	station_type	station_#	station_name	net_elect_ricity	fossil_fuel_type	amount_fuel_type	Net_Calorific_Value		fuel_CO2_EF										
y		m		EG _{m,y}	i	FC _{i,m,y}	factor for NCV	NCVi,y	Option	Required EFCO2	factor for EF	EFCO2,i,y or EFCO2,m,i,y	η _m ; y	Partial Em,y	EFEL,m,y				
				[MWh]				[t]				[GJ/unit]				[tCO2/GJ]		[tCO2]	[tCO2/MWh]
2012	Grid	1	S. Tomé	20,336	Diesel	m3	4,564	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	13,717	0.6745			
2012	Grid	2	Santo Amaro	40,471	Diesel	m3	8,593	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	25,827	0.6382			
2012	Grid	3	Bobô-Fôrro 1	6,813	Diesel	m3	1,461	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	4,392	0.6446			
2012	Grid	4	Bobô-Fôrro 2 (Private)	-	Diesel	m3	-	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	-	0.0000			
2012	Grid	5	Contador	6,386	-	-	-	1	0.0000	Option A1	EFCO2,i,y	1	0	-	-	0.0000			
2012	Grid	6	Guegue (Private)	-	-	-	-	1	0.0000	Option A1	EFCO2,i,y	1	0	-	-	0.0000			
2013	Grid	1	S. Tomé	21,996	Diesel	m3	3,778	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	11,357	0.5163			
2013	Grid	2	Santo Amaro	41,125	Diesel	m3	8,898	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	26,744	0.6503			
2013	Grid	3	Bobô-Fôrro 1	9,608	Diesel	m3	2,636	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	7,923	0.8247			
2013	Grid	4	Bobô-Fôrro 2 (Private)	-	Diesel	m3	-	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	-	0.0000			
2013	Grid	5	Contador	6,390	-	-	-	1	0.0000	Option A1	EFCO2,i,y	1	0	-	-	0.0000			
2013	Grid	6	Guegue (Private)	-	-	-	-	1	0.0000	Option A1	EFCO2,i,y	1	0	-	-	0.0000			
2014	Grid	1	S. Tomé	18,898	Diesel	m3	3,227	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	9,699	0.5132			
2014	Grid	2	Santo Amaro	49,978	Diesel	m3	11,393	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	34,244	0.6852			
2014	Grid	3	Bobô-Fôrro 1	8,655	Diesel	m3	2,294	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	6,895	0.7966			
2014	Grid	4	Bobô-Fôrro 2 (Private)	-	Diesel	m3	-	1	41.4000	Option A1	EFCO2,i,y	1	0.0726	-	-	0.0000			
2014	Grid	5	Contador	7,696	-	-	-	1	0.0000	Option A1	EFCO2,i,y	1	0.0000	-	-	0.0000			
2014	Grid	6	Guegue (Private)	-	-	-	-	1	0.0000	Option A1	EFCO2,i,y	1	0.0000	-	-	0.0000			

Note: According to the *Tool* (UNFCCC, 2013), “power plants can be considered if all power units at the site of the power plant belong to the group of low-cost/must-run units or if all power units at the site of the power plant do not belong to the group of low-cost/must-run units”. In this case, as all power units within each of the individual power plants are of the same type, data will be presented at an aggregated level for each power plant. Only aggregated power plant data is available in the annual reports of EMAE.

Table 4. 3-year generation weighted average of the Simple OM emission factor for the period 2012-2014.

2012	0.6497	[tCO2/MWh]
2013	0.6328	[tCO2/MWh]
2014	0.6557	[tCO2/MWh]
2012-2014	0.6462	[tCO2/MWh]

Table 5. Sample group of power units to calculate the BM emission factor.

Unit_Name	Commissioning _date	Energy that comprises up to 20% of the system generation - EGm,y		Amount of fossil fuel type consumed by grid power units comprises up to 20% of the system generation	Reference	Remarks
		Total	Aggregated	Diesel		
		dd/mm/yy				
		[MWh]	[%]	t		
Bobô-Fôrro 1	01/01/2011	8,655	10.15%	2,294	Official data from EMAE	
Santo Amaro	01/01/2010	49,978	68.80%	11,393	Official data from EMAE	

Table 6. Build Margin Emission Factor

2014	EFgrid,BM,y	0.7016	[tCO2/MWh]
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Table 7. Combined Margin Emission Factor.

2012-2014	EFgrid,CM,y	0.6739	[tCO2/MWh]	Other project activities
2012-2014	EFgrid,CM,y	0.6601	[tCO2/MWh]	Wind and Solar project activities