CLEAN DEVELOPMENT MECHANISM

CDM-EB88-AA-A08

Draft Standardized baseline

Cape Verde Standardized Baseline for the power sector

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. An initial submission of standardized baseline PSB0007 “Cape Verde Standardized baseline for the Power Sector” was received from the designated national authority (DNA) of the Republic of Cape Verde (hereinafter referred to as “Cape Verde”) on 28 November 2013 and since then four further submissions have been received in response to issues raised on data quality and other aspects. The last communication was received from the DNA on 9th February 2016.

2. In accordance with the “Procedure: Development, revision, clarification and update of standardized baselines” the following steps were undertaken:

(a) The submission of the proposed standardized baseline PSB0007 “Cape Verde Standardized baseline for the Power Sector” was assessed by the secretariat;

(b) A draft recommendation was prepared by the secretariat. It was reviewed and assessed by two members of the Small-Scale Working Group (SSC WG). The recommendation was sent to the DNA for their action;

(c) The DNA provided further input in response to the recommendation;

(d) The further inputs provided by the DNA were assessed by the secretariat. The secretariat prepared the draft version of the standardized baseline. The SSC WG members assessed it and recommended the proposed standardized baseline for the approval by the Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board).

(e) The standardized baseline was submitted to the Board on 10 December 2015 for consideration and approval. An objection to automatic approval was raised by a Board member in accordance with paragraph 43 of the "Procedure: Development, revision, clarification and update of standardized baselines", and consequently the PSB0007 was included as an item on the agenda of the eighty-eighth meeting of the Board.

2. Purpose

3. The purpose of this document is to propose a standardized baseline applicable to the independent grids of nine inhabited islands of Cape Verde, namely São Nicolau, Boa Vista, Maio, Fogo, Brava, Sal, São Vicente, Santo Antão and Santiago.

3. Key issues

4. The Cape Verde archipelago is a small island country approximately 570 kilometres off the coast of West Africa. The country is a cluster of ten islands (nine inhabited) with an area of 4,033 km² and a population of about 542,000 inhabitants.

5. In the objection raised, the application of the “Guidelines for the Establishment of Sector Specific Standardized Baselines” (hereinafter referred to as SB guidelines) to determine grid emission factor, where only one or two power generating systems are connected to the project electricity system, has been questioned. It is argued that in this case the thresholds that are based on penetration, performance and cost of technologies do not hold. Further, concerns have been raised regarding the application of only barrier analysis to develop the positive list of technologies.

6. In response to the issues raised, the DNA of Cape Verde has prepared and submitted an alternative version of the standardized baseline (Appendix 2) using version 04.0 of the grid tool without applying the SB guidelines. Also, in contrast to the original version submitted on 10 December 2015, the updated submission (pages 18-27) does not include the positive list of technologies. The comparison of values of grid emission factors in the original version and the revised submission shows that the differences in emission factors are minimal (i.e. no more than +/-1 per cent change for all the islands except the island of Fogo in which case there is a 3.5 per cent change).

7. In the original version submitted on 10th December 2015 (Appendix 1):

(a) Both the baseline emission factors and the positive list of renewable electricity generation technologies (microscale and small-scale solar and wind energy technologies) have been included in the proposed standardised baseline (PSB). The PSB was developed using the ex-ante data vintage (2010–2012) using version 04.0 of the “Tool to calculate the emission factor for an electricity system” (hereinafter referred to as “the grid tool”) and version 02.0 of the SB guideline.

(b) The approach from the SB guideline with a default baseline threshold value of 80 per cent is used for the determination of the baseline emission factors in the case of five islands of Cape Verde (São Nicolau, Boa Vista, Maio, Fogo and Brava).

(c) For the remaining four islands of Cape Verde (Sal, São Vicente, Santo Antão and Santiago) the grid tool is used to determine the baseline emission factors (i.e. operating margin, build margin and combined margin emission factor).

(d) In the case of Sal and São Vicente islands of Cape Verde, the applicability of the SB guideline was limited by the fact that renewable energy technologies produce aggregately about 23-24 per cent of the output Oi of the power sector in each island. With fossil fuels still having a major share in electricity generation, application of the SB guideline would have resulted in a baseline emission factor of zero. The application of the grid tool demonstrated that the grid emission factor is significantly higher than a zero value considering that the share of fossil fuels is high. In addition, although the wind technology does face barriers in the islands (e.g. the capital investment costs in Euro/kW of wind power is double that of conventional fossil fuel power plants), it would turn out to be non-additional if the SB guideline were to be applied. Therefore, the grid tool approach was chosen for these islands.

(e) In the case of Santiago and Santo Antão islands of Cape Verde, the cumulative plant output could not be determined in line with the requirements of the SB guideline (i.e. based on the last three years cumulative output). This was

because the required data, spanning three years, were not available for each plant due to decommissioning/commissioning during the triennium. The application of grid tool would not entail similar constraints for this specific case. Therefore, it was chosen for the standardisation of grid factors for these islands.

(f) The positive list is determined using the “Methodological tool: Demonstration of additionality of small-scale project activities” and the “Methodological tool: Demonstration of additionality of microscale project activities,” prescribed under small-scale CDM methodologies.

8. Regardless of the option chosen, the standardized baseline needs to be used together with any CDM methodology that requires a grid emission factor. Further, project participants who do not wish to use the standardized baseline will be able to use other approaches, allowed by the Board, to estimate the grid emission factor and demonstrate additionality for their CDM project.

4. Impacts

9. The standardized baseline, if adopted, would facilitate the development of CDM projects in Cape Verde and any cost implications negatively affecting third-parties/stakeholders is not foreseen.

5. Subsequent work and timelines

10. No further work is required.

6. Recommendations to the Board

11. The secretariat recommends that the Board consider the original draft standardized baseline and the revised draft standardized baseline and approve one of them.

7. References

12. The documents pertaining to the submission of standardized baselines are available at the following page on the CDM website:
<http://cdm.unfccc.int/methodologies/standard_base/index.htm>.

Appendix 1. Draft Standardized Baseline (version 01.0) (original version submitted to the Board on 10 December 2015)

TABLE OF CONTENTS **Page**

1. Introduction

1. This standardized baseline provides the values for grid emission factors (i.e. the carbon dioxide (CO_2) emission factors) for the independent grids on nine islands of the Republic of Cape Verde (hereinafter referred to as “Cape Verde”): São Nicolau, Boa Vista, Maio, Fogo, Brava, Sal, São Vicente, Santo Antão and Santiago. The standardized baseline also provides a positive list of renewable electricity generation technologies for these islands that are automatically additional.

2. Scope, applicability, entry into force and validity

2.1. Scope and applicability

2. The scope of this standardized baseline covers the baseline emission factors and the positive list of renewable electricity generation technologies.

3. The approach from the “Guidelines for the establishment of sector specific standardized baselines” (version 02.0) (hereinafter referred to as the SB guideline) with default threshold value of 80 per cent is used for the determination of grid emission factors in the case of five out of nine islands (i.e. São Nicolau, Boa Vista, Maio, Fogo and Brava).

4. For the remaining four islands – Sal, São Vicente, Santo Antão and Santiago –“Tool to calculate the emission factor for an electricity system” (hereinafter referred to as the grid tool) is used to determine baseline emission factors (i.e. operating margin, build margin and combined margin emission factor).

5. The positive list of technologies is determined using the “Methodological tool: Demonstration of additionality of small-scale project activities” and the “Methodological tool: Demonstration of additionality of microscale project activities” prescribed under small-scale CDM methodologies.

6. Clean development mechanism (CDM) project activities or programmes of activities (hereinafter referred to as project activities) can apply this standardized baseline under the following conditions:

   (a) The project activity is implemented on any of the above-mentioned islands of Cape Verde and is connected to the project electricity system;

   (b) The project activity applies small-scale CDM methodologies that requires a grid emission factor

7. Project participants who do not wish to use this standardized baseline may alternatively estimate their own values for the grid emission factor, by applying the latest applicable version of the grid tool.

8. Project participants can either use the technologies listed in table 6 or any other technologies not covered under this table for which they separately demonstrate the additionality using provisions prescribed in the applied methodology.

2.2. Entry into force and validity

9. This standardized baseline enters into force upon its adoption by the CDM Executive Board on DD/MM/YYYY. This standardized baseline is valid from DD/MM/YYYY to DD/MM/YYYY.

3. Normative references

10. This standardized baseline is based on the proposed new standardized baseline PSB0007 "Cape Verde Standardized baseline for the Power Sector" submitted by the designated national authority (DNA) of the Republic of Cape Verde.

11. This standardized baseline is derived based on version 04.0 of the grid tool, version 02.0 of the SB guidelines, (version 10.0) of the "Methodological tool: Demonstration of additionality of small-scale project activities" and (version 7.0) of the "Methodological tool: Demonstration of additionality of microscale project activities".

12. For more information regarding proposed new standardized baselines as well as their consideration by the CDM Executive Board, please refer to: <http://cdm.unfccc.int/methodologies/standard_base/index.html>.

4. Definitions

13. Project electricity system[1]: the spatial extent of the power plants that are physically connected through transmission and distribution lines to supply electricity to the independent grid electricity systems on the following nine islands of Cape Verde: São Nicolau, Boa Vista, Maio, Fogo, Brava, Sal, São Vicente, Santo Antão and Santiago.

14. The definitions contained in the Glossary of CDM terms shall apply.

15. The definitions contained in the grid tool and the SB guideline shall apply.

5. Parameters and values

16. This standardized baseline provides ex ante values for the parameters mentioned in table 1 to table 5, and provides a positive list of renewable electricity generation technologies in table 6.

[1] The project electricity system of each island is an independent grid. Currently, no grid-interconnection exists among the islands.

Table 1. Emission factor for grid electricity system of the island of Sal, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.595		
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.0		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.446		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.297	0.149	0.149

Table 2. Emission factor for grid electricity system of the island of São Vicente, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.587		
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.0		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.440		

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.294	0.147	0.147

Table 3. Emission factor for grid electricity system of the island of Santo Antão, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.651		
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.580		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.634		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.616	0.598	0.598

Table 4. Emission factor for grid electricity system of the island of Santiago, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.573		
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2	All project	0.523		

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
		emission factor for the project electricity system	activities			
***EF**$_{grid,CM,y}$*	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.560		
***EF**$_{grid,CM,y}$*	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.548	0.536	0.536

Table 5. Emission factors for grid electricity systems of the Cape Verdean islands of São Nicolau, Boa Vista, Maio, Fogo, and Brava

No.	Island	Baseline emission factor (tCO_2/MWh)
1	São Nicolau	0.744
2	Boa Vista	0.629
3	Maio	0.724
4	Fogo	0.718
5	Brava	0.670

Table 6. List of renewable electricity generation technologies that are automatically additional in Cape Verde (positive list)

No.	Technologies
1	Any grid connected renewable energy technology up to 5 MW of installed capacity that are included in approved small scale CDM methodologies
2	Solar photovoltaic or solar thermal electricity generation up to 15 MW of installed capacity
3	On-shore wind power up to 15 MW of installed capacity

Attachment to Appendix 1. Assessment of on-shore wind power up to 15 MW as automatically additional in Cape Verde

1. Background

1. The proposed standardized baseline (SB) recommends the following technologies as deemed automatically additional:

Table 1. Positive list of technologies

No.	Technologies	Basis of additionality
1	Solar technologies (photovoltaic (PV) or solar thermal electricity generation) up to 15 MW	Automatically additional based on the positive list defined under the "Methodological tool: Demonstration of additionality of small-scale project activities"
2	The project activity is to employ any renewable energy technology up to 5 MW of installed capacity	Automatically additional for least developed countries/small island developing States based on the "Methodological tool: Demonstration of additionality of microscale project activities"
3	On-shore wind power up to 15 MW	Based on "Barrier Analysis" referring to the "Methodological tool: Demonstration of additionality of small-scale project activities"

2. For the proposed technology of "on-shore wind power up to 15 MW" above, the designated national authority (DNA) has used the following barrier analysis,[1] applicable to the power sector, as per the "Methodological tool: Demonstration of additionality of small-scale project activities":

   (a) Financial and economic barriers;

   (b) Institutional and regulatory barriers;

   (c) Technical barriers;

   (d) Barrier due to lack of awareness and information.

3. According to the submission, the high capital investment cost (measured in Euro/MW), among others, is a key barrier associated with wind power technology on all the islands of Cape Verde. It is shown that the cost of wind technology is on average more than double than that of a baseline diesel power plant and that the upfront investment cost

[1] The "Methodological tool: Demonstration of additionality of small-scale project activities" and "Methodological tool: Demonstration of additionality of microscale project activities" do not cover additionality for **on-shore** wind energy technology.

(capital cost including CDM transaction cost) is the major barrier for the deployment of wind power technology in terms of affordability and access to finance in Cape Verde.

4. The submission states:

(a) Renewable energy requires a greater level of financing for the same capacity and financial institutions usually require a premium in lending rates because more capital is being risked up-front when compared to financing conventional thermal power generation projects. Although the lower fuel and operating costs for renewable power projects may make renewable energy cost-competitive on a life-cycle basis, the much higher initial capital costs can mean that renewable energy provides less installed capacity per dollar invested than conventional heavy fuel oil or diesel engine generators that are dominating Cape Verde’s power system at the time of submitting this standardized baseline proposal. Experience shows that many of the suitable sites for wind or solar energy development are very difficult to access and significant upfront costs are required to build access roads from the nearest port to the project sites.

(b) Affordability is a problem due to the high upfront investment cost of renewable (mainly wind/solar) technologies and inadequate financing mechanisms. Financial institutions (in the region and outside) generally perceive renewable energy technologies as unreliable and lacking long-time viability. For smaller projects (e.g. up to 15 MW) suitable to the size of Cape Verde as a country (then the small islands), it is extremely difficult to mobilise risk capital for its development such as conducting the feasibility studies, undertaking measurements on-site.

(c) The sector has been relying mainly on external donor funding such as soft loan credit line (preferential loan) from Portugal and other countries, and grants for project development from different donors as such the Dutch government.

(d) Prior to the start (in 2009) of implementation of the registered CDM project PA9570: “Bundled wind power project Cape Verde” (a 25.5 MW bundled wind project across 4 islands (Sal, São Vicente, Santiago and Boa Vista), developed by the company Cabeolica), Cape Verde’s power generation was dominated (nearly 100%) by diesel engine generators – only 2.4 MW very old wind generating capacity was available but those were very old equipment installed back in early 1990 and they had stopped operating before 2010. Between January 2009 and December 2013, there is another micro-scale wind project, a 2*250kW (500 kW) wind project being installed by Electric Wind, on Santo Antão island which was developed based on second-hand equipment and a Dutch government grant to cover 50% of the project investment. Apart from these, there are two solar PV parks: a 2.5 MW on Sal, and 5 MW on Santiago islands respectively, which were implemented in 2010, based on a preferential loan by Portuguese government.

(e) Even though the renewable energy Decree-Law has been in place since almost 3 years, Cape Verde has not observed any major projects at scale that are implemented without pursuing CDM or donor country preferential loan or grant; there remains the particular difficulty of mobilising risk capital for funding the

development costs of smaller scale projects (e.g. feasibility studies, measurements of resources) for a country like Cape Verde.

(f) There are two micro-scale wind plants in Palmeira wind plant (600 kW) in Sal and Matiota wind plant (900 kW) in San Vicente which have been developed based on 100% grant by Denmark government and were commissioned in October 1994. These plants were decommissioned in November 2010 and July 2012 respectively."

2. Assessment/analysis of the DNA's justification as listed above on the proposed positive lists

5. The proposed positive list of technologies covering solar PV up to 15 MW and all renewable electricity generation technologies up to 5 MW (number 1 and 2 of table 1 above) are based on the criteria under small-scale and microscale additionality tools and considered appropriate.

6. The following paragraph assessed the wind power (up to 15 MW) proposed by the DNA.

7. An analysis based on the submission shows that the share of wind power in total installed capacity in Cape Verde as a whole is quite small (below 2 per cent) without taking into account CDM wind projects (See table 2 below). According to the table, there is no penetration of non-CDM wind projects on six islands (Santiago, Boa Vista, Brava, Fogo, Maio and São Nicolau) and on three islands (Sal, São Vicente and Santo Antão) the penetration is in the range of 2.7 to 8 per cent. It is noted, however, that the non-CDM microscale wind projects on Sal, São Vicente and Santo Antão were pilot projects using second-hand equipment and developed based on bilateral government grants. In the case of Santo Antão, the Government of the Netherlands provided a grant covering 50 per cent of the project investment while in the case of Sal and São Vicente, the Government of Denmark provided a 100 per cent grant.

Table 2. Share of wind in Cape Verde

Island	Installed capacity (MW)					% share of wind (CDM and non-CDM) [(A+B)/C]	% share of wind (non-CDM) [A/C]
	Fossil fuel	Wind (non-CDM) (A)	Wind (CDM registered) (B)	Solar	Total capacity (C)		
Sal	11.36	0.60	7.65	2.50	22.11	37.3%	2.7%
São Vicente	18.35	0.90	5.95		25.20	27.2%	3.6%
Santiago	62.98		9.35	5.00	77.33	12.1%	0.0%
Santo Antão	5.60	0.50			6.10	8.2%	8.2%
Boa Vista	2.14		2.55		4.69	54.4%	0.0%
Brava	1.06				1.06	0.0%	0.0%
Fogo	3.80				3.80	0.0%	0.0%
Maio	1.38				1.38	0.0%	0.0%
São Nicolau	2.22				2.22	0.0%	0.0%
Total	108.89	2.00	25.50	7.50	143.89	19.1%	1.4%

Source: Based on the submission PSB0007

8. It is thus found that in Cape Verde, even though the renewable energy decree-law has been in place for almost three years, no wind projects are implemented without pursuing CDM or donor country preferential loan or grant. For example a 25.5 MW bundled wind project across four islands (Sal, São Vicente, Santiago and Boa Vista) is a CDM registered project.

9. The above information shows that in Cape Verde there exist barriers and therefore additional incentives are needed for the deployment of wind energy projects, particularly those associated with a high upfront cost and access to finance. Further analysis below is carried out to further substantiate these aspects.

10. Analysis of CDM on-shore wind projects in Cape Verde in the pipeline[2] shows that wind projects in Cape Verde are not financially attractive. The project design documents (PDDs) present the following barriers to investment in wind projects:

    (a) Internal rate of return (IRR) of wind project with or without consideration of the return of the carbon credit (even CER price used as EUR 11/tonne) does not reach the benchmark. The benchmark was established based on weighted average cost of capital (60 per cent debt, 40 per cent equity) which was considered conservative;

[2] One CDM wind project (bundled) in Cape Verde at validation (using ACM0002) covering the following islands: Santiago (10 MW); Sal (6 MW); São Vicente (8 MW); and Boa Vista (4 MW), and another CDM wind bundled project (9570) registered using ACM0002 covering the following islands: Santiago (9.35 MW) ; Sal (7.65 MW); São Vicente (5.95MW); Boa Vista (2.55 MW).

(b) The PDDs indicated that the upfront investment (including CDM transaction cost) required for the implementation of wind projects is considerably higher than the initial investment required for implementing thermal power plants. In addition, given the well-known technology and the lower implementation costs, thermal power plants represent a more attractive option for entrepreneurs when compared to similar alternative with approximately the same installed power (the capacity factors for wind farm is much lower than thermal power plant), operated by renewable energy sources such as wind power;

(c) PDDs also stated that revenues from carbon credits are instruments of great importance for entrepreneurs to overcome the barriers faced, improving the quality of investments and consequently encouraging future investment in other projects to generate clean energy.

11. The average capital investment cost for on-shore wind power projects reported in the PDDs is EUR 2,388/kW which can be considered comparable to the figure reported in the SB submission which is EUR 2,126/kW. Both figures correspond to the year 2011. The sensitivity analysis on IRR carried out in the PDDs show that the projects cross the benchmark if the investment cost reduces by about 18 per cent (i.e. below EUR 1,958/kW). The average capital investment cost of wind in Cape Verde provided in the submission (see table 3 below) is, however, higher than the benchmark threshold of EUR 1,958/kW, except in the case of Boa Vista which has lower investment cost than benchmark. It is however to be noted that there is so far no non-CDM wind project developed on Boa Vista (See Table 2 above).

Table 3. Share of wind in Cape Verde

Plant	Average Capital investment [€/kW]
Santiago	2,207
S. Vicente	2,001
Sal	2,119
S. Antão	2,184
Fogo	2,128
S. Nicolau	2,541
Boavista	1,740
Maio	2073
Brava (average)	2030
Average (all islands)	2,126
Fuel oil	1,000
Diesel	800

Source: Based on the submission PSB0007

12. Therefore, it is recommended that wind projects in Cape Verde up to 15 MW (applicable under AMS-I.D and AMS-I.F) to be considered automatic additional.

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Document information

Version	*Date*	*Description*
01.0	10 December 2015	Initial publication. For the approval of the CDM Executive Board in accordance with the “Procedure for development, revision, clarification and update of standardized baselines” (CDM-EB63-A28-PROC).

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Appendix 2. Revised Draft Standardized Baseline (version 02.0)

TABLE OF CONTENTS **Page**

1. Introduction

1. This standardized baseline provides the values for grid emission factors (i.e. the carbon dioxide (CO_2) emission factors) for the independent grids on nine islands of the Republic of Cape Verde (hereinafter referred to as “Cape Verde”): São Nicolau, Boa Vista, Maio, Fogo, Brava, Sal, São Vicente, Santo Antão and Santiago. The standardized baseline also provides a positive list of renewable electricity generation technologies for these islands that are automatically additional.

2. Scope, applicability, entry into force and validity

2.1. Scope and applicability

2. The scope of this standardized baseline covers the baseline emission factors and the positive list of renewable electricity generation technologies.

3. The approach from the “Guidelines for the establishment of sector specific standardized baselines” (version 02.0) (hereinafter referred to as the SB guideline) with default threshold value of 80 per cent is used for the determination of grid emission factors in the case of five out of nine islands (i.e. São Nicolau, Boa Vista, Maio, Fogo and Brava).

4. For the remaining four islands – Sal, Sao Vicente, Santo Antao and Santiago –“Tool to calculate the emission factor for an electricity system” (hereinafter referred to as the grid tool) is used to determine baseline emission factors (i.e. operating margin, build margin and combined margin emission factor).

5. The positive list of technologies is determined using the “Methodological tool: Demonstration of additionality of small-scale project activities” and the “Methodological tool: Demonstration of additionality of microscale project activities” prescribed under small-scale CDM methodologies.

6. For all islands, tool to calculate the emission factor for an electricity system” (hereinafter referred to as the grid tool) is used to determine baseline emission factors (i.e. operating margin, build margin and combined margin emission factor).

7. Clean development mechanism (CDM) project activities or programmes of activities (hereinafter referred to as project activities) can apply this standardized baseline under the following conditions:

   (a) The project activity is implemented on any of the above-mentioned islands of Cape Verde and is connected to the project electricity system;

   (b) The project activity applies small-scale CDM methodologies that requires a grid emission factor.

8. Project participants who do not wish to use this standardized baseline may alternatively estimate their own values for the grid emission factor, by applying the latest applicable version of the grid tool.

9. Project participants can either use the technologies listed in table 6 or any other technologies not covered under this table for which they separately demonstrate the additionality using provisions prescribed in the applied methodology.

2.2. Entry into force and validity

10. This standardized baseline enters into force upon its adoption by the CDM Executive Board on DD/MM/YYYY. This standardized baseline is valid from DD/MM/YYYY to DD/MM/YYYY.

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13. For more information regarding proposed new standardized baselines as well as their consideration by the CDM Executive Board, please refer to: <http://cdm.unfccc.int/methodologies/standard_base/index.html>.

4. Definitions

14. Project electricity system[3]: the spatial extent of the power plants that are physically connected through transmission and distribution lines to supply electricity to the independent grid electricity systems on the following nine islands of Cape Verde: São Nicolau, Boa Vista, Maio, Fogo, Brava, Sal, São Vicente, Santo Antão and Santiago.

15. The definitions contained in the Glossary of CDM terms shall apply.

16. The definitions contained in the grid tool ~~and the SB guideline~~ shall apply.

5. Parameters and values

17. This standardized baseline provides ex ante values for the parameters mentioned in table 1 to table ~~5~~ 9, ~~and provides a positive list of renewable electricity generation technologies in table 6~~.

[3] The project electricity system of each island is an independent grid. Currently, no grid-interconnection exists among the islands.

Table 1. Emission factor for grid electricity system of the island of Sal, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
EF*grid,OM,y*	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.595		
EF*grid,BM,y*	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.0		
EF*grid,CM,y*	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.446		
EF*grid,CM,y*	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.297	0.149	0.149

Table 2. Emission factor for grid electricity system of the island of São Vicente, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
EF*grid,OM,y*	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.587		
EF*grid,BM,y*	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.0		
EF*grid,CM,y*	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.440		

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$\boldsymbol{EF_{grid,CM,y}}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.294	0.147	0.147

Table 3. Emission factor for grid electricity system of the island of Santo Antão, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$\boldsymbol{EF_{grid,OM,y}}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.651		
$\boldsymbol{EF_{grid,BM,y}}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.580		
$\boldsymbol{EF_{grid,CM,y}}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.634		
$\boldsymbol{EF_{grid,CM,y}}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.616	0.598	0.598

Table 4. Emission factor for grid electricity system of the island of Santiago, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$\boldsymbol{EF_{grid,OM,y}}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.573		
$\boldsymbol{EF_{grid,BM,y}}$	tCO_2/MWh	Build margin CO_2	All project	0.523		

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
		emission factor for the project electricity system	activities			
***EF**$_{grid,CM,y}$*	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.560		
***EF**$_{grid,CM,y}$*	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.548	0.536	0.536

Table 5. Emission factor for grid electricity system of the island of Brava, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
***EF**$_{grid,OM,y}$*	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.670		
***EF**$_{grid,BM,y}$*	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.664		
***EF**$_{grid,CM,y}$*	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.669		
***EF**$_{grid,CM,y}$*	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.667	0.666	0.666

Table 6. Emission factor for grid electricity system of the island of Fogo, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.752		
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.720		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.744		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.736	0.728	0.728

Table 7. Emission factor for grid electricity system of the island of Santo Maio, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.724		
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.728		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.725		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.726	0.727	0.727

Table 8. Emission factor for grid electricity system of the island of São Nicolau, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.746		
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.745		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.745		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.745	0. 745	0. 745

Table 9. Emission factor for grid electricity system of the island of Boavista, Cape Verde

Parameter	Unit	Description	Applicable project types	Applicable values		
				First crediting period	Second crediting period	Third crediting period
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	All project activities	0.635		
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	All project activities	0.564		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	Wind and solar power generation project activities	0.617		
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system	All project activities except wind and solar power generation project activities	0.599	0.581	0.581

Table 4. Emission factors for grid electricity systems of the Cape Verdean islands of São Nicolau, Boa Vista, Maio, Fogo, and Brava

No.	Island	Baseline emission factor (tCO_2/MWh)
1	São Nicolau	0.744
2	Boa Vista	0.629
3	Maio	0.724
4	Fogo	0.718
5	Brava	0.670

Table 5. List of renewable electricity generation technologies that are automatically additional in Cape Verde (positive list)

No.	Technologies
1	Any grid connected renewable energy technology up to 5 MW of installed capacity that are included in approved small scale CDM methodologies
2	Solar photovoltaic or solar thermal electricity generation up to 15 MW of installed capacity
3	On-shore wind power up to 15 MW of installed capacity

Attachment to Appendix 2. Assessment of on-shore wind power up to 15 MW as automatically additional in Cape Verde

1. Background

18. The proposed standardized baseline (SB) recommends the following technologies as deemed automatically additional:

Table 1. Positive list of technologies

No.	Technologies	Basis of additionality
1	Solar technologies (photovoltaic (PV) or solar thermal electricity generation) up to 15 MW	Automatically additional based on the positive list defined under the "Methodological tool: Demonstration of additionality of small-scale project activities"
2	The project activity is to employ any renewable energy technology up to 5 MW of installed capacity	Automatically additional for least developed countries/small island developing States based on the "Methodological tool: Demonstration of additionality of microscale project activities"
3	On-shore wind power up to 15 MW	Based on "Barrier Analysis" referring to the "Methodological tool: Demonstration of additionality of small-scale project activities"

19. For the proposed technology of "on-shore wind power up to 15 MW" above, the designated national authority (DNA) has used the following barrier analysis,[4] applicable to the power sector, as per the "Methodological tool: Demonstration of additionality of small-scale project activities":

(a) Financial and economic barriers;

(b) Institutional and regulatory barriers;

(c) Technical barriers;

(d) Barrier due to lack of awareness and information.

20. According to the submission, the high capital investment cost (measured in Euro/MW), among others, is a key barrier associated with wind power technology on all the islands of Cape Verde. It is shown that the cost of wind technology is on average more than double than that of a baseline diesel power plant and that the upfront investment cost

[4] The "Methodological tool: Demonstration of additionality of small-scale project activities" and "Methodological tool: Demonstration of additionality of microscale project activities" do not cover additionality for **on-shore** wind energy technology.

~~(capital cost including CDM transaction cost) is the major barrier for the deployment of wind power technology in terms of affordability and access to finance in Cape Verde.~~

~~21. The submission states:~~

~~(a) Renewable energy requires a greater level of financing for the same capacity and financial institutions usually require a premium in lending rates because more capital is being risked up-front when compared to financing conventional thermal power generation projects. Although the lower fuel and operating costs for renewable power projects may make renewable energy cost-competitive on a life-cycle basis, the much higher initial capital costs can mean that renewable energy provides less installed capacity per dollar invested than conventional heavy fuel oil or diesel engine generators that are dominating Cape Verde's power system at the time of submitting this standardized baseline proposal. Experience shows that many of the suitable sites for wind or solar energy development are very difficult to access and significant upfront costs are required to build access roads from the nearest port to the project sites.~~

~~(b) Affordability is a problem due to the high upfront investment cost of renewable (mainly wind/solar) technologies and inadequate financing mechanisms. Financial institutions (in the region and outside) generally perceive renewable energy technologies as unreliable and lacking long-time viability. For smaller projects (e.g. up to 15 MW) suitable to the size of Cape Verde as a country (then the small islands), it is extremely difficult to mobilise risk capital for its development such as conducting the feasibility studies, undertaking measurements on-site.~~

~~(c) The sector has been relying mainly on external donor funding such as soft loan credit line (preferential loan) from Portugal and other countries, and grants for project development from different donors as such the Dutch government.~~

~~(d) Prior to the start (in 2009) of implementation of the registered CDM project PA9570: "Bundled wind power project Cape Verde" (a 25.5 MW bundled wind project across 4 islands (Sal, Sao Vicente, Santiago and Boa Vista), developed by the company Cabeolica), Cape Verde's power generation was dominated (nearly 100%) by diesel engine generators – only 2.4 MW very old wind generating capacity was available but those were very old equipment installed back in early 1990 and they had stopped operating before 2010. Between January 2009 and December 2013, there is another micro-scale wind project, a 2*250kW (500 kW) wind project being installed by Electric Wind, on Santo Antao island which was developed based on second-hand equipment and a Dutch government grant to cover 50% of the project investment. Apart from these, there are two solar PV parks: a 2.5 MW on Sal, and 5 MW on Santiago islands respectively, which were implemented in 2010, based on a preferential loan by Portuguese government.~~

~~(e) Even though the renewable energy Decree-Law has been in place since almost 3 years, Cape Verde has not observed any major projects at scale that are implemented without pursuing CDM or donor country preferential loan or grant; there remains the particular difficulty of mobilising risk capital for funding the~~

development costs of smaller scale projects (e.g. feasibility studies, measurements of resources) for a country like Cape Verde.

(f) There are two micro-scale wind plants in Palmeira wind plant (600 kW) in Sal and Matiota wind plant (900 kW) in San Vicente which have been developed based on 100% grant by Denmark government and were commissioned in October 1994. These plants were decommissioned in November 2010 and July 2012 respectively."

2. Assessment/analysis of the DNA's justification as listed above on the proposed positive lists

22. The proposed positive list of technologies covering solar PV up to 15 MW and all renewable electricity generation technologies up to 5 MW (number 1 and 2 of table 1 above) are based on the criteria under small-scale and microscale additionality tools and considered appropriate.

23. The following paragraph assessed the wind power (up to 15 MW) proposed by the DNA.

24. An analysis based on the submission shows that the share of wind power in total installed capacity in Cape Verde as a whole is quite small (below 2 per cent) without taking into account CDM wind projects (See table 2 below). According to the table, there is no penetration of non-CDM wind projects on six islands (Santiago, Boa Vista, Brava, Fogo, Maio and Sao Nicolau) and on three islands (Sal, Sao Vicente and Santo Antao) the penetration is in the range of 2.7 to 8 per cent. It is noted, however, that the non-CDM microscale wind projects on Sal, Sao Vicente and Santo Antao were pilot projects using second-hand equipment and developed based on bilateral government grants. In the case of Santo Antao, the Government of the Netherlands provided a grant covering 50 per cent of the project investment while in the case of Sal and Sao Vicent, the Government of Denmark provided a 100 per cent grant.

Table 2. Share of wind in Cape Verde

Island	Installed capacity (MW)					% share of wind (CDM and non-CDM) [(A+B)/C]	% share of wind (non-CDM) [A/C]
	Fossil fuel	Wind (non-CDM) (A)	Wind (CDM registered) (B)	Solar	Total capacity (C)		
Sal	11.36	0.60	7.65	2.50	22.11	37.3%	2.7%
Sao Vicente	18.35	0.90	5.95		25.20	27.2%	3.6%
Santiago	62.98		9.35	5.00	77.33	12.1%	0.0%
Santo Antao	5.60	0.50			6.10	8.2%	8.2%
Boa Vista	2.14		2.55		4.69	54.4%	0.0%
Brava	1.06				1.06	0.0%	0.0%
Fogo	3.80				3.80	0.0%	0.0%
Maio	1.38				1.38	0.0%	0.0%
Sao Nicolau	2.22				2.22	0.0%	0.0%
Total	108.89	2.00	25.50	7.50	143.89	19.1%	1.4%

Source: Based on the submission PSB0007

25. It is thus found that in Cape Verde, even though the renewable energy decree-law has been in place for almost three years, no wind projects are implemented without pursuing CDM or donor country preferential loan or grant. For example a 25.5 MW bundled wind project across four islands (Sal, Sao Vicente, Santiago and Boa Vista) is a CDM registered project.

26. The above information shows that in Cape Verde there exist barriers and therefore additional incentives are needed for the deployment of wind energy projects, particularly those associated with a high upfront cost and access to finance. Further analysis below is carried out to further substantiate these aspects.

27. Analysis of CDM on-shore wind projects in Cape Verde in the pipeline[5] shows that wind projects in Cape Verde are not financially attractive. The project design documents (PDDs) present the following barriers to investment in wind projects:

    (a) Internal rate of return (IRR) of wind project with or without consideration of the return of the carbon credit (even CER price used as EUR 11/tonne) does not reach the benchmark. The benchmark was established based on weighted average cost of capital (60 per cent debt, 40 per cent equity) which was considered conservative;

[5] One CDM wind project (bundled) in Cape Verde at validation (using ACM0002) covering the following islands: Santiago (10 MW); Sal (6 MW); São Vicente (8 MW); and Boa Vista (4 MW), and another CDM wind bundled project (9570) registered using ACM0002 covering the following islands: Santiago (9.35 MW) ; Sal (7.65 MW); São Vicente (5.95MW); Boa Vista (2.55 MW).

(b) The PDDs indicated that the upfront investment (including CDM transaction cost) required for the implementation of wind projects is considerably higher than the initial investment required for implementing thermal power plants. In addition, given the well-known technology and the lower implementation costs, thermal power plants represent a more attractive option for entrepreneurs when compared to similar alternative with approximately the same installed power (the capacity factors for wind farm is much lower than thermal power plant), operated by renewable energy sources such as wind power;

(c) PDDs also stated that revenues from carbon credits are instruments of great importance for entrepreneurs to overcome the barriers faced, improving the quality of investments and consequently encouraging future investment in other projects to generate clean energy.

28. The average capital investment cost for on-shore wind power projects reported in the PDDs is EUR 2,388/kW which can be considered comparable to the figure reported in the SB submission which is EUR 2,126/kW. Both figures correspond to the year 2011. The sensitivity analysis on IRR carried out in the PDDs show that the projects cross the benchmark if the investment cost reduces by about 18 per cent (i.e. below EUR 1,958/kW). The average capital investment cost of wind in Cape Verde provided in the submission (see table 3 below) is, however, higher than the benchmark threshold of EUR 1,958/kW, except in the case of Boa Vista which has lower investment cost than benchmark. It is however to be noted that there is so far no non-CDM wind project developed on Boa Vista (See Table 2 above).

Table 3. Share of wind in Cape Verde

Plant	Average Capital investment [€/kW]
Santiago	2,207
S. Vicente	2,001
Sal	2,119
S. Antão	2,184
Fogo	2,128
S. Nicolau	2,541
Boavista	1,740
Maio	2073
Brava (average)	2030
Average (all islands)	2,126
Fuel oil	1,000
Diesel	800

Source: Based on the submission PSB0007

~~29. Therefore, it is recommended that wind projects in Cape Verde up to 15 MW (applicable under AMS-I.D and AMS-I.F) to be considered automatic additional.~~

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