Proposed standardized baseline submission form (Version 02.0)

To be used by a designated national authority (DNA) when submitting a proposed standardized baseline in accordance with the "Procedure: Development, revision, clarification and update of standardized baselines" (CDM-EB63-A28-PROC).

INFORMATION TO BE COMPLETED BY THE DNA	
Title of the proposed standardized baseline:	Emission factors for the electricity grid systems in The Gambia
Name(s) of the Party or Parties to which the proposed standardized baseline applies:	Republic of The Gambia
DNA submitting this form:	The Gambia
Is this one of the first three submissions for a Party with 10 or fewer than 10 registered CDM project activities as of 31 December 2010? *(For such a Party, the submission of an assessment report may be omitted. Not required to check Yes or No if the submission is for a group of Parties.)*	☒ Yes ☐ No

Attachments:

☒ Additional documentation supporting the submission (e.g. relevant data, documentation, statistics, studies, calculation tables, etc.), where applicable:

- Gambia Standardized baseline Calculation Sheet.xls

☒ Data used to establish the proposed standardized baseline

☐ An assessment report on the quality of the data collection, processing and compilation prepared by a designated operational entity (DOE)

☐ Letters of approval of all the DNAs of the Parties to which the proposed standardized baseline applies, where the standardized baseline applies to a group of Parties

Name of authorized officer signing for the DNA:	Bubacar Zaidi Jallow
Date (DD/MM/YYYY) and signature for the DNA:	 6/11/2014
Contact information of the focal point(s) of the DNA: *(Names, email-addresses and phone contacts for procedural and technical communication on the submission)*	Bubacar Zaidi Jallow Email: bubazj@gmail.com Tel: 220 3653113
Name(s) of the proponent(s) of the proposed standardized baseline:	United Nations Development Programme with the support of Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.
Affiliation of the proponent(s):	☐ Party ☐ Project Participant (PP) ☐ International Industry Organization

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(The definition of "admitted observer organization" can be found at http://unfccc.int/resource/ngo/art7_6.pdf)	☒ Admitted Observer Organization
Contact information of the focal point(s) of the proponent (s): *(Names, email-addresses and phone contacts for procedural and technical communication on the submission. Not required to complete this section if the DNA(s) is(are) the proponent(s) of the proposed standardized baseline.)*	Ms. Alexandra Soezer E-mail: alexandra.soezer@undp.org Tel: +1-212-906-6433 Mr. Vladislav Arnaoudov E-mail: arnaoudov-vladislav@sc.mufg.jp Tel: +81-3-6213-6382

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Proposed standardized baseline submission form
CDM-PSB-FORM (Version 02.0)

Title: Emission factors for the electric systems in The Gambia

Submission date: 06/11/2014

Version number: 02.0

Approach

The standardized baseline is developed using the approach contained in the following methodology and tool:

- AMS-I.F. "Renewable electricity generation for captive use and mini-grid", ver. 02.0[1]
- Tool to calculate the emission factor for an electricity system, ver. 04.0[2]

Elements to be standardized

Please check below all the elements to be standardized by the proposed standardized baseline.

☐ Additionality demonstration

☒ Baseline identification

☒ Baseline emission/removal estimation

☐ Land eligibility demonstration (applicable only to afforestation and reforestation project activities).

Further inputs requested to the DNA (To be completed by the secretariat)

Please provide a list of additional information and/or modifications that are required.

[1] https://cdm.unfccc.int/methodologies/DB/9V3T8W0N5PMCJH4YVEA04YYFTVHP3Q
[2] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf

SECTION A: PROPOSED STANDARDIZED BASELINE DEVELOPED USING THE "GUIDELINES FOR THE ESTABLISHMENT OF SECTOR SPECIFIC STANDARDIZED BASELINES"

Applicability of the proposed standardized baseline

Not applicable.

Additionality demonstration

Not applicable.

Baseline identification

Not applicable.

Baseline emission factor estimation

Not applicable.

Use of the proposed standardized baseline with an approved methodology

Not applicable.

Validity of the proposed standardized baseline

Not applicable.

Deviations from the guidelines (if applicable)

Not applicable.

References and any other information

Not applicable.

SECTION B: PROPOSED STANDARDIZED BASELINE DEVELOPED USING A METHODOLOGICAL APPROACH CONTAINED IN AN APPROVED METHODOLOGY

Applicability of the proposed standardized baseline

The proposed standardized baseline is applicable to project connected to or substituting electricity from the regional grids of the Republic of The Gambia.

Additionality demonstration (if applicable)

Not applicable.

Baseline identification (if applicable)

The proposed standardized baseline determines the emission factors of the regional electric grids in The Gambia.

The Gambia has a Central Grid around the capital Banjul with an installed capacity of more than 15 MW and six regional mini-grids with installed capacity of less than 15 MW each. The installed capacity in each of the regional grids is provided in the table below[3].

Table 1: Installed Capacity of the Regional Grids in The Gambia

Electricity Systems	Power Plant	Type	Fuel	Year of Commissioning	Installed Capacity (MW)	Source
Regional Mini-Grids	Essau	Thermal	diesel	2006	0.58	NAWEC
	Kerewan	Thermal	diesel	2006	0.90	NAWEC
	Farafenni	Thermal	diesel	2006	3.30	NAWEC
	Kaur	Thermal	diesel	2006	0.22	NAWEC
	Bansang	Thermal	diesel	2006	0.90	NAWEC
	Basse	Thermal	diesel	2006	2.60	NAWEC

The regional grid systems have capacity of less than 15 MW; therefore they can be classified as "mini-grids" as per the definition of AMS-I.F., paragraph 2. All generators in the mini-grids are exclusively diesel-fired and the grid emission factor will be determined as per the provisions of AMS-I.F., paragraph 13.

[3] The data on installed capacity and type of fuel for the regional grids is based on information provided by NAWEC to the DNA of The Gambia through data delivery protocols.

The Central Grid cannot be classified as a mini-grid as the installed capacity is larger than 15 MW; therefore, the baseline and the emission factor is determined as per the provisions of "Tool to calculate the emission factor for an electricity system", ver. 04.0. The baseline emission factor is determined as described in Section C below.

Baseline emission estimation (if applicable)

All regional grids have capacity of less than 15 MW and are categorized as mini-grids, as per the definition in AMS-I.F., paragraph 2. Therefore, the emission factor is determined by selecting the appropriate values provided in Table I.F.1 in AMS-I.F.

Table I.F.1

Emission Factors for diesel generator systems (in kg CO_2e/kWh*) for three different levels of load factors**

Cases:	Mini-grid with 24 hour service	(i) Mini-grid with temporary service (4-6 hr/day); (ii) Productive applications; (iii) Water pumps	Mini-grid with storage
Load factors [%]	25%	50%	100%
<15 kW	2.4	1.4	1.2
>=15 <35 kW	1.9	1.3	1.1
>=35 <135 kW	1.3	1.0	1.0
>=135<200 kW	0.9	0.8	0.8
> 200 kW***	0.8	0.8	0.8

*A conversion factor of 3.2 kg CO_2 per kg of diesel has been used (following revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories)

**Values derived from figures reported in RETScreen International's PV 2000 model retrieved from:
>http://retscreen.net/>

***Default values

The installed capacity of each of the mini-girds is presented in the table below. All the plants operate on diesel only.

Table 2: Generation Capacity of Individual Generators[4]

Grid	Manufacturer	Install Capacity kW
Essau	Deutz	200
	Volvo	380
Kerewan	Volvo	500
	Iveco	400
Farafenni	Caterpillar	1,800
	Caterpillar	1,500
Kaur	Deutz	60
	Deutz	60
	Deutz	100
Bansang	Deutz	200
	Deutz	200
	Perkins	500
Basse	Deutz	600
	Perkins	2,000

It was confirmed through interviews with NAWEC that the grids provide service for at least 10 hours a day. PURA's website[5] reports daily operations in excess of 12 hours in most localities, 6 hours in the morning and 6 hours in the evening. The capacity of all mini-grids exceeds 200 kW, therefore the default value of 0.8 tCO_2/MWh is applied as an emission factor for all regional grids.

The results are summarised in the table below.

Mini-Grid	Emission Factor (tCO_2e)
Essau	0.8
Kerewan	0.8
Farafenni	0.8
Kaur	0.8
Bansang	0.8
Basse	0.8

Use of the proposed standardized baseline with the approved methodology

This standardized baseline is applicable to projects that displace electricity from one of the Gambian regional grids, as described above.

[4] The data is based on information provided by NAWEC Provincial division.
[5] http://www.pura.gm/index.php?option=com_content&view=section&layout=blog&id=3&Itemid=102

Any project based in The Gambia and using the values provided in Table I.F.1 of AMS-I.D. "Grid Connected Renewable Electricity Generation" shall apply this standardized baseline.

Validity of the proposed standardized baseline

The proposed Standardized baseline is valid for three (3) years from the time of its adoption in line with Appendix I of the "Guidelines for the Establishment of Sector Specific Standardized Baselines".

The standardized baseline will be updated every three years after that based on the most recent available information on the operation of the regional grids in The Gambia at the time of the update as well as the relevant methodological tools and guidelines.

Deviations from the approved methodology (if applicable)

Not applicable

References and any other information

No additional references are provided.

SECTION C: PROPOSED STANDARDIZED BASELINE DEVELOPED USING A METHODOLOGICAL APPROACH CONTAINED IN AN APPROVED TOOL

Applicability of the proposed standardized baseline

Not applicable.

Baseline emission factor estimation

The proposed standardized baseline determines the emission factors of the Central Electric Grid in The Gambia.

The Gambia has a Central Grid around the capital Banjul with an installed capacity of more than 15 MW and six regional mini-grids with installed capacity of less than 15 MW each. The installed capacity in the Central Grid is provided in the table below[6].

Table 3: Installed Capacity in the Central Grid

Electricity Systems	Power Plant	Type	Fuel	Year of Commissioning	Installed Capacity (MW)	Source
Central Grid	Kotu Power Plant	Thermal	HFO	1981	25.30	NAWEC[7]
	Brikama Power Plant (GEG)	Thermal	HFO	2006	26.00	NAWEC
	Batokunku	Wind	-	2009	0.15	CONREPP[8]
	Brikama Power Plant (Wartsila)	Thermal	HFO	2011	9.00	NAWEC
	Tanji Power Plant[9]	Wind	-	2012	0.90	CONREPP

The Central Grid cannot be classified as a mini-grid as the installed capacity is larger than 15 MW; therefore, the baseline and the emission factor is determined as per the provisions of "Tool to calculate the emission factor for an electricity system", ver. 04.0.

The emission factor of the Central Grid is determined following the provisions of the "Tool to calculate the emission factor for an electricity system", ver. 04.0. As the proposed standardized baseline provides a

[6] The data on installed capacity is on data provided by NAWEC (for all HFO plants operated by NAWEC and GEC), and CONREPP, in its capacity of engineering consultant (for Batokunku Wind Power Plant and Tanji Wind Power Plant). The data was provided to the DNA through data delivery protocols.
[7] www.nawec.gm
[8] www.conrepp.com
[9] For the plant operator, Gamwind, please see: www.gamwind.com

comprehensive approach covering all grids in The Gambia, the calculations of the emission factor for the Central grid are described in this section and not in Section C of this form.

Step 1: Identify the relevant electricity system

The project electricity system is the Central Grid in The Gambia and consists of the following five plants that are connected through transmission and distribution lines to any project activity applying this standardized baseline.

- Kotu Power Plant
- Bircama Power Plant (GEC)
- Birkama Power Plant (Wartsila)
- Tanji Power Plant
- Batokunku

There are no connected electricity systems, as the Central grid is not connected through transmission lines to any other grid in The Gambia, or in neighbouring Senegal.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional);

Option 1, only grid power plants are included in the calculation, is selected.

Step 3: Select a method to determine the operating margin (OM)

The average OM will be applied for the calculation of the emission factor in The Gambia. The OM will be determined using the *ex-ante* option based on the most recent three year generation average available, i.e. the period 2010 – 2012.

Step 4: Calculate the Operating margin emission factor according to the selected method[10]

"Option A - Calculation based on average efficiency and electricity generation of each plant" is applied as follows:

[10] As no local values are available, data for NCV and emission factors of the different fuels are based on IPCC 2006 Guidelines.

$$EF_{grid,OMaverage,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad [1]$$

Where:

$EF_{grid,OMaverage,y}$	Average operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power plant/unit m in year y (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2e/MWh)
m	All power units serving the grid in year y
y	The relevant year as per the data vintage chosen

Determination of $EF_{EL,m,y}$

The emission factor of each power unit m is determined according to Option A1.

Option A1. If for a power unit m data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) is determined as follows:

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

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2e/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type *i* in year *y* (TJ/mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/TJ)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	All power units serving the grid in year *y*
i	All fossil fuel types combusted in power unit *m* in year *y*
y	The relevant year as per the data vintage chosen in Step 3

The OM is fixed *ex-ante* and the generation weighted three year average OM is calculated. Based on this above, the OM emission factor is estimated to be **0.713 tCO_2/yr**.

Step 5: Calculate the build margin (BM) emission factor

For the purpose of this standardized baseline, the Build Margin Emission Factor will be fixed *ex-ante* (Option 1).

The sample group of power generation units *m* used to calculate the build margin is determined as per the procedure below using data for 2012, the most recently available data for electricity generation.

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

The five most recently built power plants in The Gambia Central Grid are presented in the table below.

Table 4: Five Most Recently Built Power Plants in The Gambia Central Grid

Electricity Systems	Power Plant	Type	Fuel	Year of Commissioning	Installed Capacity (MW)	Source
Central Grid	Kotu Power Plant	Thermal	HFO	1981	25.30	NAWEC
	Brikama Power Plant (GEG)	Thermal	HFO	2006	26.00	NAWEC
	Batokunku	Wind	-	2009	0.15	CONREPP
	Brikama Power Plant (Wartsila)	Thermal	HFO	2011	9.00	NAWEC
	Tanji Power Plant	Wind	-	2012	0.90	CONREPP

For the five most recently built power plants ($SET_{5\text{-}units}$) total annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$) is 237,220.33 MWh.

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET-\geq 20\%}$, in MWh);

The total power generation in The Gambia in 2012 was 237,220.33 MWh.

The most recently built power units that supplied 20 % or more of total electricity generation are provided in the table below. As no power units are registered as CDM projects in The Gambia, the relevant provisions for CDM registered projects are not applied.

Table 5: Share of Power Plants in Total Generation

	Power station/power generating units	Year commissioned	Share in Total Generation
1	Brikama Power Plant (Wartsila)	2011	21.24 %
2	Tanji Power Plant	2012	0.08 %

For set of power units ($SET_{\geq 20\%}$), annual electricity generation ($AEGSET_{-\geq 20\%}$) in 2012 is 50,582.68 MWh.

(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

As $SET_{5\text{-}units}$ has higher value, it is selected as a relevant set *(SET_{sample})*

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore steps (d), (e) and (f).

The SET_{sample} include power units started to supply electricity to the grid more than 10 years ago.

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample-CDM}$) the annual electricity generation ($AEG_{SET-sample-CDM}$, in MWh); If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET-sample-CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample-CDM}$ to calculate the build margin. Ignore steps (e) and (f).

The only plant that is built more than 10 years ago is the Kotu Power Plant (1981). Excluding it, gives a set of power plants generating 57 % of the total electricity, i.e. more than 20 %. This results in the following set of plants used for the calculation of the BM:

Table 6: Power Plants Used in the Calculation of the Build Margin

	Power station/power generating units	Year commissioned	Share in Total Generation
1	Birkama Power Plant (GEC)	2006	35.63 %
2	Batokunku Wind Plant	2009	0.04 %
3	Brikama Power Plant (Wartsila)	2011	21.24 %
4	Tanji Power Plant	2012	0.08 %

Steps (e) and (f) are skipped as the set of power plants included in the calculation of the build margin is determined in the previous steps.

The build margin emissions factor ($EF_{grid,BM,y}$) is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during 2012, the most recent year *y* for which electricity generation data is available, and is calculated as per Option A as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad [3]$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	Power units included in the build margin
y	Most recent historical year for which power generation data is available, 2012

Based on the above data, the build margin emission factor is estimated to be **0.651 tCO_2/MWh**.

Step 6: Calculate the combined margin

The combined margin is calculated using "Option (a): Weighted average CM". The combined margin emission factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad [4]$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor (per cent)
w_{BM}	Weighting of build margin emissions factor (per cent)

The weights w_{OM} and w_{BM} (where $w_{OM} + w_{BM} = 1$) by default are equal for the first crediting period ($w_{OM} = w_{BM} = 0.5$).

$EF_y = 0.5 * 0.713 + 0.5 * 0.651 = 0.682\ tCO_2/MWh.$

Thus, $CM_{EF,ex\text{-}ante}$ for The Gambia grid is estimated to be **0.682 tCO_2/MWh**.

For wind and solar projects, different weights are applied, i.e. $w_{OM} = 0.75$ and $w_{BM} = 0.25$. Then,

$EF_y = 0.75 * 0.713 + 0.25 * 0.651 = 0.697\ tCO_2/MWh.$

Thus, $CM_{EF,ex\text{-}ante,WS}$ for The Gambia grid for solar and wind projects is estimated to be **0.697 tCO_2/MWh**.

Validity of the proposed standardized baseline

The proposed Standardized baseline is valid for three (3) years from the time of its adoption in line with Appendix I of the "Guidelines for the Establishment of Sector Specific Standardized Baselines".

The standardized baseline will be updated every three years after that based on the most recent available information on the operation of the Central Grid in The Gambia at the time of the update as well as the relevant methodological tools and guidelines.

Deviations from the approved tool (if applicable)

Not applicable.

References and any other information

Not applicable.

SECTION D: PROPOSED STANDARDIZED BASELINE DEVELOPED USING THE "GUIDELINE: ESTABLISHMENT OF STANDARDIZED BASELINES FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES UNDER THE CDM"

Applicability of the proposed standardized baseline

Not applicable.

Additionality demonstration

Not applicable.

Baseline identification

Not applicable.

Baseline removals estimation (if applicable)

Not applicable.

Land eligibility demonstration (if applicable)

Not applicable.

Validity of the proposed standardized baseline

Not applicable.

Deviations from the guideline (if applicable)

Not applicable.

References and any other information

Not applicable.

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Document information

Version	*Date*	*Description*
02.0	1 December 2013	The document title has changed from “Proposed standardized baseline form” (F-CDM-PSB) to “Proposed standardized baseline submission form” (CDM-PSB-FORM). Revision to: • Reflect updated requirements in the “Procedure: Development, revision, clarification and update of standardized baselines” • Include editorial improvement
01.0	23 March 2012	Initial publication.
Decision Class: Regulatory Document Type: Form Business Function: Methodology Keywords: standardized baselines		