Project design document form
(Version 11.0)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the project activity	NorthWind Bangui Bay Project
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	07.1
Completion date of the PDD	20/09/2019
Project participants	1. NorthWind Power Development Corporation (Philippines - host)
Host Party	Philippines
Applied methodologies and standardized baselines	"Grid-connected electricity generation from renewables sources" version 19".
Sectoral scopes	Sectoral Scope Number: 1 Energy industries (renewable-/ non-renewable resources)
Estimated amount of annual average GHG emission reductions	59,268 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The project is a 33 MW wind turbine power plant located in Bangui Bay (Republic of the Philippines) is at the northwest tip of Luzon and is adjacent to Barangays Masikil, Abaca, Manayon, Tanguiporo and Baruyen. It is located at N18o31'30" longitude and E120o40'30" up to 120o45'30" latitude. The site facing the sea is free of any trees and vegetation. The project will utilize wind energy to produce electricity without emitting greenhouse gases (GHG). The electricity generated by the project is expected to displace grid electricity generated from fossil fuels and reduce GHG emissions by an amount of approximately 47,988 tCO_2e (tons of carbon dioxide equivalent) per year for the duration of the project activity. A reduction of approximately 335,916 tCO2e, is forecast for the third 7-year crediting period.

The project activity developed by NorthWind Power Development Corporation, installed 20 wind turbines with individual capacity of 1.65MW and with a total installed capacity of 33MW. The project boundary is the area where Northwind's wind turbines and transmission line are placed; and as the transmission line reaches the Luzon-Visayas grid by interconnecting the Northwind's Bangui Substation to NGCP's Laoag substation, the Luzon-Visayas grid is also being included in the project boundary.

The expected load factor of the plant is 30 %, resulting in an annual electricity generation of 86.7 GWh. The project will have an expected minimum plant operating life of at least 21 years. While the theoretical plant life is 20 years, in practice these plants extend their life to at least 25 years.

This project represents the first commercial wind power project in the ASEAN region. It will provide zero GHG emission power and help to enhance technology transfer to the Philippines. The baseline scenario is the same as the scenario existing prior to the project activity implementation, and will be detailed in section B3 and B4. Also the scenario existing prior to the project activity implementation is only the place without any other power plant constructed (this is a greenfield project).

Employment and job opportunities for locals are expected during the wind turbines installation phase of the plant and for the duration of its operation. The project will become an effective transfer medium for wind power technology. Additionally, being the first wind power plant in the ASEAN region, it will also potentially attract an increased number of tourists to the area. This could result in the injection of much needed revenue into local businesses and the local community as a whole.

A.2. Location of project activity

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a. Host country:
Philippines
b. Region/State/Province etc.
Ilocos Norte Province.
c. City/Town/Community etc.
Bangui Bay, Bangui.

The project site is located approximately 460 km north of Manila on the main island of Luzon on the foreshore of Bangui Bay, Bangui, Ilocos Norte Province, Philippines. This area borders the Bien Dong, Vietnam and was identified by a governmental study[1] as a good-excellent wind

[1] The United States National Renewable Energy Laboratory conducted a wind resource analysis and mapping study using Geographic Information System (GIS) technology. In this study Ilocos Norte was identified as an area of good-excellent wind resource.

resource for utility-scale applications. The site is located on a strip of cleared land (free of any trees and vegetation) that measures approximately 9 km long by 100 meters wide.

The GPS coordinates of the wind turbines are as given below:

1 Name	Code	Longitude	Latitude
WTG01	RW01	+120.68742400	+18.52987300
WTG02	RC12	+120.69049200	+18.52958400
WTG03	RC13	+120.69357100	+18.52931300
WTG04	RC14	+120.69664500	+18.52907200
WTG05	RC15	+120.69971100	+18.52885700
WTG06	RC16	+120.70276800	+18.52867900
WTG07	RC17	+120.70584200	+18.52853300
WTG08	RC18	+120.70890800	+18.52842500
WTG09	RC19	+120.71199800	+18.52833400
WTG10	RC20	+120.71508400	+18.52833600
WTG11	RC21	+120.71815800	+18.52840200
WTG12	RC22	+120.72124700	+18.52848000
WTG13	RC23	+120.72427500	+18.52862900
WTG14	RC24	+120.72738600	+18.52882400
WTG15	RC25	+120.73044700	+18.52912800
WTG16	RC26	+120.73368100	+18.52960500
WTG17	RC27	+120.73710600	+18.53017600
WTG18	RC28	+120.74066100	+18.53093200
WTG19	RC29	+120.74435200	+18.53193000
WTG20	RC30	+120.74818400	+18.53310300
Base Station	NWP	+120.68715300	+18.52687500

A.3. Technologies/measures

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This project involves the development and operation of a wind farm consisting of 20 wind turbine towers, a switchyard and a control station, and the installation and operation of a 50-km, 69 kV overhead transmission line. The wind turbine towers will be erected on a 9-km stretch of undeveloped and uninhabited foreshore area in Bangui Bay, which is covered by lease agreement with the Philippine Government.

The wind turbines to be used in the project are state-of-the-art models designed, tested and manufactured by NEG Micon (NEGM). The turbine model is called NM82 and it has a generation capacity of 1650 kW. This particular model to be used in the project was issued a Statement of Compliance by Det Norske Veritas (DNV) on December 1, 2003. The NM82/1650 Bangui Bay

version complies with requirements as outlined in IEC61400-1:1999 and IEC WT01 covering the actual conditions:

Ve50 of 70m/s
$V_{average}$ of 7.0m/s at 50M
L15 of 11% at 50M

The main technical parameters of the project are shown in table below:
Table A.3.1. Main technical parameters of the wind turbines[2]

Key parameters	Value	Unit
Wind turbine Model	NM82	
Hub height	78	m
Rotor diameter	82	m
Blade length	40	m
Swept area	5,281	m^2
No. of turbines	20	unit
Nominal power	1,650	kW
Rotation speed	14.4	rpm
Turbine lifetime	20	years

The NM82/1650 turbine is equipped with 3 pitchable blades and mechanical brakes acting on the high-speed side of the gear. Blades and mechanical brakes are driven independently by hydraulics and designed to be fail-safe even if the system is not pressurized.
NEGM is one of the world's leading suppliers of wind turbines and has supplied equipment for approximately 20% of the world's wind power capacity. The company specializes in supplying turnkey wind turbine solutions as well as offering project development and execution services, and plant services/maintenance.
The project, being the first wind power plant in the Philippines, will contribute significantly to the country's knowledge base in terms of wind power plant operation. This transfer of technology and expertise from one of the leading wind power generation companies in the world will provide Philippine staff with the necessary skills to operate the equipment.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Philippines (host Party)	NorthWind Power Development Corporation	No

A.5. Public funding of project activity

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This project has not received any public funding.

A.6. History of project activity

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The proposed CDM project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA);

The proposed CDM project activity is not a project activity that has been deregistered.

A.7. Debundling

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[2] Main specification of WTG.

Not applicable for the project activity.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

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1. "Consolidated baseline methodology for grid-connected electricity generation from renewable sources (ACM0002)"- version 19.0.0.
2. The above methodology is hereafter referred to as the "Baseline Methodology".

The Baseline Methodology will be used in conjunction with the approved monitoring methodology ACM0002 ("The Monitoring Methodology").

3. Tools referenced in this methodology:

Tool for the demonstration and assessment of additionality

Tool to calculate the emission factor for an electricity system

4. Standardize baseline is not applicable for the project.

B.2. Applicability of methodologies and standardized baselines

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The baseline and monitoring methodology ACM0002 is applicable to the proposed project activity, because it meets all the applicability criteria stated in the methodology:

Table B.2.1: Applicability conditions of methodology ACM0002 version 19.0.0

Applicability Conditions	Justification
3) This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) install a greenfield plant; (b) involve a capacity addition to (an) existing plant(s); (c) involve a retrofit of (an) existing operating plants/units; or (d) involve a rehabilitation of (an) existing plant(s)unit(s); or (e) involve a replacement of (an) existing plant(s)/unit(s).	*Applicable.* *The project activity will involve installing a new wind power plant at the site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plants)*
4) The methodology is applicable under the following conditions:	
(a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	*Applicable* *The Project will consist of the installation of a wind power plant.*
(b) In the case of capacity additions, retrofits, rehabilitation or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	*Not relevant as the project activity does not involve capacity addition, retrofit or replacement of any existing wind power plant.*

5) In case of hydro power plants, one of the following conditions shall apply[3]:	
a) The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or	*Not relevant as the project activity will consist of a wind power plant*
b) The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of the reservoirs is increased and the power density, calculated using equation (3), is greater than 4 W/m^2; or	
c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m^2.	
d) The project activity is an integrated hydro power plants involving multiple reservoirs where the power density of any of the reservoirs, calculated using equation (3), is lower than 4 W/m^2 all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m^2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plants with power density lower than or equal to 4 W/m^{2}shall be: a. Lower than or equal to 15 MMW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	*Not relevant as the project activity will consist of a wind farm power plant*

[3] Project participants wishing to undertake a hydroelectric project activity that result in a new reservoir or an increase in the volume of an existing reservoir, in particular where reservoirs have no significant vegetative biomass in the catchments area, may request a revision to the approved consolidated methodology.

6) In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power projects; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	*Not relevant as the project activity will consist of a wind farm power plant*
7) The methodology is not applicable to the following: a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; b) Biomass fired power plants/units;	*Not relevant for project activity since:* *The project activity will be a Greenfield wind energy project, so there will be no fuel switching.*
8) In the case of retrofits, replacements, rehabilitations, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	*Not relevant* *The project activity is not a case of retrofit, replacement or capacity addition. The project activity is a Greenfield project.*

B.3. Project boundary, sources and greenhouse gases (GHGs)

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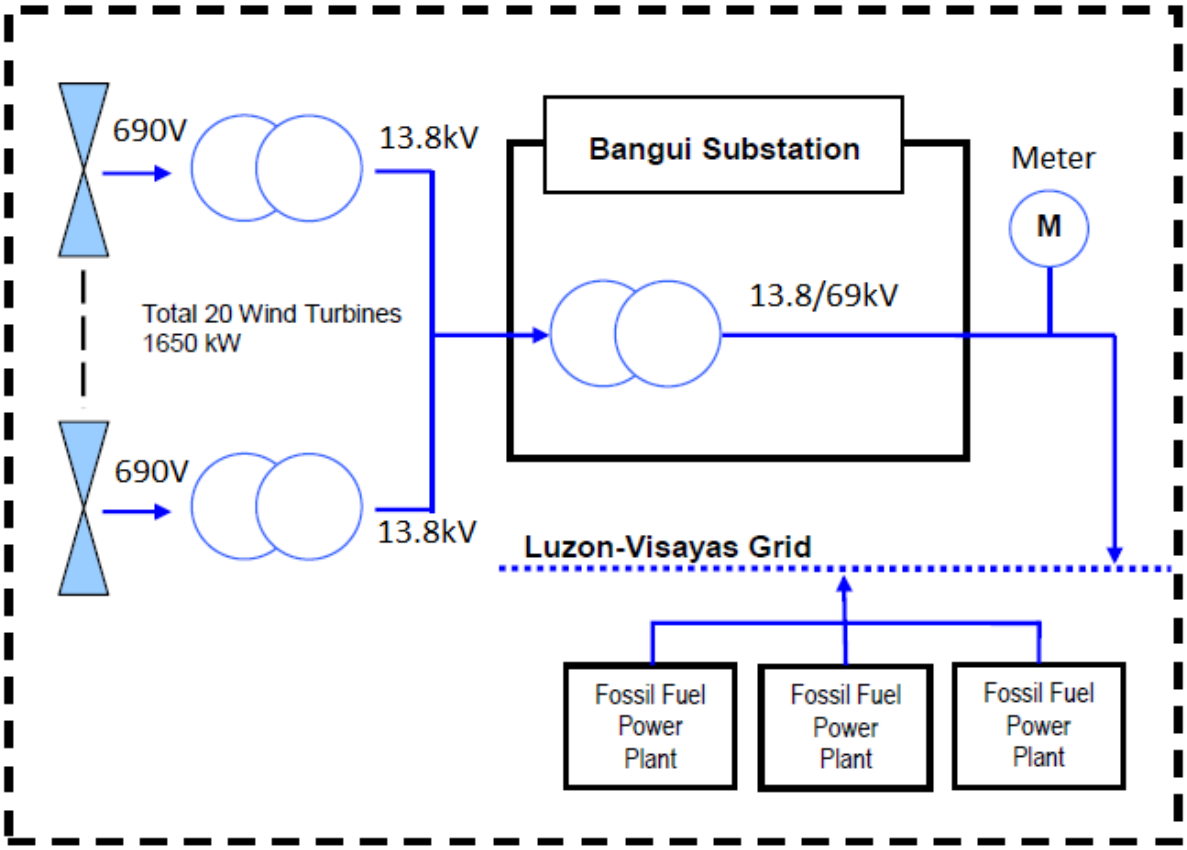
The Project boundary:

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to, which in this case is the Luzon-Visayas Grid.

Flow Diagram:

The schematic diagram of the project in relation to the project boundary is shown below:



As stipulated in the Baseline Methodology, the only greenhouse gas included in the ER calculation is CO2.

The spatial extent of the project boundary includes the project site and all power plants connected physically to the Luzon-Visayas gird.

The Philippine transmission system is composed of three grids, the Luzon Grid, Visayas Grid, and Mindanao Grid. The Luzon Grid is interconnected with the Visayas Grid through HVDC Leyte-Luzon, a high voltage direct current transmission line and submarine cable with a transfer capacity of 440 MW between Naga and Ormoc, which was commissioned in 1998 aiming to transmit electricity from the large 610 MW geothermal plant in Leyte, Visayas to power hungry Luzon. Hence, there is a clear physical connection between the two grids making the proposed project activity able to displace grid electricity stemming from both. The Luzon-Visayas grids can therefore be considered as one grid.

Source		GHG	Included?	Justification/Explanation
Baseline	Fossil fuel plants connected to the grid	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	Project activity	CO_2	No	Minor emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source

B.4. Establishment and description of baseline scenario

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The Project Activity is the installation of a new Greenfield power plant, and is not a capacity addition, retrofit, rehabilitation or replacement of existing grid-connected renewable power

plant/unit. Therefore, the baseline scenario is prescribed in the methodology: Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".
The selected methodology prescribes the baseline scenario; thus no further analysis is required. The combined margin is calculated in Section B.6 below. According to the ACM0002 (version 19.0) and Project Standard (version 02.0), the methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (version 3.0.1) is adopted to assess the continued validity of the baseline and to update the baseline. This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism.

Step 1: Assess the validity of the current baseline for the next crediting period.
Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

If the current baseline complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation or the submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period, go to Step 1.2.

There are no new national and/or sectoral policies come into effect after the submission of the project activity or the submission of the previous request of renewal of the crediting period. The current baseline complies with all national laws and/or sectoral policies. Furthermore, the Energy Regulatory Commission of Republic of the Philippines issued the Certificate of Compliance (COC) to the proposed project and the project participant of Northwind Power Development Corporation, confirming that the project participant and the proposed project complied with all the requirements stipulated in the republic Act and the guidelines for the issuance of the COC on 15 June 2015.
Hence, in the absence of the project activity the electricity would still have been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system"

The Renewable Energy Act: a case of E- policy
The Renewable Energy Act has been issued in 2008 which is a clear example of an E- policy, since it is National and/or sectoral policy or regulation that gives comparative advantages to less emissions-intensive technologies over more emissions intensive technologies. As such, it qualifies as an E- policy which should be disregarded in the process of establishing additionality, in accordance with EB16 Annex 3 and EB 22 Annex 3, since the Board agreed that National and/or sectoral policies or regulations under paragraph 6 (b) that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) need not be taken into account in developing a baseline scenario (i.e. the baseline scenario could refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place) (EB 22, Annex 3).

Step 1.2. Assess the impact of circumstances

Assess the impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions, without reassessing the baseline scenario.

In the situation where the baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment, an assessment of the changes in market characteristics is required for the renewal of the crediting period.

The baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment. Baseline emissions are primarily derived from the fossil fuel power plants in Luzon-Visayas Grid. The Renewable Energy Act of 2008 (RA) came into effect from December 2008 which is known as the new Law aiming to provide incentives to promote the development and use the renewable energy in Philippines. However the REA has not been affecting the baseline as the electricity generated from fossil fuel power plants was still predominant of Luzon-Visayas Grid, even slightly increased from the first crediting period to the second one, and apparently the share of renewable energy seemed to be declining as it can be seen in the table B.4.1 below.

Table B.4.1- showing how the total generation produced by fossil fuel power plants in Luzon-Visayas Grid which are calculated following DOE's data as of 31/12/2018, released on 29/03/2019.[4]

Average of	**The first crediting period (2005-2012)**	**The second crediting period (2012-2019)**
Fossil Fuel (FF)		
Electricity generation produced by fossil fuel power plants (MWh)	42,995,194	60,396,240
Percentage of electricity generation produced by fossil fuel power plants (%)	73%	78%
Renewable Energy (RE)		
Electricity generation produced by RE plants (MWh)	14,372,083	16,462,071
Percentage of electricity generation produced by RE plants (%)	27%	22%

Due that similar circumstances prevail as when the first and second PDDs were submitted for the first and second registrations respectively, the continued validity of the current baseline is plausible.

Evaluate whether the conditions used to determine the baseline emissions in the previous crediting period are still valid. Assess the validity of the new fuels or raw materials and the impact of electricity or fuel prices in the identification of the current practice for the baseline emissions.

The conditions used to determine the baseline emissions in the previous crediting period are still valid. The availability of new fuels or raw materials or the level of fuel prices has no impact on the identification of the current practice for the baseline emissions. Presently the Luzon-Visayas Grid is dominated by the fossil fuel power plants. The availability of new fuels or raw materials or the level of fuel prices has no impact on the baseline emissions.

If the new circumstances make a continued validity of the current baseline not plausible, then the current baseline needs to be updated for the subsequent crediting period.

As there is no new circumstance that make a continued validity of the current baseline not plausible, the current baseline scenario does not need to be updated for the third crediting period.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

4 https://www.doe.gov.ph/sites/default/files/pdf/energy_statistics/03_2018_power_statistics_as_of_29_march_2019_generation_per_type.pdf

The sub-step should only be applied if the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the project proponents or third party (or parties) would undertake an investment later, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology.

Assess whether the remaining technical lifetime of the equipment that would have continued to be used in the absence of the project activity, as determined in the CDM-PDD or CDM-PDD-REN, exceeds the crediting period for which renewal is requested.
Following the provisions of the Procedures for renewal of the crediting period of a registered CDM project activity (version 06.0), this sub-step would only be applicable in the situation where the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology. Therefore, this step would not be applicable as the baseline scenario is not the continuation of current practice at the project site.

Take into consideration the market penetration of different technologies. Evaluate the penetration rate of different technologies that are available in the market and evaluate how they could affect the baseline.

As determined in the PDD, the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources in Luzon-Visayas Grid, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system". The project proponents or third party (or parties) would not undertake an investment later. The combined margin calculation automatically takes account of any issues regarding technical lifetime or market penetration.

If the baseline scenario of the project activity is the continuation of use of the current equipment(s) without any investment and the projects proponents or third party(ies) will undertake an investment later, but before the end of a crediting period, then the current baseline needs to be updated for that crediting period or the crediting of emission reductions should be limited to the period before the baseline equipment would cease its operation.

Therefore, the current baseline scenario does not need to be updated for the third crediting period.
Step 1.4 Assessment of the validity of the data and parameters
Assess whether data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are still valid or whether they should be updated. Updates should be undertaken in the following cases:

- Where IPCC default values are used, the values should be updated if any new default values have been adopted and published by the IPCC, for example, in guidelines for national GHG inventories, IPCC assessment report or special reports by the IPCC.
- Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity.

If any of the data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, the current baseline needs to be updated for the subsequent crediting period.

In accordance with the methodology, the grid emission factor and all the values in its calculation are updated in section B.6.

If the application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the current baseline as well as data and parameters are still valid for the subsequent crediting period, then this baseline, data and parameters can be used for the renewed crediting period. Otherwise, proceed to Step 2.

As the analysis above, the current baseline scenario is still valid and does not need to be updated for the third crediting period. But, the baseline grid emission factor and all the values in its calculation that was determined only at the start of the previous crediting period are no more valid on account of change in the grid configuration. As per the requirement of ACM0002 version 19.0 and the methodological tool "Tool to calculate the emission factor for an electricity system" version 07, new data available should be used to update the baseline grid emission factor at the start of the third crediting period.

Step 2: Update the current baseline and the data and parameters

This step is only applicable if any of the Steps 1.1, 1.2, 1.3 and/or 1.4 showed that the current baseline needs to be updated.

Step 2.1: Update the current baseline
Update the current baseline emissions for the subsequent crediting period, without reassessing the baseline scenario, based on the latest approved version of the methodology applicable to the project activity. The procedure should be applied in the context of the sectoral policies and circumstances that are applicable at the time of request for renewal of the crediting period.
As shown in step 1.1 above, in accordance with the procedures for renewal of the crediting period of a registered CDM project activity, the original baseline, as updated, remains valid taking new relevant national and/or sectoral policies and circumstances into account.

Step 2.2: Update the data and parameters

If the application of Step 1.4 showed that the data and/or parameter(s) that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, project participants should update all applicable data and parameters, following the guidance in Step 1.4. As discussed above in step 1.4, the grid emission factor and all the values in its calculation are updated in section B.6.

Conclusion regarding the assessment of the validity of the original baseline scenario
In accordance with the procedures for renewal of the crediting period of a registered CDM project activity, the original baseline scenario remains valid taking new relevant national and/or sectoral policies and circumstances into account. Meanwhile, the baseline grid emission factor and all the values in its calculation are updated in accordance with step 2.2 in section B.6.

B.5. Demonstration of additionality

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The following steps from the "Tool for the demonstration and assessment of additionality" will be completed below.

STEP 0 – Preliminary screening based on the starting date of the project activity
STEP 1 – Identification of alternatives to the project activity consistent with current laws and regulations
STEP 2 – Investment Analysis
STEP 3 – Barrier Analysis
STEP 4 – Common Practice Analysis
STEP 5 – Impact of CDM Registration

STEP 0 – Preliminary screening based on the starting date of the project activity

Although construction of the project began in April 2004, the incentive provided by the CDM was a critical factor in the decision to go ahead with the project implementation. Funding for the project was secured only on the condition that the project receives CDM status and the CERs are pledged as collateral (see STEP 3 for more information). Documentation to attest this fact is dated 21st April 2004 and was received before the start of construction[5]. Additionally, the Project Idea Note (PIN) submitted to the PCF in September 2003 provides proof that CDM assistance was seriously considered well before construction started and played an important role in the decision to implement the project.

STEP 1 – Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a – Define alternatives to the project activity

The identified realistic and credible alternatives available to the project participants that provide outputs or services comparable with the proposed CDM project activity are three:

1) Implement the project without CDM assistance
2) Implement the project as a natural gas plant
3) Do not implement the project

We consider the alternative of implementing the project as a natural gas plant as the use of this type of technology has had a considerable increase in the last years in the Philippines.

Sub-step 1b – Enforcement of applicable laws and regulations

The identified alternatives are in compliance with current laws and regulations in the Philippines.

The Electric Power Industry Reform Act of 2001 (EPIRA) states in its Section 6 that "Generation of electric power, a business affected with public interest, shall be competitive and open", which would entitle NorthWind to carry out both alternatives 1 and 2 above.

STEP 2 – Investment Analysis

Sub-step 2a – Determine appropriate analysis method

The CDM project activity generates financial and economic benefits other than CDM related income, thus the simple cost analysis does not apply. In order to determine whether the proposed project is economically or financially less attractive than the other alternatives without the revenue from the sale of CERs, Option III – "Apply benchmark analysis", is completed below.

Sub-step 2b – Option III – Apply benchmark analysis

The two indicators that will be used are:

1) Project IRR
2) Project Investment Cost

1) Project IRR

Project IRR is a suitable financial indicator for the project and is compared to a calculated benchmark which is the discount rate that represents the returns international investors or borrowers expect in the Philippines.

2) Project Investment Cost

[5] This documentation will be made available to the DOE upon request.

The project investment cost is a suitable indicator to measure the attractiveness of a project. Here it will be used as indicator to assess whether the project developer has chosen the most attractive alternative, i.e. the least cost option, to develop this electricity generation project.

The investment cost of the project will be compared to the investment cost of a natural gas plant, as this type of technology has gained considerable importance in the last years in the Philippines and currently represents an interesting option for electricity generation for private companies, which is demonstrated by the fact that since the year 2001, three natural gas plants (Santa Rita, Ilijan and San Lorenzo) have been constructed and put in operation by Independent Power Producers (totalling a generation capacity of 2,700 MW).

The indicator will be expressed in $US/MW.

Sub-step 2c – Calculation and comparison of financial indicators

1) Project IRR

Project IRR: the table below represents the main data used in the IRR calculation for the project. The calculation was conducted in a conservative manner and all assumptions are listed below in order to maintain a transparent approach.

Financial Details	
Foreign Exchange Rate	57 PHP/1 US$
Costs of Equipment and plant (initial investment cost)	51,203,000 US$
Electricity Tariff	0.078 US$/kWh (PHP 4.43/kWh)
Electricity sales (86,724 MWh/year)	6,740,128 US$
Project Life	21 Years
O&M costs/year	1,000,000 US$
Project IRR	9.3%

Source: Project Sponsor

Data assumptions:

- The costs of equipment and plant were supplied by the project developer based on quotes and current prices.
- The electricity will be sold to the Luzon-Visayas Grid through the Wholesale Electricity Sport Market (WESM).
- The expected life of the equipment is approximately 21 years.
- The O&M costs were estimated by the project developer.

The Discount Rate: it is calculated using the Capital Asset Pricing Model (CAPM) formula, as determined by Brealy and Myers in their book “Principles of Corporate Finance”. The CAPM formula establishes that a return on an asset (r) equals the risk free return (rf) plus the “Beta” of that asset times the risk market premium (rm-rf). We add the country-specific risk premium (CRP) to reflect the minimum expected returns from international investors or borrowers in the Philippines.

$$r = rf + \beta (rm-rf) + CRP$$

Where:

- rf = 5.04%; average yield of the 20-year Treasury Bonds for the year 2004 (Federal Reserve System, information released on 03/07/2005)

- β = 0.47; beta of the electric utility sector in the US (Brealy and Myers, p.219)
- (rm-rf) = 8.4%; traditional returns on stock investments for the last 69 years (Brealy and Myers, p.180)
- CRP = 4.17%; spread of the bond Phil 2017 as of 16 February 2005 (Source: Asia Bond Indicators – Asia Development Bank).

Therefore a conservative[6] Discount Rate to be used as benchmark to compare with the project IRR is:

r = 5.04% + (0.47*8.4%) + 4.17% = 13.158% = **13.2%**

Comparison:

The Project IRR is compared to the benchmark to examine the financial attractiveness of the project. The project IRR is estimated to be **9.3%**, which is much lower than the project's benchmark **13.2%**. Low IRR, compared to the hurdle rate, indicates that the project is not financially attractive without CDM assistance. The low return does not justify the high risks associated with implementing this new renewable energy project.

2) Project Investment Cost

The information contained in the table below shows the cost range of installing 1 MW of a natural gas plant and compares it with the cost of installing 1 MW of NorthWind's plant.

The generation set cost only includes equipment cost and transport cost. On the other hand, the turnkey cost includes the generation set cost and the civil works and the installation costs.

Technology Cost Comparison		
	Cost of a Gas Turbine	Northwind Wind Turbine Cost
Generation Set Cost ($/MW)	300,000 to 600,000	890,000
Turnkey Cost-No Heat Recovery ($/MW)	300,000 to 650,000	1,100,000
Heat Recovery Added Cost ($/MW)	150,000 - 300,000	----------
Source: Meherwan P. Boyce, Ph.D, P.E (2002); Gas Turbine Engineering Handbook, p.8		

Comparison:

- *Generation set cost:* considering a conservative approach (i.e. choosing the highest cost of the cost range for natural gas), the cost of 1MW generation set of wind generation technology for NorthWind ($US 890,000) is **48% higher** than 1MW simple cycle gas turbine ($US 600,000). If the lowest cost of the cost range is chosen ($US 300,000), the cost for NorthWind would be **196% higher**.

- *Turnkey cost:* in this case the cost of NorthWind is **between 69% and 266% higher** than the cost for the natural gas plant. ($US 1,100,000 versus $US 300,000 to $US 650,000)

If the cost of the heat recovery component is added, the turnkey cost for NorthWind is **between 16% and 144% higher** than for the natural gas plant ($US 1,100,000 versus $US 450,000 to $US 950,000)

[6] It is conservative because it uses US returns on US public utilities and the US stock market. The Philippine markets are much more volatile. Also local expectations of equity investors are higher than 20%.

It is clearly demonstrated that taking into account the investment cost, building a natural gas plant is financially much more attractive than building a wind farm.

Furthermore, Philippines has recently discovered natural gas fields and the Government wants to develop its internal natural gas market in order to increase the country's energy self-sufficiency. With this purpose, the Government has developed a "Natural Gas Policy and Regulatory Framework" which makes the investment in new natural gas generation plants much more attractive for private investors than the investment in wind farms.

Since the year 2001, three natural gas plants (Santa Rita, Ilijan and San Lorenzo) have been constructed and put in operation by Independent Power Producers (totaling a generation capacity of 2,700 MW). On the contrary, there hasn't been any wind farm project in the country to date. This demonstrates that from a private company's perspective, natural gas is financially a more attractive alternative for generating electricity in the Philippines.

Sub-step 2d –Sensitivity Analysis

The following assumptions are established to examine whether the conclusion regarding the financial attractiveness of the project is robust:

a) Project IRR

As shown in the table below, if the investment cost of the project was 15% less than expected, the project IRR would be 11.7% which is still below the benchmark (13.2%).

In the case that the electricity tariff was 20% higher than it is now, the project IRR would be 12.5 % which is still below the benchmark (13.2%).

With a 10% more electricity production, the project IRR would be 10.9% which is also below the benchmark (13.2%).

Finally, if the operation and maintenance costs was 10% less than expected, the project IRR would be 9.9%, which is far below the benchmark (13.2%).

Sensitivity Analysis	+15% Inv.	-15% Inv.	+20% Tariff	-20% Tariff	+10% Production	-10% Production	+10% O&M cost	-10% O&M cost
Project IRR	7.4%	11.7%	12.5%	5.7%	10.9%	7.6%	9.1%	9.9%

Source: Own elaboration

b) Project Investment Cost

Simple Cycle Gas Turbine	Generation Set Cost ($/MW)	Turnkey Cost. No Heat Recovery ($/MW)	Turnkey Cost + Heat Recovery Added Cost ($/MW)
Average cost	**450,000**	**475,000**	**700,000**
Average cost - 20%	360,000	380,000	560,000
Average cost - 15%	382,500	403,750	595,000
Average cost - 10%	405,000	427,500	630,000
Average cost + 10%	495,000	522,500	770,000
Average cost + 15%	517,500	546,250	805,000
Average cost + 20%	540,000	570,000	840,000
NorthWind Wind Turbine	**890,000**	**1,100,000**	

Source: Own elaboration

In this table, the average cost of the gas turbine (taken from the Technology Cost Comparison table above) is compared against the cost of NorthWind's wind turbine. Furthermore, an increase/decrease of up to 20% is considered for the cost of the gas turbine (generation set cost, turnkey cost and turnkey cost + heat recovery added cost) in order to see how a change in the cost affects the attractiveness of the natural gas technology against NorthWind technology.

The results show that in the most conservative assumption (average cost +20% for the gas turbine), the cost of NorthWind's wind turbine is always higher (comparing generation set cost, turnkey cost or even turnkey cost with heat recovery added cost).

Conclusion:

The sensitivity analysis confirms the fact that the project is less financially attractive than other options available in the market and that successful implementation depends on CDM assistance.

STEP 3 – Barrier Analysis

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed activity

Main identified barriers:

- Debt funding is not available for this type of project in the Philippines on a commercial basis (either from international or domestic institutions). First, the IRR of the project (9.3%) is too low (as demonstrated in step 2b above). Furthermore, being the first wind farm to be developed in this country, the project is seen by financial institutions as very risky.

- As this technology has not been used in the Philippines before, there is a lack of skilled labor to operate and maintain the equipment. Therefore, skilled workers from outside the country would need to be hired in order to train local workers and supervise the operation and maintenance of the plant. This will probably result in an increase of the plant's operation costs

- NorthWind has only been able to obtain financing on the condition that the project is developed as a CDM activity. The project will receive financing from the Danish International Development Agency (DANIDA), and the Philippine Export and Import Credit Agency (PhilEXIM) will act as the loan guarantor on the condition that the project attains CDM status. DANIDA would have not financed the project without PhilEXIM's guarantee[7].

  Benefits from CER revenues will enable PhilEXIM to offset high project risk. PhilEXIM further stipulates that the CERs, when acquired, must be pledged as collateral for its guarantee. This shows that without the CDM, the project would have never reached financial closure and therefore could not be implemented.

- There are currently no Philippine governmental subsidies for wind energy projects to improve its profitability. Governmental subsidies are a key element to promote the development of wind energy projects. The countries where there has been an important development of this type of technology, have a regulatory framework in place which establishes different kind of incentives that make investment in wind energy generation economically attractive.

  This is the case of Germany and Spain, which are currently the countries with more wind generation installed capacity in the world (16,628 MW and 8,263 MW respectively) and the ones that have seen the highest increase in new capacity addition in the year 2004 (2019 MW and 2061 MW respectively). In both countries the electricity generated from wind

[7] Documentation will be made available to the DOE upon request.

energy sources is paid to the generators at a price that is enough to make this type of investment economically attractive. In Germany this remuneration is based on a fixed price that is guaranteed for the entire generation plant's life and in Spain it is based on the pool price plus a bonus. Furthermore, the electricity distribution companies are obliged to buy all the electricity generated from these plants.

- The Government of Philippines is promoting the development of the country's natural gas market (since new natural gas fields were discovered) which has a direct negative effect on the development of other type of electricity generation technologies, particularly renewables. If investing in a natural gas plant is economically more attractive for a private investor than investing in a wind farm, it is obvious that the plants most likely to be developed in the country will include mostly natural gas.

  The case of the Ilijan natural gas plant is a good example for the Government's support to the development of the natural gas market. Ilijan entered into a take-or-pay contract for the purchase of natural gas with the Shell Exploration B.V./Occidental Philippines, Inc. Consortium, which was assigned the service contract to exploit the Camago-Malampaya natural gas reservoir. This take-or-pay- agreement is guaranteed by the Philippine Government.

- The Philippines is prone to typhoons that generate extremely strong winds. A typhoon could potentially damage the Project's wind power generation equipment. In fact, on the 12th of September 2003[8], typhoon No.14 battered the island of Okinawa, Japan, damaging wind power equipment owned by Okinawa Power. At their facilities in Hirara alone, 2 of the 4 wind turbines were blown down and another lost its blade.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

None of the barriers identified in Sub-step 3a prevent the implementation of the project as a natural gas plant.

STEP 4 – Common Practice Analysis

Sub-step 4a – Analyze other activities similar to the proposed project activity

The project will be the first commercial wind power project in the Philippines. No other wind farm projects have been implemented to date.

Sub-step 4b –Discuss any similar options that are occurring

No other similar activities are being carried out by private enterprises in the Philippines at present. Private project developers are reluctant to invest in this untested technology because in their view the high risks do not justify the low returns.

STEP 5 – Impact of CDM Registration

The approval and registration of the project activity as a CDM activity will enable the project to be undertaken, as PhilEXIM has agreed to guarantee the loan of DANIDA only on condition that the project receives CDM support and the CERs are pledged as collateral for its guarantee. At the same time, the fact that PhilEXIM guarantees the loan has attracted other investors to the project. Without these investors, it wouldn't have been possible to undertake the project either.

[8] An article appeared in the Asahi Newspaper, 12th September 2003.

Considering the price of US$ 5.63[9] per tCO_2e, the registration of the project as a CDM activity has a considerable impact on the project's IRR. Without the CER income the IRR is 9.3% and with the CER income the IRR goes to 10%, which still is considered quite low but makes the investment in the project more attractive than without the CDM incentive.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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The proposed project activity is to be established a wind energy project. According to the methodology ACM0002 (version 19.0.0), the baseline scenario of the proposed project activity is electricity delivered to the Grid by the proposed project activity, which would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

In accordance with the 'ACM0002 methodology' (version 19.0.0), baseline emissions for the year *y* are calculated as:

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y} \quad (1)$$

Where:

- BE_y = Baseline emissions in year *y* (tCO_2)
- $EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh/yr)
- $EF_{grid,CM,y}$ = Combined Margin CO_2 emission factor for grid connected power generation in year *y*, calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

As the project involves the construction of a new wind power project, therefore:

$$EG_{PJ,y} = EG_{facility,y} \quad (2)$$

Where:

- $EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)
- $EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

For the calculation of Combined Margin CO_2 emission factor, $EF_{grid,CM,y}$, the methodology refers to the 'Tool to calculate the emission factor for an electricity system' ("EF tool"). The National Grid Emission Factor (NGEF) has been calculated based on the EF tool version 07 and published officially on website of Department of Energy, Republic of the Philippines[10].

In accordance with this tool, the baseline emission factor is calculated as a "combined margin" emission factor (CM) of the electricity system: a weighted average of two emission factors

[9] Weighted average price given in the study "State and Trends of Carbon Market 2005", The World Bank.

[10] https://www.doe.gov.ph/electric-power/2015-2017-national-grid-emission-factor-ngef and Email confirmation on GEF by Department of Energy has been provided to DOE for review.

There is no material difference between v5.0 and v7.0 as far as the emission factor calculation aspect is concerned. Then the calculation by DNA complied with EF Tool version 07.

pertaining to the electricity system: the operating margin (OM) and the build margin (BM). Both the OM and BM emission factors are calculated *ex ante*.

Based on the data in 2015-2017, Department of Energy (Republic of Philippines) has calculated and released the Grid emission factor on their website[11] with the details in below:

2015-2017 NATIONAL GRID EMISSION FACTOR (NGEF)

Tables below shows the computed grid emission factor derived using the 2015-2017 power statistics.

Table 1. Summary of the NEG for Luzon-Visayas Grid

a. Simple Operating Margin (OM) Emission Factor

Parameters	(t-CO_2/MWh)
2015-2017 Average EFgrid, OMsimple,y	0.7122

b. Build Margin (BM) Emission Factor

Parameters	(t-CO_2/MWh)
BM Emission Factor	0.5979

c. Combined Margin (CM) Emission Factor

Parameters	(t-CO_2/MWh)
2015-2017 EFgrid, CM,y (Wind and solar)	0.6836
2015-2017 EFgrid, CM,y (Other projects)	0.5979

The Baseline Emission Factor is calculated as a Combined Margin, using a weighted average of the Operating Margin and Build Margin.

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

The "Tool to calculate the emission factor for an electricity system" provides the following default weights for wind power projects the first crediting period and for subsequent crediting periods: Operating Margin, w_{OM} = 0.75; Build Margin, w_{BM} = 0.25

Applying these default weights and the calculated emission factors, we calculate a combined margin Baseline Emission Factor of 0.6836 tCO_2e/MWh.

Calculation of Baseline Emissions

[11] https://www.doe.gov.ph/electric-power/2015-2017-national-grid-emission-factor-ngef

There is no material difference between v5.0 and v7.0 as far as the emission factor calculation aspect is concerned. Then the calculation by DNA complied with EF Tool version 07.

Baseline Emissions are calculated by multiplying the Baseline Emission factor by the net quantity of electricity supplied to the grid electricity system by the project according to the formula 1 repeated below for convenience:

$$BE_y = EG_{facility,y} \times EF_{grid,CM,y}$$

The estimated baseline emissions are based on expected net power supply to the grid and an *ex ante* calculation of the emission factor in the first crediting period, and will hence be revised during the implementation of the project activity on the basis of actual net power supply to the grid. However, the combined margin baseline emission factor will not be updated during the first crediting period.

Calculation of Emission Reductions

As mentioned in the ACM0002, version 19.0.0, no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.

Emission reductions are calculated in accordance with methodology ACM0002 as follows:

$$ER_y = BE_y - PE_y \quad (5)$$

Where:

- ER_y = Emission reductions in year *y* (tCO_2)
- BE_y = Baseline emissions in year *y* (tCO_2)
- PE_y = Project emissions in year *y* (tCO_2)

Project emissions

According to the methodology ACM002, for most renewable power generation project activities, PEy = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad (6)$$

Where:

PE_y	=	Project emissions in year y (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year y (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year y (tCO2e/yr)

The methodology provides procedures to calculate the project emissions from the following sources:

- fossil fuel combustion in geothermal and solar thermal projects;
- emissions of non-condensable gases from the operation of geothermal power plants, and;
- emissions from water reservoirs of hydropower plants.

As the proposed project which is a wind energy project, does not involve either geothermal or solar thermal or hydropower aspects, hence the three sources mentioned above do not apply for the project.

Hence $PE_y = 0$.

Leakage

As per ACM0002, no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.

Using the results of the preceding sections, we conclude that emission reductions are equal to baseline emissions and calculate the emission reductions using formula 6:

$$ER_y = EG_{facility,y} \times 0.6836 \quad (7)$$

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "Tool to calculate the emission factor for an electricity system".
Source of data	Data provided by DNA Philippines[12]
Value(s) applied	0.7122
Choice of data or measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system", version 07.0.0
Purpose of data	Calculation of baseline emissions
Additional comment	Value is fixed and ex-ante for the entire crediting period

Data/Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "Tool to calculate the emission factor for an electricity system"
Source of data	Data provided by DNA Philippines[13]
Value(s) applied	0.5979
Choice of data or measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system", version 07.0.0
Purpose of data	Calculation of baseline emissions
Additional comment	Value is fixed and ex-ante for the entire crediting period

Data/Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh

[12] Confirmed directly by DNA Philippines (i.e. Department of Energy) to provide data to calculate Emission Factor of Visayas- Luzon electricity grid system in 03 years 2015-2017 on 06/05/2019.

There is no material difference between v5.0 and v7.0 as far as the emission factor calculation aspect is concerned. Then the calculation by DNA complied with EF Tool version 07.

[13] Confirmed directly by DNA Philippines (i.e. Department of Energy) to provide data to calculate Emission Factor of Visayas- Luzon electricity grid system in 03 years 2015-2017 on 06/05/2019.

There is no material difference between v5.0 and v7.0 as far as the emission factor calculation aspect is concerned. Then the calculation by DNA complied with EF Tool version 07.

Description	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "Tool to calculate the emission factor for an electricity system".
Source of data	Data provided by DNA Philippines[14]
Value(s) applied	0.6836
Choice of data or measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system", version 07.0.0.
Purpose of data	Calculation of baseline emissions
Additional comment	Value is fixed and ex-ante for the entire crediting period

Data/Parameter	**$EG_{m,y}$**
Data unit	MWh
Description	Net electricity generated by power plant/unit *m,* in year *y*
Source of data	Data provided by DNA Philippines[15]
Value(s) applied	For detailed values; see Appendix 4
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	Value is fixed and ex-ante for the entire crediting period

Data/Parameter	**$EF_{CO2,m,i,y}$**
Data unit	tCO_2/GJ
Description	CO_2 emission factor of fuel type I used in power unit m in year y
Source of data	Data provided by DNA Philippines[16]
Value(s) applied	For detailed values; see Appendix 4
Choice of data or measurement methods and procedures	-

[14] Confirmed directly by DNA Philippines (i.e. Department of Energy) to provide data to calculate Emission Factor of Visayas- Luzon electricity grid system in 03 years 2015-2017 on 06/05/2019.

There is no material difference between v5.0 and v7.0 as far as the emission factor calculation aspect is concerned. Then the calculation by DNA complied with EF Tool version 07.

[15] Confirmed directly by DNA Philippines (i.e. Department of Energy) to provide data to calculate Emission Factor of Visayas- Luzon electricity grid system in 03 years 2015-2017 on 06/05/2019.

There is no material difference between v5.0 and v7.0 as far as the emission factor calculation aspect is concerned. Then the calculation by DNA complied with EF Tool version 07.

[16] Confirmed directly by DNA Philippines (i.e. Department of Energy) to provide data to calculate Emission Factor of Visayas- Luzon electricity grid system in 03 years 2015-2017 on 06/05/2019.

There is no material difference between v5.0 and v7.0 as far as the emission factor calculation aspect is concerned. Then the calculation by DNA complied with EF Tool version 07.

Purpose of data	Calculation of baseline emissions
Additional comment	Value is fixed and ex-ante for the entire crediting period

Data/Parameter	$\eta_{m,y}$
Data unit	-
Description	Average net energy conversion efficiency of power unit m in year y.
Source of data	Data provided by DNA Philippines[17]
Value(s) applied	For detailed values; see Appendix 4
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	Value is fixed and ex-ante for the entire crediting period

B.6.3. Ex ante calculation of emission reductions

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Baseline emissions (BE_y)

Baseline emissions are calculated as follows:

$BE_y = EG_{facility,y} \times EF_{grid,CM,y}$

Where:

$EG_{facility,y}$ = 86,700 MWh/year

$EF_{grid,CM,y}$ = The combined margin CO_2 emission factor for grid connected power generation in year y. This factor is as follows:

$EF_{grid,CM,y}$= *0.6836* tCO_2/MWh (resulted from B.6.1 above)

Therefore:

BE_y = 86,700 × 0.6836 = 59,268 tCO_2/year

Project emissions (PE_y)

$PE_y = 0\ tCO_2$

Leakage (LE_y)

As mentioned above, ***LE_y =0***

Emission Reductions (ER_y)

Emission reductions are calculated as follows:

$ER_y = BE_y - PE_y$ = 59,268 tCO_2/year

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2019 (8 months)	39,512	0	0	39,512
2020	59,268	0	0	59,268
2021	59,268	0	0	59,268
2022	59,268	0	0	59,268

[17] Confirmed directly by DNA Philippines (i.e. Department of Energy) to provide data to calculate Emission Factor of Visayas- Luzon electricity grid system in 03 years 2015-2017 on 06/05/2019.

There is no material difference between v5.0 and v7.0 as far as the emission factor calculation aspect is concerned. Then the calculation by DNA complied with EF Tool version 07.

2023	59,268	0	0	59,268
2024	59,268	0	0	59,268
2025	59,268	0	0	59,268
2026 (4 months)	19,756	0	0	19,756
Total	414,876	0	0	414,876
Total number of crediting years	7			
Annual average over the crediting period	59,268	0	0	59,268

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{facility,y}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	TRANSCO/NGCP and WESM (project activity site)
Value(s) applied	86,700 (estimate value for ex-ante calculation. Actual value is monitored)
Measurement methods and procedures	Net electricity is calculated according to the following formulae: Net electricity delivered: EGy = Electricity delivered by the project activity to WESM - Electricity received by the project activity from WESM For details please refer to section B.7.3. These two parameters, import and export to the grid, are measured at the same location near the connection to the grid in Bangui, through standard (bi-directional) electricity metering instrument(s) M_x. The metering instruments will be installed at the grid-connected point to measure the amount of electricity going from and to the grid. The readings of electricity will be continuously measured by metering instrument itself and monthly recorded. The accuracy of the meter(s) will meet the requirements of national standards and regulations, shall be of IEC 687 class 0.2. Person/entity responsible for the measurements: the project participant (i.e. NorthWind)
Monitoring frequency	Continuously measurement and at least monthly recording
QA/QC procedures	Double check with receipt of electricity sales to WESM and information from TRANSCO/NGCP This data will be directly used for calculation of emission reductions. Measurement results of electricity supplied to the grid and that delivered from the grid to the project will be cross-checked with records for sold electricity. The meter(s) will be calibrated annually in accordance with national standards and procedures.
Purpose of data	Calculation of baseline emissions
Additional comment	

B.7.2. Sampling plan

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Not applicable for the project activity.

B.7.3. Other elements of monitoring plan

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I. Background Information

The baseline methodology and monitoring methodology for Northwind Bangui Bay ("the project") are in accordance with the approved consolidated baseline methodology ACM0002, which is applicable to grid-connected electricity generation from renewable sources.
The project's installed capacity and estimated yearly average generation are as follows:

Project name	Installed capacity (MW)	Generation (GWh/yr)
Northwind Bangui Bay	33	86.7

Source: The project's feasibility study
The project is a 33 MW wind turbine power plant located in Bangui Bay (Republic of the Philippines) that will produce electricity without emitting GHG. The electricity generated by the project is expected to displace grid electricity generated from fossil fuels and reduce GHG emissions by an amount of approximately 59,268tCO_2e per year for the duration of the project activity. A reduction of approximately 414,876tCO_2e, is forecasted for the last 7-year crediting period.
The project boundary is the area where Northwind's wind turbines and transmission line are placed; and as the transmission line reaches the Luzon-Visayas grid by interconnecting the Northwind's Bangui Substation to NGCP's Laoag substation, the Luzon-Visayas grid will also be included in the project boundary.

II. Organizational, Operational and Monitoring Obligations

A. Obligations of the Operator
Monitoring the project's performance in terms of ERs achievement requires the fulfillment of operational data collection and processing obligations from the operator. The operator has the primary obligation to calculate the project ERs based on the most recent available information, following the ERs Calculation Procedure ("ERCP") presented in this Monitoring Plan (MP) and to abide to the ERCP Organizational Structure and the ERCP Quality Control presented in the annex section of this MP. Please see annex for both the ERCP Organizational Structure and the ERCP Quality Control.
The ERCP Organizational Structure aims at showing that the ERCP Manager will be the responsible for performing the ERCP (monthly), and the MP Steering Committee will be the responsible for supervising the ERCP Manager monitoring work (monthly). The ERCP Manager will report to the MP Steering Committee (monthly); and both the ERCP Manager and MP Steering Committee co-ordinately will report to the verifier (when the verification takes place), allowing for a successful verification of the project accounted ERs.
The ERCP Quality Control aims at providing guidance on how to handle monitoring data as to ensure that sufficient and accurate information is made available to the verifier, allowing for a successful verification of accounted ERs. The ERCP Quality Control presented in the annex section of this MP provides guidance on how to trace back the electricity produced by the project from the load profiles provided by National Transmission Company, TRANSCO/ National Grid Corporation of the Philippines, NGCP and from the invoices of WESM. It is responsibility of the operator to enter in agreements with the data-sources to ensure that data is made available monthly to the ERCP Manager. All data required for the MP will come from third parties: TRANSCO/NGCP and WESM information systems.
It is believed that the MP approach presented here will result in an accurate, yet conservative calculation of ERs. However, some uncertainties may lead to a deviation of monitored ERs and the verified ERs, especially errors in the data monitoring and processed system. The operator is expected to prevent such errors and the verification audits are expected to uncover any possible errors. The Certified Emissions Reductions ("CERs") would be granted ex-post verification.

Monthly Data Collection – Parties Involved

WESM (Data Provider)	Should provide monthly to the operator a written proof of the net kwh purchased by WESM from the project activity
TRANSCO/NGCP	- Should provide monthly to the operator a written proof (load profile data)

(Data Provider)	of the billing meters at the Bangui substation, showing the following: 1. measurement of electricity delivered by the project activity to WESM; and 2. measurement of electricity received by the project activity from WESM. The electricity meters have been calibrating every year by a qualified third party following national regulations.
The operator (Data Processor)	- Should keep statement of account of sales from WESM; - Should keep load profile data from TRANSCO/NGCP; - Should perform monthly calculation of ERs following the ERCP. - Should perform the annual report of ERs achieved to the verifier. - Should establish the necessary agreements with WESM and TRANSCO/NGCP to assure that they provide (monthly) a written report of the project's monthly generation bought and registered, respectively. All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period.

Source: Own production

II. A of the MP is to be complemented with annexes in mention: the ERCP Organizational Structure and the ERCP Quality Control.

B. Emissions Reductions Calculation Procedure and Required Spreadsheets

The ERCP is the basic instrument for gathering, recording and processing information that will result in the measured ERs. The operator shall consider the project's ERCP as a manual. The ERCP should contain: i) data gathered from WESM and TRANSCO/NGCP information systems, and ii) data processed by the operator. All data processing should be done in Excel. The ERCP is designed for monthly and yearly calculation, based on final monthly TRANSCO/NGCP reports and WESM monthly recording. Filling data monthly in the required spreadsheets will provide time to review formulas, minimize errors and have data readily available for the verifier in any period of the year. There will be in only 1 spreadsheet to be reviewed by the verifier named Northwind ERs at "yearly period in question".xls**.** However, as the verifier could require preliminary calculations, the ERCP responsible ("ERCP manager") should keep the name of the file and follow by the date at which the latest adjustment is made, every time he works on the file. Doing so will allow to save old versions in disk and keep them as a record to show to the verifier, if required.

When the ERs calculation for the month is completed, the file should be named Northwind ERs at "month in question".xls, to allow differentiating scratch versions from the final monthly calculation. Likewise, after the calculation of the ERs of the last month of the year, the file should change its name to Northwind ERs at "yearly period in question".xls.

The year for the monitoring was supposed to run from the 1st of May to the 30th of April of the following year initially, and then to be followed by same period yearly thereafter. But since this CDM activity's application for registration had not been approved by the UNFCCC then, Northwind adjusted the first period to 01 May 2005 through 31 August 2006, as it represented the entire period immediately preceding the 10/09/2006 registration. Also, the change of date of every 25th instead of 30th or 31st of each month is for consistency with the billing cut-off period in the Philippines, hence, was applied starting the second period.

This monthly-filled file will be composed of 3 worksheets:

1. Worksheet # 1: Load Profile Data from TRANSCO/NGCP
2. Worksheet #2: Statement of Account from WESM
3. Worksheet # 3: Organized Data, Processed Data and Result.

1. Worksheet #1: Should contain data as it was handed in, by TRANSCO/NGCP, through a password-protected email, arranged in months. The ERCP manager should not manipulate this

data other than copy and paste it from the file it was handed in. The e-mail through which data comes from provider should be kept as proof for the verifier.

2. Worksheet # 2: This worksheet is the Statement of Account from WESM that indicates the total quantity supplied by the project activity to WESM as measured at Bangui substation. This will serve as countercheck for the load profile data provided by TRANSCO/NGCP. Likewise, this document should be kept as proof for the verifier.

3. Worksheet # 3: The ERCP manager should put the input data in 3 rows (electricity supplied by the project activity at Bangui substation, electricity delivered by WESM in to the project at Bangui substation and the net electricity supplied by the project to WESM, 1 column per month) which is a formula:

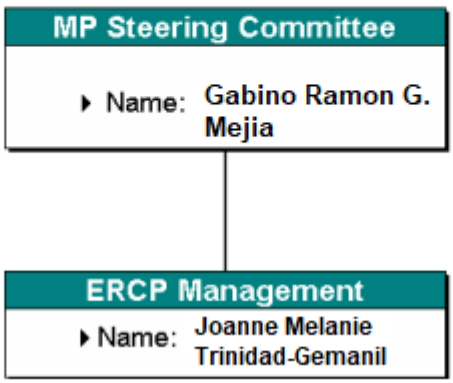
EGy = Electricity delivered by the project activity to WESM - Electricity received by the project activity from WESM.

In this same Worksheet, the ERCP manager should calculate monthly ERs (measured in tCO2e) by multiplying the net electricity in MWh (Row 3) times 0.6836 in tCO2e/MWh, which is the baseline emission factor for the project that will be used for the first crediting period (7 years). No rounding needs to be made per month when calculating monthly ERs -as this is only done to measure progress. At the end of the year, the ERCP manager should sum the resulting monthly ERs of the project to obtain the yearly project ERs ready for verification. Resulting yearly ERs must be rounded down to the nearest integer. Once the yearly ERs calculation is completed in the Northwind ERs this file should become Northwind ERs at “yearly period in question”.xls.
Worksheet # 3 also allows the ERCP manager to calculate the cumulative generation and cumulative ERs along the year and be aware of the project’s environmental benefits progresses regarding ERs.

The ERCP Quality Control and Organizational Structure can be seen below.

Monitoring Plan (MP) – Emissions Reductions Calculation Procedure (ERCP)

ERCP Organizational Structure



SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>

24/04/2004. This is date of ground breaking ceremony. The documented evidence has been provided to DOE for review.

C.2. Expected operational lifetime of project activity

>>
The project is expected to have a minimum operating lifetime of 21 years 0 month.

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>
Renewable crediting period type (this is the third crediting period)

C.3.2. Start date of crediting period

>>
01/05/2019

C.3.3. Duration of crediting period

>>
07 years 0 month

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
Environmental Impact Assessment (EIA) studies one for the wind turbines and for the transmission line have been completed and the Philippine Department of Environment and Natural Resources (DENR) has issued an Environmental Clearance Certificate (ECC).

Environmental Issues
The EIA reports for the wind turbines and transmission line did not identify any significant environmental impacts from the project. The wind farm site is uninhabited and almost bare of vegetation while the transmission line will be installed on the roadside, over the existing distribution line of the local electric utility. However, site visits and detailed review by World Bank Safeguards Team of available documents and the additional information and studies provided by the project sponsor resulted in the identification and assessment of the following environmental issues and concerns (Table I).

Table I. Environmental Issues and Concerns and Impact Assessment

Issues and Concerns	Assessment of Impacts
A. Construction Phase	
Generation of dusts	Minimal dust generation is expected in the beach area because the ground is sandy and often wet. Less intense use of road is expected as turbine towers will be unloaded from the sea via barges.
Sedimentation of nearshore waters	Excavated materials will consist almost entirely of sand and gravel and are not expected to significantly alter sediment load of the normally turbid waters fronting the wind farm site. There is however a small possibility that finer sands or dirt coming from excavated materials may increase turbidity, reaching the coral reefs located beyond the project area.
B. Operation Phase	
Noise generation from wind turbines	The nearest house is about 200 meters from a wind turbine tower. Modern wind turbine technology generates minimal noise. Turbine noise is also expected to be dampened by

	the sounds from strong waves during windy days.
Possible oil and grease contamination of beach area	Around 2.4 kg of grease will be applied to the turbines every 6 months and approximately 260 liters of oil every two years. Contamination of the beach area by oil and grease is highly unlikely because the turbines are sealed to the surroundings and all equipment containing oil are provided with fail safe containment.

The above assessments indicate that the project is not expected to cause any large and long-term adverse effects to the environment.

D.2. Environmental impact assessment

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The EIA reports for the wind turbines and transmission line did not identify any significant environmental impacts from the project.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

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The Philippine Environmental Impact Statement (EIS) process requires the project sponsor to undertake consultations with the project stakeholders especially the host communities. The project's EIA documents are also considered public documents under the Philippine EIS Law and are available at the DENR. The project preparation as the project sponsor's foreshore lease application included the conduction of barangay-level and municipal-level consultations, individual visits to adjacent landowners, meetings with the provincial, municipal and barangay officials/councils, and consultations with the fishermen association in the municipality of Bangui. The high awareness and acceptance by the local leaders, fishermen and local residents of the project have been validated by World Bank officials during its visits to the area where it had the opportunity to meet and interview both local leaders and residents.

E.2. Summary of comments received

>>

The project is regarded by the Local Government Units (LGU) and the local residents very favorably due to the anticipated economic benefits in terms of improved employment opportunities, additional tax revenues, and increased tourist visits. The improvement in the power supply in the area is also being seen as a magnet for investors. Fishermen look forward to the construction of an all-weather access road to be constructed as part of the project, which will improve their access to the shore area. The issues and concerns raised during consultations and interviews with the local residents are evaluated in the table below (Table II).

Table II. Social Issues and Concerns and Impact Assessment

Social Issues and Concerns	Assessment of Impacts
A. Construction Phase	
Land acquisition	Land acquisition is limited to a small lot for the switchyard and control station. The wind farm area is covered by a foreshore lease agreement with the Philippine government while the transmission line will utilize the existing right-of-way of INEC.
Indigenous People	A field investigation by National Commission on Indigenous People (NCIP) confirmed that the wind farm area is outside Indigenous People territories.
Disruption of livelihood	Local residents will have continued access to the foreshore area.
Local employment	Local residents will be given priority in the hiring of employees and workers for the project

B. Operation Phase	
Fishermen's access to the sea	The public, including local fishermen will continue to have access to the foreshore even during the operation of the wind farm.
Social Development Program	The project sponsor has indicated that it will allocate funds and pursue social development program benefiting the host villages.

The project will not entail any major land acquisition. Land acquisition will be limited to a small lot needed for the switchyard and wind farm control station. It will not affect any settlement as the wind farm area is uninhabited and free from man made improvements while the transmission line will be installed over the existing distribution line of the local electric utility. The project site is outside any Indigenous People territory or ancestral domain and there are no known structure of cultural significance that could be affected by the wind farm or the transmission line. Also, the project sponsor has committed to adopt the Philippine Transmission Corporation (TRANSCO) Guidelines for compensation of any damage to private properties during the installation of the transmission line. Livelihood activities in the beach area are expected to continue during and after the construction of the wind farm as continued public access to the foreshore area is ensured under the project's ECC. In addition, the project sponsor has committed to undertake the following social enhancement measures:

Priority hiring of local residents. The project sponsor has committed to work closely with the village leaders and the local government units in the hiring of local labor. Since the start of construction in July 2004, the municipal government of Bangui has been coordinating and monitoring local employment. During its site visit on the 22nd of October 2004, the World Bank Task Team observed that the project sponsor and local government were jointly monitoring local employment and records indicated that about 80% of laborers were residents of Bangui. Local employment effects were also confirmed by one of the village chiefs and a civil works contractor interviewed by the Safeguards Team.

Social development program. The project sponsor has verbally indicated that it will set aside funds to implement social development program for the host villages. But such was not reflected in any of the documents reviewed by the Safeguards Team. In particular, the project ECCs (Wind Farm and Transmission Line) do not require the project sponsor to implement any social development program. Power projects under the Philippines Energy laws are normally required to set aside social development and environmental enhancement funds for the host communities from their annual revenue streams. However renewable energy projects such as wind power projects are exempted from these requirements (Philippine ER I-94, Section 8-b).

E.3. Consideration of comments received

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Implementation of social development program for the host villages. To formalize its commitment to provide social development program for the host villages, the project sponsor should formulate a social development plan (SDP) in coordination with the local government. The program shall include a livelihood development component to be implemented through a participatory approach. The program may be financed from a portion of the carbon finance generated by the proposed project. The SDP document shall be submitted to the Bank before the end of the construction activities

SECTION F. Approval and authorization

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Letters of approval have been received from the Philippines, Netherlands and Finland.

Appendix 1. Contact information of project participants

Organization name	NorthWind Power Development Corporation
Country	Philippines
Address	22nd Floor, 6750 Building, Ayala Avenue, Makati City 1226 Philippines
Telephone	+632 815 9521
Fax	+632 818 2551
E-mail	
Website	N/A
Contact person	Joanne Melanie Trinidad-Gemanil

Appendix 2. Affirmation regarding public funding

Not applicable for the project activity

Appendix 3. Applicability of methodologies and standardized baselines

Not applicable for the project activity.

Appendix 4. Further background information on ex ante calculation of emission reductions

2015-2017 NATIONAL GRID EMISSION FACTOR (NGEF)

Tables below shows the computed grid emission factor derived using the 2015-2017 power statistics.

Table 1. Summary of the NEG for Luzon-Visayas Grid

a. Simple Operating Margin (OM) Emission Factor

Parameters	(t-CO_2/MWh)
2015-2017 Average $EF_{grid, OMsimple,y}$	0.7122

b. Build Margin (BM) Emission Factor

Parameters	(t-CO_2/MWh)
BM Emission Factor	0.5979

c. Combined Margin (CM) Emission Factor

Parameters	(t-CO_2/MWh)
2015-2017 $EF_{grid, CM,y}$ (Wind and solar)	0.6836
2015-2017 $EF_{grid, CM,y}$ (Other projects)	0.5979

Appendix 5. Further background information on monitoring plan

No further information is discussed here.

Appendix 6. Summary report of comments received from local stakeholders

No further information

Appendix 7. Summary of post-registration changes

There is one approved revision of the registered monitoring plan. The revision to the monitoring plan requested on 12/11/2010 and approved on 21/02/2011, was requested to adopt a formula changing the methodology in establishing the net electrical energy delivered by the project to the grid, based on the change in the metering scheme of the NorthWind Bangui Project as agreed with its off-taker, Ilocos Norte Electric Cooperative, Inc. (“INEC”) in a Memorandum of Agreement dated 10 November 2007. For the details of revision to the monitoring plan, please refer to http://cdm.unfccc.int/Projects/DB/DNV-CUK1149535405.35/view.

Another post registration change, which involved correction from the registered monitoring plan or applied methodology, was requested and approved during the application for issuance of the 5th Monitoring Period. The correction was requested when the ESA between Northwind and INEC became ineffective and the parties agreed to pre-terminate the agreement. The pre-termination resulted for Northwind to deliver bulk of the plant's generation to the Wholesale Electricity Spot Market (WESM), while continuously supplying to INEC's Burgos substation.

For this 6th and final monitoring period under the first crediting period, covering the period from 26 February 2011 to 30 April 2012, a revision of the Monitoring Plan became necessary when the billing meters were transferred from NGCP's Laoag Substation to the project activity's Bangui Substation on 25 February 2011. The transfer was in pursuant to the order of ERC regarding the parties' agreement to pre-terminate the ESA.

Starting on said date, all of the plant's net electrical energy generated is supplied to WESM, meaning all including the supply supposedly for INEC's Burgos substation.
The new metering set-up follows the net metering arrangement with WESM wherein settlement is determined hourly based on the difference in quantity delivered by the project activity to WESM and the quantity purchased by the project activity from WESM, illustrated as follows:

EGy = Net electricity delivered by the project activity to WESM
= Electricity delivered by the project activity to WESM – Electricity received by the project activity from WESM

The revision required a change in the Monitoring Plan, including the sources of data, i.e. which shall now come from both Transco/NGCP and WESM.

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Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.

Version	*Date*	*Description*
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the “CDM project standard for project activities” and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the “CDM project standard for project activities” (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the “Project design document form for small-scale CDM project activities” (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).

Version	*Date*	*Description*
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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