THEPARAK WIND IN THAILAND

Document Prepared By (Kosher Climate India Private Limited)

Contact Information: vamsi@kosherclimate.com

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Prepared By	Kosher Climate India (P) Limited
Contact	#109, 2nd Floor, 27th Main, Sector – 1, HSR Layout, Bangalore-560102, India Mobile: +91- 9945343475 Ph: +91- 80- 25720814 Email: carbon@kosherclimate.com, vamsi2kris@gmail.com

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1 PROJECT DETAILS

1.1 Summary Description of the Project and its Implementation Status

The proposed project activity involves the installation of Wind Turbine Generators (WTG) in Nakhon Ratchasima of Thailand (T1 Wind farm). The project is developed by Theparak Wind Co., Ltd, Thailand. Theparak Wind Co., Ltd is a subsidiary of Wind Energy Holding Co., Ltd.

The purpose of the project activity is to generate clean electricity with utilization of wind energy. The project consists of 30 numbers of GE 137 Wind Turbine Generators (WTGs) of 3.0 MW capacities each. The project WTGs are installed in the Nongwang, Bueng Prue and Samnaktakhro sub-districts of Thepharak District, Nakhonratchasima Province in Thailand.

All the WTGs of the project activity were commissioned on 27/11/2018.

The electricity generated by the project is exported to the Thailand National grid. The project activity will therefore displace an equivalent amount of electricity which would have otherwise been generated by fossil fuel dominant electricity grid. Since wind power is Greenhouse Gas (GHG) emissions free, the power generated will prevent the anthropogenic gas emissions generated by fossil fuel based thermal power stations comprising coal, natural gas, diesel, and bunker oil.

There was no activity at the site prior to implementation of the project activity. Hence the scenario existing prior to the project activity is same as baseline scenario which is continual use of highly carbon intensive electricity in the regional grid.

The estimation of GHG reductions by this project is limited to carbon dioxide (CO2) only. Thus the project activity leads to an emission reduction of 156,167 tCO_2 per year or 1,561,670 tCO2 for the chosen crediting period of 10 years.

The current monitoring period chosen is from 27-November-2018 to 31-October-2019 (inclusive of first & last date) and the GHG emission reductions calculated are 136,087 tCO_2

1.2 Sectoral Scope and Project Type

Sectoral Scope: 01- Energy Industries (Renewable/Non-Renewable Sources)

Project Type: Type I

Methodology:

ACM0002: Grid-connected electricity generation from renewable sources, version 19.0

The project is not a grouped project.

1.3 Project Proponent

Organization name	Theparak Wind Co., Ltd
Contact person	Kelly DALLAS
Title	Director
Address	25th Floor, Capital Tower, All Seasons Place, 87/1, Wireless road, Lumpini, Patumwan, Bangkok 10330, Thailand
Telephone	+66(0) 2106 8000
Email	kelly@windenergyholding.com

1.4 Other Entities Involved in the Project

Organization name	Kosher Climate India Private Limited
Contact person	Vamsi Krishna
Title	Global Business Head
Address	#109, 2nd Floor, 27th Main, HSR Layout, Bangalore- 560102
Telephone	080-25720814
Email	vamsi@kosherclimate.com

1.5 Project Start Date

The start date for this project is 27-November-2018. This is the date of commissioning of the project.

1.6 Project Crediting Period

27-November-2018 to 26-November-2028 will be the 1st crediting period.

The project activity adopts renewable crediting period of 10 years period which can be renewed for maximum 2 times

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

The project annual emission reduction is estimated to be 156,167 tCO_2 which is less than 300,000 tonnes of CO_2e per year. As per the Section 3.9.1 of Project standard the projects falls under the category of 'Projects'.

Project Scale	
Project	√ (Yes)
Large project	--

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	156,167
Year 2	156,167
Year 3	156,167
Year 4	156,167
Year 5	156,167
Year 6	156,167
Year 7	156,167
Year 8	156,167
Year 9	156,167
Year 10	156,167
Total estimated ERs	1,561,670
Total number of crediting years	10
Average annual ERs	156,167

1.8 Description of the Project Activity

The project activity envisages implementation of a 90 MW wind power project consisting of 30 Wind Turbine Generators (WTGs) of individual capacity 3.0 MW.

The electricity generated by the project will be exported to the Thailand National grid. The project activity will therefore displace an equivalent amount of electricity which would have otherwise been generated by fossil fuel dominant electricity grid. The project proponent plans to avail VERs benefits for the project.

The project activity is in line with the sustainable development priorities of the country. The electricity generated from the wind farm will be exported to the Thailand national grid and sold to the EGAT, thereby marginally contributing to reducing the energy demand supply gap in Thailand.

The life time of the Project is 25 years.

Technology

The technology employed, converts wind energy to electrical energy. In wind power generation, energy of wind is converted into mechanical energy and subsequently into electrical energy. The project activity is the installation of an environmentally safe and sound technology since there are no GHG emissions associated with the electricity generation.

The technical specifications of the WTGs have been provided as below

GE 137-3.0 MW

Rated power:	3.0 MW
Rotor diameter	137 m
Number of blades	3
Swept area	14741 m2
Rotational director	Clockwise (viewed from an upward wind location)
Maximum speed of the blade tips	82.1 m/s
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brake	Full feathering
Color of outer components	RAL 7035 (light gray)
Reflection degree/Gloss degree of steel tower	30-60 units measured at 60 degree per ISO2813
Reflection degree/Gloss degree of Rotor blades, nacelle, Hub	60-80 gloss units measured at 60 degree per ISO2813
Reflection degree/Gloss degree of Hybrid tower	15-30 gloss units measured at 60 degree per ISO2813

Emission Reductions from anthropogenic sources:

The wind power generated from the project site will be displacing the electricity generated from thermal power stations feeding into Thailand national grid and will be replacing the usage of fossil fuels for meeting the power demand in the region. Since wind power is Green House Gas (GHG) emissions free, the power generated will prevent the anthropogenic GHG emissions generated by the fossil fuel based thermal power stations comprising coal, natural gas, diesel and furnace oil. The estimation of GHG reductions by this project is limited to carbon dioxide (CO_2) only.

1.9 Project Location

The project activity is located is located in Nakhon Ratchasima province of Thailand. The geo-coordinates of the project location are as follows:

S.No	WTG ID	Latitude N	Longitude E	Sub-District	District
1	T1-001	15.242054	101.460692	Nongwang	Thepharak
2	T1-002	15.246658	101.456607	Nongwang	Thepharak
3	T1-003	15.256905	101.452232	Nongwang	Thepharak
4	T1-005	15.254707	101.455412	Nongwang	Thepharak
5	T1-006	15.258259	101.463981	Nongwang	Thepharak
6	T1-008	15.263423	101.451656	Nongwang	Thepharak
7	T1-009	15.260403	101.452248	Nongwang	Thepharak
8	T1-010	15.266278	101.450251	Nongwang	Thepharak
9	T1-012	15.269408	101.449759	Nongwang	Thepharak
10	T1-014	15.277282	101.452011	Bueng Prue	Thepharak
11	T1-015	15.271481	101.47077	Nongwang	Thepharak
12	T1-016	15.27439	101.466817	Nongwang	Thepharak
13	T1-017	15.280839	101.450052	Bueng Prue	Thepharak
14	T1-020	15.26096	101.463356	Nongwang	Thepharak

15	T1-021	15.29131	101.452738	Bueng Prue	Thepharak
16	T1-022	15.287584	101.454698	Bueng Prue	Thepharak
17	T1-101	15.254172	101.468782	Nongwang	Thepharak
18	T1-102	15.250278	101.454386	Nongwang	Thepharak
19	T1-103	15.283807	101.489087	Bueng Prue	Thepharak
20	T1-104	15.285599	101.485604	Bueng Prue	Thepharak
21	T1-106	15.283887	101.473835	Bueng Prue	Thepharak
22	T1-108	15.305588	101.483107	Bueng Prue	Thepharak
23	T1-109	15.3008	101.484177	Bueng Prue	Thepharak
24	T1-110	15.297277	101.484846	Bueng Prue	Thepharak
25	T1-111	15.300758	101.479076	Bueng Prue	Thepharak
26	T1-112	15.297185	101.502467	Samnaktakhro	Thepharak
27	T1-113	15.293929	101.501811	Bueng Prue	Thepharak
28	T1-114	15.289313	101.50348	Samnaktakhro	Thepharak
29	T1-115	15.283835	101.50148	Samnaktakhro	Thepharak
30	T1-119	15.308079	101.492939	Bueng Prue	Thepharak

1.10 Conditions Prior to Project Initiation

The project is Greenfield project. There was no project installed prior to commissioning of this project. The project activity is set up to produce clean power from the wind energy converters (WEC's) which can be also named as Wind Turbine Generator (WTG). The project activity involves supply, erection, commissioning and operation of 30 machines of rated capacity 3MW each totalling an installed capacity of 90 MW.

The project does not generate any GHG emissions and hence it can be said that the project has not been implemented to generate GHG emissions for the purpose of their subsequent reduction, removal or destruction.

In the absence of the project activity the equivalent amount of electricity sold to grid would have been generated by grid connected power plants (which is predominantly based on fossil fuels) and by the addition of new generation sources..

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The power sector in Thailand is regulated by Energy Industry Act, B.E. 2550 (2007). The Energy Industry Act, 2007, does not restrict the choice of fuel for power generation. Moreover, it does not mandate electricity generation from wind projects, although it promotes the use of renewable sources of energy. Hence, no national or sectoral policies prevent the implementation of either the baseline or the project activity.

The Electricity Generating Authority of Thailand Act, B.E. 2511 (1968) permits the Electricity Generating Authority (EGAT) of Thailand to promulgate regulations in accordance with its objectives, relating primarily to the purchase of electricity from independent producers and the operation of the transmission system network

As per the Electricity Generating Authority of Thailand (EGAT) regulations, the project falls under Small Power Producer (SPP) category as the project capacity is between 10-90 MW. As per the requirements of EGAT the project received all the necessary approvals for development of wind energy project which are listed below:

- License to operate the SPP with EGAT
- Factory license (ror ngor 4)
- Certificate of Building Construction
- Energy Industry Operation, Controlled Energy Production, Electricity Industry Operation License
- Certificate of Electricity Quality

The project complies with all relevant local and national laws & regulations in Thailand.

1.12 Ownership and Other Programs

1.12.1 Project Ownership

Theparak Wind Co., Ltd is the sole owner of project activity, however it have authorised Kosher Climate India Pvt. Ltd to act as the project participant on their behalf. Further the Ownership is demonstrated through the following documents.

- Commissioning certificates for the Wind projects in the name of Theparak Wind Co., Ltd
- Power Purchase Agreement with EAGAT by Theparak Wind Co., Ltd

1.12.2 Emissions Trading Programs and Other Binding Limits

Not Applicable. The project activity has applied for registration under VCS programme only and hence GHG emission reductions and removals generated by the project will not be used for compliance under such programs or mechanisms. Further it is clarified that GHG emissions from Project activity are not included in any other emissions trading program or any other mechanism that includes GHG allowance trading.

1.12.3 Other Forms of Environmental Credit

Not Applicable.

1.12.4 Participation under Other GHG Programs

The project is not seeking registration under any other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

No, the project activity is not rejected by other GHG programs

1.13 Additional Information Relevant to the Project

Eligibility Criteria

Not Applicable.

Leakage Management

Not Applicable.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Sustainable Development

Social wellbeing: The project helps in generating employment opportunities during the construction and operation phases. The project activity leads to development in infrastructure in the region like development of roads and also may promote locals business with improved power generation.

Economic wellbeing: The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits. The project activity will also help to reduce the demand supply gap in Thailand.

Environmental Wellbeing: The project activity will generate power using zero emissions wind based power generation which helps to reduce GHG emissions and specific pollutants like SOx, NOx, and SPM associated with the conventional thermal power generation facilities.

Technological wellbeing: The successful operation of project activity would lead to promotion of wind based power generation and would encourage other entrepreneurs to participate in similar projects.

Further Information

Not applicable as, there are no information that may have a bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

The methodology applied for the project is Approved Large Scale Consolidated Methodology: ACM0002 "Grid-connected electricity generation from renewable sources" (Version 19.0, EB100)[1]

ACM0002 draws upon the following tools which have been used in the PD:

- Methodological Tool: Tool to calculate the emission factor for an electricity system - Version 7.0, EB 100, Annex 6[2].
- Methodological Tool: Tool for the demonstration and assessment of additionality - Version 07.0.0, EB 70 Annex 8[3].

2.2 Applicability of Methodology

The following steps will show the applicability of the project under this methodology.

Applicability Criteria	Applicability status
This methodology is applicable to grid-connected	The proposed project activity is

[1] http://cdm.unfccc.int/methodologies/DB/VJI9AX539D9MLOPXN2AY9UR1N4IYGD

[2] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf/history_view

[3] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

renewable power generation project activities that: (a) install Greenfield power plant; (b) involve a capacity addition to (an) existing plant(s); (c) involve a retrofit of (an) existing plant(s)/unit(s); (d) involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) involve a replacement of (an) existing plant(s)/unit(s)	a Green field, Thailand national grid connected renewable power plant. Therefore, it confirms to the said criteria
The methodology is applicable under the following conditions: 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	The project activity is the installation of a new grid connected renewable wind power project. Thus, it meets the first applicability condition
In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit 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 or 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	The proposed project activity is the installation of new wind power plants/units. Therefore, the said criteria is not applicable
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or (b) The project activity is implemented in an existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3) is greater than 4 W/m2; or (c) The project activity results in new single or multiple reservoirs and the power density calculate equation (3), is greater than 4 W/m2. (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density of any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m2, 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 4W/m2; (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 plant(s) with power density lower than or equal to 4 W/m2shall be: (a) Lower than or equal to 15 MW; and (b) Less than 10% of the total installed capacity of	The proposed project activity is the installation of a new wind power plant/units. Therefore, the said criteria is not applicable

integrated hydro power project	
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 project; 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 indifferent 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.	The proposed project activity is the installation of wind power plant/units. Therefore, the said criteria is not applicable
The methodology is not applicable to: (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;	The proposed project activity is the installation of wind power plant/units. Therefore, the said criteria is not applicable
In the case of retrofits, rehabilitations, replacements, 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".	The proposed project activity is the installation of wind power plant/unit. Therefore, the said criteria is not applicable
In addition, the above applicability conditions of the methodology, the Tool to calculate emission factor of electricity system (version 7) referred in the methodology has been justified here under:	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid(e.g. demand-side energy efficiency projects).	This condition is applicable. OM, BM and CM are estimated using the tool for calculating baseline emissions.
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the	Since the project activity is grid connected, this condition is applicable and the emission

latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	factor has been calculated accordingly.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity is located in Thailand, a non-Annex I country. Therefore, this criterion is not applicable for the project activity
Under this tool, the value applied to the CO_2 emission factor of bio fuels is zero	The project activity is a grid connected wind power project and therefore, this criterion is not applicable for the project activity

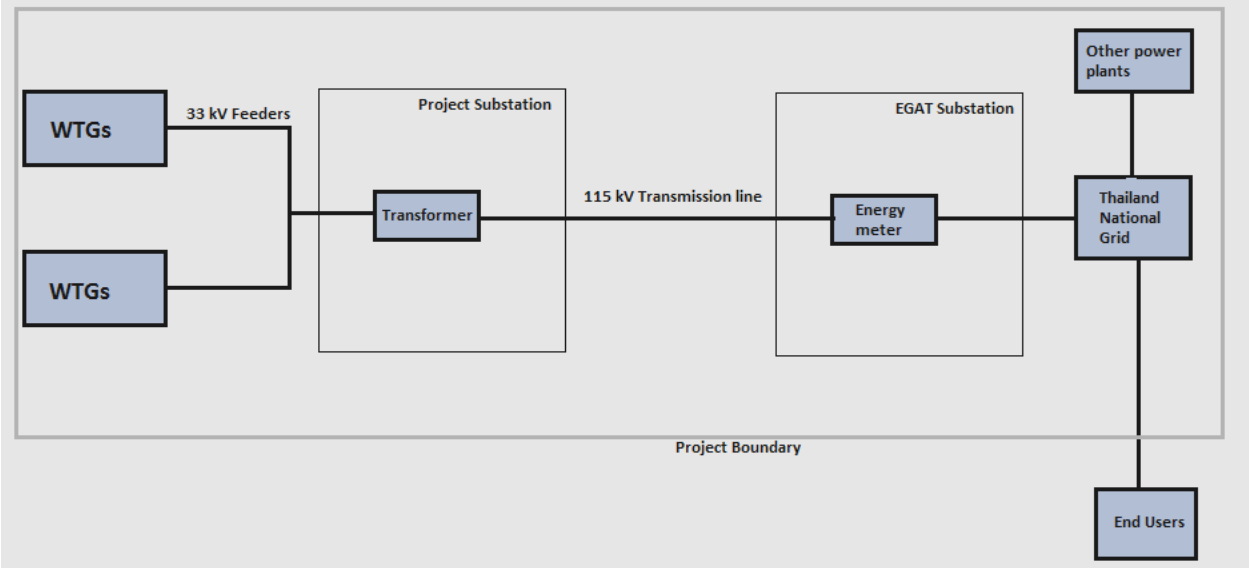
2.3 Project Boundary

As per ACM0002 version 19 - "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".

The project boundary includes the wind project, sub-stations, grid and all power plants connected to grid. The proposed project activity will evacuate power to the Thailand national grid. Therefore, the entire Thailand national grid and all connected power plants have been considered in the project boundary for the proposed VCS project activity.

Source		GHGs	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project	For dry or flash steam geothermal power plants, emissions of CH4 and CO_2 from non condensable gases contained in geothermal steam	CO_2	No	Not Applicable
		CH_4	No	Not Applicable
		N_2O	No	Not Applicable
	For binary geothermal power plants, fugitive emissions of CH4 and CO_2 from non condensable gases contained in geothermal steam	CO_2	No	Not Applicable
		CH_4	No	Not Applicable
		N_2O	No	Not Applicable
	For binary geothermal power plants, fugitive emissions of hydrocarbons such as n-butane and isopentane (working fluid) contained in the heat exchangers	Low GWP hc/ refrige-rant	No	Not Applicable
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	Not Applicable
		CH_4	No	Not Applicable
		N_2O	No	Not Applicable
	For hydro power plants, emissions of CH4 from the reservoir	CO_2	No	Not Applicable
		CH_4	No	Not Applicable
		N_2O	No	Not Applicable

Project Boundary



2.4 Baseline Scenario

ACM0002 also specifies a step-wise approach for identifying the baseline for project activities which involve the retrofit or replacement of existing grid-connected renewable power plant/unit(s) at the project site.

The project activity is a new renewable power plant; therefore the step-wise approach is not applicable. The "Tool for the demonstration and assessment of additionality" requires the consideration of EB guidance on national/local/sectoral policies in the calculation of financial indicators utilised for the assessment of additionality. Para 65 (b) of Project standard,v2, specifies that national policies or regulations that give comparative advantage to less emissions-intensive technologies (E- policies) may be excluded if the national policy or regulation was implemented after 11 November 2001. Wind power projects are eligible to receive an adder tariff in accordance with the National Energy Policy Council (NEPC) policy for 'adder payments' which was approved by the NEPC in the third resolution of its 106th meeting (3/2006) on 4 September 2006. The Thailand adder tariff is specifically for renewable energy projects

As per the approved consolidated Methodology ACM0002 (Version 19.0, EB 100, Annex 6) para 22:

"If the project activity is the installation of a Greenfield power plant, the baseline scenario is 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", Version 7.0, EB 100, Annex 4.

The project activity involved setting up of WTGs to harness the power of wind to produce electricity and supply to the grid. In the absence of the project activity, the equivalent amount of

power would have been supplied to the electricity grid by the operation of grid-connected power plants (mainly by fossil fuel fired plants) and by the addition of new generation sources, as reflected in the combined margin (CM) calculations.

Hence, the baseline for the project activity is the equivalent amount of power from the Thailand National grid.

The combined margin ($EF_{grid,CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publically available.

The combined margin of the Thailand national grid used for the project activity is as follows:

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.5692 tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.75) & build margin (0.25) values, sourced from Report 'Thailand Grid Emission Factor for GHG Reduction Project/Activity' dated 28/09/2017 Published by Thailand Greenhouse Gas Management Organisation (Public Organisation)[4]
$EF_{grid,OM,y}$	0.5719 tCO_2/MWh	Operating margin CO_2emission factor for the project electricity system in year y	Calculated as the last 3 year (2014, 2015 & 2016) generation-weighted average, sourced from Report 'Thailand Grid Emission Factor for GHG Reduction Project/Activity' dated 28/09/2017 Published by Thailand Greenhouse Gas Management Organisation (Public Organisation)
$EF_{grid,BM,y}$	0.5609 tCO_2/MWh	Build margin CO_2emission factor for the project electricity system in year y	Report 'Thailand Grid Emission Factor for GHG Reduction Project/Activity' dated 28/09/2017 Published by Thailand Greenhouse Gas Management Organisation (Public Organisation)

The baseline case is in compliance with all applicable legal and regulatory requirements references.

2.5 Additionality

Additionality is justified based on the Project method:

Step 1: Regulatory Surplus

The power sector in Thailand is regulated by Energy Industry Act, B.E. 2550 (2007). The Energy Industry Act, 2007, does not restrict the choice of fuel for power generation. Moreover, it does not mandate electricity generation from wind projects, although it promotes the use of renewable sources of energy. In Thailand no laws, statutes, regulatory frameworks or policies implemented since 11 November 2001 give comparative advantage to less emissions intensive technologies or activities relative to more emissions-intensive technologies or activities.

[4] http://ghgreduction.tgo.or.th/images/Grid_Emission_Factor_2559_-_Finalised.pdf

Step 2: Implementation of barrier:
The financial barrier is justified as per the step 2 of the Tool for the demonstration and assessment of additionality" v7.0.0. The same is explained below:

Step 2 of Addtionality tool: Investment Analysis
As per para 29 of "Tool for the demonstration and assessment of additionality" v7.0.0, it is determined that the proposed project activity is not an economically attractive or financially feasible option.
To conduct the investment analysis, Methodological tool: Investment analysis, version 8.0, EB 97 Annex 8 has been referred.

Sub-step 2a: Determine appropriate analysis method
As per "Tool for the demonstration and assessment of additionality" (version 07.0.0), for financial analysis of the project, the following three options are available:

Option I: Simple Cost Analysis
Option II: Investment Comparison Analysis
Option III: Benchmark Analysis

The project will generate revenues from sale of electricity, therefore Option I is not applicable in line with para 32 of the Methodological tool: "Tool for the demonstration and assessment of additionality", version 7.0. Same applies to the Option II which is applied in case there are alternatives to the project activity as per para 42 of the "Tool for the demonstration and assessment of additionality", version 7.0.

Since, identified baseline for the proposed project activity is continuation of current practice (i.e. equivalent amount of energy would be generated by grid electricity system through its currently operating power plants and by new capacity addition) and which is outside the direct control of the project participant, hence benchmark analysis (option III), where the returns on investment in the project activity are compared to benchmark returns that are available to any investors in the country is selected as the most appropriate method.

Sub-step 2b: Option III. Apply benchmark analysis
As per Para 15 of Tool 27: Investment analysis, version 9 states that Required/expected returns on equity are appropriate benchmarks for equity IRR. The project participant has chosen benchmark analysis to demonstrate the additionality of the project. The project is promoted by limited company and hence the return on equity and the risks associated with the investments for their shareholder is of primary concern. Hence, in order to analyse the financial viability of the project activity, the prime financial indicator that has been used is the post-tax equity IRR of the project activity.

Selection of Appropriate Benchmark
The benchmark has been considered in accordance with Guidance 17 and 18 of Tool 57, version 9, "The values in the table in the Appendix may also be used, as a simple default option".

Methodology deployed for arriving at a suitable value of Benchmark using Default Value has been described below:

- As the proposed project activity generates power utilizing wind energy, Group 1 as per para 5a of Appendix of Tool 27, version 9 has been identified as a suitable category.
-
- The investment analysis has been carried out in Nominal terms. Accordingly, Default value as given in table under the Appendix, Tool 27 has been adjusted by adding suitable forecasted

inflation rate taken from IMF world Economic database as no inflation forecast or inflation target published by Bank of Thailand (Central Bank of Thailand).

- Average forecasted inflation rate for the host country (Thailand) published by the IMF (International Monetary Fund World Economic Outlook- April 2016) for the next five years has been considered

The benchmark has been computed in the following manner:

Default Value Benchmark:

The cost of equity is determined by selecting the values provided in the table of the Appendix, i.e. Default values for cost of equity (expected return on equity) in the 'Methodological tool: Investment analysis'.

The Required return on equity (benchmark) was computed in the following manner:

Nominal Benchmark[5] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where:
Default value for Real Benchmark = 9.44% (as per Tool 27)
Inflation Rate forecast for by IMF.

Benchmark estimation:
The Cost of Equity has been considered using the "Methodological tool: Investment analysis" available at the time of decision making as well as the latest available value.
Table under Appendix in EB97, Annex 8 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in Thailand = **9.44%**[6]

5 year inflation Forecast for Thailand as IMF World Economic Outlook[7] available at the time of investment decision and corresponding benchmark values is 2.5%

Hence,
Nominal Benchmark = {(1+9.44%)*(1+2.5%)}-1 = 12.18%

Sub-step 2c: Calculation and comparison of financial indicators
The period considered for Post Tax Equity IRR calculations is 25 years, which corresponds to the operational lifetime of the project activity.

Depreciation, and other non-cash items related to the project activity, which have been deducted in estimating gross profits on which tax is calculated, is added back to net profits for the purpose of calculating the financial indicator.

Post Tax Equity IRR for the project activities against the benchmark values are shown in table below. Thus, it is evident that the project is not financially attractive as the equity IRR is less below the benchmark value.

[5] As per Pg. 320 of Corporate Finance, Second Edition of Aswath Damodaran

[6] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v7.0.pdf

[7] https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx (Historical WEO Forecasts Database)

https://www.imf.org/external/pubs/ft/weo/2016/01/

Post tax Equity IRR	7.188%
Benchmark Value	12.18%

Sensitivity Analysis
The robustness of the conclusion drawn above, namely that the project is not financially attractive, has been tested by subjecting critical assumptions to reasonable variation. As required by Annex 08 of EB 97, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation. PP has identified the total revenue from the project activity is dependent on the Tariff, Plant Load Factor, Project Cost and O&M Costs constitute more than 20% of the project costs. These factors have been subjected to a 10% variation on either side and the results of the sensitivity analysis indicate that even after applying such variation the EIRR does not cross the benchmark.

Factors	-10%	Normal	10%	% Variation to reach benchmark	Value required to reach benchmark
Tariff	5.14%	7.88%	10.55%	16.20%	5.130 BHT/kWh (peak) & 2.738 BHT/kWH (non-peak)
PLF	5.30%	7.88%	10.39%	17.22%	40.79%
Project Cost	10.04%	7.88%	6.12%	-18.00%	5478.28 Mn BHT
O&M Cost	8.47%	7.88%	7.27%	-80.00%	29.268 Mn BHT

The sensitivity analysis proves that varying the parameters does not lead to a Post Tax Equity IRR without carbon credits revenue, which will cross the benchmark value.

The carbon revenue from the project activity would provide significant amount of returns from the sale of the Emission Reductions accrued from the project activity and in turn increase the financial attractiveness of the project activity and hence make the project activity more financially viable.

Step 3: Barrier analysis
Barrier analysis has not been used.

Step 4 – Common Practice Analysis

As per paragraph 10 of tool for “Common Practice” the project is a measure (b) where a switch of technology with a change of energy source. Therefore the steps outlined in Section 5 of the tool are outlined below, and the full spreadsheet with the Common Practice analysis is provided to the DOE:

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity:
The project output is electricity generated for the Thailand grid. In accordance with step 1 of section 5, the total design capacity is equal to 90 MW. Therefore +/-50% of the design capacity range is 45 MW - 135 MW.

Step 2: Identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

a) As the project is located in Thailand, therefore, the applicable geographical area is Thailand and projects in the host country India have been chosen for analysis.
b) The projects applying same measure (i.e, only renewable energy through wind) are selected as the proposed project activity is wind power project.
Therefore, all projects applying same measure (b) as the proposed project activity are candidates for similar projects.
c) The energy source used by the project activity is wind. Hence, only wind energy projects have been considered for analysis.
d) The project activity produces electricity; therefore, all power plants that produce electricity are candidates for similar projects.
e) The capacity range of the projects is within the applicable capacity range for the chosen projects (45 MW to 135 MW)
f) The decision making date for is on 25th October 2016. As Kyoto Protocol was ratified by India on 26/08/2002 [8], therefore projects which had started commercial operation between 26/08/2002 to project's start date, have been identified.

Numbers of similar projects identified, which fulfil above-mentioned conditions are**:**
N_{wind} = 5[9]

The list of projects is given below:

No	Project Name	Capacity
1	First Korat Wind Co.,Ltd	90 MW
2	K.R.TWO Co.,Ltd.	90 MW
3	KaoKhor Win Power Co.,Ltd.	60 MW
4	WaTaBak Win Co.,Ltd	60 MW
5	PattaPalunglom Co.,Ltd.	50 MW

Step (3): *within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.*

CDM project activities, which have got registered, submitted for registration or are under validation have been excluded in this step. The list of the power plants identified is provided to the DOE.

No	Project Name	Capacity	CDM Registration No
1	First Korat Wind Co.,Ltd	90 MW	7650
2	K.R.TWO Co.,Ltd.	90 MW	7474
3	KaoKhor Win Power Co.,Ltd.	60 MW	5530
4	WaTaBak Win Co.,Ltd	60 MW	-
5	PattaPalunglom Co.,Ltd.	50 MW	

[8] http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php

[9] https://www.egat.co.th/en/images/statistics/2559/eng-private-power-plant-1259.pdf

After excluding the registered, submitted for registration and under validation projects the total number of projects,

$\mathbf{N_{all}}$ = 2

Step (4): *within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number* N_{diff}.

From the projects identified above, those projects which employ "**different technologies**" have been excluded and the number of such projects has been identified as N_{diff}.

All the Nall wind power projects use the same wind technology. Hence,

$\mathbf{N_{diff}}$ = 0

Step (5): *calculate factor* $F=1-N_{diff}/N_{all}$ *representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.*

Calculate $\mathbf{F = 1-N_{diff}/N_{all}}$
$\mathbf{F}$ = 1-(0/2) = **1**
$\mathbf{N_{all} - N_{diff}}$ = 2 - 0 = 2

Outcome of Step 5:

As,

i. **F =1; is greater than 0.2**
ii. $\mathbf{N_{all}-N_{diff}}$ **= 2; is not more than 3**

Since, $\mathbf{N_{all}-N_{diff}}$ ***is less than 3, the project is "not a common practice" within a sector in the applicable geographical area.***

Chronology:
The below table represents the chronology of the project activity:

Events related to project implementation	VCS relevant events	Date
Completion of DPR/PIM		18/10/2016
Board decision for investment & securing carbon credits	Investment decision	25/10/2016
Placement of the Purchase Orders	Projects' construction Start	31/12/2016
Commissioning of Project	Start Date	27/11/2018
VCS Compliance	Engaging VCS Consultant	10/08/2019
VCS Compliance	Stakeholder' Meeting	02/09/2019

From the above chronology it is evident that the project proponent has seriously considered the carbon revenue since investment decision and has taken necessary steps to secure carbon benefits in parallel with the implementation of the project activity.

Conclusion:
As described above, the project fulfils all necessary requirements of additionality specified in the 'Tool for the demonstration and assessment of additionality' v7.0.0. Hence, the project is additional.

2.6 Methodology Deviations

There is no methodology deviation.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

The baseline emission is calculated in line with para 42 of ACM0002, Version 19.0, using equation below

$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$

Where,

BE_y = Baseline emissions in year y (t CO_2/yr)
$EG_{PJ,y}$= 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/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" (t CO_2/MWh)

AS per para 44 of ACM0002, version 19.0, when the project activity is installation of Greenfield power plant, then:

$EG_{PJ,y} = EG_{facility,\ y}$

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/yr)

$EG_{facility,\ y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

The $EG_{facility,\ y}$ is estimated from the PLF provided as per the third party engineering company report as below:

Project	**$EG_{facility,\ y}$ (MWh)**
T1	274,363

The methodology follows the latest version of "tool to calculate the emission factor of an electricity system" provides following approaches for emission factor calculations:

(a) Combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology "Tool to calculate the emission factor for an electricity system". OR

(b) The weighted average emissions (in t CO2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Option (a) has been considered to calculate the grid emission factor as per the 'Tool to calculate the emission factor for an electricity system' since data is available from an official source.

Thailand Grid Emission Factor for GHG Reduction Project/Activity dated 28/09/2017 Published by Thailand Greenhouse Gas Management Organisation (Public Organisation)[10] has been used for the calculation of emission factor.

As per the "Tool to calculate the emission factor for an electricity system" Version 07.0, the following steps have been followed.

STEP 1: Identify the relevant electricity systems;

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

STEP 3: Select a method to determine the operating margin (OM);
STEP 4: Calculate the operating margin emission factor according to the selected method;
STEP 5: Calculate the build margin (BM) emission factor;
STEP 6: Calculate the combined margin (CM) emission factor.

STEP 1: Identify the relevant electricity systems
For the purpose of determining the electricity emission factor, the project electricity system is defined as the electricity transmission system of Thailand which is a single system connected by transmission lines throughout the country[11] and owned by the Electricity Generating Authority of Thailand (EGAT). Electricity imports from a connected electricity system are included and as per Tool to calculate emission factor of an electricity system, for the purpose of determining the operating margin emission factor, 0 tCO_2/MWh is applied.

STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional_:
Only grid connected power plants are included in the calculation, as per Option I of the "Tool to calculate the emission factor for an electricity system" version 07.0.0

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

[10] http://ghgreduction.tgo.or.th/images/Grid_Emission_Factor_2559_-_Finalised.pdf

[11] The study of emission factor for an electricity system in Thailand 2009, DNA of Thailand, page 2

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:
1) Simple OM
2) Simple adjusted OM
3) Dispatch data analysis OM
4) Average OM

The simple OM method (Option a) is used for this study as the low-cost/must-run resources (LC/MR) constitute less than 50% of total electricity production. The share of low-cost/must run power plants in the last two years are in the range of 4.55% to 6.69 as shown in the below table.

ปี พ.ศ.	การผลิตพลังงานไฟฟ้ารวม (GWh)	LC/MR Analysis			
		Hydro	RE	Total LC/MR	% of LC/MR
2555	166,446	8,431	2,701	11,132	**6.69**
2556	164,826	5,412	3,427	8,839	**5.36**
2557	168,685	5,164	3,993	9,157	**5.43**
2558	169,040	3,724	4,230	7,954	**4.71**
2559	169,168	3,019	4,685	7,704	**4.55**

Source: EGAT(2017)

As per tool to calculate emission factor for an electricity system (Version 07), The simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. Since the low cost/must run resources constitute less than 50% of total grid generation as seen from the average of five most recent years, the Simple OM method can be used to calculate the Operating Margin Emission factor.

PP has chosen ex ante option, thus, no monitoring and recalculation of the emissions factor during the crediting period is required. PP has considered a data vintage of 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units.

The simple OM may be calculated:

Option A: Based on the net electricity generation and a CO2 emission factor of each power unit; or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Thailand Greenhouse Gas Management Organisation (Public Organisation) has published the Thailand Grid Emission Factor for GHG Reduction Project/Activity on 28/09/2017 based on detailed authenticated information obtained from EGAT. This provides information about the Combined Margin Emission Factor of Thailand national grid. The Combined Margin is calculated ex ante using the guidelines provided by the UNFCCC in the "Tool to calculate the emission factor for an electricity system, Version 07". We have, therefore, used the Combined Margin data published in the Grid Emission Factor for GHG Reduction Project/Activity, for calculating the Baseline Emission Factor.

As per "Tool to calculate the emission factor for an electricity system", Option B ("Calculation based on total fuel consumption and electricity generation of the system") is used to calculate simple OM emission factor. Where Option B is used, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including lowcost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

Where:

$EF_{grid,OMsimple,y}$ Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ - Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

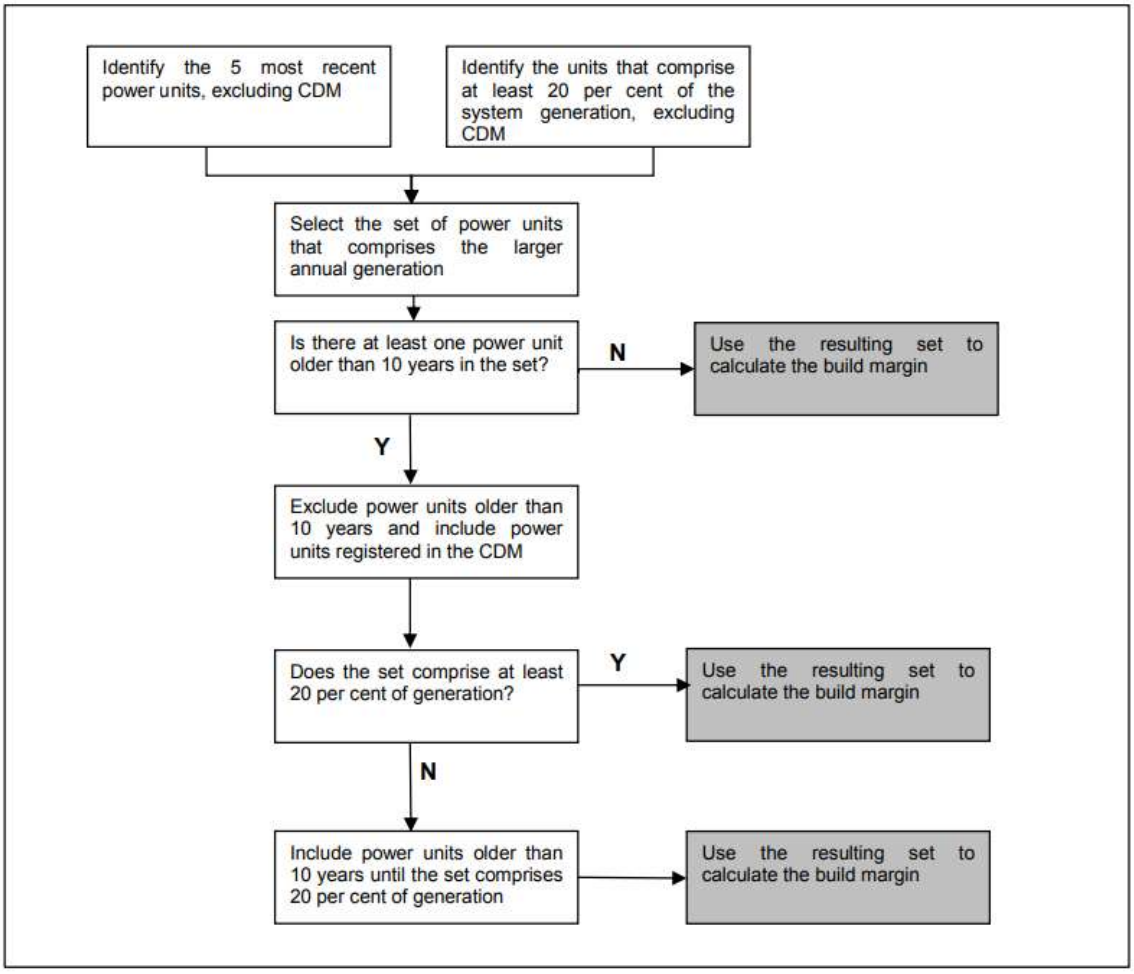
$FC_{i,y}$ - Amount of fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$ - Net calorific value (energy content) of fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$ - CO2 emission factor of fuel type i in year y ($t\ CO_2/GJ$)
EG_y - Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
i - All fuel types combusted in power sources in the project electricity system in year y
y- the relevant year as per the data vintage chosen in STEP 3

As per the Thailand emission factor database published on 28th September 2017 weighted average operating margin is as below:
$EF_{OM,y}$ = 0.5719 tCO_2/MWh

STEP 5: Calculate the build margin (BM) emission factor, $EF'_{grid',BM,y}$

The project participants have chosen Option I, i.e. fixing build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM PDD submission to the DOE for validation. The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of a sample group of power units, during the most recent year y for

which power generation data is available. The Sample group of power units m used to calculate the build margin should be determined via the procedure summarised in the diagram of the Tool



Following this procedure, AEGSET >/20% is larger than AEGSET 5-units and all of these power units started supplying electricity to the grid less than 10 years ago, therefore AEGSET >/20% is applied as power units m for the Build Margin

Using the equation given in the step 5 for the OM calculation, the Built margin is calculated for the year 2016 is as below:

$\mathbf{EF}_{\mathbf{BM,y}} = 0.5609\ tCO_2/MWh$

Step 6: Calculate the combined margin (CM) emissions factor

The combined margin is the weighted average of the simple operating Margin and the build margin. In particular, for intermittent and non-dispatchable generation types such as wind and solar photovoltaic, the 'Tool to calculate the emission factor for an electricity system (Version 07.0.0)', allows to weigh the operating margin and Build margin at 75% and 25%, respectively

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

$$= (EF_{OM,y} \times 75\%) + (EF_{BM,y} \times 25\%)$$

Electronic spreadsheet showing calculation of all these parameters is being submitted separately and the final values are presented below:

Parameter	Value	Units
Operating Margin : $EF_{OM,y}$	0.5719	tCO_2e/MWh
Build Margin : $EF_{BM,y}$	0.5609	
Combined Margin : $EF_{Thailand,grid,y}$	=0.5719*75%+0.5609*25%	
Combined Margin : $EF_{Thailand,grid,y}$	0.5692	

As per above, the combined margin grid emission factor ($EF_{grid,CM,y}$) 0.5692 tCO_2/MWh

Hence the annual baseline emission is calculated as below:

$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$ = 274,363 MWh **x** 0.5692 tCO_2/MWh = **156,167 tCO_2**

3.2 Project Emissions

The project activity involves in harnessing wind power. As per the approved consolidated Methodology ACM0002 (Version 19.0, EB 100, Annex 6) para 34:

"For most renewable energy power generation project activities, PE_y = 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:

$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$ *Equation (1)*

Where;	
PE_y	*Project emissions in year y (t CO_2e/yr)*
$PE_{FF,y}$	*Project emissions from fossil fuel consumption in year y (t CO_2/yr)*
$PE_{GP,y}$	*Project emissions from the operation of dry, flash steam or binary geothermal power plants in year y (t CO_2e/yr)*
$PE_{HP,y}$	*Project emissions from water reservoirs of hydro power plants in year y (t CO_2e/yr)"*

As the project activity is the installation of a new grid-connected Wind power plant/ unit and does not involve any project emissions from fossil fuel, operation of dry, flash steam or binary geothermal power plants, and from water reservoirs of hydro power plants. Therefore $PE_{FF,y}$, $PE_{GP,y}$, $PE_{HP,y}$ are equal to zero and thus, PE_y = 0.

So the emissions from the project are zero.

3.3 Leakage

As per applied methodology no source of leakage emissions identified under proposed project activity.

Hence, LE_y= 0

3.4 Estimated Net GHG Emission Reductions and Removals

Emission reduction (ER_y):

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plant by renewable electricity. The emission reduction ER_y by the project activity during a given year y is the difference between Baseline emission and Project emission & Leakage emission. As er the applied methodology, leakage emissions are excluded for wind projects and hence the same is not used. The emission reduction is calculated in line with para 57 of ACM0002, Version 19, using equation below:

$ER_y = BE_y - PE_y$
Where,
ER_y = Emission Reduction in tCO_2/year
BE_y = Baseline emission in tCO_2/year
PE_y = Project emissions in tCO_2/year

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 1	156,167	0	0	156,167
Year 2	156,167	0	0	156,167
Year 3	156,167	0	0	156,167
Year 4	156,167	0	0	156,167
Year 5	156,167	0	0	156,167
Year 6	156,167	0	0	156,167
Year 7	156,167	0	0	156,167
Year 8	156,167	0	0	156,167
Year 9	156,167	0	0	156,167
Year 10	156,167	0	0	156,167
Total	1,561,670	0	0	1,561,670

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{OM, y}$
Data unit	tCO_2/MWh
Description	Operating margin CO_2 emission factor of Thailand National Grid
Source of data	Report 'Thailand Grid Emission Factor for GHG Reduction Project/Activity' dated 28/09/2017 Published by Thailand

	Greenhouse Gas Management Organisation (Public Organisation)
Value applied:	0. 5719
Justification of choice of data or description of measurement methods and procedures applied	Calculated in Report 'Thailand Grid Emission Factor for GHG Reduction Project/Activity' dated 28/09/2017 Published by Thailand Greenhouse Gas Management Organisation (Public Organisation) in line with "*Tool to calculate the emission factor for an electricity system*". The value used is calculated ex-ante as generation based weighted average of last three years of the operating margin provided in the Thailand Grid Emission Factor for GHG Reduction Project/Activity' Weighted average = $\sum_{i=1 \text{ to } n}$ (Net generation in operating margin in year i * Simple operating margin in year i)/$\sum_{i=1 \text{ to } n}$ (Net generation in operating margin of year i)
Purpose of Data	Baseline Emission calculation
Comments	The operating margin emission factor is a 3-year generation-weighted average (2014, 2015 & 2016). The operating Margin is calculated ex ante and fixed during the crediting period

Data / Parameter	$EF_{BM,y}$
Data unit	tCO_2/MWh
Description	Build margin CO2 emission factor of Thailand National grid
Source of data	Report 'Thailand Grid Emission Factor for GHG Reduction Project/Activity' dated 28/09/2017 Published by Thailand Greenhouse Gas Management Organisation (Public Organisation)
Value applied:	0.5609
Justification of choice of data or description of measurement methods and procedures applied	Calculated in Report 'Thailand Grid Emission Factor for GHG Reduction Project/Activity' dated 28/09/2017 Published by Thailand Greenhouse Gas Management Organisation (Public Organisation) in line with "*Tool to calculate the emission factor for an electricity system*".
Purpose of Data	Baseline Emission calculation
Comments	The Build Margin would be calculated ex ante and fixed during the crediting period. For ex ante calculation the most recent data (2016) available has been used and the build margin is thus calculated.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined margin CO2 emission factor of Thailand National grid

Source of data	Report 'Thailand Grid Emission Factor for GHG Reduction Project/Activity' dated 28/09/2017 Published by Thailand Greenhouse Gas Management Organisation (Public Organisation)
Value applied:	0.5692
Justification of choice of data or description of measurement methods and procedures applied	The date has been considered in accordance to the Tool to calculate emission factor of an electricity system. The tool guides to take 75% weightage of $EF_{grid,OMsimple,}$ & 25% weightage of $EF_{grid,BM,y}$.
Purpose of Data	Baseline Emission calculation
Comments	The combined margin would be calculated ex-ante and fixed for the entire crediting period and the combined margin thus calculated is 0.5692.

4.2 Data and Parameters Monitored

Data / Parameter	$\mathbf{EG}_{facility,y}$[12]
Data unit	MWh/year
Description	Quantity of net electricity supplied by the project activity to the grid in the year y
Source of data	Monthly Energy meter reading
Description of measurement methods and procedures to be applied	Data Type: Measured & Calculated. Monitoring equipment: Energy meters of accuracy class 0.2s Archiving Policy: Paper & Electronic. Location of Energy Meter: EGAT Substation These meters are two-way meter through which export and import data will be continuously monitored. These data will be printed and recorded on a monthly basis. Additionally, two back up meters also installed. The Net electricity supplied to the grid by each wind project is estimated as below Net electricity = Export – Import
Frequency of monitoring/recording	Measurement: Continuous Recording: Monthly
Value applied:	274,363 (estimation)
Monitoring equipment	Energy meters of accuracy class 0.2s
QA/QC procedures to be applied	The export reading shall be crosschecked with the Invoice raised by the developer to EGAT The import reading shall be crosschecked with the invoice raised

[12] If the project activity is the installation of a Greenfield power plant, then: $EGPJ,y = EGfacility,y$

<table>
<tr><td></td><td>by EGAT to developer.

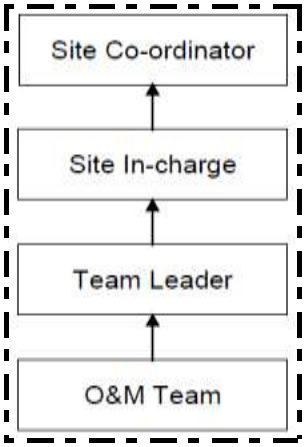
The meter(s) shall be calibrated and maintained by the EGAT as per their own schedule, and this frequency of meter calibration is not within the control of the Project Proponent.
Meter & Calibration Details:
<table><tr><th>Details</th><th>Line-1</th></tr><tr><td>Meter Number</td><td>Main:151515191
backup: 151515192</td></tr><tr><td>Accuracy</td><td>0.2s</td></tr><tr><td>Location</td><td>Si Khiu 3 Substation (EGAT)</td></tr><tr><td>Calibration Frequency</td><td>1 year</td></tr></table></td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Calculation method</td><td>-.</td></tr>
<tr><td>Comments</td><td>The data would be archived electronically and maintained for the entire crediting period plus two years.</td></tr>
</table>

4.3 Monitoring Plan

All the three wind projects in the bundle have entered into agreement with the respective WTG Suppliers for the operation and maintenance of WTGs. And the solar project has entered into agreement with the O&M contractor for the operation and maintenance of the project. O&M contractor will provide a monthly report, which includes generation data, major breakdown events and machine availability. Project manager is responsible for recording of monthly meter readings of export and import. Monthly power export and import data will be sent regularly to site in charge of each project separately.

Monitoring roles and responsibilities:

The data for the project is compiled by the O&M Contractor and subsequently stored by the PP, the reporting and data flows as per the below mentioned flow chart starting from Site O&M team which monitors day to day operational data and monthly recording. The reporting responsibilities for the project are described as below;



The Site In-charge will be responsible for carrying out internal auditing and QA/QC. All the values from generation record will be checked with JMR and invoices for consistency. In case there are any non-conformances identified. The Site In-charge will investigate the error and revise the record to correct it. In any case where values have slightest of variation in different records the most conservative value will be taken in the project monitoring report.

Personal Training:
The training for operating and maintaining the plant will be provided to the O&M team whenever there would be necessity or any technological up gradation.

Emergency preparedness:

In case Main meter or Check meter is found to be outside the acceptable limits of accuracy or faulty or not functioning properly, it will be repaired, recalibrated or replaced as soon as possible. In the event that the Main meter is not in service as a result of maintenance, repairs or testing, the Check meter will be used for readings

Data recording & archiving: The project proponent shall maintain data both in electronic form and hard copies. The monitored data shall be archived till 2 years after the completion of crediting period.

Monitoring Process at project site

Developer will monitor the quantity of electricity exported to the grid and imported to the project activity using the electricity meters installed in the solar power plant, which undertaken by EGAT. Both electricity meters will measure the amount of electricity continuously and record electronically. The O&M operator also manually record amount of the electricity import and export meter to the grid from meters in the log book monthly. The monitoring reports will be checked and discussed periodically.

All monitored data will be stored for at least two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Oversight and accountability:
The possibility of oversight is unlikely as the energy meter readings are recorded jointly by PP and EGAT which is the basis for the electricity billings. Also a backup meter is available to crosscheck any considerable difference in the energy reading.

Internal auditing and QA/QC
No requirement of internal audit for the data monitored as the data is measured by the energy meter installed by EGAT (government authority) and the reading is recorded every month by jointly by PP & representative from EGAT. The main energy meter readings are verified against the reading of the backup meter to check any considerable variation. In case, considerable variation found, then either main meter reading or check meter reading whichever lower will be considered. The electricity readings recorded are used for electricity invoicing to EGAT. Hence, the data collected is of high accuracy and authorised by EGAT.

Handling Non-conformities
Not applicable as the energy meter recording is done my EGAT and hence no internal audit will be carried out to verify the data.

Sampling approaches:
No sampling approach is used as all the monitoring parameter is monitored 100%.

5 SAFEGUARDS

5.1 No Net Harm

There were no harm identified form the project and hence no mitigations measures are applicable.

5.2 Environmental Impact

According to the announcement by Ministry of Natural resource and Environment dated 16 June 2009, the EIA report is required only for the thermal based electricity generation projects whose capacity is more than 10 MW. Since the project is a wind power project, it is not required to conduct EIA for this project.

5.3 Local Stakeholder Consultation

PP decided the date and venue for local stakeholder consultation and informed local stakeholder regarding the meeting. The followings are the local stakeholders for the project activity:

- Local community
- Local village administration
- Technology suppliers
- Local vendors
- Local NGOs

The stakeholder meeting took place at the site office on 2nd September 2019. Invitation notices were put up in the local government offices at least a week in advance of the consultations. In the introductory speech, the representatives of developer welcomed the gathering and informed the stakeholders about the project activity; project's associated benefits with respect to CO_2 emission reductions and explained the purpose of conducting the stakeholder meeting in order to gather the views and comments of the local stakeholders on the project activity. Subsequent to the introductory speech, comments were received from the stakeholders.

No negative feedback was received from any of the stakeholders. All of them supported the initiative and appreciated the project proponent for carrying out such an activity in the region. Hence no comments warranting action from the project proponent were received.

5.4 Public Comments

Comments: The project received positive comments from stakeholders; comments received from the stakeholders have been summarized below:

- The presence of the project has also ensured employment opportunities and infrastructure development in the project region.

- The project does not require any displacement of local population.

Consideration of Comments: The stakeholders expressed their views and welcomed the project activity. They also conveyed their best wishes to the success of the project activity. Since there were no negative comments received from the stakeholders, therefore, it was not necessary to take due account of any comments.

Also the draft PD is webhosted in the VCS project database and it was open for public comment from 15 November – 15 December 2019. However, no public comments received during this period.

6 ACHIEVED GHG EMISSION REDUCTION AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Calculated (based on the measured values of electricity exported and imported)
Value applied:	239,086.2
Comments	Net electricity supplied to the grid by the project activity is calculated from the export & import value that are sourced from monthly energy meter readings and cross checked with invoices. The calibration details of the energy meters are given below:

Details	Calibration dates	Calibration due date
Main Meter Mt No: 151515191	23/02/2018	23/02/2019
	22/02/2019	22/02/2020
Backup meter Mr. No: 151515192	23/02/2018	23/02/2019
	22/02/2019	22/02/2020

6.2 Baseline Emissions

As per description earlier under this document:

$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$

$EF_{grid,CM,y}$ is Combined margin CO2 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" (tCO2/MWh) (i.e, 0.5692 tCO2/MWh).
and;

$EG_{PJ,y} = EG_{facility,y}$

Here,

BE_y = 239,086.2 MWh * 0.5692 tCO_2/MWh

Net Electricity Project wise:

Net electricity supplied to grid (kWh)			
Month	**Import**	**Export**	**Net Export**
Nov-18	825,570	-	825,570
Dec-18	8,216,420	154,800	8,061,620
Jan-19	27,212,480	18,000	27,194,480
Feb-19	13,638,970	16,800	13,622,170
Mar-19	19,865,840	13,200	19,852,640
Apr-19	15,348,250	42,000	15,306,250
May-19	15,213,040	50,400	15,162,640
Jun-19	24,758,810	21,600	24,737,210
Jul-19	33,678,280	2,400	33,675,880
Aug-19	37,688,690	-	37,688,690
Sep-19	22,619,040	-	22,619,040
Oct-19	20,340,020	-	20,340,020
Total	**239,405,410**	**319,200**	**239,086,210**

Calculations of baseline emissions:

Year	**Net Electricity (MWh)**	**Grid Emission Factor** tCO_2/MWh	**Baseline Emissions (tCO_2)** $EG_{PJ,y}$ (MWh) x $EF_{grid,CM,y}$ (tCO_2/MWh)
2018	8887.2	0.5692	5,058
2019	230,199.0	0.5692	131,029
Total	239,086.2	0.5692	**136,087**

6.3 Project Emissions

The project activity involves in harnessing wind power. So, the emissions from the project are zero.

6.4 Leakage

No leakage emissions have been considered and hence the leakage emission is zero.

6.5 Net GHG Emission Reductions and Removals

As per the applied methodology, emission reductions are calculated as follows:
$ER_y = BE_y - PE_y$

Where,
ER_y = Emission Reduction in tCO_2e/year
BE_y = Baseline emission in tCO_2/year

PE_y = Project emissions in tCO_2e/year

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year 2018	5,058	0	0	5,058
Year 2019	133,846	0	0	133,846
Total	**136,087**	0	0	**136,087**

Comparison of Estimated ER and actual:

Description	Value	Unit
Estimated emission Reduction as per PDD	156,167	tCO_2e/year
Total days in the Monitoring period	339	days
Estimated ERs for this monitoring period	145,043	tCO_2e
Actual Emission Reduction	136,087	tCO_2e
Difference in Emission reduction	-6.17%	

The actual emission reduction is 6.17% is less than the estimated emission reduction. Hence no justification is required.