Project design document form for CDM project activities

(Version 07.0)

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	InfraVest Taiwan Wind Farms Bundled Project 2012
Version number of the PDD	2.0
Completion date of the PDD	27/05/2016
Project participant(s)	South Pole Carbon Asset Management Ltd. (private entity) Infra Vest Co., Ltd. (private entity)
Host Party	Taiwan
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	ACM0002: Grid-connected electricity generation from renewable sources --- Version 17.0
Sectoral scope(s) linked to the applied methodology(ies)	Sectoral Scope 1: Energy industries (Renewable source)
Estimated amount of annual average GHG emission reductions	126,120 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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InfraVest Taiwan Wind Farms Bundled Project 2012 is constructed and operated by InfraVest Wind Group. The project in total comprises 34 wind turbines, each having a capacity up to 2.3 MW. The total installed capacity of the proposed project is 78.2 MW. At full capacity, the output of the project is expected to be 187,680 MWh/ year, which is to be delivered to the state-owned power grid, Taipower Grid (TPG), displacing part of the electricity supplied by the power grid currently dominated by fossil fuel-fired power plants. Accordingly, the project will lead to carbon dioxide emission reduction. The annual emission reductions are estimated as about 126,120 tCO_2e/year. The proposed activity is not a CPA project.

The scenario prior to the start of implementation of the project activity is provision of the equivalent amount of electricity generated by the power plants connected with the grid, which is dominated by thermal power plants, thus leads to mass of GHG emissions. The baseline scenario is the same as the scenario prior to the start of implementation of the project activity.

InfraVest Taiwan Wind Farms Bundled Project 2012 is a bundle project:

1. Chubei Wind Farm Project: a 11.5 MW onshore wind farm in Chubei township, Hsinchu County, which comprises 5 wind turbines. The annual electricity generated is 27,600 MWh with emission reductions of 18,547 t CO2e/year.

2. Zhaowei Wind Farm Project: a 13.8 MW onshore wind farm in Tongxiao Township, Miaoli County, which comprises 6 wind turbines. The annual electricity generated is 33,120 MWh with emission reductions of 22,257 t CO2e/year.

3. Tongyuan Wind Farm Project: a 27.6 MW onshore wind farm located in Tongxiao & Yuanli Township, Miaoli County, comprised 12 wind turbines. The annual electricity generated is 66,240 MWh with emission reductions of 44,513 t CO2e/year.

4. Taichung III Wind Farm Project: 5 wind turbines with total capacity of 11.5 MW in Da-an Township and Da-jia Township, Taichung County. The annual electricity generated is 27,600 MWh with emission reductions of 18,547 t CO2e/year.

5. Taichung Chingfeng Wind Farm Project: 1 wind turbine of 2.3 MW in Chingfeng Township, Taichung County. The annual electricity generated is 5,520 MWh with emission reductions of 3,709 t CO2e/year.

6. Taichung Anwei Wind Farm Project: 5 wind turbines with total capacity of 11.5 MW in Da'an Township, Dajia Township, and Chingshui Township, Taichung County. The annual electricity generated is 27,600 MWh with emission reductions of 18,547 t CO2e/year.

Prior to implementation of the proposed project, electricity demand in local society is supplied by the TPG dominated by the thermal power. The purpose of the project activity is to produce electricity with clean and renewable wind sources and to displace part of the electricity from fossil fule-fired power plants connected to the TPG. Thus, greenhouse gas emission reductions can be achieved.

Contribution to sustainable development

The project contributes significantly to the region's sustainable development. The specific goals for the project are to:

1. reduce the greenhouse gas emissions in Taiwan by replacing fossil fuel based power generation;
2. produce clean, renewable energy that contributes to alleviate the global warming;
3. contribute to the development of the wind energy sector in Taiwan;
4. create local employment both during the construction and operational phase;

A.2. Location of project activity

A.2.1. Host Party

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Taiwan

A.2.2. Region/State/Province etc.

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Hsinchu County, Miaoli County, Taichung County

A.2.3. City/Town/Community etc.

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Chubei township, Tongxiao Township, Yuanli Township, Da-an Township and Da-jia Township, Chingshui Township

A.2.4. Physical/Geographical location

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Chubei Wind Farm Project: located in Chubei township, Hsinchu County, which comprises 5 wind turbines.

Zhaowei Wind Farm Project: located in Tongxiao Township, Miaoli County, which comprises 6 wind turbines

Tongyuan Wind Farm Project: located in Tongxiao & Yuanli Township, Miaoli County, which comprises 12 wind turbines.

Taichung III Wind Farm Project: located in Da-an Township and Da-jia Township,Taichung County, which comprises 5 wind turbines.

Taichung Chingfeng Wind Farm Project: located in Chingshui Township, Taichung County, which comprises 1 wind turbine.

Taichung Anwei Wind Farm Project: located in Da'an Township, Dajia Township, and Chingshui Township, Taichung County, which comprises 5 wind turbines.

The proposed project activities are distributed in these zones, which are at the geographical positions of :

Wind Farm Name	Coordinates for center of farm
Chubei Wind Farm Project	24°51'47"N, 120°56'23"E
Zhaowei Wind Farm Project	24°29'57''N, 120°40'28"E
Tongyuan Wind Farm Project	24°25'37"N, 120°36'57"E
Taichung III Wind Farm Project	24°22'32''N, 120°34'49"E
Taichung Chingfeng Wind Farm Project	24°18'21"N, 120°32'55"E
Taichung Anwei Wind Farm Project	24°24'14"N, 120°36'40"E

A.3. Technologies and/or measures

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The proposed project activity generates electricity by utilizing the renewable wind resources, providing clean electricity, thus does not produce GHG emissions. The scenario prior to the start of implementation of the project activity is provision of the equivalent amount of electricity generated by the power plants connected with the grid, which is dominated by thermal power plants, thus leads to mass of GHG emissions. The baseline scenario is the same as the scenario prior to the start of implementation of the project activity.

The project in total comprises 34 Enercon E-70 wind turbines with the unit capacity of 2.3 MW.

Tongyuan Wind Farm Project: The electricity generated will be delivered to 22.8kV/69kV transformer via two 22.8 kV bus lines, and then to the 69 kV Taipower Grid.

TaiChung III Wind Farm Project: The electricity generated will be delivered to 22.8kV/69kV transformer via one 22.8 kV bus line, and then to the 69 kV Taipower Grid.

AnWei Wind Farm Project: The electricity generated will be delivered to 11.4 kV Taipower Grid via four 11.4 kV bus lines.

Taichung Chingfeng Wind Farm Project: The electricity generated will be delivered to 11.4 kV Taipower Grid via one 11.4 kV bus line.

Chubei Wind Farm Project: The electricity generated will be delivered to 11.4 kV or 22.8 k V Taipower Grid

Zhaowei Wind Farm Project: The electricity generated will be delivered to 11.4 kV Taipower Grid.

Power connection diagram is provided in Section B.7.2.

The technical data of the turbine units of turbine type E-70 are given in the tables below.

Wind Turbine Type	E-70					
Site	Chubei	Zhaowei	Tongyuan	Taichung III	Taichung Chingfeng	Taichung Anwei
Number of Turbine	5	6	12	5	1	5
Rated Power	2.3 MW					
Output Voltage	400 V					
Rotor diameter	71m					
Generator	Enercon direct-drive synchronous annular generator					
Grid feeding	ENERCON converter					
Technical lifetime	20 years					

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Taiwan (host)	InfraVest Co. Ltd., (Private entity)	No
Switzerland	South Pole Carbon Asset Management Ltd. (Private entity)	No

A.5. Public funding of project activity

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There is no public funding from Annex I countries involved in the project activity.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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The approved consolidated baseline and monitoring methodology ACM0002 (version 17.0) “Grid-connected electricity generation from renewable sources. ” has been used.

The methodology was applied with the following tools:

- Tool for the demonstration and assessment of additionality (Version 07.0.0)
- Tool to calculate the emission factor for an electricity system (Version 05.0.0)

Details are available at the following website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved

B.2. Applicability of methodology and standardized baseline

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The choice to use the ACM0002 (Version 17.0) methodology is applicable to the project because the project meets its applicability criteria:

- The project activity is a grid-connected renewable power generation project activity installing new power plants at sites where no renewable power plant was operated prior to the implementation of the project activity.
- The project activity does not involve switching from fossil fuels to renewable energy source at the site of the project activity, the project is not a biomass power plant, or hydro power plant that result in new reservoirs / increase in existing reservoirs.

The choice to use the “Tool to calculate the emission factor for an electricity system” (Version 05.0.0) is applicable to the project because the proposed project activity supplies electricity to the grid and substitutes the grid electricity of which system is not located partially or totally in Annex 1 country.

B.3. Project boundary

Source		GHGs	Included ?	Justification/Explanation
Baseline scenario	Source 1 CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. (Power plants in TPG)	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source. Excluded for simplification. This is conservative.
		N_2O	No	Minor emission source. Excluded for simplification. This is conservative.
Project scenario	Source 1 Emission Sources of Project Activity (Infra Vest Taiwan Wind Farms Bundled Project 2012)	CO_2	No	Excluded, as per ACM0002 Version 17.0
		CH_4	No	Excluded, as per ACM0002 Version 17.0
		N_2O	No	Excluded, as per ACM0002 Version 17.0

According to the methodology ACM0002 (Version 17.0), the spatial extent of the project boundary includes project power plant and all power plants connected physically to the electricity system that the project power plant is connected to Taiwan is island with a single power grid with no cable connection with the continent. Thus there is no other connected electricity system in Taiwan, besides Taipower Grid (TPG). Therefore, the project boundary as described in flow chart below, is defined as the Infra Vest Chubei, Zhaowei, Tongyuan,Taichung III, Taichung Chingfeng, Taichung Anwei wind farm and all power plants connected to Taipower grid.

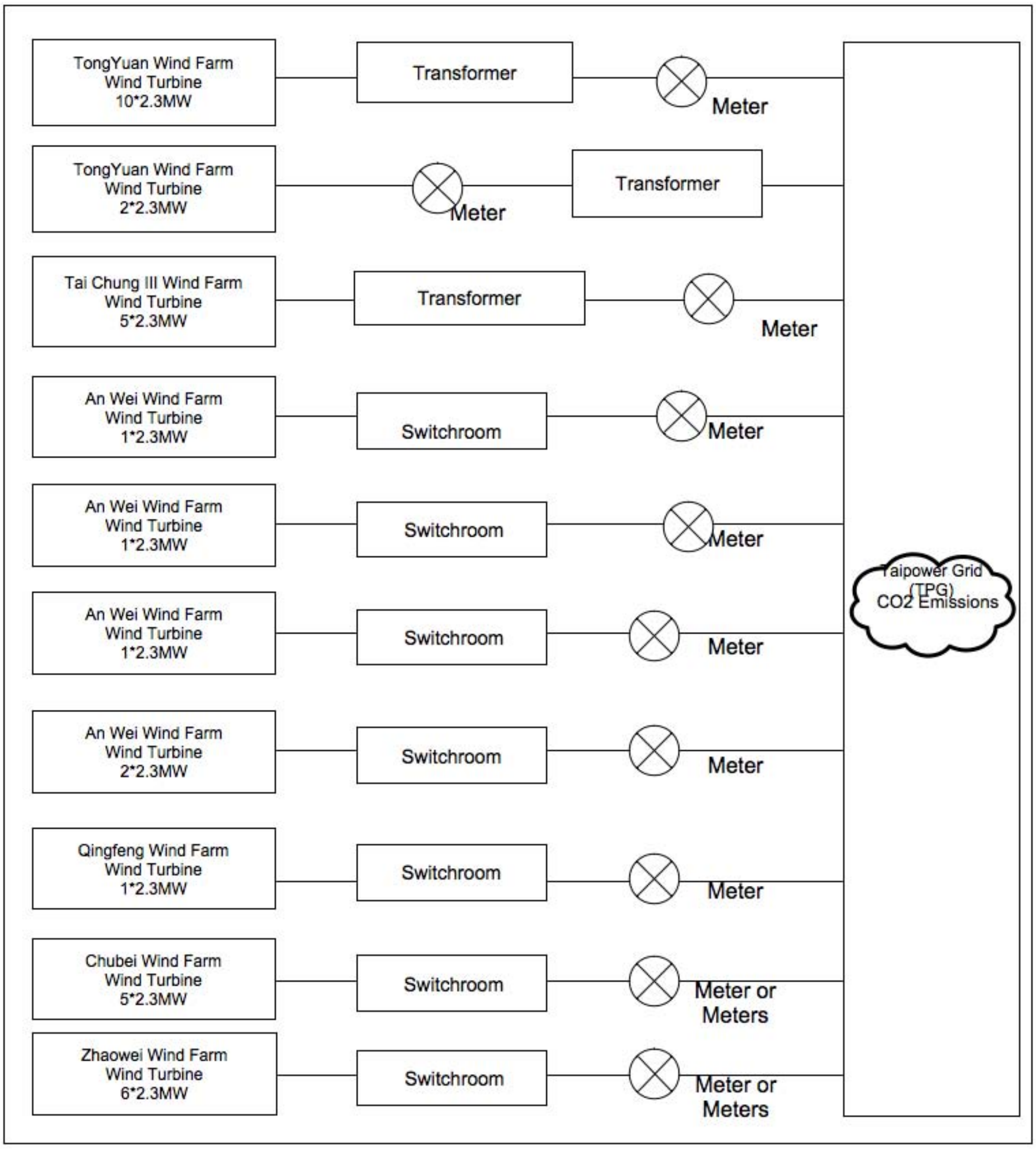

Figure B-1 Project boundary

B.4. Establishment and description of baseline scenario

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According to the methodology ACM0002 (Version 17.0), 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 into the grid.

B.5. Demonstration of additionality

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Prior consideration

There was no public announcement of the project going ahead without the VER for the proposed project.

Chubei Wind Farm Project

Date	Event
12/2001-12/2002	InfraVest was already aware of carbon credit financing support and had approached several interested buyers for its future CDM and VER wind projects in China and in Taiwan
09/2006-05/2007	InfraVest contacts with several potential carbon buyers for its upcoming VER wind projects in Taiwan
10/07/2007	Cooperation agreement between InfraVest and South Pole
07/2011	FSR completed
05/03/2012	Board Decision
16/11/2015	ERPA signed
05/2017	Estimated starting date of commission

Zhaowei Wind Farm Project

Date	Event
12/2001-12/2002	InfraVest was already aware of carbon credit financing support and had approached several interested buyers for its future CDM and VER wind projects in China and in Taiwan
09/2006-05/2007	InfraVest contacts with several potential carbon buyers for its upcoming VER wind projects in Taiwan
10/07/2007	Cooperation agreement between InfraVest and South Pole
12/2011	FSR completed
05/03/2012	Board Decision
16/11/2015	ERPA signed
05/2017	Estimated starting date of commission

Tongyuan Wind Farm Project

Date	Event
12/2001-12/2002	InfraVest was already aware of carbon credit financing support and had approached several interested buyers for its future CDM and VER

	wind projects in China and in Taiwan
09/2006-05/2007	InfraVest contacts with several potential carbon buyers for its upcoming VER wind projects in Taiwan
10/07/2007	Cooperation agreement between InfraVest and South Pole
07/2011	FSR completed
05/03/2012	Board Decision
13/12/2012	Construction Daily Report (starting date)
30/05/2013	Commission start
16/11/2015	ERPA signed

Taichung III Wind Farm Project

Date	Event
12/2001-12/2002	InfraVest was already aware of carbon credit financing support and had approached several interested buyers for its future CDM and VER wind projects in China and in Taiwan
09/2006-05/2007	InfraVest contacts with several potential carbon buyers for its upcoming VER wind projects in Taiwan
10/07/2007	Cooperation agreement between InfraVest and South Pole
11/2011	FSR completed
05/03/2012	Board Decision
06/08/2014	Construction Daily Report (starting date)
04/11/2014	Commission start
16/11/2015	ERPA signed

Taichung Chingfeng Wind Farm Project

Date	Event
12/2001-12/2002	InfraVest was already aware of carbon credit financing support and had approached several interested buyers for its future CDM and VER wind projects in China and in Taiwan
09/2006-05/2007	InfraVest contacts with several potential carbon buyers for its upcoming VER wind projects in Taiwan
10/07/2007	Cooperation agreement between InfraVest and South Pole

10/2011	FSR completed
05/03/2012	Board Decision
14/09/2014	Construction Daily Report (starting date)
07/05/2015	Commission start
16/11/2015	ERPA signed

Taichung Anwei Wind Farm Project

Date	Event
12/2001-12/2002	InfraVest was already aware of carbon credit financing support and had approached several interested buyers for its future CDM and VER wind projects in China and in Taiwan
09/2006-05/2007	InfraVest contacts with several potential carbon buyers for its upcoming VER wind projects in Taiwan
10/07/2007	Cooperation agreement between InfraVest and South Pole
11/2011	FSR completed
05/03/2012	Board Decision
13/08/2014	Construction Daily Report (starting date)
04/05/2015	Commission start
16/11/2015	ERPA signed

Since year of 2001, the project owner of the proposed project, InfraVest has been considering the potential of carbon credits for financing its wind power projects and been in discussion actively with carbon consultants and buyers. Copies of mail exchange between Infra Vest and several carbon consultants and buyers during 2001~2002 and 2006~2007 dealing about the VER development in Taiwan will be provided to the DOE at validation.

In the beginning of September 2006, InfraVest started to look actively for carbon consultants that would be able to assist in developing VER projects in Taiwan and several brokers.

In July 2007, the draft cooperation agreement was drafted between InfraVest and South Pole Carbon in Taiwan. In December 2007, south Pole Carbon finally signed the cooperation agreement with InfraVest and South Pole Carbon in Taiwan. In December 2007, South Pole Carbon finally signed the cooperation agreement with Infra Vest, for Infra Vest’s wind projects in Taiwan about the VER development for wind projects in Taiwan are provided to the DOE at validation.

Demonstration of additionality

As prescribed by the Gold Standard, the projects' additionality is demonstrated through use of the Tool for the demonstration and assessment of additionality.

The approved methodological tool "Tool for the demonstration and assessment of additionality" (Version 07.0.0) provides a step-wise approach to demonstrate project additionality and is applied to determine whether the project is additional following the steps below:

(a) Step 0 Demonstration whether the proposed project activity is the first-of-its-kind;

(b) Step 1 Identification of alternatives to the project activity consistent with current laws and regulations;

(c) Step 2 Investment analysis to determine whether the proposed project activity is not:

1) The most economically or financially attractive; or

2) Economically or financially feasible, without the revenue from the sale of certified emission reduction (CERs);

(d) Step 3 Barriers analysis; and

(e) Step 4 Common practice analysis.

Step 0 : Demonstration whether the proposed project activity is the first-of-its kind

The proposed project activity is not the first-of-its-kind. Prior to the proposed bundled project, there are already wind projects operated in Taiwan.

Outcome of step 0: the propose project is not the first-of –its-kind.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations.

This step involves the definition of realistic and credible alternatives to the project activity through the following Sub-steps:

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

As per paragraph 8 of the " Tool for the demonstration and assessment of additionality" (Version 07.0.0), project activities that apply this tool in context of approved consolidated methodology ACM 0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than proposed activity.

The project owner of the proposed project is an independent power producer (IPP)[1] investing solely in wind energy[2].

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[1] https://en.wikipedia.org/wiki/Independent_Power_Producer

Outcome of Step 1a: Since the aim of the proposed project activity is to produce electricity by utilizing wind energy, therefore, alternatives available for the project include:

Alternative A InfraVest Wind Farm Bundle Project without VER revenue

Alternative B Continuation of the current situation (provision of the equivalent amount of project's annual power output by the grid)

Sub-step 1b: Consistency with mandatory laws and regulations:

The mandatory preliminary permits have been obtained for the project activity, showing that it is in compliance with the current laws and regulations.

- Renewable Energy Development Act[3]
- The electricity Act[4]
- Electricity registration rules[5]

Outcome of Step 1b: All the alternatives to the project outlined in Step 1a above are in compliance with applicable laws and regulations.

For the demonstration of additionality, both UNFCCC and Gold Standard guidelines allow to conduct an investment analysis or a barrier analysis, we choose to conduct an investment analysis.

Step 2: Investment analysis

The main purpose of carrying out investment analysis is to determine whether the proposed project activity is not (a) the most economically or financially attractive; or (b) economically or financially feasible, without the revenue from the sale of VERs. All steps followed in this analysis are according to "Tool for the demonstration and assessment of additionality".

Sub-step 2a: Determine appropriate analysis method

The project activity and alternative A in Step 1 do have related financial benefits other than VER, therefore, simple cost analysis (Option I) is not applicable. As alternative B is not an investment project, therefore investment comparison (Option II) is not applicable. Hence, benchmark analysis (option III) will be applied to alternative A to demonstrate that it is not economically feasible.

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[2] http://www.infra-vest.com/

[3] web3.moeaboe.gov.tw/ECW/main/content/wHandEditorFile.ashx?file_id=546

[4] http://law.moj.gov.tw/LawClass/LawContent.aspx?PCODE=J0030011

[5] http://law.moj.gov.tw/LawClass/LawContent.aspx?PCODE=J0030012

Sub-step 2b: Option III. Apply benchmark analysis

For a private project developer, the most suitable economic indicator for the project type and decision context is the internal rate of return (IRR). Therefore, the benchmark analysis using an Equity IRR (EIRR) as financial indicator is applied to the proposed project.

Five options can be used to derive the benchmark of EIRR:
(a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;
(b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;
(c) A company internal benchmark (weighted average capital cost of the company), only in the particular case referred to above in paragraph 5. The project developers shall demonstrate that this benchmark has been consistently used in the past, i.e. that project activities under similar conditions developed by the same company used the same benchmark;
(d) Government/official approved benchmark where such benchmarks are used for investment decisions;
(e) Any other indicators, if the project participants can demonstrate that the above Options are not applicable and their indicator is appropriately justified.

Since there is no officially approved benchmark for investment decisions in Taiwan, in this case, the option (a) is chosen to determine the benchmark of EIRR. According to Professor Aswath Damodaran at Stern School of Business at New York University[6], a fairly simple alternative is to assume that a company's exposure to country risk is proportional to its exposure to all other market risk, which is measured by the beta. Prof. Damodaran's approach has been widely used in VER projects and the same approach was validated and accepted by the Gold Standard through the previous InfraVest's wind project in Taiwan. The cost of equity is determined by using Damodaran's Capital Asset Pricing Model (CAPM). For a firm in an emerging market, the cost of equity is determined as follows:

Cost of equity= Risk free rate+Beta*(Mature Market Premium+Country Risk Premium)[7]

This approach calculates the risk premium associated with the specific risk involved in a particular project type. The riskiness is calculated by means of the beta that measures the relative riskiness

[6] Aswath Damodaran, "Measuring Company Exposure to Country Risk: Theory and Practice," Stern School of Business Working paper, September 2003
http://people.stern.nyu.edu/adamodar/pdfiles/papers/CountryRisk.pdf

[7] http://people.stern.nyu.edu/adamodar/New_Home_Page/dataarchived.html#discrate

of the particular project type in the market. This approach assesses risks at a market level and not by looking at an individual's risk preferences. Therefore, the cost of equity is defined by analyzing governmental bond rates (risk free rate), increased by a suitable risk premium to reflect private investment.

The risk free rate is taken as the average of US treasury 10 years bond rates in the period of 3 months prior to the earliest investment decision time (05/03/2012) of all the six wind farms under this bundled proposed project (05/12/2011-04/03/2012) (1.97%[8]). The total risk premium is calculated as beta of stock multiplied by the sum of the long-term risk premium for the country under consideration and the risk premium for a mature equity market. The risk premium for a mature equity market was 6% (represents the equity market risk for countries with zero risk); and the country risk premium of Taiwan is 1.05%. This results in a risk premium of 7.05%[9]. The average beta of stocks for power sector in the same year is 1.35[10].

The benchmark EIRR estimation for the whole electricity generation sector in Taiwan is 1.97%+1.35*(6%+1.05%)=11.50%.

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

The basic financial parameters of the proposed project are listed in the following table:

Table B.1 The financial parameters of Chingfeng Wind Farm

Parameter	Unit	Value (1*2.3 MW)	Source
Total Investment	EUR	3,573,464	FSR
Operation Cost	EUR/y	80,760	FSR
Loan/equity ratio	%	82/18	FSR
Loan interest	%	5.5%	FSR
Net electricity generation	MWh/y	5520.0	FSR
Emission reduction	tCO2/y	3,709	Calculated
Project lifetime	Years	20	FSR
Income tax rate	%	17%	FSR
Depreciation period	Years	20	FSR
Electricity Price	NTD/kWh	2.6138	FSR

Anwei Wind Farm

In order to make the financial assessment more reasonable, the financial analysis is calculated based on each turbine separately.

Table B.2 The financial parameters of Anwei Wind Farm

[8] https://research.stlouisfed.org/fred2/graph/?g=5SD

[9] http://people.stern.nyu.edu/adamodar/pc/archives/ctryprem11.xls

[10] http://people.stern.nyu.edu/adamodar/pc/archives/betas11.xls

Parameter	Unit	Value of turbine A01-2 (1*2.3 MW)	Value of turbine A12 (1*2.3 MW)	Value of turbine A02 (1*2.3 MW)	Value of turbine A10 (1*2.3 MW)	Value of turbine A 05 (1*2.3 MW)	Source
Total Investment	EUR	3,392,500	3,392,500	3,392,500	3,392,500	3,392,500	FSR
Operation Cost	EUR/y	76,671	76,671	76,671	76,671	76,671	FSR
Loan/equity ratio	%	82/18	82/18	82/18	82/18	82/18	FSR
Loan interest	%	5.5%	5.5%	5.5%	5.5%	5.5%	FSR
Net electricity generation	MWh/y	5,520	5,520	5,520	5,520	5,520	FSR
Emission reduction	tCO2/y	3,709	3,709	3,709	3,709	3,709	Calculated
Project lifetime	Years	20	20	20	20	20	FSR
Income tax rate	%	17%	17%	17%	17%	17%	FSR
Depreciation period	Years	20	20	20	20	20	FSR
Electricity Price	NTD/kWh	2.6138	2.6138	2.6138	2.6138	2.6138	FSR

Taichung III Wind Farm

In order to make the financial assessment more reasonable, the financial analysis is calculated based on each turbine separately.

Table B.3 The financial parameters of Taichung III Wind Farm

Parameter	Unit	Value of turbine 38A (1*2.3 MW)	Value of turbine 29B (1*2.3 MW)	Value of turbine 63 (1*2.3 MW)	Value of turbine 67 (1*2.3 MW)	Value of turbine 70 (1*2.3 MW)	Source
Total Investment	EUR	3,457,813	3,457,813	3,457,813	3,457,813	3,457,813	FSR
Operation Cost	EUR/y	78,147	78,147	78,147	78,147	78,147	FSR
Loan/equity ratio	%	82/18	82/18	82/18	82/18	82/18	FSR
Loan interest	%	5.5%	5.5%	5.5%	5.5%	5.5%	FSR
Net electricity generation	MWh/y	5520	5,520	5,520	5,520	5,520	FSR
Emission reduction	tCO2/y	3,709	3,709	3,709	3,709	3,709	Calculated
Project lifetime	Years	20	20	20	20	20	FSR
Income tax rate	%	17%	17%	17%	17%	17%	FSR
Depreciation period	Years	20	20	20	20	20	FSR
Electricity Price	NTD/kWh	2.6138	2.6138	2.6138	2.6138	2.6138	FSR

Chubei Wind Farm

In order to make the financial assessment more reasonable, the financial analysis is calculated based on one turbine and 4 turbines separately.

Table B.4 The financial parameters of Chubei Wind Farm

Parameter	Unit	Value of turbine 01 (1*2.3 MW)	Value of turbine 15,16,18,19 (4*2.3 MW)	Source

Total Investment	EUR	3,450,000	13800000	FSR
Operation Cost	EUR/y	77,970	311880	FSR
Loan/equity ratio	%	82/18	82/18	FSR
Loan interest	%	5.5%	0.055	FSR
Net electricity generation	MWh/y	5520.0	22080	FSR
Emission reduction	tCO2/y	3,709	14837	Calculated
Project lifetime	Years	20	20	FSR
Income tax rate	%	17%	0.17	FSR
Depreciation period	Years	20	20	FSR
Electricity Price	NTD/kWh	2.6138	2.6138	FSR

Tongyuan Wind Farm

Table B.5 The financial parameters of Tongyuan Wind Farm

Parameter	Unit	Value (12*2.3 MW)	Source
Total Investment	EUR	40,986,000	FSR
Operation Cost	EUR/y	926,284	FSR
Loan/equity ratio	%	82/18	FSR
Loan interest	%	5.5%	FSR
Net electricity generation	MWh/y	66240.0	FSR
Emission reduction	tCO2/y	44,513	Calculated
Project lifetime	Years	20	FSR
Income tax rate	%	17%	FSR
Depreciation period	Years	20	FSR
Electricity Price	NTD/kWh	2.6138	FSR

Zhaowei Wind Farm

Table B.6 The financial parameters of Zhaowei Wind Farm

Parameter	Unit	Value (6*2.3 MW)	Source
Total Investment	EUR	20,511,250	FSR
Operation Cost	EUR/y	463,554	FSR
Loan/equity ratio	%	82/18	FSR
Loan interest	%	5.5%	FSR
Net electricity generation	MWh/y	33120.0	FSR
Emission reduction	tCO2/y	22,256	Calculated
Project lifetime	Years	20	FSR
Income tax rate	%	17%	FSR
Depreciation period	Years	20	FSR
Electricity Price	NTD/kWh	2.6138	FSR

The table below shows the financial analysis for the project activity:

Table B.7 The summary of EIRR of the project activity

Wind Farm	**Unit and Capacity**	**EIRR**
Chingfeng	1unit*2.3MW	4.31%
Anwei	5 unit*2.3 MW	6.13%
Taichung III	5 unit*2.3 MW	5.45%
Chu bei	5 unit*2.3 MW	5.53%
Tongyuan	12 unit*2.3 MW	5.89%
Zhaowei	6 unit*2.3 MW	5.86%

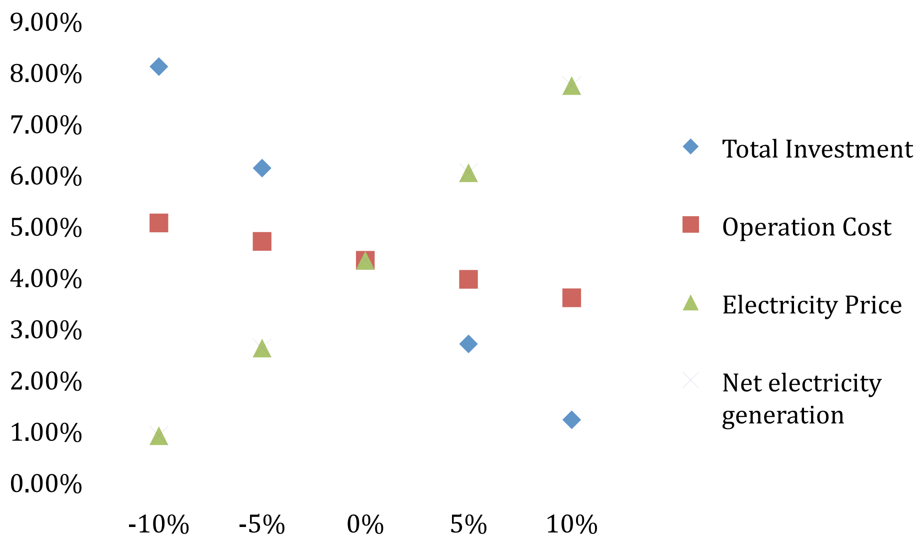
Without carbon revenue, EIRRs of the six wind farms in the proposed project are all lower than the benchmark. Thus, the proposed project is not financially attractive.

Sub-step 2d: Sensitivity analysis

Purpose of sensitivity analysis is to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The variables chosen for sensitivity analysis are operation cost, total investment, and net electricity generation/electricity price. The sensitivity of this analysis is tested by considering an increase and a decrease of up to 10% of each variable, as summarized in the following tables:

Chingfeng Wind Farm sensitivity analysis

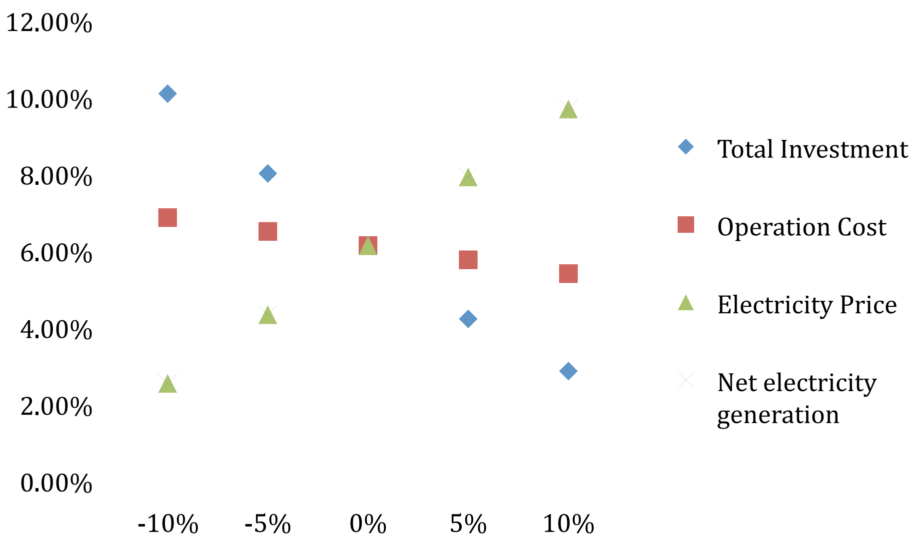
	-10%	-5%	0%	5%	10%
Total Investment	8.09%	6.11%	4.31%	2.68%	1.20%
Operation Cost	5.04%	4.68%	4.31%	3.94%	3.58%
Electricity Price	0.89%	2.60%	4.31%	6.02%	7.72%
Net electricity generation	0.89%	2.60%	4.31%	6.02%	7.72%



Anwei Wind Farm sensitivity analysis

The sensitivity analysis of each turbine is the same, the detailed information is summarized as followed:

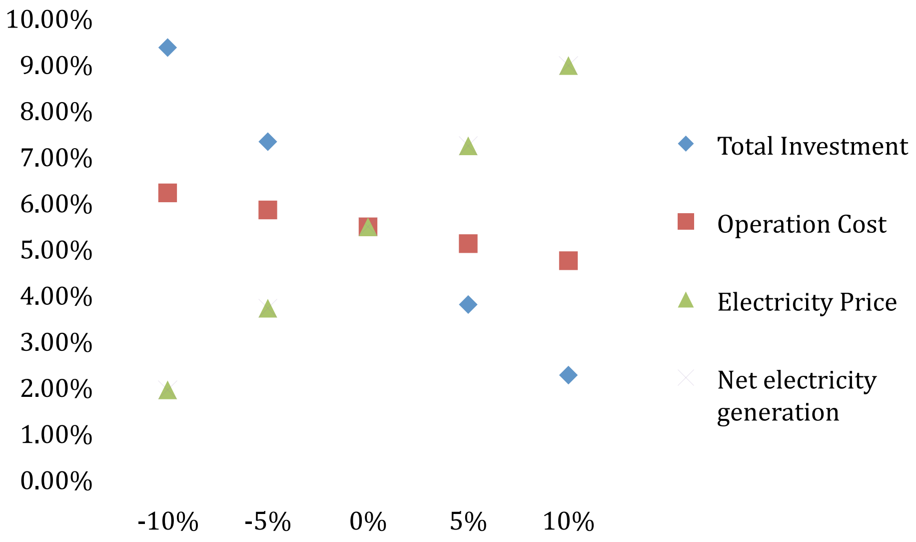
	-10%	-5%	0%	5%	10%
Total Investment	10.09%	8.01%	6.13%	4.22%	2.86%
Operation Cost	6.86%	6.50%	6.13%	5.76%	5.40%
Electricity Price	2.54%	4.33%	6.13%	7.92%	9.69%
Net electricity generation	2.54%	4.33%	6.13%	7.92%	9.69%



Taichung III wind farm

The sensitivity analysis of each turbine is the same, the detailed information is summarized as followed:

	-10%	-5%	0%	5%	10%
Total Investment	9.34%	7.30%	5.45%	3.77%	2.24%
Operation Cost	6.19%	5.82%	5.45%	5.09%	4.72%
Electricity Price	1.92%	3.69%	5.45%	7.21%	8.95%
Net electricity generation	1.92%	3.69%	5.45%	7.21%	8.95%

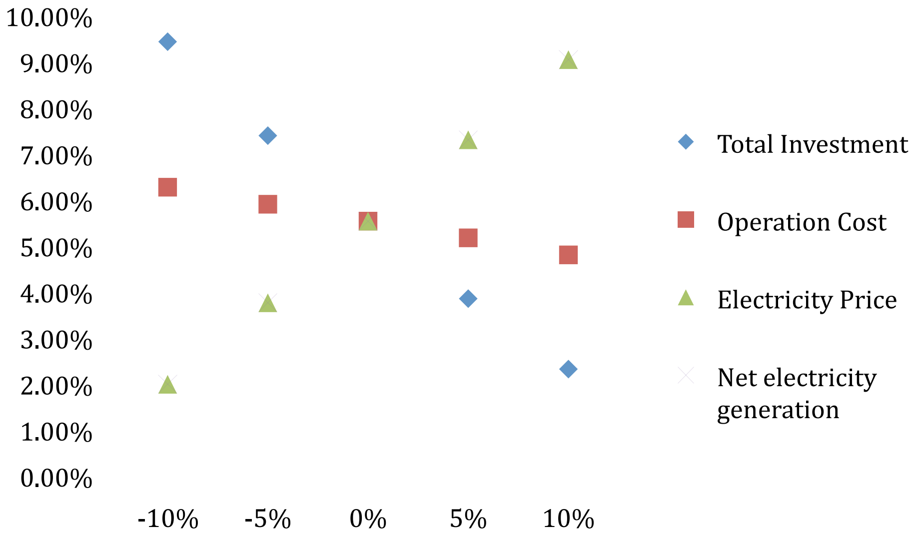


Chubei Wind Farm

The sensitivity analysis of the turbine 01 is the same with the turbine 15,16,18,19, the detailed information is summarized as followed:

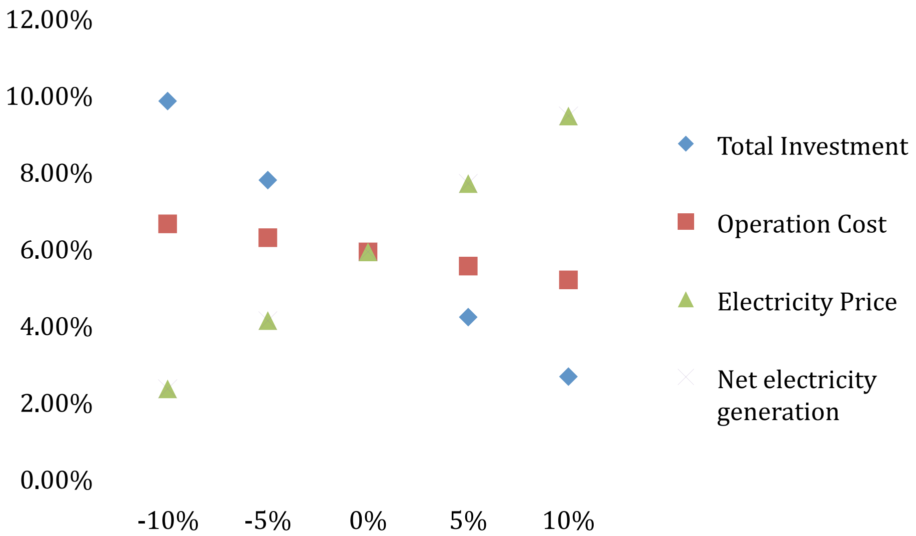
	-10%	-5%	0%	5%	10%
Total Investment	9.43%	7.39%	5.53%	3.85%	2.32%
Operation Cost	6.27%	5.90%	5.53%	5.17%	4.80%

Electricity Price	1.99%	3.76%	5.53%	7.30%	9.04%
Net electricity generation	1.99%	3.76%	5.53%	7.30%	9.04%



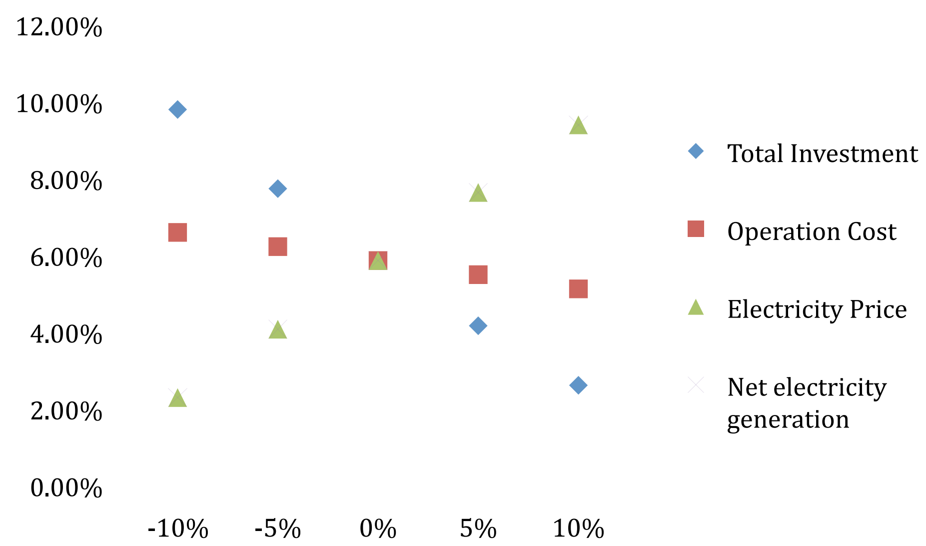
Tongyuan Wind Farm

	-10%	-5%	0%	5%	10%
Total Investment	9.82%	7.76%	5.89%	4.19%	2.64%
Operation Cost	6.62%	6.26%	5.89%	5.52%	5.16%
Electricity Price	2.32%	4.10%	5.89%	7.67%	9.43%
Net electricity generation	2.32%	4.10%	5.89%	7.67%	9.43%



Zhaowei Wind Farm

	-10%	-5%	0%	5%	10%
Total Investment	9.79%	7.73%	5.86%	4.16%	2.61%
Operation Cost	6.59%	6.22%	5.86%	5.49%	5.12%
Electricity Price	2.29%	4.07%	5.86%	7.63%	9.39%
Net electricity generation	2.29%	4.07%	5.86%	7.63%	9.39%



The above analyses show that the EIRR is more sensitive to the total investment and net electricity generation/electricity price, while it is less elastic to operation cost. The sensitivity analyses result in the EIRRs mostly below the benchmark.

A critical point analysis is further carried out towards the main financial parameters: total investment, operation costs, and electricity revenues. Outcomes of the calculation are presented as follows:

Benchmark IRR		Critical Point		
11.5%		Total Investment	Operation Cost	Net Electricity Generation/Electricity Price
Chingfeng	1unit*2.3 MW	-17.47%	-98.5%	21.17%
Anwei	5 unit*2.3 MW	-13.06%	-73.70%	15.03%
Taichung III	5 unit*2.3 MW	-14.70%	-82.97%	17.25%
Chubei	5 unit*2.3 MW	-14.51%	-81.80%	16.98%
Tongyuan	12 unit*2.3 MW	-13.65%	-77%	15.80%
Zhaowei	6 unit*2.3 MW	-13.72%	-77.4%	15.90%

The above results show that IRRs would reach the benchmark if the total investment decreased by 13.06%~17.47%, operation cost decreased by 77%~ 98.5% or the net electricity generation/electricity price increased by 15.03% ~ 21.17%. These conditions are impossible to occur for the following reasons:

1. Total investment: When the total investment decreases by 13.06%~17.47% in the critical point scenario, the IRR would reach the benchmark. But the investment cannot be decreased by 13.06%~17.47% or above. According to the Records Abstracts of the Draft Renewable Energy

Electricity Purchase Rate Calculation Formula Hearing in 2015[11], the unit installation investment cost of land-based wind power projects has already reached 6.5 *10^4 NTD/kW in local private wind energy developers. While the estimated unit investment cost for the proposed project is about 5.66 *10^4 NTD/kW~ 5.97* 10^4 NTD/kW, lower than 6.5 *10^4 NTD/kW. The actual unit installation investment cost for Fengwei Wind Farm and Longwei Wind Farm (GS 1001) is about 6.48 *10^4 NTD/kW and 6.51*10^4 NTD/kW[11]. Both of the two projects were constructed and operated by InfraVest. Tongyuan wind farm of the proposed project is fully commission, and the actual unit installation investment cost for Tongyuan Wind Farm is 6.95 * 10^4 NTD/kW according to the Electricity Licence Application Report. Therefore, the total investment is already conservatively estimated and is impossible to decrease by 13.06%~17.47%.

2. Operation Costs: The IRR would only reach the benchmark if operation costs decreases by 77% ~ 98.5%, but the operation costs can never be decreased by 77% ~ 98.5%. Based on the actual operation experiences from the local wind energy developers in Taiwan, the average operation cost of the land-based wind power is 0.867 NTD/kWh for wind power station[11], and the value will increase in future. The estimated operation cost for the proposed project is about 0.533 NTD/kWh ~ 0.562 NTD/kWh, which is already highly conservative. In addition, Tongyuan wind farm of the proposed project is fully commission. According to the Tax Report, the first year actual operation cost rate of Tongyuan Wind Farm is about 2.7% of the total investment, which is higher than the value of 2.26% in the PDD. Therefore, the operation cost is impossible to decrease by 83.6%.

3. Net electricity generation/Electricity price: The IRR would reach the benchmark if electricity price or electricity generation increased by around 15.03% ~ 21.17%.

The electricity price (2.6138 NTD/kWh) showed in the FSR for IRR calculation is from Regulations of Renewable Energy Development in Taiwan[12,13]. The actual electricity prices in the PPA, which will be stay same for 20 years, is between 2.5971 to 2.7229 NT/kwh. Even with the actual highest price (2.7229 NT/kWh), the IRR is still much lower than the benchmark. Therefore, it is impossible for the electricity price to increase by 15.03% ~ 21.17%.

According to the Records Abstracts of the Draft Renewable Energy Electricity Purchase Rate Calculation Formula Hearing in 2015[11], the average operation hour is 2200 hours for wind farms in Taiwan is recommended. Due to the fact that the primary wind farms with high operation hours have been developed already during the last several years, the full operation hour for the secondary wind farm is about 2000 hours[14]. Tongyuan wind farm of the proposed projet is fully

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[11] http://web3.moeaboe.gov.tw/ECW/renewable/content/wHandMenuFile.ashx?menu_id=2903

[12] web3.moeaboe.gov.tw/ECW/renewable/content/wHandMenuFile.ashx?menu_id=1203

[13] http://mepopedia.com/forum/read.php?198,3265

[14] web3.moeaboe.gov.tw/ECW/renewable/content/wHandMenuFile.ashx?menu_id=2158

commission. According to the Records Abstracts by InfraVest during the Renewable Energy Electricity Purchase Rate Calculation Formula Hearing, the actual operation hour of Tongyuan wind farm under the proposed project from 07/2013 to 07/2014 is 1996 hours[11]. Further, the expected full operation hour of Chubei Wind Farm under the proposed project is 1800-2000 hours according to the Tester Report of the Wind Energy[11]. Thus Chubei Wind Farm still does not start to construct due to the low operation hour. Therefore, for the proposed project activity it is impossible for the operation hours to increase by 15.03% ~ 21.17% or above.

Outcome of Step 2: In conclusion, the project shows EIRR below benchmark when variation is applied to the chosen parameters in the sensitivity analysis. Critical point analysis further shows that the EIRR is impossible to reach the benchmark EIRR. The conclusion that the proposed project is not financially attractive is therefore robust.

Step 3: Barrier analysis

This step is skipped because investment analysis is discussed in Step 2.

Step 4: Common practice analysis

According to the “Guidelines on common practice” (Version 03.1), stepwise approach for common practice analysis is applied:

Step 1: calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity.

The design capacities of the wind farms under the proposed project activity are between 2.3 MW to 27.6 MW. Therefore, the applicable capacity range is from 1.15 MW to 41.4 MW.

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

(a) The projects are located in the applicable geographical area;

(b) The projects apply the same measure as the proposed project activity;

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

(f) The project started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

Applicable geographical area

Taiwan is selected as the applicable geographical area for the common practice, and the reasons are detailed as below:

- Taiwan is an island with a single power grid with no cable connection with the continent. Thus there is no other connected electricity system in Taiwan, besides Taipower Grid (TPG). The unique geological conditions in Taiwan results in the different wind resources, compared to wind plants in other regions or countries;
- The investment environments are different among regions and countries. This is due to a number of factors including the economic development level, the industrial structure, and the fundamental infrastructure, the development strategy and the policy framework. These can all affect the final investment decision;
- Finally, a number of other key economic factors vary from region to region, including tariff of products, the cost of materials, and other utilities such as water, the cost of labour and services and the types of loan that can be obtained. These all vary between regions. The electricity price of every region is different. This is the most important factor influencing the revenue from wind power generation, and hence affects the investment analysis of the projects. Wind power companies within the same region are therefore selected for the common practice analysis.

Similar projects

The applicable conditions for the similar projects are summarized as below:

- Applicable geographical area: Taiwan
- Applicable measure and technology: wind power projects
- Applicable output or capacity: 1.15 MW to 41.4 MW
- Applicable date: started before the start date of the project (13/12/2012)

Based on the Energy Statistics Hand Book 2014[15], published by Bureau of Energy, Ministry of Economics Affairs, Gold Standard database and other public available information, the similar projects are identified and listed in the table below:

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[15] web3.moeaboe.gov.tw/ECW/populace/content/wHandMenuFile.ashx?menu_id=682 page 114

	Wind Farm Name	Total Capacity (MW)	Earliest Commission Start date	Project Owner	Apply UNFCCC or GS
1	Hengchun Wind Project	4.5	08/2004	Taipower Company	No
2	Datan Wind Power Project	15.1	06/2005	Taipower Company	No
3	Guanfeng Wind Power	30	05/2006	Taipower Company	No
4	Zhonghuo Wind Power Project	6	04/2007	Taipower Company	No
5	Zhonggan Wind Power Project	36	04/2007	Taipower Company	No
6	Wanggong Wind Power Project	23	03/2011	Taipower Company	No
7	Xiangshan Wind Power Project	12	12/2007	Taipower Company	No
8	Sihu Wind Power Project	28	05/2010	Taipower Company	No
9	Jinmen Wind Power Project	4	07/2010	Taipower Company	No
10	GuanWu Wind Power Project	4.6	12/2011	InfraVest	yes[16]
11	FongWei Wind Power Project	13.8	05/2011	InfraVest	yes[16]
12	Chung Wei Wind Power Project	29.9	02/2011	InfraVest	yes[16]
13	Tao Wei Wind Power Project	4.6	02/2011	InfraVest	yes[16]
14	Penghu Wind Power Project	4.8	09/2001	Taipower Company	No
15	Shimen Wind Power Project	3.96	10/2004	Taipower Company	No
16	Zhonghuo Wind Power Project	8	04/2007	Taipower Company	No
17	Mailiao Wind Power Project	30	01/2009	Taipower Company	No
18	Maliao Wind Power Project	2.64	12/2000	Formosa Heavy Industries Corp.(http://www.fhi.co m.tw/english/wind.htm)	No
19	Chunfeng Wind Power Project	3.5	10/2002	Chengloong Corp. (http://www.clc.co m.tw/htmltest/com munity/community_adante.asp)	No
20	Miaoli Dapong Wind Power Project	42	04/2006	Macquarie International Infrastructure Fund (MIIF) (The wind farm is previously owned by InfraVest Group)	yes[17]
21	MiaoLi Zhunan Wind Power Project	7.8	02/2006	Macquarie International Infrastructure Fund (MIIF)27 (The wind farm is previously owned by InfraVest Group)	yes[17]

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}.

Within the 21 similar projects identified in Step 2, 6 projects have already been registered as GS VER projects, which shall not be included in this common practice analysis; and the remaining 15 projects had not sought for VER revenue.

Therefore, N_{all}=15

[16] https://mer.markit.com/br-reg/public/project.jsp?project_id=103000000001929

[17] http://www.thesouthpolegroup.com/uploads/docs/832_SFR_nontech_CN.pdf

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}.

As shown in the table above, 13 of all the 15 similar projects identified in Step 3 are owned by Taipower Company; and InfraVest is the main active, foreign wind farm developer and wind IPP in Taiwan. As the only state-owned grid company and largest power provider in Taiwan, Taipower does not face similar level of difficulty in terms of bank loan and financial closure as opposed to a private company like InfraVest. Moreover, two other private-owned projects can also be identified (Mailiao and Chunfeng Wind Power Demonstration Systems), but they were subsidized[18] by the government, and therefore do not face significant access to financial barriers.

According to the "Guidelines on Common Practice" (Version 03.1), different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed project activity and applicable geographical area):

(a) Energy source/fuel;
(b) Feed stock;
(c) Size of installation (power capacity)/energy savings:

(i) Micro;

(ii) Small;

(iii) Large;

(d) Investment climate on the date of the investment decision, inter alia:

(i) Access to technology;

(ii) Subsidies or other financial flows;

(iii) Promotional policies;

(iv) Legal regulations;

(e) Other features, inter alia:

[18] http://www.fhi.com.tw/english/wind.htm
http://old.npf.org.tw/PUBLICATION/SD/092/SD-C-092-086.htm

(i) Nature of the investment (example: unit cost of capacity or output is considered different if the costs differ by at least 20%).

Based on the principles mentioned above, the 13 Taipower's projects and the two other private-owned projects (Mailiao and Chunfeng Wind Power Demonstration Systems) are incomparable to the proposed project due to different technologies applied compared with that applied in the proposed project activity (investment climate on the date of the investment decision).

Therefore, N_{diff}=15

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.

$N_{all}-N_{diff}=15-15=0$

$F=1-N_{diff}/N_{all}=1-15/15=0$

According to the Guideline on common practice (version 03.1), if the factor F is greater than 0.2 and $N_{all}-N_{diff}$ is greater than 3, the project activity would be a "common practice".

For the proposed project, $F=0<0.2$ and $N_{all}-N_{diff}=0<3$, therefore, the proposed project is not common practice.

In a conclusion, the proposed project activity faces significant financial barrier, and requires carbon revenue in order to improve its financial status and future risks. Furthermore, the proposed project is not common practice in the region. Therefore, the proposed project is additional.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

The approved consolidated baseline and monitoring methodology ACM0002 (version 17.0) "Grid-connected electricity generation from renewable sources" has been used.

The methodology was applied with the following tools:

- Tool for the demonstration and assessment of additionality (Version 07.0.0)
- Tool to calculate the emission factor for an electricity system (Version 05.0.0)

1. Project Emission

As per ACM0002, the project emission for most renewable energy (including wind farm) project activities is zero (PE_y=0).

2. Baseline Emission

As per ACM0002, baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

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

Where:

BE_y: Baseline emissions in year y (tCO_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" (tCO_2/MWh)

The proposed project is the installations of new grid-connected renewable power plants at sites where no renewable power plant was operated prior to the implementation of the project activity, so:

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

Where:

$EG_{facility,y}$: Quantitiy of net electricity generation supplied by the project plant/nit to the grid in year y (MWh/yr)

3. Leakage

For the leakage, according to 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.

Therefore, the leakage in this project is zero as well (LE_y=0).

4. Emission reductions

Emission reductions of the project are calculated as follows:

$ER_y=BE_y-PE_y$

Where：

ER: Emission reductions in year y (tCO_2e/yr)

BE_y: Baseline emissions in year y (tCO_2/yr)

PE_y: Project emissions in year y (tCO2/yr)

After simplification, the final result for calculating this project's emission reduction is the following:

$ER_y=EG_{facility,y}*EF_{grid,CM,y}$

Emission Factor

The Baseline Emission Factor is calculated as a Combined Margin, using the weighted average of the operating margin and build margin.

$EF_{gird,CM,y}=EF_{gird,OM,y}* w_{OM}+EF_{grid,BM,y}* w_{BM}$

$EF_{gird,CM,y}$:Operating Margin Emission Factor (tCO_2/MWh)

$EF_{gird,BM,y}$: Build margin emission factor (t CO_2/MWh)

w_{OM}: Weighting of operating margin emission factor

w_{BM}: Weighting of build margin emission factor

Based on above equation, the operating margin emission factor ($EF_{gird,OM,y}$) of Taiwan is 0.688 tCO_2/MWh and the build margin emission factor ($EF_{gird,BM,y}$) is 0.625 tCO_2/MWh. The defaults weights for wind power are used as specified in the emission factor tool: w_{OM}=0.75; w_{BM}=0.25. The result of the Baseline Emission Factor calculation is 0.672tCO_2/MWh. The calculations are presented in Appendix 4.

B.6.2. Data and parameters fixed ex ante

Data / Parameter	EG_y
Unit	MWh
Description	Net electricity generated in the project electricity system in year y
Source of data	Energy Balances in Taiwan
Value(s) applied	See Table in Appendix 4
Choice of data or Measurement methods and procedures	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$FC_{i,y}$
Unit	Ton, litre or $1000m^3$
Description	Amount of fuel type I consumed by power plants/units in year y
Source of data	Energy Balances in Taiwan
Value(s) applied	Step 4 Table in Appendix 4
Choice of data or Measurement methods and procedures	Fuel consumption breakdown by power plant/unit is unavailable, total consumption amounts are published annually.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$NCV_{i,y}$
Unit	GJ/mass or volume unit
Description	Net calorific value (energy content) of fuel type I in year y
Source of data	GHG Emission Factor Inventory- Industrial Development Bureau, Ministry of Economic Affairs, Taiwan
Value(s) applied	Please refer to the table in Appendix 4
Choice of data or Measurement methods and procedures	Numbers are adopted from the reference document.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$EF_{C02,i,y}$
Unit	t CO2/GJ
Description	CO2 emission factor of fuel type i in year y
Source of data	GHG Emission Factor Inventory– Industrial Development Bureau, Ministry of Economic Affairs, Taiwan R.O.C.
Value(s) applied	Please refer to the table in the Appendix 4

Choice of data or Measurement methods and procedures	Publicly available data from Bureau of Energy, Ministry of Economic Affairs
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$EF_{coal, Adv}$ $EF_{gas,Adv}$ $EF_{oil,Adv}$
Unit	tCO2/MWh
Description	Emission factor of commercialized coal-fired, oil-fired and gas-fired power plant
Source of data	Equipment energy efficiency benchmark from Energy Information Network by Industrial Technology Research Institute, Bureau of Energy , Ministry of Economic Affairs
Value(s) applied	Step 5 in Appendix 4
Choice of data or Measurement methods and procedures	Publicly available data from Bureau of Energy, Ministry of Economic Affairs
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$CAP_{source,y}$
Unit	MW
Description	Installed capacity by different sources from 2012 to 2014
Source of data	Statistic data of power generation capacity and total generation published by Bureau of Energy, Ministry of Economic Affairs
Value(s) applied	Step 5 in Appendix 4
Choice of data or Measurement methods and procedures	Publicly available data from Bureau of Energy, Ministry of Economic Affairs
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO2e/MWh
Description	Combined Emission factor
Source of data	Calculated
Value(s) applied	0.672
Choice of data or Measurement methods and procedures	The Baseline Emission Factor is calculated as a Combined Margin, using the weighted average of the Operating Margin and Build Margin.
Purpose of data	Calculation of baseline emissions
Additional comment	

B.6.3. Ex ante calculation of emission reductions

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Project Emissions

In according to ACM0002, the project emission for most renewable energy (including wind farm) project activities is zero (PE_y=0).

Leakage

Based on ACM0002, there is no need of leakage calculation or monitoring for this kind of activity, thus leakage is considered to be zero (0 tCO_2e).

Baseline Emissions

Based on ACM0002, baseline emissions (BE_y) include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the proposed project activity, which is calculated as follows:

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

Where:

BE_y: Baseline emissions in year y (tCO_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" (tCO_2e/MWh)

According to Section B.6.1, the final result for calculating this project's emission reduction is the following:

Chubei Wind Farm

ER= BE_y- PE_y= 27,600 MWh *0.672 tCO2e/MWh-0 tCO_2e =18,547 tCO_2e

Zhowei Wind Farm

ER= BE_y- PE_y= 33,120 MWh *0.672 tCO2e/MWh-0 tCO_2e =22,257 tCO_2e

Tongyuan Wind Farm

ER= BE_y- PE_y= 66,240 MWh *0.672 tCO2e/MWh-0 tCO_2e =44,513 tCO_2e

Taichung III Wind Farm

ER= BE_y- PE_y= 27,600 MWh *0.672 tCO2e/MWh-0 tCO_2e =18,547 tCO_2e

Taichung Chingfeng Wind Farm

ER= BE_y- PE_y= 5,520 MWh *0.672 tCO2e/MWh-0 tCO_2e =3,709 tCO_2e

Taichung Anwei Wind Farm

ER= BE_y- PE_y= 27,600 MWh *0.672 tCO2e/MWh-0 tCO_2e =18,547 tCO_2e

The total emission reduction of the proposed project is calculated as followed:

BE_y =18,547 tCO2e + 22,257 tCO2e +44,513 tCO2e+18,547 tCO2e+3,709 tCO2e+18,547 tCO2e=126,120 tCO2e

ER= BE_y- PE_y= 126,120 tCO_2e-0 tCO_2e = 126,120 tCO_2e

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)
Year 1	126,120	0	0	126,120
Year 2	126,120	0	0	126,120
Year 3	126,120	0	0	126,120
Year 4	126,120	0	0	126,120
Year 5	126,120	0	0	126,120
Year 6	126,120	0	0	126,120
Year 7	126,120	0	0	126,120
Total	882,840	0	0	882,840
Total number of crediting years	7			
Annual average over the crediting period	126,120	0	0	126,120

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{export,y}$
Unit	MWh/yr
Description	Quantity of electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Electricity meters
Value(s) applied	The total generation of the project is 187,680 MWh: The generation of Chubei Wind Farm: 27,600 MWh The generation of Zhaowei Wind Farm: 33,120 MWh The generation of Tongyuan Wind Farm:66,240 MWh The generation of Taichung III Wind Farm: 27,600 MWh The generation of Taichung Chingfeng Wind Farm:5,520 MWh The generation of Taichung Anwei Wind Farm: 27,600 MWh

Measurement methods and procedures	Bi-directional electricity meters are applied in the project for all wind farms. Data from the electricity meters will be recorded remotely and digitally at the Taipower office. Taipower's personnel download the electronic data from the meters, and subsequent to meter reading sessions, the meters data are then incorporated in the monthly electricity receipts, which are then sent to the project owner by Taipower for confirmation on the amount of both electricity exported and imported. After confirmation from the project owner, the confirmed electricity exported to the grid is then considered as the basis on which Taipower conducts the payment to the project owner for purchasing electricity generated by the proposed project and the project owner sends the invoice to Taipower. As for TaiChung III wind farm, the electricity meter monitors the electricity amount of not only the proposed project but also part of the electricity from owner's other project. For separation of electricity between Tai Chung III wind farm and owner's other project, the automatic electricity record system (SCADA, owned by the project owner) has been used. The generation electricity data of each wind turbine would be recorded by SCADA and the recorded data would be submitted to Taipower. Taipower would separate the electricity value from the electricity meter based on the recorded data and then issue the receipts to the project owner for Tai Chung III wind farm under the proposed project.
Monitoring frequency	Continuous measurement and at least monthly recording.
QA/QC procedures	Meter reading records will be crosschecked with the electricity receipts. The electricity meters will undergo maintenance/calibration according to Taiwan national standards (based on The Weight and Measures Act, Regulation no. CNMV 46, 'Technical Specification for Verification and Inspection of Electricity Meters') Accordingly, meter calibration is conducted every 8 years period.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$EG_{import,y}$
Unit	MWh/yr
Description	Quantity of electricity consumption of the project plant/unit from the grid in year y
Source of data	Electricity meters
Value(s) applied	The value is estimated as zero.
Measurement methods and procedures	Bi-directional electricity meters are applied in the project for all wind farms. Data from the electricity meters will be recorded remotely and digitally at the Taipower office. Taipower's personnel download the electronic data from the meters, and subsequent to meter reading sessions, the meters data are then incorporated in the monthly electricity receipts, which are then sent to the project owner by Taipower for confirmation on the amount of both electricity exported and imported. After confirmation from the project owner, the confirmed electricity imported is then considered as the basis on which the project owner conducts the payment to Taipower for electricity imported from Taipower by the proposed project and Taipower sends the invoice to the project owner. As for Taichung III wind farm, the electricity meter monitors the electricity amount of not only the proposed project but also part of the electricity from owner's other projects. For separation of electricity between Taichung III wind farm and other projects, the automatic electricity record system (SCADA, owned by the project owner) has been used. The generation electricity data of each wind turbine would be recorded by SCADA and the recorded data would be submitted to Taipower. Taipower would separate the electricity value from the electricity meter based on the recorded data and then issue the receipts to the project owner for Taichung III wind farm under the proposed project.
Monitoring frequency	Continuous measurement and at least monthly recording.

QA/QC procedures	Meter reading records will be crosschecked with the electricity receipts. The electricity meters will undergo maintenance/calibration according to Taiwan national standards (based on The Weight and Measures Act, Regulation no. CNMV 46, 'Technical Specification for Verification and Inspection of Electricity Meters') Accordingly, meter calibration is conducted every 8 years period.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$EG_{facility,y}$
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y ()
Source of data	Calculated by the difference of $EG_{export,y}$ - $EG_{import,y}$
Value(s) applied	The total generation of the project is 187,680 MWh: The generation of Chubei Wind Farm: 27,600 MWh The generation of Zhaowei Wind Farm: 33,120 MWh The generation of Tongyuan Wind Farm:66,240 MWh The generation of Taichung III Wind Farm: 27,600 MWh The generation of Taichung Chingfeng Wind Farm:5,520 MWh The generation of Taichung Anwei Wind Farm: 27,600 MWh
Measurement methods and procedures	Calculated by the difference of $EG_{export,y}$ and $EG_{import,y}$, which are measured continuously and at least monthly recording.
Monitoring frequency	N/A
QA/QC procedures	Meter reading records of $EG_{export,y}$ and $EG_{import,y}$ will be crosschecked with the electricity receipts, and calculation will be double checked and verified.
Purpose of data	Calculation of baseline emissions
Additional comment	

B.7.2. Sampling plan

>>

Not applicable.

B.7.3. Other elements of monitoring plan

>>

1. Monitoring Objectives:

As per ACM0002, the emission reductions achieved by the project activity will be determined ex-post through direct measurement of the amount net electricity supplied to the grid multiplied by the combined margin emission factor:

$ER_y=EG_{facility,y}*EF_{grid,CM,y}$

As the emission factor is fixed for the first crediting period, the aim of the monitoring is therefore only to monitor the quantity of net electricity generation supplied by the project plant to the grid using energy meters. The project proponent may use electricity from the grid for start up purpose so both electricity consumption and generation will be monitored:

$EG_{facility,y}=EG_{export,y}-EG_{import,y}$

2. Electricity meters:

Electricity generation ($EG_{export,y}$) and consumption ($EG_{import,y}$) are measured continuously by bi-directional meters installed at the wind farms switchrooms, which are owned band supervised by Taipower. The accuracy for meters is equal to or higher than 0.5. The indicative grid connection diagrams of each wind farm are listed as below:

Tongyuan Wind Farm

One bi-directional electricity meter M1 is located after the 22.8 / 69 kV Transformer, before connected to Taipower 69 kV grid in Tongyuan wind farm Switchroom.

One bi-directional electricity meter M2 is located at Tongyuan Wind Farm Switchroom.Then the electricity generated by Tongyuan Wind Farm is delivered to Taipower grid 69 kV through Tai Chung wind farm Switchroom by 22.8 /69 kV Transformer.

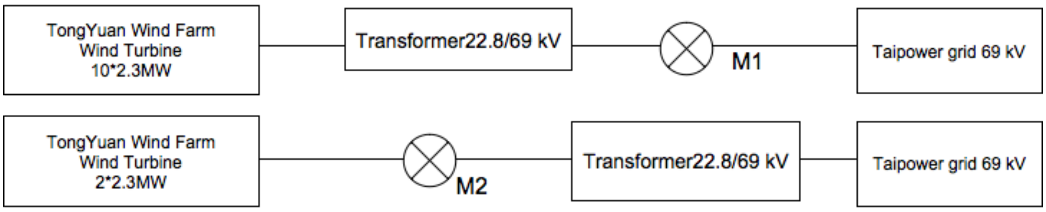

Figure.A.1 Electricity grid connection diagram of Tongyuan Wind Farm

Taichung III Wind Farm

One bi-directional electricity meter M3 is located after the 22.8/69 kV Transformer in Taichung wind farm Switch room. Then the electricity was connected to Taipower 69 kV grid. The meter M3 is connected by other wind farm projects now or in future.

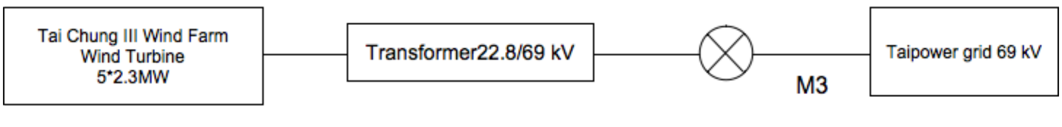

Figure.A.2 Electricity grid connection diagram of Tai Chung Wind Farm

Anwei Wind Farm

Four bi-directional electricity meters (M4, M5, M6, M7) are located at four 11.4 kV Switchrooms separately, before connected to Taipower 11.4 kV grid respectively.

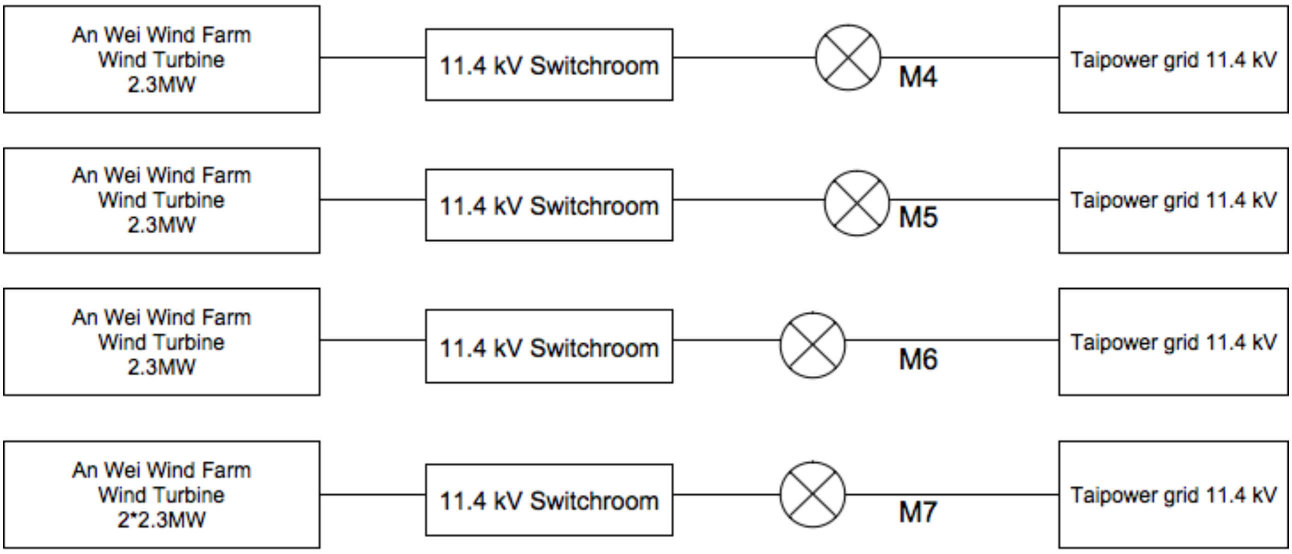

Figure.A.3 Electricity grid connection diagram of Anwei Wind Farm

Chingfeng Wind Farm

One bi-directional electricity meter is located in Chingfeng wind farm 11.4 kV Switch room, before connected to 11.4 kV Taipower grid at Wuqi S/S Substation.

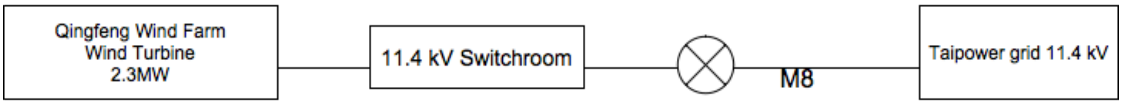

Figure.A.4 Electricity grid connection diagram of Qingfeng Wind Farm

Chubei Wind Farm

One or several bi-directional electricity meters will be located at 11.4kV or 22.8 kV Switch room, before connected to 11.4 kV or 22.8 kV Taipower grid. Due to the fact that the Chubei Wind Farm does not start to construct until now, the detailed information of the meters is not confirmed.

Zhaowei Wind Farm

One or several bi-directional electricity meters will be located at 11.4kV switch room, before connected to 11.4 kV Taipower grid. Due to the fact that the Zhaowei Wind Farm does not start to construct until now, the detailed information of the meters is not confirmed.

3. Responsibility of Parties

Two parties are involved: InfraVest Co., Ltd.and Taipower.

Infra Vest is in charge of overall wind projects operation & maintenance.

Taipower is in charge of monitoring.

4. Data Monitoring &Management Procedures:

The monitoring is done according to the following procedures:

1. Data from electricity meters are recorded remotely and digitally at the Taipower office. Taipower's personnel download the electric data.

2. Taipower incorporates the downloaded electric data into the monthly electricity receipts and sends to InfraVest for confirmation on the amount of both electricity export and import;

3. InfraVest confirms the electricity amount on the receipts.

4. Taipower pays the money to InfraVest for the confirmed export amount and receives export receipts from InfraVest. InfraVest pays to Taipower for the confirmed import amount and receives import receipts from Taipower.

GS VER monitoring training for the staffs will be provided.

5. Quality assurance and quality control procedures

The meter specification complies with The Weight and Measures Act, Regulation no. CNMV 46, 'Technical Specification for Verification and Inspection of Electricity Meters'[19]. The accuracy class of the electricity meters used for the project activity would be at least 0.5%, in line with the official standard error for electricity meter (MOF) at ±0.5%[20].

The official period of validity for the electronic electricity meter in this project is determined as 8 years. Request for calibration, error check and adjustment can be made by the project owner at its own expense. Taipower's calibration procedures are in accordance to and governed by the Bureau of Standards, Metrology and Inspection, Ministry of Economic Affairs, Taiwan R.O.C. All the calibration records will be documented by the project owner and provided to the DOE during verification.

[19] Technical Specification for Verification and Inspection of Electricity Meters , Clause 3.9.3
http://www.bsmi.gov.tw/wSite/public/Attachment/f1224657229438.doc
[20] Technical Specification for Verification and Inspection of Electricity Meters, Clause 3.3.4 Table 4
http://www.bsmi.gov.tw/wSite/public/Attachment/f1224657229438.doc

All emergency and disputes management procedures related to the electricity meter are regulated by Bureau of Standards, Metrology and Inspection, M.O.E.A., R.O.C[21]. In case of meter performance failure or malfunction, Taipower and the project owner would follow the Power Purchase Agreement (PPA) clause 6: Taipower and the project owner will jointly recalculate the amount of electricity dispatched by the project during the malfunction period based on the electricity dispatched during the same period last year or on the average electricity dispatched normally during the previous three periods for electricity purchasing and sales.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>

Date of completion of application of methodology and standardized baseline:

27/05/2016

Responsible persons/ entities:

Ms.Fang Qun

South Pole Carbon Asset Management Ltd.

[21] http://www.bsmi.gov.tw/wSite/laws/review.jsp?lawId=8a8a85591c30ce08011c31d0b3860006&mp=1

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>

13/12/2012, the construction starting date of Tongyuan Wind Farm.

C.1.2. Expected operational lifetime of project activity

>>

20 years and 0 months

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Renewable crediting period. This is the first crediting period.

C.2.2. Start date of crediting period

>>
30/06/2014

C.2.3. Length of crediting period

First crediting period: 7 years and 0 months

Total: 21 years

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

The Environmental Impacts Assessment (EIA) of the project activity was carried out by InfraVest and was supervised by the Environmental Protection Administration Executive Yuan, R.O.C. (Taiwan). As every requirement set by the Environmental Protection Administration Executive Yuan, R.O.C. (Taiwan) was completed for the project, the project activity will start to take place.

D.2. Environmental impact assessment

>>

Requirements and main conclusions of the EIA

Requirement of the EIA		Conclusion
Physics and Chemical Environment Assessment	1.Terrain, Geology and Earch	No negative effects result from the wind farms construction and operation.
	2.Water Quality	No negative effects are reported. The project is not in the water quality protection areas and is in a safe distance of any source of drinking water.
	3.Waste from projects	Wind farms produce few wastes during their activities. Therefore, the impact is considered negligible.
	4.Noise and Vibration	Wind turbines produce low frequency noises; the measured values are below the standard requirements.No vibration takes place during the activity. The impact is thus considered very limited and can be negligible.
	5.Weather and Air Quality	
Ecology Environment	6.Animals	The construction areas are not located in any protected and sensitive regions. Thus construction activities do not increase the burden of environment for animals. Conerns regrarding the impact of the wind farm on birds' activity is raised, but ht eturbines' height are below the birds' migration (flying) altitude. During landing, birds will dodge these wind turbines. Thus, birds' issues are considered very limited.
	7.Plants	No protected or rare plants are found in the construction areas. And the wind turbines and blades are higher that the plants, they will not impede the growth of plants. Therefore, the impacts on the plants can be negligible.
Sociology and Economy	8.Residents Characteristics	The project activity will make the second industry and third industry more prosperous by bringing more job opportunities.
	9.Economic Environment	Job opportunities are increased and the service industry and income of the local residents will be promoted as well
	10.Industry Structure	The wind-farm is expected to promote tourist activities in the area and increase opportunities to the local industries.Farming will not be influenced by the proposed project.
	11.Usage of Land	Concerns over the usage of land arise from Taiwan‘s mountainous geographical characteristic, which limites the human‘s activity space and agrarian lands. However, the project is to develop in terms of dots not facets, meaning the distance between Each turbine is considered significant and there is plenty of room for other purpose of land, if any. Basically there will be no severe impact on the usage of land. Furthermore, the turbines are built on public land, managed by the government, and it is not dedicated for agrarian or residential purposes.

	12.Infrastructure	No extra infrastructure is expected
	13. Transportation	Imact on traffic depends on the service quality of the road during the transportation of staff, machine and materials. However, the construction period is short and the transportation will avoid the heavy hours in such extent that generally the overall impact on traffic is very limited
Tourism Impact	14.Scenery Study and Entertainment Study	The locations of these wind turbines are far from the residential areas. No any specific scenery is sited aroud or within these locations. Thus the impacts on the scenery and entertainment places very limited.
Cultural Environment	15.Excavation	No excavation found
	16.Ancient Buildings	No ancient buildings in the designated sites have been reported.
	17.Cultural Customs and Religions	No impact on close cultural customs and religions activities.

There is no significant impact deriving from the project activity

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

Southpole Carbon Asset Management Co., Ltd. invited international stakeholders through email to attend the local stakeholder consultation meeting for the proposed project on 3rd, 4th September 2012 and 27th November 2015. Recipients of invitation included Gold Standard, local supporters of Gold Standard, Greenpeace and WWF International. The local community were involved in the consultation process of the proposed project through inviting the local residents and the community representatives to the stakeholder consultation meeting. Invitations were sent out to local villages and counties that might be impacted by the project bundle, including areas of the six wind farms. Most of the invitations were delivered in person to the village heads and community representatives; this is aimed to encourage them to gather the residents (men and women) in their community to join the meeting. This approach is considered more effective to invite the local people as compared to putting announcements through media or at local offices. Around 33 stakeholders in 2012 and 26 stakeholders in 2015, from the villages and counties where the six wind farms located, including the Township Mayor, local residents, community representatives, village heads, county/township officers attended the stakeholder consultation meeting, among which 16 were women.

The local NGO invited to the stakeholder consultation is NEAT Taiwan (New Energy Association of Taiwan), which is an independent local NGO focusing on the climate sustainability, and the development of the clean, efficient energy technologies in the region. This NGO has a touch-base experience in the renewable energies cultivation than other NGOs in the region. Given the organization's background, it was expected to present an objective perspective regarding the proposed project development.

The LSC meeting of Tongyuan Wind Farm and Zhaowei Wind Farm was held on Sep 3rd 2012 at Tongxiao County. The LSC meeting of Chubei Wind Farm was held on Sep 4th 2012 at Chubei Township. The LSC meeting of Taichung III wind Farm, Taichung Chingfeng Wind Farm, Taichung Anwei Wind Farm was held on 27th Nov 2015 at Taichung County.

List of the Participants

Date and time : Sep 3rd and 4th 2012					
Location : Tongxiao County, Chubei Township					
Category Code	Name of participant, job/ position in the community	Male/ Female	Signature	Organisation (if relevant)	Contact details
B	Zheng Guoxiong, Representative of People's congress of Tongxiao County	Male		N/A	0932665403
A	Zhang Youji	Male		Local resident of Tongxiao County	0912754125
A	Zhang A'jia	Male		Local resident of Tongxi County	0933861985
A	Lai Cilang	Male		Resident of Wubei Village	0933754998
A	Luo Pingshi	Male		Resident of Tongxiao County	0958052689
A	Zhuang Zhaoyang	Male		Resident of Wubei Village	0916211513
A	Qiu Yonghe	Male		Resident of Tongxi Village	0930888562
A	Luo Mubiao	Male		President of Tongxi Coummunity	0935275752
A	Wu Yangqing	Male		General whip of Tongxi Community	0919905756
A	Gan Qiunan	Male		The head of Wubei village	0933409025

A	Zheng A'jin	Male		Villager of Tongwan Village	0910517629
A	Xu Linsheng	Male		Villager of Tongwan Village	0910115659
A	Lai Jinlong	Male		President of Wunan Community	0919827664
A	Li A'xin	Male		Villager of Tongwan Village	No.105, Tongwan Village
A	Wang Xuanrong	Male		The head of Yuangang village	0925968689
A	Zhang Chunji	Male		President of Haigang vallige community	0935734659
A	Zeng Shihong	Male		President of Hai'an village community	0919855030
A	Lai Yuzhong	Male		Resident of Xiping village	0952752088
A	Li Zhizhong	Male		Resident of Xiping Village	0915942588
A	Chen Jiding	Male		Resident of Hai'an Village	0932863406
A	Jiang Shufen	Female		General Whip of Wunan Village	0989205892
A	Zhang Chuanfa	Male		The head of Tongxi Village	0916836135
A	Liu Shoufu	Male		Resident of Tongxi Village	0916751533
A	Chen Chunchang	Male		Resident of Tongxi Village	0916753038
A	Tu Dingqi	Male		Resident of	0983803636

				Wunan Village	
B	Huang Rongcong	Male		The chairman of People's Congress	0927788886
A	Zeng Guoqing	Male		Resident of Chubei County	0988613638
A	Zeng Zhong'an	Male		Resident of Chubei County	0989200925
A	Zeng Wenqi	Male		Resident of Chubei County	0981178231
A	Lin Qiurong	Male		The head of Chongyi Village	0937121390
A	Huang Guojia	Male		Resident of Chubei County	0916737947
A	Guo Gongbao	Male		Reisident of Chubei County	0910295205
A	Chen Zhihui	Female		Resident of Chubei County	0939420888

Date and time:November 27th 2015					
Location:TaiChuang County, Dajia Township					
Category Code	Name of participant, job/ position in the community	Male/ Female	Signature	Organisation (if relevant)	Contact details
A	Lin Mingda	Male		Local Residents in Dajia Township	0932677192
A	Xu Shuwen	Female		Local Residents in	0426816186

				Da'an Township	
A	Huang Bixia	Female		Local Residents in Da'an Township	0426713224
A	Xiao WeiYu	Female		Local Residents in Da'an Township	0426710082
A	Lin Qiulan	Female		Local Residents in Da'an Township	0988080305
A	Zhang Bizhu	Male		Local Residents in Da'an Township	0426713611
A	Wu Wencan	Male		Local Residents in Da'an Township	0912323476
A	Su meizhu	Female		Local Residents in Da'an Township	0963341434
B	Chen panquan	Male		Director of Guikeli	0932569534
B	Bai yintang	Male		Director of Gaobei	0935039730
A	Xu Wenyi	Female		Local Residents in Gaobei	0980217199
A	Lin Wenqin	Male		Local Residents in Gaobei	0933433428
A	Lin Shiguang	Male		Local Residents in Gaobei	0933232222
A	Zhen Chunjia	Male		Local Residents in Gaobei	0426111358
A	Zhen Qili	Male		Local	0921782206

				Residents in Gaobei	
A	Zhuang Yunhe	Female		Local Residents in Gaobei	0426113377
A	Chen Zizhang	Male		Local Residents in Xiqi	0932605929
A	Pan haishen	Male		Local Residents in Xiqi	0426813920
A	Li zhuanghuang	Female		Local Residents in Xiqi	0426813920
A	Zhen Lixiuqing	Female		Local Residents in Xiqi	0426815186
A	Li bixia	Female		Local Residents in Xiqi	0426813895
A	Chen jianquan	Male		Local Residents in Xiqi	0910245635
A	Zen Qingli	Female		Local Residents in Xiqi	0426812961
A	Wang rongnan	Female		Local Residents in Xiqi	
A	Wang a’e	Female		Local Residents in Xiqi	0426816610
A	Chen Mirong	Female		Local Residents in Xiqi	0426812638

E.2. Summary of comments received

>>

In the meeting, at first the project owner representative provided a brief introduction of the background of Infra Vest Wind Farm Group and its various records in wind farm constructions. The general information of each wind farm in the proposed project was provided as well such as locations and technical parameters. Then the possible impacts and mitigation measures were explained to the attendants.

After the explanation, the meeting went to Q&A section and a few concerns were raised by the stakeholders. The following table summarizes the concerns and the response made by the project owner:

Stakeholder comment	Was comment taken into account (Yes/ No)?	Explanation (Why? How?)
Noise problem might occur for some of the residents from a wind turbine. Is there any approach planned to overcome this problem?	Yes	Monitoring of noise will be monitored continuously and airtight window will be installed to the house affected for free by the project participants if needed.
Traffic conditions and soil condition	Yes	The project participants promised that a good maintenance would be done for the road if it is impacted by the constructions of the project activity. And replantations could be considered according to EIA report if there are any.
Public safety	No	As the project activity will be constructed and operated strictly according to the design and EIA assessment, therefore no public safety issues would be involved. And this has been explained to the stakeholders during the meeting, and a consensus has been made that.

An open discussion was held. The attendants felt satisfied and did not express any other inquiries or concerns.

Finally, the evaluation forms were filled by the attendants. The summary of comments in the filled forms are summarized as below:

Name	
What is your impression of the meeting?	The meeting helps locals understanding more about the planning and ideals of the wind farm project. Some of the stakeholders

	pointed out that the project owner explained in detail about the importance of wind power to the environment and the renewable energy development.
What do you like about the project?	It is concluded that the project positively contributes to a sustainable environment: it uses renewable energy (wind) to generate clean electricity.
What do you not like about the project?	Not indicated. The stakeholders do not think that the project would lead to any negative effects. Theny are quite supportive towards the renewable energy development in their area.
Signature	

E.3. Report on consideration of comments received

>>

According to the stakeholder consultation processes, it is clear that the stakeholders are in favour of the development of the proposed project. Some minor questions such as noise impact were raised; however these are minor issues and mitigation measures had already been planned in the earliest stage of project design.

Besides these, no comments received up to the date of the completion of this PDD.

SECTION F. Approval and authorization

>>

N/A

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Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Infra Vest Co.Ltd.,
Street/P.O. Box	10-2F,No.9, Sec.2, Roosevelt Rd.,
Building	
City	Taipei
State/Region	
Postcode	100
Country	Taiwan
Telephone	+886 2 2395 4886
Fax	+886 2 2395 1580
E-mail	info@infra-vest.com
Website	http://www.infra-vest.com/
Contact person	Karl Eugen Feifel
Title	President
Salutation	Dr.
Last name	Feifel
Middle name	Eugen
First name	Karl
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	feifel@infra-vest.com

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	South Pole Carbon Asset Management Ltd.
Street/P.O. Box	Technoparkstrasse 1
Building	
City	Zurich
State/Region	Zurich
Postcode	8005
Country	Switzerland
Telephone	+41 43 501 35 50
Fax	+41 43 501 35 99

E-mail	info@southpolecarbon.com
Website	www.southpolecarbon.com
Contact person	Renat Heuberger
Title	
Salutation	Mr.
Last name	Heuberger
Middle name	
First name	Renat
Department	
Mobile	
Direct fax	+41 43 501 35 99
Direct tel.	+41 43 501 35 99
Personal e-mail	r.heuberger@southpolecarbon.com

Appendix 2. Affirmation regarding public funding

The project does not involve any ODA financing. As confirmed with the GS[22], GS projects in Taiwan have been exempted from ODA declaration. Taiwan is not an OECD member, and it is not included in the DAC list of ODA recipients. Taiwanese projects are therefore not eligible for receiving ODA funding.
There is no public funding from Annex I countries involved in the project activity.

Appendix 3. Applicability of methodology and standardized baseline

N/A

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

According to the "Tool to calculate the emission factor for an electricity system" (Version 05.0), six steps shall be applied for calculating the emission factor:

STEP 1. Identify the relevant electric system

A project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

[22] Email correspondence with Leon Wang, GS Regional Manager of China and East Asia Region, dated October 19, 2011. Please also refer to the GS Passport of Registered Project #GS612 – InfraVest Guanyin Wind Farm Project – Taiwan. The email has been provided.

A national connected electricity system is defined as an electricity system that is connected by transmission lines to the project electricity system. Taiwan is an island with no cable connection with the continent. Thus there is not any connected electricity system in Taiwan. The spatial extent of the Project Boundary is defined as the insular electricity grid of Taiwan operated by Taipower Company.

The source of data used in calculation of OM and BM is publicly available in Taiwan:

- Energy Balances in Taiwan (from the Bureau of Energy), which give access to electricity production and fossil fuel consumption in Taiwan by sectors.

As it will be explained below, the data will be used for calculating the operating margin and the build margin.

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

According to “Tool to calculate the emission factor for an electricity system (Version 05.0)”, project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

Since option II requires collecting data on off-grid power generation, while such data is not publicly available in the region, thus the off-grid power plants are excluded from the calculation and option I is chosen.

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

In order to calculate the Operating Margin, the emission factors of fossil fuels are listed in the following table:

Table A1 Net Calorific Values ($NCV_{i,y}$) multiplied by ($EF_{co2,i,y}$) of fossil fuel used for OM and BM calculation

Fuel Type	Emission Factor	Unit
Bituminous Coal - Steam Coal	**2.22**	tCO2/t
Sub-Bituminous Coal	**1.90**	tCO2/t
Coke Oven Gas	**0.66**	$KgCO2/M^3$
Blast Furnace Gas	**0.71**	$KgCO2/M^3$
Oxygen Steel Furnace Gas	**1.13**	$KgCO2/M^3$
Diesel Oil	**2.55**	KgCO2/L
Residual Fuel oil	**3.03**	KgCO2/L
LNG	**2.05**	$KgCO2/M^3$
Petroleum Coke	**2.85**	KgCO2/Kg

Natural Gas	**1.82**	KgCO2/M3
Refinery Gas	**1.82**	KgCO2/M3

According to the experts[23], coal should not be considered as low cost/must run. Thus only nuclear, biomass, hydro, geothermal electricity, solar photovoltaic and wind power plants are included as low-cost/must-run resources, hereafter referred as lc-mr, which turns out to be between 20.32% and 21.4% of the total electricity generation on average during years 2010 and 2014:

Table A2: Gross and Net Electricity Generation in Taiwan[24]

	Units	2010	2011	2012	2013	2014
Total electricity generation	MWh	250,785,847	255,733,038	253,862,468	255,875,507	256,834,324
Total low-cost/must-run	MWh	53,658,833	54,138,650	54,091,229	55,750,472	52,187,634
Total Power plant Own Use	MWh	10,628,686	10,678,208	10,556,467	10,223,738	14,078,785
Total LCMR power Plant Own Use	MWh	1,645,131	1,642,496	1,584,200	1,610,638	4,854,133
share of LCMR	MWh	21.40%	21.17%	21.31%	21.79%	20.32%

The baseline methodology allows a choice among four methods for the calculation of OM emission factor;

1. (a) Simple OM, or
2. (b) Simple adjusted OM, or
3. (c) Dispatch Data Analysis OM, or
4. (d) Average OM

Since the average share of electricity generation by lc-mr plants for five most recent years is found to be less than 50%, option (a) is chosen. The simple OM emission factor can be calculated using either of the two data vintages:

[23] According to Dr. Chung-Huang Huang (黃宗煌教授), a professor at Department of Economics, National Tsing Hua University, coal power plants are not 'low-cost' in calculation of Operating Margin because when evaluating the total costs of the electricity generation technologies, the external costs also have to be taken into account besides the internal costs (such as the operational cost, construction cost, etc). With the external costs included in the calculation, the total social cost (internal cost + external cost) of coal power plants is proved to be higher than that of renewable power generation. Furthermore, when the grid was going to reduce power plant operation during the lower load demand period, the coal-fired power plants are prioritized to undertake such function. Thus, coal cannot be considered as 'low-cost / must-run'.

[24] Extracted from the "Energy Balances Sheet in Taiwan", Bureau of energy,

(a) Ex-ant option: if the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emission factor during the crediting period is required. For grid power plants, use a 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. For off-grid power plants, use a single calendar year within the five most recent calendar years prior to the time of submission of the CDM-PDD for validation;

(b) Ex-post option: if the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

The ex-ante option is selected to calculate the operating margin for the Project. Monitoring and recalculation of the emission factor during the second crediting period is not required.

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 CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options;

The simple OM may be calculated by one of the following two options:
(a) Option A : Based on the net electricity generation and a CO2 emission factor of each power unit; or
(b) 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.
Option B can only be used if:
(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost/must- run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation.
Complete plant-specific data required by Option A is unavailable, Taipower can furnish some plant specific data but only for the power plants they operate, these numbers do not comprise all independent power producers for which plant specific statistics are not available.
Option B is adopted since the necessary data for option A is not available; only renewable sources and nuclear are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and the off-grid power plants are not included in the calculation. According to the “Tool to calculate the emission factor for an electricity system” under this option, 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 low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

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

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO2 emission factor in year y (tCO2/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)
	EFco2,i,y: CO2 emission factor of fuel type i in year y (tCO2/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

Table A3: The total CO2 emissions by fuels of 2012, 2013 and 2014

Total Emission in 2012	tCO_2	134,596,672
Total Emission in 2013	tCO_2	133,783,653
Total Emission in 2014	tCO_2	129,416,076

Thus the results of OM:

EF_{OM} 2012	tCO_2/MWh	0.705
EF_{OM} 2013	tCO_2/MWh	0.699
EF_{OM} 2014	tCO_2/MWh	0.662
Average EF_{OM}	tCO_2/MWh	**0.688**

The result of Operating Margin emission factor calculation is **0.688** tCO2e/MWh

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

In accordance to the calculation method proposed by the NDRC[25] which was approved by CDM EB[26], since it is impossible to separate the different generation technology capacities based on coal, oil or gas fuel etc from the generic term "thermal power" in the present energy statistics, the following calculation measures is taken:

First, according to the energy statistics of the selected period in which approximately 20% capacity has been added to the grid, the ratio of CO2 emissions produced by solid, liquid, and gas fuel consumption for power generation is determined; then multiply this ratio by the respective emission factors based on commercially available best practice technology in terms of efficiency. Finally, this emission factor for thermal power is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid. The sample group of power units chosen to calculate the build margin is therefore the set of power capacity additions in the electricity system that comprise 20% of the system capacity (in MW) that have been built most recently[27]. In terms of vintage of data, Option 1 is chosen:

For the second crediting period, build margin emission factor is updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE.

The result is the BM emission factor of the grid is calculated as follows:

Sub-step 1

All emission factors of fossil fuels used in calculation of the emissions of fossil fuels are referred to the table "the emission factors of fossil fuels in Taiwan" in Step 2.

Calculate the proportion of CO2 emissions related to consumption of coal, oil and gas fuel used for power generation as compared to total CO2 emissions from the total fossil fueled electricity generation (sum of CO2 emissions from coal, oil and gas).

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}$$

[25] The build margin calculations is derived from the "Bulletin on the baseline emission factor of the Chinese Electricity Grid", which has been published by the Chinese DNA (Office of National Coordination Committee on Climate Change) on Oct. 16. 2006.

[26] This is in accordance with the request for guidance: Application of AM0005 and AMS-I.D in China, a letter from DNV to the Executive Board, dated 07/10/2005, available online at: http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM. This approach has been applied by many registered CDM projects using methodology ACM0002 so far.

[27] Note: According to the Tool to calculate the emission factor for an electricity system (version 05.0) "If 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation."

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}$$

Fi,j,y	The amount of fuel i (in a mass or volume unit) consumed by power sources j in year y
NCVi,y	the net calorific value of fuel i in year y (GJ/t for solid and liquid fuels, GJ/m^3 for gas fuels)
EF co2,i,j,y	the CO2 emission coefficient of fuel i (tCO2/GJ)

Coal, Oil and Gas stands for solid, liquid and gas fuels respectively.

Table A4 The total CO2 emissions by fuel of 2014

	Fuel	Fuel Unit	Allocated Emission (tCO2e)	Emission (tCO2e)	
Solid	Bituminous Coal-Steam Coal	t	21,312,794	66,389,116	
	Sub-Bituminous Coal	t	686,589	25,407,523	-
	Coke Oven Gas	M3	478,445	478,445	
	Blast Furnace Gas	M3	1,230,658	1,230,658	-
	Oxygen Steel Furnace Gas	M3	169,211	169,211	
	Sub-total	-	-	93,674,952	-
	Refinery Gas	M3	12,688	12,688	72.38%
Liquid	Diesel Oil	L	0	212,925	-
	Residual Fuel Oil	L	1,129,685	5,893,831	-
	Petroleum Coke	t	619,431	619,431	-
	Sub-total	-	-	6,738,875	-
Gas	Natural Gas	M3	7,571	7,571	5.21%
	LNG	M3	136,791	28,994,678	-

	Sub-total	-	-	29,002,249	-
		-	25,783,863	129,416,076	22.41%

Data Source: Energy Balances in Taiwan-New Format by Taiwan's Bureau of Energy

Sub-step 2 Calculate the operating margin emission factor of fuel-based generation.

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y}$$

Where

$EF_{Thermal,y}$	The weighted emissions factor of thermal power generation with the efficiency level of the best commercially available technology in Taiwan in the previous three years
$EF_{coal,Adv}$,$EF_{Oil,Adv}$,$EF_{Gas,Adv}$	the emission factors of coal, oil and gas-fired power generation with efficiency levels of the optimal commercially available technology in Taiwan in the previous three years.

The optimal efficiency and emission factors of commercialized coal-fired, oil-fired power plant are shown as below:

Type of power plant	Variables	Emission factor (tCO2e/MWh)
Coal fire power plant	$EF_{Coal,Adv}$	0.792
Gas fired power plant	$EF_{Gas,Adv}$	0.367
Oil fired power plant	$EF_{Oil,Adv}$	0.506

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \cdot EF_{Thermal}$$

Where

CAPtotal	the total capacity addition of the selected period in which close but not lower to 20% capacity has been added to the grid
CAPthermal	the total thermal power capacity addition of the selected period in which approximately 20% capacity has been added to the grid

The below is shown the installed capacity of Taiwan Power Grid.

	Installed capacity in 2002 (MW)	Installed capacity in 2014 (MW)	Newly added installed capacity from 2002 till 2014 (MW)	Proportion against newly added installed capacity
Hydro	4,422.0	4,683.4	261.4	2.687%
Nuclear	5,144.0	5,144.0	0.0	0.000%
Thermal	27,829.0	36,650.4	8,821.4	90.677%
Renewable Energy	611.8	1,257.3	645.5	6.636%
Total	38,006.8	47,735.1	9,728.3	100.00%

The result of Build Margin emission factor calculation is **0.625** tCO2e/MWh.

Step 6. Calculate the combined margin emissions factor

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

$$EF_{grid,CM,y} = w_{OM} \cdot EF_{grid,OM,y} + w_{BM} \cdot EF_{grid,BM,y}$$

Where:

wOM	Weighting of operating margin emissions factor (per cent)
wBM	Weighting of build margin emissions factor (per cent)

The operating margin emission factor (EFgird,OM,y) of Taiwan is 0.688 tCO2e/MWh and the build margin emission factor is 0.625 tCO2e/MWh. The defaults weights for wind power are used as specified in the emission factor tool:

wOM=0.75; wBM=0.25

The result of the Baseline Emission Factor calculation is 0.672 tCO2e/MWh.

Appendix 5. Further background information on monitoring plan

Please refer to Sec.B.5 for more details

Appendix 6. Summary of post registration changes

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