CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
Title: Miaoli 49.8MW Wind Farm Project
Version: 1.0
Date of completion: 06/07/2009

A.2. Description of the project activity:

>>
The Miaoli 49.8MW Wind Farm Project (hereinafter referred to as "the project") includes the construction and operation of a 49.8MW Wind Farm located in Miaoli County, Taiwan. The project was developed by Miaoli Wind Co., Ltd (hereafter refer as "Miaoli Wind") and is currently owned by Macquarie International Infrastructure Fund Limited (hereafter refer as "MIIF"). The Wind Farm is comprised of 25 wind energy converters ("WEC") in two separate areas of Miaoli County:, Houlong (21 WECs) and Chunan (4 WECs), for a total feed output of 49.8MW. The purpose of the project is to encourage the use of renewable energy in Taiwan. The project displaces part of the electricity supplied by the regional state electricity authority, Taipower ("TPC"), which is currently dominated by fossil fuel-fired power plants, and thus reduces greenhouse gas emissions. The average annual electricity delivered to TPC (based on full operation years 2007-2009) is 140,305 MWh, and the average annual emission reductions generated during the crediting period is estimated at 107,067 tCO_2e.

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

- reduce the greenhouse gas emissions in Taiwan by replacing fossil fuel based power generation;
- produce clean, renewable energy that contributes to alleviate the global warming;
- contribute to the development of the wind energy sector in Taiwan;
- provide clean electricity to the equivalent of 36,930 households[1];
- create local employment both during the construction and operational phase;
- technology and know-how transfer as the employees are trained by German wind turbine manufacturer Enercon on maintenance, safety and operational issues;
- contribute to the reduction of pollutants such as sulphur dioxide, nitrogen oxides and particles resulting from the electricity generation from fossil fuels in Taiwan;
- contribute to Taiwan's energy sustainability and security by reducing the dependency on fossil fuel imports.

A.3. Project participants:

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Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Taiwan (Host)	Macquarie International Infrastructure Fund Limited ("MIIF")	No

[1] Taipower Statistic Data (2005-2009): Average household power usage is 316.6 kWh/month (3,799.2 kWh/year)
http://www.taipower.com.tw/left_bar/jing_ying_ji_xiao/5year_effects.htm

	(private entity)	

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>>
Taiwan

A.4.1.2. Region/State/Province etc.:

>>
Miaoli County

A.4.1.3. City/Town/Community etc.:

>>
Dapong and Chunan Township

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The wind farm site is located in Taiwan’s Miaoli district, directly off the coast of the Taiwan Strait. The area extends from south-west to north-east over a distance of nearly 10km along the coastline. The project consists of 21 turbines in Dapong, the main area located in the south and an additional 4 turbines in Chunan.

The proposed project activities are distributed in these zones which are at the geographical position of 24°43’0.27”N, 120°51’48.60”E for the Chunan Site and 24°35’37.42”N, 120°42’58.68”E for the Dapong Site.

The locations are depicted in the pictures shown below. Figure A-1 shows the geographic location of the project, Figure A-2 shows the locations of the wind turbines in Chunan, and Figure A-3 shows the location of the wind turbines in Dapong.

Fig.A-1 Geographic location of the project

Fig.A-2: Map of Chunan Site

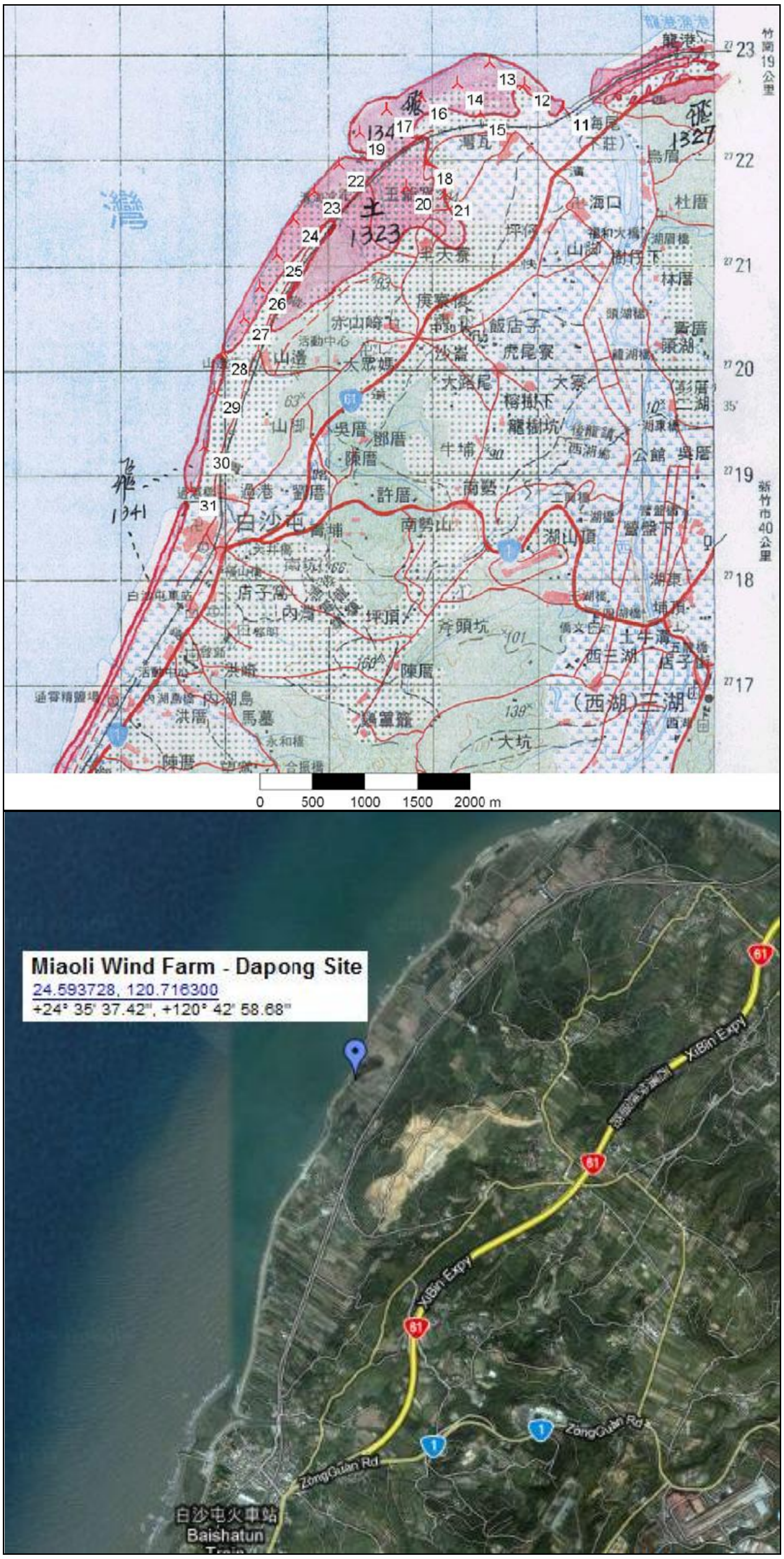

Fig.A-3: Map of Dapong site.

A.4.2. Category(ies) of project activity:

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The project activity category falls into:
Sectoral Scope 1: Energy industries (Renewable energy)

A.4.3. Technology to be employed by the project activity:

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The Chunan wind farm utilizes 3 2000KW turbines and 1 1800KW turbine. The Dapong wind farm utilizes 21 2000KW turbines. The machines are made by the German company, Enercon GmbH. The technology used, type E-70 WECs with 70m diameters and 65m hub heights is some of the newest available. The turbines in Chunan are directly connected to TPC through 22.8KV underground cables. The turbines in Dapong are connected to the Tung Ho Steel Substation through 22.8KV underground cables. After the voltage is raised to 161KV, the energy is then transferred to TPC via a 40m transmission line.

The technical data of the turbine units of turbine type E-70 is given in the table below.

Rated power:	1,800-2,000 kW
Rotor diameter:	70 m
Hub height:	65 - 114 m
Wind class (IEC):	IEC/NVN I
Turbine concept:	Gearless, variable speed, variable blade pitch
Rotor	
Type:	Upwind rotor with active pitch control
Direction of rotation:	Clockwise
Number of blades:	3
Swept area	3,848 m
Blade material:	Fibreglass (reinforced epoxy); with integral lightning protection
Rotational speed:	Variable, 10 - 22 rpm
Pitch control:	3 synchronized blade pitch system, with allocated emergency supply
Drive train with generator	
Hub:	Rigid
Main bearings:	Tapered/ cylindrical roller bearings
Generator:	Direct-driven synchronous Enercon ring generator
Grid feeding:	ENERCON inverter
Braking systems:	3 independent blade pitch systems with emergency supply - Rotor brake - Rotor lock for service and maintenance
Yaw control:	Active via adjustment gears, load-dependent damping
Cut-in wind speed	2.5 m/s
Cut-out wind speed:	28 - 34 m/s
Remote monitoring:	ENERCON SCADA

Table 1. Characteristics of the wind turbine E-70

http://www.economypoint.org/e/enercon.html

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

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The project will operate for the renewable crediting period of 7×3 years. The crediting period starts on the first day of documented electricity supply to the grid. The yearly net generated electricity delivered to the grid is estimated at 140,305 MWh, and the average annual emission reductions is 107,067 tCO_2e. The table below demonstrates the estimated emission reductions during the first crediting period.

Year	Estimation of annual emission reductions in tonnes of CO_2 e
2008 (01/12/2008-31/12/2008)[2]	13,712
2009 (01/01/2009-31/12/2009)	101,640
2010 (01/01/2010-31/12/2010)	101,697
2011 (01/01/2011-31/12/2011)	108,324
2012 (01/01/2012-31/12/2012)	108,324
2013 (01/01/2013-31/12/2013)	108,324
2014 (01/01/2014-31/12/2014)	108,324
2015 (01/01/2015-30/11/2015)	99,124
Total estimated reductions (tonnes of CO_2 e)	749,466
The number of crediting years	7
Annual average of the estimated reductions over the crediting period	**107,067**

A.4.5. Public funding of the project activity:

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

[2] Assuming GS registration date: 01/12/2010

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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The approved consolidated baseline and monitoring methodology ACM0002 (version 10) "Consolidated baseline methodology for grid-connected electricity generation from renewable sources --- Version 10" has been used.

The methodology was applied with the following tools:

- Tool to calculate the emission factor for an electricity system (version 2)
- Tool for the demonstration and assessment of additionality (version 05.2)

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

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

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The choice to use the ACM0002 (Version 10) methodology is applicable to the project because the project meets its applicability criteria:

- The project activity is a grid-connected renewable power generation project that adds electricity capacity from wind sources.
- The project does not involve switching from fossil fuels to renewable energy at the site of the project activity.
- The geographic and system boundaries for the relevant electricity grid, Taiwan grid, can be clearly identified and information on the characteristics of the grid is available. The project is connected to the regional state electricity authority, Taipower (TPC).

B.3. Description of the sources and gases included in the project boundary:

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According to the methodology ACM0002 (Version 10), since the proposed project is a grid connected wind power project, only CO2 emissions from fossil fuels fired power plants in baseline scenario need to be considered.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table.

Source		Gas	Included?	Justification/Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity.	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.

	(Power Plants in TPC)			
Project Activity	Emission Sources of Project Activity (Miaoli 49.8MW Wind Farm Project)	CO_2	No	Excluded. It is a clean energy project.
		CH_4	No	Excluded. It is a clean energy project.
		N_2O	No	Excluded. It is a clean energy project.

Spatial extent of the grid is as defined in the "Tool to calculate the emission factor for an electricity system (version 2)". 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.
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.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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The methodology ACM0002 determines the baseline scenario through the following:
If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

> *Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".*

Because the project is connected to TPC, the baseline scenario is the emissions generated by the operation of the power plants currently connected to TPC and the emissions generated by the addition of new power sources to TPC. This is estimated ex-ante by using the Combined Margin (CM) calculation, which is the CM of TPC multiplied by the electricity delivered to TPC by the project.

The operating margin emission factor ($EF_{grid,OM,y}$) of Taiwan is 0.80486 tCO_2e/MWh and the build margin emission factor ($EF_{grid,BM,y}$) is 0.67365 tCO_2e/MWh. The defaults weights for wind power are used as specified in the emission factor tool: $w_{OM} = 0.75; w_{BM} = 0.25$. Thus the result of the Baseline Emission Factor ($EF_{grid,CM,y}$) calculation is **0.772** tCO_2e/MWh.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered Gold Standard project activity (assessment and demonstration of additionality):

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Early Consideration

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

Zhunan and Dapeng (Miaoli) wind farms were previously owned by InfraVest, prior to the acquisition by Macquarie International Infrastructure Fund ("MIIF", listed on Singapore Stock Exchange) on 20 March 2008. Due to the low feed-in tariff for wind projects in Taiwan, additional revenues from carbon credits were essential for the viability of the project. Given the circumstances, InfraVest was seeking for VER revenues for comprehensively in the early stage of project development. The following elements will be disclosed to the DOE to prove early consideration, during project validation:

1. Since its implementation in Taiwan, previous owner of the proposed project, InfraVest has always considered the potential of carbon credits for financing its wind power projects. InfraVest is familiar with carbon credits and emission reduction projects since the beginning of the CDM. In 2003, they registered one of the first VER projects in China[3], and in Taiwan[4]. The *Qingdao Huawei Wind power project* in China is a 16.35 MW grid connected renewable energy project with annual amount of VER generated is close to 22,000[5] tCO_2e per year. The *InfraVest Changbin and Taichung bundled Wind Farms Project – Taiwan* is the first GS registered project in Taiwan, with total capacity of 142.6 MW and emission reduction estimated at 373,543 tCO_2e. InfraVest has sought for carbon revenues as well for this proposed project. Copies of correspondence between InfraVest and carbon consultants (which shall remain in private confidentiality) about the VER development for projects in Taiwan is provided to the DOE at validation.

2. The income of VER has also been considered since before the project activity commenced (construction start date: 20/05/2005). Copy of board decisions of InfraVest to undertake Miaoli wind farm as VER projects (dated 14/01/2005) is provided to the DOE during validation..

3. The project ownership was sold to MIIF on 20/03/2008. During the negotiation between InfraVest and MIIF (the current project owner), carbon revenue was also one of the considerations in the acquisition evaluation regarding financial feasibility and projections of the project. MIIF has engaged a carbon consultant subsequent to the acquisition deal closure[6]. In 19/03/2010, it has decided to contract South Pole Carbon Asset Management Ltd. to proceed with the carbon development process under the Gold Standard.

The following table shows the different steps of the project development of the Miaoli wind farm, showing all milestones and when and how InfraVest and MIIF considered the VER revenues.

Miaoli project timeline. All emails mentioned in this table shall remain confidential and will only be disclosed to DOE during validation.

Date	Event	Supporting document
2000	InfraVest opens a new office in Taiwan	Business License
December 2001	First consideration of carbon credits for financing renewable energy projects	Email
September 2002	First contact with a CER broker	Email
2003	Qingdao Huawei Wind power is registered as a VER project	
05/01/2006	Board decision to undertake Miaoli wind farms with carbon credits = **"proof of early consideration[7]"**	Board decision

[3] The project was registered as a VER project and not as a CDM because the Chinese DNA does not allow foreign companies to develop CDM project in China.
[4] InfraVest owns another GS registered wind project, 'InfraVest Changbin and Taichung Wind Power Project
[5] http://www.cdmbazaar.net/documents/CN_WPP_CDM_PDD_22_11_2006.pdf
[6] Contract between MIIF and carbon consultant for Miaoli Project carbon development, dated 25/08/2008
[7] As defined in the "GUIDANCE ON THE DEMONSTRATION AND ASSESSMENTOF PRIOR CONSIDERATION OF THE CDM (version 1)" http://cdm.unfccc.int/EB/041/eb41_repan46.pdf

September 2006	InfraVest approaches a carbon consultant to present its new projects in Taiwan.	Email[8]
20/05/2005	Construction starts	Permit
10/02/2006	Project starts commissioning	TPC feed-in confirmation letter
February 2007	InfraVest asks KfW to help them to find a carbon consultants	Email
April 2007	South Pole starts its activities in Taiwan	
June 2007	First contact between South Pole and InfraVest	Email
10/07/2007	First draft of the cooperation agreement between SP and InfraVest	Contract
16/11/2007	Cooperation agreement between SP and InfraVest is signed	Contract[9]
20/03/2008	Acquisition agreement between InfraVest and MIIF	Announcement[10]
06/05/2008	First contact between MIIF and carbon consultant	Email[11]
25/08/2008	Cooperation agreement between MIIF and carbon consultant	Contract
31/03/2010	Cooperation agreement between MIIF and South Pole	Contract

As shown in the table above, InfraVest was aware of carbon credits since 2001 and of its financial impact on wind projects. The VER has always therefore been seriously considered by InfraVest as a mean to better compensate the low investment return for its wind farms.

In the beginning of September 2006, InfraVest started to look actively for carbon consultants that would be able to develop VER projects in Taiwan, but the discussions failed after a few months due to the difficulty to find a VER buyer.

South Pole is the first carbon asset management company present on the island; it started its activities in April 2007, and two months after, in May 2007, South Pole established the first contact with InfraVest. The board decisions from InfraVest had been made to undertake Miaoli wind farm as a VERs project in January 2006. However, the VER development process was postponed since it was under negotiation process with the MIIF. During this acquisition negotiations, MIIF was aware of the potential VER revenues of the project, and of InfraVest‘s efforts to secure carbon credits for the project. Subsequent to the acquisition, MIIF has also been searching for the VER benefits for the Miaoli[12].

As discussed above, it is clear that:

- InfraVest has always sought actively for a carbon credits consultants, before and during the construction of Miaoli wind farm;
- MIIF included the carbon revenue into consideration prior to project acquisition and has been trying to develop carbon credits of the project thereafter;
- Both InfraVest and MIIF have always expected carbon credits as a mean to finance its wind-farms. It is evidenced that both owners have sought for carbon development for the proposed project prior to the project start date.

Additionality

As prescribed by the Gold Standard the projects’ additionality is demonstrated through use of the Tool

[8] The first email making reference to carbon credits for wind farm in Taiwan is dated 5th September.
[9] Signed offer regarding VER development for Miaoli wind farm, by South Pole Carbon Asset Management Ltd. Signature of the project owner dated 16/11/2007.
[10] http://www.macquarie.com/miif/news.htm?20070912_0
http://www.macquarie.com/miif/news.htm?20080320_0
[11] Internal correspondence within MIIF stating communication with carbon consultant
[12] Email correspondence between InfraVest and MIIF

for the demonstration and assessment of additionality (version 05.2).

The approved methodological tool "*Tool for the demonstration and assessment of additionality*" (Version 05.2) provides a step-wise approach to demonstrate project additionality and is applied to determine whether the project is additional following the steps below:
(a) Identification of alternatives to the project activity
(b) Investment analysis to determine that the proposed project activity is either:
1) not the most economically or financially attractive, or
2) not economically or financially feasible;
(c) Barriers analysis; and
(d) Common practice analysis.

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 that can be part of the baseline scenario.

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

As per "Tool for the demonstration and assessment of additionality"[13], a hydropower, PV power, biomass power plant and fossil fuel fired power plant may not be an alternative for an independent power producer (IPP) investing in wind energy. 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 *Miaoli wind farm 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. Enforcement of applicable 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.

- Tai-power renewable energy premium purchase program [14]
- Electricity law[15]
- Electricity registration law[16]

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 a barrier analysis or a financial analysis, we choose to conduct a barrier analysis.

Step 2. Investment analysis

The main purpose of carrying out investment analysis is to determine whether the proposed project

[13] Tool for the demonstration and assessment of additionality, version 5.2 page 4, footnote 4.
[14] http://www.moeaboe.gov.tw/opengovinfo/Laws/secondaryenergy/LSecondaryMain.aspx?PageId=l_secondary_list
[15] http://law.moj.gov.tw/Scripts/Query4B.asp?FullDoc=%A9%D2%A6%B3%B1%F8%A4%E5&Lcode=J0030011
[16] http://law.moj.gov.tw/Scripts/Query4B.asp?FullDoc=%A9%D2%A6%B3%B1%F8%A4%E5&Lcode=J0030012

activity is not economically or financially attractive 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" (Version 05.2)*.

Sub-step 2a. Determine appropriate analysis method

As the project activity and the alternatives identified in Step 1 do have related financial benefits other than VER, the benchmark analysis (Option III) is used. As alternative B does not include any additional investment and revenues, benchmark analysis is not applicable. Only alternative A will further undergo a benchmark analysis together with the project activity.

Sub-step2b. Option 3 - Apply benchmark analysis

For a private project developer, an Equity IRR calculation is a determinative factor in an assessment of the financial viability of a project. Therefore, the benchmark analysis using an Equity IRR target is applied to the proposed project.

The most suitable economic indicator for the project type and decision context is the project's internal rate of return (IRR). Thus, the benchmark of IRR should be determined. Five options can be used to derive the benchmark of IRR:

(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 equity IRR. According to Professor Aswath Damodaran at Stern School of Business at New York University[17], 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. Thus, the cost of equity for a firm in an emerging market can be written as follows:

$$Benchmark = RiskfreeRate + \sum \beta * (CountryRisk + EquityMarketRisk)$$

This benchmark is defined by analyzing governmental bond rates (risk free rate), increased by a suitable risk premium to reflect private investment:

- long term **government bond** auctions resulted in rates of 3.095%[18] in February 2004, i.e. the

[17] Damodaran, Aswath,Equity Risk Premiums (ERP): Determinants, Estimation and Implications(September 23, 2008). Available at SSRN: http://ssrn.com/abstract=1274967

[18] http://www.cbc.gov.tw/public/Data/06101441571.pdf

time of the investment decision.

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 long term country risk premium is based on the country's rating[19], and the default spread of bond rates (US corporate and country bonds) compared to the US Treasury bond rate due to that rating. This becomes a measure of the country-specific risk premium for that country, to which a risk premium for a mature equity market is added. In practical terms, scaling the country risk premium to the beta of a stock ((overall exposure to macro economic risk) implies that stocks with betas above one will be more exposed to country risk and equity market risk than stocks with a beta below one. For the year 2004, the current risk premium for a mature equity market was 4.84% (represents the equity market risk for countries with zero risk); and the country risk premium of Taiwan is 1.05%. This results in a total risk premium of 4.80%. While average beta of stocks for power sector in the same year is 1.56.

The benchmark IRR estimation for the whole electricity generation sector in Taiwan is 3.095% + (1.56 * (4.84% + 1.05%)) = **12.27%**. Since we cannot conclude that benchmark is before or after tax, for conservative approach, the benchmark here is regarded as the before tax benchmark.

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

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

Parameter	Unit	Value
Net electricity production (projection)	MWh/year	186,509
Emission reduction	tCO_2/year	144,171
Project lifetime	Years	20
Tax rate	%	25.00%
Depreciation	Years	15
Increase rate for operation cost	%	1.5%
Exchange rate	NTD/EUR	40.70
Electricity Price (NTD2.00/kWh)	EUR/MWh	49.14

Source: Project financial model, dated 16/02/2004

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

Benchmark	Before-Tax Equity IRR		After-Tax Equity IRR	
Assumed before tax	IRR (Without VERs)	IRR (With VERs)	IRR (Without VERs)	IRR (With VERs)
12.27%	11.66%	18.47%	9.54%	15. 08%

Without carbon revenue, the before and after tax Equity IRRs of the proposed project is only 11.66% and 9.54%, respectively, which are lower than the benchmark IRR. Thus, the proposed project is not financially attractive.

When carbon revenue is introduced, the before and after tax Equity IRRs of the project is 18.47% and 15.08%, which are higher than the benchmark. Carbon revenue significantly improves the IRRs of total investment by over 5.0%, thus makes the project commercially feasible and more financially attractive.

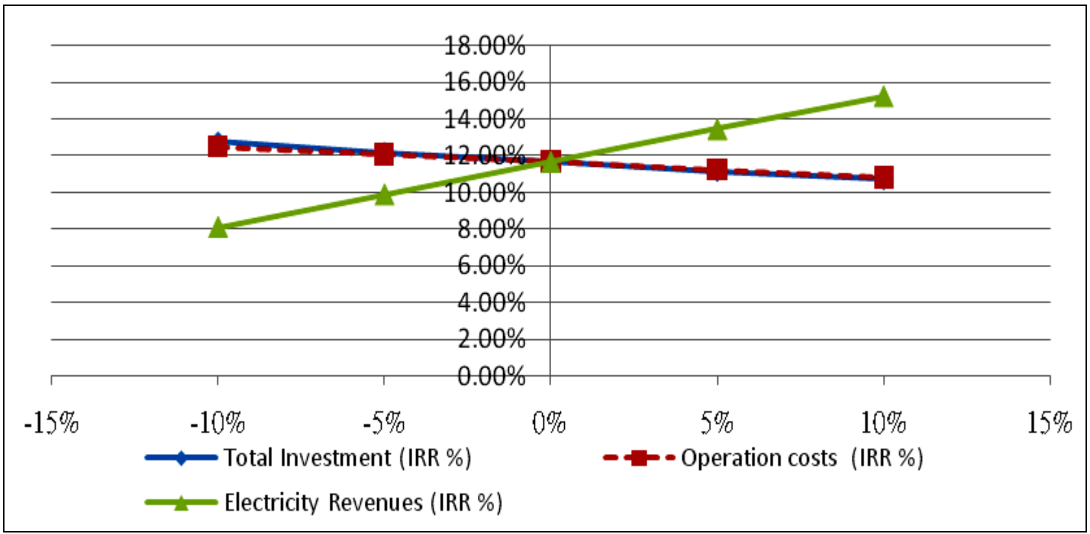
[19] http://www.moodys.com

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 cost of operation and maintenance (O&M), total investment, and annual electricity revenues (derived from the fluctuation in total generation). 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:

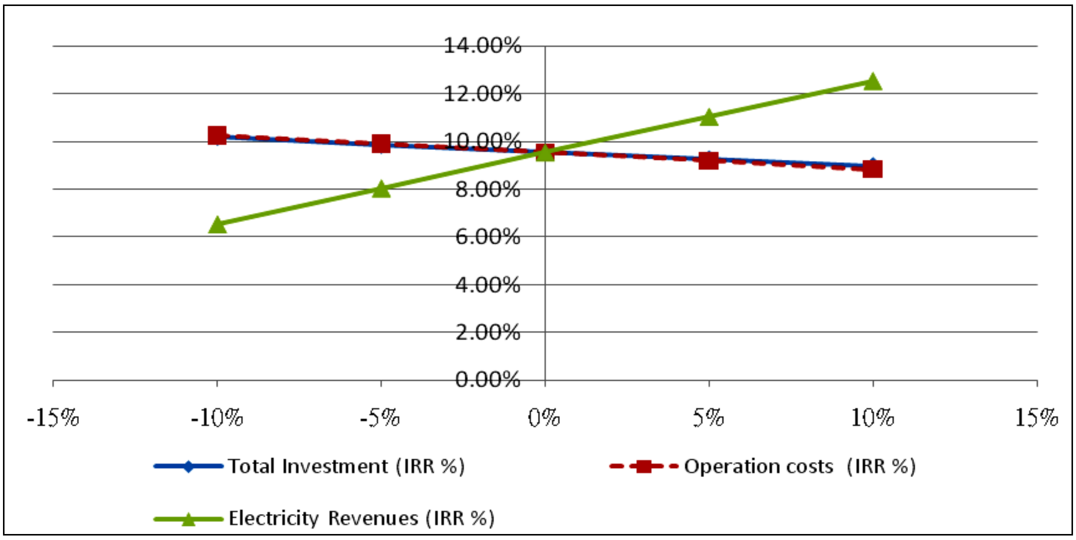
Sensitivity analysis of before-tax IRR

Variation	Total Investment (IRR %)	Operation costs (IRR %)	Electricity Revenues (IRR %)
-10%	12.75%	12.50%	8.10%
-5%	12.19%	12.08%	9.88%
0%	11.66%	11.66%	11.66%
5%	11.17%	11.24%	13.45%
10%	10.71%	10.83%	15.25%



Sensitivity analysis of after-tax IRR

Variation	Total Investment (IRR %)	Operation costs (IRR %)	Electricity Revenues (IRR %)
-10%	10.19%	10.24%	6.53%
-5%	9.85%	9.89%	8.04%
0%	9.54%	9.54%	9.54%
5%	9.25%	9.19%	11.04%
10%	8.97%	8.83%	12.54%



The above analysis shows that the IRR is more sensitive to the net electricity revenues, while it is less elastic to O&M cost and total investment. In fact, the annual financial statements of the project up until 31 Dec 2009 show that the electricity revenue is much lower than the estimation, and is continuously decreasing since the project started operation in 2006. This was mainly caused by the lower wind resource as opposed to the optimistic initial projections. This results in financial loss throughout the operation years[20]. The following table compares Miaoli Wind's EBITDA and annual debt service requirements:

	2006	2007	2008	2009	NT$
Total Generation (kWh)	84,242,400	148,137,600	141,130,800	131,648,000	
Revenue	175,166,400	313,396,066	288,197,800	260,340,876	
Opex	(19,880,744)	(49,536,938)	(72,954,829)	(56,731,076)	
EBITDA	**155,285,656**	**263,859,128**	**215,242,971**	**203,609,800**	
Debt Service (paid)	126,652,056	196,785,294	-	219,233,231	
Debt Service (unpaid)	8,036,512	35,100,458	-	-	
Total Debt Service	**134,688,568**	**231,885,752**	**-**	**219,233,231**	
EBITDA / Debt Service	**115.3%**	**113.8%**	**-**	**92.9%**	
Note: Miaoli Wind debt was refinanced in April 2008. Debt service for 2008 is not comparable to other years.					

The previous owner of Miaoli wind farm, InfraVest, arranged a loan with KfW and DEG, in 2005. The proceeds from the loans were used to fund the construction of the wind farm. In 2006, Miaoli Wind started operations. EBITDA in 2006 and 2007 was sufficient to cover debt service, although there was not much headroom. As a result, InfraVest did not fully pay debt service in 2006 and 2007 as there was insufficient cash. In early 2008, MIIF acquired Miaoli Wind from InfraVest. At the same time, Miaoli Wind obtained a long-term loan from ANZ and Calyon to refinance the existing loans.

The EBITDA of Miaoli Wind in 2009 was 5.4% lower compared to the prior year due to lower power generation as a result of poor wind performance. Hence, MIIF management has now revised its forecast to the average actual historic generation this is reflected in the valuation of the business[21]. In addition, Miaoli Wind was unable to satisfy a financial ratio in accordance with the loan agreement, resulting in a

[20] Financial statements of the project year 2004-2009

[21] MIIF SGX Quarterly Report for the Quarter and Year Ended 31 December 2009 http://www.macquarie.com/miif/news/attachments/MIIFFY2009SGXReport.pdf

breach. As a consequence, MIIF injected cure equity of NT$39,000,000 into Miaoli Wind to avoid breach of the debt service cover ratio[22].

Since commencing operations in 2006, generation has been significantly lower than forecast. Over this period, Miaoli Wind has only paid one distribution to its shareholders. Under normal operating conditions, EBITDA is only sufficient to cover debt service. When generation was lower than average (as seen in 2009), Miaoli Wind was unable to meet the requirements of the loan agreement, requiring shareholders to inject cure equity. Without revenue from carbon credits, it is unlikely that Miaoli Wind will be able to meet its debt obligations. Further breaches of the loan agreement will give the lenders the right to sell MIIF's shares in Miaoli Wind, resulting in the loss of MIIF's equity investment in Miaoli Wind. Carbon income is therefore also expected to improve the financial condition and decrease the risks of the project.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:
All project activities which are identified as the similar type are identified in the following table:
Wind Farms in Taiwan, until 2007 plus IPP projects under development[23],.

Location	Total Capacity (MW)	Completion Date	Project Owner	Ownership	Turbine unit capacity	Seeking for VER revenues
Taipower 1st Nuclear Power Plant	3.96	Dec-04	Taipower	State-owned	660KW	No
Taipower 3rd Nuclear Power Plant	4.5	Jan-05	Taipower	State-owned	1.5 MW	No
Datan Power Plant	4.5	Jun-05	Taipower	State-owned	1.5 MW	No
Sinjhu Project	12	Feb-06	Taipower	State-owned	2 MW	No
Guanying Project	30	Dec-05	Taipower	State-owned	2 MW	No
Taichung Power Plant	8	Feb-06	Taipower	State-owned	2 MW	No
Taichung Harbour Project	36	Aug-06	Taipower	State-owned	2 MW	No
Jhangbin Project	46	Dec-06	Taipower	State-owned	2 MW	No
Chunfeng Project	3.5	2003	Chengloong Paper Company	IPP	1.75MW	No
Mailiao	2.64	Nov-00	Formosa Heavy	IPP	660KW	No
Zhunan and Dapeng (Miaoli) Project (the proposed project)	49.8	Feb-06	Macquarie International Infrastructure Fund (MIIF)[24] (Project is previously owned by InfraVest)	IPP	2MW	Yes
Changbin (Phase I)	75.9	Jun-07	InfraVest	IPP	2.3MW	Yes
Changbin (Phase II)	27.6	Aug-07	InfraVest	IPP	2.3MW	Yes

[22] http://www.macquarie.com/miif/news/attachments/MIIFFY2009SGXReport.pdf
[23] Statistics from ITRI (Contact: Dr. Yan, Wen-jih wenjyh@itri.org.tw)
[24] http://www.macquarie.com/miif/investment_portfolio/miaoliwind.htm#

Taichung	52.9	Nov-08	InfraVest	IPP	2.3MW	Yes
Taoyuan-Guanyin	43.7	Jan -10	InfraVest	IPP	2.3MW	Yes

Sub-step 4b. Discuss any similar options that are occurring:
As shown in the table above, Miaoli Wind Farm is the first large scale private financed project in Taiwan. Most of the previously built wind farms are owned by Taipower (state-owned grid company), with total capacity ranging from 3.96 MW to 46 MW. Even though two other private-owned projects are identified (Mailiao and Chungfen Project), they are not comparable in terms of project scale, to that of the proposed project. Furthermore, Mailiao and Chungfen were subsidized[25,26] by the government. Therefore these projects do not face significant financial barriers, and are excluded from the analysis. Meanwhile, Changbin (Phase I and II), Taichung, and Taoyuan-Guanyin wind farms are excluded from the comparison of common practice analysis since they sought for carbon income[27] to improve their financial status and decrease risks.

Since there are essential distinctions between Miaoli wind power project and other wind farm projects that did not seek for VER benefits, the proposed project . In a broader perspective, based on *Energy Statistic Yearbook, 2008 – **28.Power Generation Statistics***[28], wind power generation amounted only 0.25% of total grid generation. Therefore, wind power generation cannot be considered as common practice in the region.

Conclusion of the additionality demonstration

In a conclusion, the proposed project activity is not a common practice in the region, and it had obtained mandatory operational permits as in accordance with applicable laws in Taiwan R.O.C. As demonstrated above, Miaoli wind project faces significant financial barrier and requires carbon revenue in order to improve its financial status and future risks. Therefore, the emission reductions are additional to baseline scenario of the project activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

The approved consolidated baseline and monitoring methodology ACM0002 (version 11) “Consolidated baseline methodology for grid-connected electricity generation from renewable sources --- Version 11” has been used.

The methodology was applied with the following tools:

- Tool to calculate the emission factor for an electricity system (version 02)
- Tool for the demonstration and assessment of additionality (version 05.2)

The methodology referenced above is applicable to this project activity because it fulfills the required criteria:

- The project consists of a wind power electricity capacity addition and is a grid-connected

[25] Communication by Dr.Yan, ITRI. Maialo (Formosa, total investment NTD90,000,000, subsidy 38,000,000). Chungfen (Chenloong paper company, total investment NTD115,000,000, subsidy 56,000,000). http://energy.ie.ntnu.edu.tw/file_download.asp?KeyID=1194&file_path=Periodical_Paper
[26] http://www.fhi.com.tw/english/wind.htm
[27] InfraVest Changbin and Taichung bundled Wind Farms Project - Taiwan : Gold standard project GS472
InfraVest Guanyin Wind Farm Project: Gold Standard project GS612 https://gs1.apx.com/myModule/rpt/myrpt.asp?r=111
[28] Bureau of Energy, Ministry of Economic Affairs, Energy Statistic Yearbook, 發電裝置容量及發電量統計表(082~097), ‘*28.Power Generation’,* http://www.moeaboe.gov.tw/opengovinfo/Plan/all/energy_year/main/EnergyYearMain.aspx?PageId=default

electricity generation project;

- The project does not involve switching from fossil fuel use to renewable energy at the site of the project activity; and
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.

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:

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

where:

$EF_{grid,CM,y}$	Combined Margin Emission Factor in year y
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)

3. Leakage

For the leakage, according to ACM0002, it can be regarded as follows:

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.

The leakage in this project therefore is zero as well ($LE_y = 0$).

The emission reductions are defined as per methodology ACM0002 version 11:

Emission reductions are calculated as follows:
ER y = BE y − PE y

Where:

ERy Emission reductions in year *y* (tCO2e/yr)
BEy Baseline emissions in year *y* (tCO2/yr)
PEy Project emissions in year *y* (tCO2e/yr)

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

$$ER_y = EF_{grid,CM,y} * EGPJ,y$$

Emission factor

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

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

$EF_{grid,OM,y}$	Operating Margin Emission Factor (tCO_2e/MWh)
$EF_{grid,BM,y}$	Build margin emission factor (tCO_2e/MWh)
w_{OM}	Weighting of operating margin emissions factor
w_{BM}	Weighting of build margin emissions factor

Based on above equation, the operating margin emission factor ($EF_{grid,OM,y}$) of Taiwan is 0.805 tCO_2e/MWh and the build margin emission factor ($EF_{grid,BM,y}$) is 0.675 tCO_2e/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 ($EF_{grid,CM,y}$) calculation is **0.772 tCO_2e/MWh**. The calculations are presented in Annex 3

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	The net electricity generation excluding the low-cost must-run (up until 2008)
Source of data used:	Energy Balances in Taiwan - New Format
Value applied:	See Table A2 in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units
Any comment:	

Data / Parameter:	**$FC_{i,y}$**
Data unit:	Ton, litre or 1000 m^3
Description:	Total amount of fossil fuel type i consumed by power plants/units in year y
Source of data used:	Energy Balances in Taiwan-New Format
Value applied:	Step 4 Table A4 in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Fuel consumption breakdown by power plant/unit is unavailable, total consumption amounts are published annually.
Any comment:	

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	TJ/ KL, TJ/kt or TJ/milion m^3

Description:	Net calorific value of fossil fuel type i in year y
Source of data used:	Heat Content of Energy Products, Bureau of Energy, Ministry of Economic Affairs[29]
Value applied:	Please refer to the table of Heat Content of Various Energy Commodities: http://www.moeaboe.gov.tw/opengovinfo/Plan/all/energy_balance/main/en/files/old/03/Heat%20Content%20of%20Energy%20Products.pdf
Justification of the choice of data or description of measurement methods and procedures actually applied :	Numbers are adopted from the reference document.
Any comment:	The BoE provides directly emission factor by unit of mass or volume in which is equal to the product of $NCV_{i,y}$ and $EF_{CO2,i,y}$

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of fossil fuel type i in year y
Source of data used:	Bureau of Energy, Ministry of Economic Affairs
Value applied:	Step 2 Table A1 in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Numbers are adopted from the reference document. (See: Annex 3 – Step 2, Table A1)
Any comment:	The BoE provides directly emission factor by unit of mass or volume which is equal to the product of $NCV_{i,y}$ and $EF_{CO2,i,y}$

Data / Parameter:	**$EF_{grid,CM,y}$**
Data unit:	tCO_2e/MWh
Description:	Combined Emission factor
Source of data used:	Calculated
Value applied:	0.772
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Baseline Emission Factor is calculated as a Combined Margin, using the weighted average of the Operating Margin and Build Margin.
Any comment:	The emission of the build and operating margin are calculated according to the ex-ante option.

B.6.3. Ex-ante calculation of emission reductions:

Project Activity Emissions

GHG emissions by source

[29] Heat Content of Energy Products, http://www.moeaboe.gov.tw/opengovinfo/Plan/all/energy_balance/main/en/default.htm

In accordance 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 0 (zero) tCO_2e.

The sum of project emissions and leakage represents the *project activity emissions*. Thus, it is identified as zero.

Baseline Emission
Based on ACM0002, baseline emissions (BE_y) include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the proposed project activity, which is calculated as follows:

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

where:

$EF_{grid,CM,y}$	Combined Margin Emission Factor in year y
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)

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

$\mathbf{ER_y} = BE_y - PE_y - LE_y = \mathbf{EF_{grid,CM,y} * EG_{PJ,y}}$

The result of emission reduction:

$EG_{PJ,y}$	Net electricity delivered annually to grid by the Project at full capacity	140,305[30]	MWh/year
$EF_{grid,CM,y}$	Combined Emission Factor	0.772	tCO_2e/MWh
ER_y	Emission reduction annually	107,067	tCO_2e/year

B.6.4. Summary of the ex-ante estimation of emission reductions:

>>

Year	**Estimation emissions of project activity (tCO_2e)**	**Estimation of baseline emissions (tCO_2e)**	**Estimation of leakage (tCO_2e)**	**Estimation of overall emission reductions (tCO_2e)**
2008(01/12/2008-31/12/2008)	0	13,712	0	13,712
2009(01/01/2009-31/12/2009)	0	101,640	0	101,640

[30] For conservativeness, average annual generation based on actual data is applied.

2010(01/01/2010-31/12/2010)	0	101,697	0	101,697
2011(01/01/2011-31/12/2011)	0	108,324	0	108,324
2012(01/01/2012-31/12/2012)	0	108,324	0	108,324
2013(01/01/2013-31/12/2013)	0	108,324	0	108,324
2014(01/01/2014-31/12/2014)	0	108,324	0	108,324
2015(01/01/2015-30/11/2015)	0	99,124	0	99,124
TOTAL	0	749,466	0	749,466

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{e,y}$
Data unit:	MWh
Description:	Quantity of electricity generation supplied by the project plant/unit to the grid
Source of data to be used:	*Electricity meter*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous measurement and at least monthly recording. Data from the electricity meters will be collected and monitored by both, the project owner and Taipower. The confirmed electricity supplied to the grid is then recorded in the electricity receipts obtained from Taipower every month.
QA/QC procedures to be applied:	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') Besides this, Taipower has agreed on meter calibration in every 3 years period. In addition, electricity receipt is kept for cross reference as per ACM0002
Any comment:	

Data / Parameter:	EGi,y
Data unit:	MWh
Description:	Quantity of electricity consumption of the project plant/unit from the grid
Source of data to be used:	*Electricity meter*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of	Continuous measurement and at least monthly recording.

measurement methods and procedures to be applied:	Data from the electricity meters will be collected and monitored by both, the project owner and Taipower. The confirmed electricity consumption is then recorded in the electricity receipts obtained from Taipower every month.
QA/QC procedures to be applied:	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') Besides this, Taipower has agreed on meter calibration in every 3 years period. In addition, electricity receipt is kept for cross reference as per ACM0002
Any comment:	

Data / Parameter:	$EG_{PJ,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid
Source of data to be used:	*Calculated by the difference of* EG_e-EG_i
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Ex-ante estimation of net electricity delivered annually to grid: 106,049 MWh
Description of measurement methods and procedures to be applied:	Calculated by the difference of EG_e and EG_i which are measured continuously and at least monthly recording.
QA/QC procedures to be applied:	Meter reading records of EG_e and EG_i will be crosschecked with the electricity receipts, and calculation will be double checked and verified.
Any comment:	

B.7.2. Description of the 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:

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

Where :

$EF_{grid,CM,y}$	Combined Margin Emission Factor in year y
EG_{PJ}	Net electricity delivered to grid by the Project in year y
ER_y	Emission reduction in year y

As the emission factor is fixed for the whole crediting period, the aim of the monitoring is therefore only to monitor the net electricity generated 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:

$EG_{PJ,y} = EG_{e,y} - EG_{i,y}$

$EG_{PJ,y}$	Net electricity delivered to grid by the Project
$EG_{e,y}$	Electricity delivered to grid by the Project
$EG_{i,y}$	Electricity imported from grid

(2) Electricity meters:

Electricity generation ($EG_{e,y}$**)**
The electricity generated by the wind turbines will be transmitted to Taipower's substation in which an electricity meter is installed to record the transmitted electricity.

Electricity consumption ($EG_{i,y}$**)**
The wind farm needs to use electricity from grid during the turbines start up. Electricity consumptions are also recorded by Taipower.

(3) Monitoring Management

Since the baseline methodology is based on ex ante determination of the baseline, the sole parameter that must be monitored is the net electricity supplied to the grid by the project. MIIF and Taipower ensure the availability and high quality of the necessary monitoring data. As accorded by the Gold Standard, all the data necessary for emission reductions calculations will be kept by the project owner for at least two years after the last GS-VER verification. Data acquisition, management and quality assurance procedures are already in place; therefore, no additional procedures need to be established for the monitoring plan.

The operational and management structure of the project implemented by MIIF is as follows:

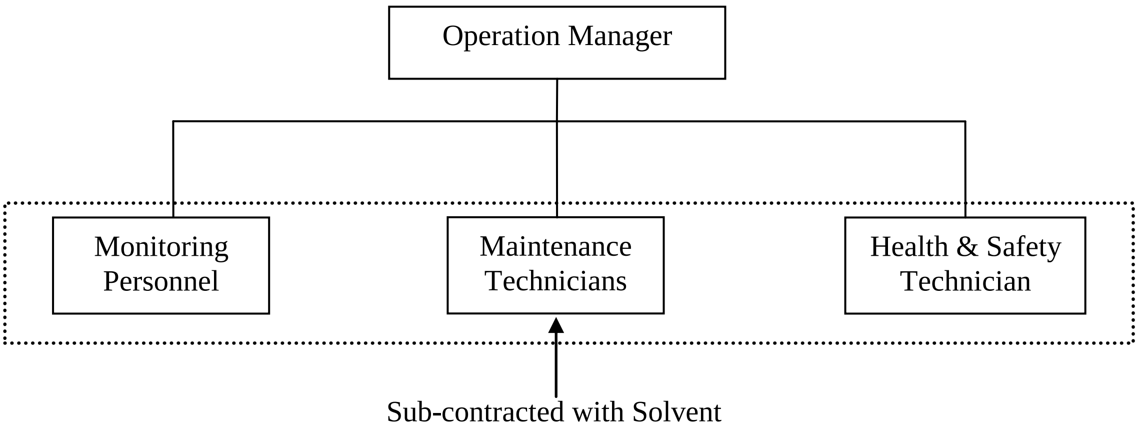


Fig.B-1. The operational and management structure of the project

As indicated in the above figure, the personnel responsible for Monitoring and Maintenance and Health & Safety are managed and trained by the sub-contracted company "Solvent". 12 personnel from Solvent will be assigned to take charge of the monitoring and maintenance of the project. The job descriptions and the prescribed trainings are presented below in Table B-3.

Table B-3 Job descriptions and prescribed trainings

Job name	Job description	Prescribed trainings

Measurement Technician	• Measuring and recording the electricity generation through the proper methods and instruments. • Data storing and reporting to Operational Manager.	Trainings on measurement and recording by Solvent
Maintenance Technician	• Making periodical and failure maintenance programmes and activities	Electrical and Mechanical Maintenance Trainings by Solvent
Health & Safety Technician	• Fulfilling occupational safety and health responsibilities. • Monitoring Environmental issue.	Safety and health trainings by Solvent

Data management

Electricity data from the Meter of Facility (MOF) in Taipower's substation is recorded on paper and downloaded using the electronic device by Taipower's monitoring staff. The MOF measures both electricity generation and consumption, both data will be recorded in the monthly and annual report. Subsequent to meter reading sessions, Taipower sends separate confirmations to the project owner regarding amount of both generation and consumption. MOF data copies and the confirmation records will be archived for at least two years after the end of the crediting period by the project owner.

Quality assurance and quality control procedures

Internal audit will be carried out to check compliance with operational procedures outlined in this monitoring plan. This internal audit will also identify potential possible adjustments for operational procedures to improve monitoring and reporting in future years.

MOF specification complies with The Weight and Measures Act, Regulation no. CNMV 46, 'Technical Specification for Verification and Inspection of Electricity Meters'[31]. The accuracy class of the electricity meters used for the project activity is 0.5S (in line with the official standard error for electricity meter (MOF) at ±0.5%). 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 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.

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[32]. Since Taipower is in charge of all electricity meter, in case of a performance failure, the handling procedures follows the Power Supply and Engineering Regulations clause 33[33]. Taipower and the project owner will jointly recalculate the amount

[31] The Weight and Measures Act www.bsmi.gov.tw/wSite/public/Attachment/f1224657229438.doc

Technical Specification for Verification and Inspection of Electricity Meters http://www.bsmi.gov.tw/wSite/public/Attachment/f1224657229438.doc Clause 3.9.3

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

[33] http://www.taipower.com.tw/TaipowerWeb//upload/files/1/main_3_6_1_3.pdf clause 33

of electricity dispatched by the project based on Electricity Tariff Regulations clauses 84-88[34] and section 4 clauses 58-63[35].

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

>>
Date of completion: 01/07/2009

The baseline calculation has been prepared by South Pole Carbon Asset Management Ltd. in consultation with the project owner.

Name and contact details of the person responsible for the baseline section:

Patrick Bürgi
South Pole Carbon Asset Management Ltd.
Technoparkstrasse 1
8005 Zurich
Switzerland
Phone: +41 43 501 35 50
Fax: +41 43 501 35 99
p.burgi@southpolecarbon.com

[34] http://www.taipower.com.tw/TaipowerWeb//upload/files/1/main_3_6_2_6.pdf , clauses.84~88.

[35] http://www.taipower.com.tw/TaipowerWeb//upload/files/1/main_3_6_1_6.pdf section 4, clause 58-63

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>> 20/05/2005[36]

C.1.2. Expected operational lifetime of the project activity:

>> 20 years

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

>> Two years prior to Gold Standard registration date, whichever later.

C.2.1.2. Length of the first crediting period:

>> 7 year

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>> Not applicable

C.2.2.2. Length:

>>Not applicable

[36] Construction Permission Issuance date

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>> According to the EIA regulations in Taiwan, for wind power projects with capacity below 50MW at a non-urban area, and below 25MW at an urban area, are exempted from EIA. Therefore, in the case of the Miaoli project, no EIA is necessary. The project is limited to a capacity of 49.8MW and is below the 50MW threshold for EIA approval[37].

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>> Not applicable

[37]RULE NO. 5, ARTICLE 29, STANDARDS FOR DETERMINING SPECIFIC ITEMS AND SCOPE OF ENVIRONMENTAL IMPACT ASSESSMENTS FOR DEVELOPMENT ACTIVITIES regulated by the Environmental Protection Administration (EPA) of the Executive Yuan – Taiwan R.O.C. http://law.epa.gov.tw/en/laws/571925793.html#art29

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>> Two stakeholder consultation meetings were held for Miaoli Wind Farm Project, one for Dapong Wind Farm and the other for Chunan Wind Farm, by the previous project owner, InfraVest.

A. Stakeholder consultation for Dapong Wind Farm
Time: 23/05/2006
Place: Meeting Room of Houlong Town government building

List of Attendants:

Name	Organization	Position
Wang Yiyun	InfraVest Wind Power Co., Ltd.	Vice General Manager
Zheng Qiufeng	Houlong Town Government	Councillor
Wen Jinyi	Zhonghe Li Government	Leader
Lin Mingshu	Nangang Li Government	Leader
Zheng Wanyi	Houlong Town	Resident representative

B. Stakeholder consultation for Chunan Wind Farm
Time: 11/07/2005
Place: Meeting Room of Chunan Town government building

Meeting minutes:

- The compensation from InfraVest will be dealt with by Chunan Town government;
- NT$2,000,000 of the compensation shall be provided to the Chunan Town government before the end of 2005;
- The NT$ 2,000,000 mentioned above can be used to build a toilet in beach forest playground area by InfraVest and the owner of this toilet shall be Chunan Town government;
- The location of the toilet mentioned above will be decided by discussion with local agriculture department.

List of Attendants:

Name	Organization	Position
Wang Yiyun	InfraVest Wind Power Co., Ltd.	Vice General Manager
Zhang Yachun	InfraVest Wind Power Co., Ltd.	Representative
Zhang Jiawen	InfraVest Wind Power Co., Ltd.	Representative
Lin Longwen	Miaoli County Government	Official
Kang Shiru	Chunan Town Government	Official
Lin Yicheng	Chunan Town Government	Official
Li Guosheng	Chunan Town Government	Official
Guo Delong	Chunan Town Government	Official
Huang Guangwu	Chunan Town Government	Official

E.2. Summary of the comments received:

>>

A. Stakeholder consultation for Dapong Wind Farm
Comments/requests from the stakeholders:

- InfraVest shall compensate NT$840,000 to Miaoli County and Houlong Town governments in 20 years;

- InfraVest shall replant Bantianliao area to improve the local environment;
- How to use the compensation from InfraVest will be decided by local governments.

B. Stakeholder consultation for Chunan Wind Farm
Comments/requests from the stakeholders:

- InfraVest shall compensate NT$ 2,000,000 to Chunan residents, prior to the end of 2005.
- The compensation shall be managed by Chunan Town government;
- The compensation shall be used to construct a public toilet in beach forest playground area, under Chunan Town government's ownership;
- Location of the toilet facility will be decided by discussion with local agriculture department.

E.3. Report on how due account was taken of any comments received:

>> InfraVest, as the previous project owner of the proposed project has made the subsequent donation according to the outcomes of each stakeholder consultation. Donation receipts are provided to the DOE during validation.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project does not involve any ODA financing.

Annex 3

BASELINE INFORMATION

STEP 1. Identify the relevant electric power 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.

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.

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

- Energy Balances in Taiwan-New Format (from the Bureau of Energy[38]), 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 the '*Tool to calculate the emission factor for an electricity system (version 02)*'**,** 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 Operating Margin, the emission factors of fossil fuels are listed in the following table:

Table A1 Net Calorific Values ($NCV_{i,y}$) multiplied by ($EFCO_2$,i,y) of fossil fuel used for OM and BM calculation

Fuel Type	EFCO2,i,y × NCVi,y [39]	Unit
Bituminous Coal-Steam Coal	2.53	tCO_2/t
Sub-bituminous	2.37	tCO_2/t
Coke oven gas	0.78	$KgCO_2/M^3$
Blast Furnace Gas	0.85	$KgCO_2/M^3$
Oxygen Steel Furnace Gas	1.42	$KgCO_2/M^3$
Diesel	2.73	$KgCO_2/L$
Fuel oil	2.98	$KgCO_2/L$

[38] Energy Balances in Taiwan-New Format, http://www.moeaboe.gov.tw/opengovinfo/Plan/all/energy_balance/main/en/default.htm

[39]http://www.ghgregistry.tw/upload/tools/%E6%BA%AB%E5%AE%A4%E6%B0%A3%E9%AB%94%E6%8E%92%E6%94%BE%E4%BF%82%E6%95%B8%E7%AE%A1%E7%90%86%E8%A1%A83.0%E7%89%88.xls

LNG	2.66	$KgCO_2/M^3$
Petroleum Coke	3.35	$KgCO_2/Kg$
Natural Gas	2.09	$KgCO_2/M^3$
Refinery gas	2.17	$KgCO_2/M^3$

According to the experts, coal should not be considered as low cost/must run[40]. 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 21.229% and 21.737% of the total electricity generation on average during years 2005 and 2009:

Table A2: Gross and Net Electricity Generation (EGy) in Taiwan[41].

	Units	2005	2006	2007	2008	2009
Total electricity generation	MWh	227,364,220	235,464,738	243,114,925	238,325,933	229,693,930
Total LCMR	MWh	48,266,756	48,578,286	50,008,751	49,710,931	49,928,004
Power Plants Own Use						
Total Own Use in power plants	MWh	9,812,126	10,502,785	10,949,893	10,420,879	11,573,918
Total Own Use of LCMR power plants	MWh	1,593,556	1,587,321	1,615,139	1,604,647	1,634,110
net generation excl. LCMR	MWh	170,878,894	177,970,988	183,771,420	179,798,770	169,826,118
share of LCMR	MWh	21.229%	20.631%	20.570%	20.858%	21.737%

Source: Energy Balances Sheet in Taiwan-New Format.

The calculation of the operating margin emission factor (*EFgrid,OM,y*) is based on one of the following methods:

(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(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:

[40] 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'.

According to Dr. Chien-Ming Lee (李堅明教授), a professor at Graduate Institute of Natural Resources Management, National Taipei University, coal power plants are not 'low-cost' since the operational cost is higher than that of the renewable power generation during the operation phase. 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'.

[41] Extracted from the "Energy Balances Sheet in Taiwan-New Format" Bureau of energy, MOEA, http://www.moeaboe.gov.tw/opengovinfo/Plan/all/energy_balance/main/en/default.htm

- *Ex-ante option*, where a 3-year generation-weighted average based on the most recent data is used. Monitoring and recalculation of the emission factor is not required, or
- *Ex-post option*, where the data of the year is used, in which the project activity displaces grid electricity. Yearly update of the emission factor is required.

The *ex-ante option* is selected to carry out the baseline methodology for the Project.

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

The Simple OM emission factor is calculated as the generation weighted average CO_2 emissions per unit net electricity generation of all generating power plants serving the system, excluding lc-mr sources using one of the following approaches;

- Option A: Based on data on fuel consumption and net electricity generation of each power plant/unit, or
- Option B: Based on data 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.

Complete plant-specific data required by Options A is unavailable, Taipower can furnish some plant specific data but only for the power plants they operate, these numbers do not comprise all IPP 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 lc-mr 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 (option I in step 2 was chosen). According to the "*Tool to calculate the emission factor for an electricity system version 2*," 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 CO_2 emission factor in year *y*(tCO_2/MWh)
$FC_{i,y}$	Amount of fossil 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 fossil fuel type *i* in year *y* (energy unit / mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2 /energy unit)
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 fossil fuel types combusted in power sources in the project electricity system in year *y*
Y	the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

Table A3: The total CO2 emissions by fuels of 2007, 2008 and 2009.

Total Emission in 2007	tCO_2	147,219,017
Total Emission in 2008	tCO_2	145,459,899
Total Emission in 2009	tCO_2	136,619,046

Thus we have the results of Operatin Margin:

$EF_{grid,OM,y}$ (2007)	tCO_2/MWh	0.80110
$EF_{grid,OM,y}$ (2008)	tCO_2/MWh	0.80901
$EF_{grid,OM,y}$ (2009)	tCO_2/MWh	0.80446
Average $EF_{grid,OM,y}$ (2007~2009)	tCO_2/MWh	0.80486

The result of Operating Margin is **0.80486** tCO_2e/MWh

STEP 5: Identify the group of power units to be included in the build margin

In accordance to the calculation method proposed by the Chinese NDRC[42] which was approved by CDM EB[43], 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 CO_2 emissions produced by solid, liquid, and gas fuel consumption for power generation is determined; then this ratio is multiplied 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 result is the BM emission factor of 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 generation (in MWh) that have been built most recently. In terms of vintage of data, Option 1 is chosen: *Build margin emission factor is calculated ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation.*

STEP 6. Calculate the build margin emission factor

In accordance with STEP 6, 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 fuelled electricity

[42] 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.

[43] 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.

generation (sum of CO2 emissions from coal, oil and gas).

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

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

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

Where:

$F_{i,j,y}$ the amount of fuel *i* (in a mass or volume unit) consumed by power sources j in year(s) y,

$NCV_{i,y}$ 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 CO_2 emission coefficient of fuel *i* (tCO_2/GJ)

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

Table A4 The total CO2 emissions by fuel of 2009 ((FCi,y):

	Fuel	Units	Emission (tCO_2e)	Λ
Solid	Bituminous Coal-Steam Coal	t	90,583,179	-
	Coke oven Gas	M3	103,422	-
	Blast Furnace Gas	M3	1,395,663	
	Oxygen Steel Furnace Gas	M3	224,861	-
	Sub-bituminous coal	t	14,074,294	-
	Sub-total	-	106,381,420	77.87%
Liquid	Diesel	L	185,211	-
	Refinery gas	M3	28,784	-
	Petroleum Coke	t	982,027	
	Fuel oil	L	5,258,158	-
	Sub-total	-	6,454,181	4.72%
Gas	Natural Gas	M3	6,834	
	LNG	M3	23,776,612	-
	Sub-total	-	23,783,445	17.41%
Total		-	136,619,046	100%

Data Source: Energy Balances in Taiwan-New Format by Taiwan's Bureau of Energy[44]

[44] Energy Balances in Taiwan-New Format, http://www.moeaboe.gov.tw/opengovinfo/Plan/all/energy_balance/main/en/default.htm

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 and gas-fired power plant are shown as below:

Type of power plant	Variables	Emission factor (tCO_2e/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,

CAP_{Total} the total capacity addition of the selected period in which approximately 20% capacity has been added to the grid,

$CAP_{Thermal}$ 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 2003 (MW)	Installed capacity in 2004 (MW)	Installed capacity in 2005 (MW)	Installed capacity in 2006 (MW)	Installed capacity in 2007 (MW)	Installed capacity in 2008 (MW)	Installed capacity in 2009 (MW)	Newly added installed capacity from 2002 till 2009 (MW)	Proportion against newly added installed capacity
	A	B	C	D	E	F	G	H	I=H-A	$I_{THERMAL}/I_{TOTAL}$
Thermal power	28431.88	30441.98	32292.7	33467.50	35290.55	36023.45	36440.0	37916.5	9484.62	95.61%
Hydro-power	4510.75	4510.75	4511.73	4511.73	4511.73	4534.73	4539.9	4538.9	28.15	0.28%
Nuclear power	5144	5144	5144	5144	5144	5144	5144	5144	0	0.00%
Wind power and others	8.47	8.59	8.71	25.18	105.35	190.18	257.7	415.5	407.03	4.10%
Total	38095	40105	41957	43148	45052	45892	46382	48015	9920	100.00%

The result of Build Margin is **0.67365** tCO_2e/MWh.

Step 7. 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.

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

The operating margin emission factor ($EF_{grid,OM,y}$) of Taiwan is 0.80486 tCO_2e/MWh and the build margin emission factor ($EF_{grid,BM,y}$) is 0.67365 tCO_2e/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 ($EF_{grid,CM,y}$) calculation is **0.772** tCO_2e/MWh.

Annex 4

MONITORING INFORMATION

Please refer to Section B.7