**PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Foundation Wind Energy-I Limited 50 MW Wind Farm Project
Version number of the PDD	1.3
Completion date of the PDD	21/12/2012
Project participant(s)	• Foundation Wind Energy-I Limited • UPM Umwelt-Projekt-Management GmbH
Host Party(ies)	Islamic Republic of Pakistan
Sectoral scope and selected methodology(ies)	Sectoral Scope: 1 Methodolody: ACM0002, Version 13.0.0 (EB 67 Annex 13)
Estimated amount of annual average GHG emission reductions	89,214 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The Foundation Wind Energy-I Limited 50 MW Wind Farm Project is located approx. 50 km southeast of the city of Karachi, Pakistan, on Kutti Kun New Island in Taluka Mirpur Sakro District Thatta. The project owner is Foundation Wind Energy-I Limited (formerly Beacon Energy Limited) (hereinafter FWEL-I) as mentioned below. FWEL-I is a subsidiary company and Special Purpose Vehicle (SPV) of Fauji Foundation, Pakistan.

The purpose of the Foundation Wind Energy-I Limited 50 MW Wind Farm Project (hereinafter the "proposed project" or the "project activity" or the "project" or the "wind farm") is to utilize wind resources for electricity generation through the construction of a wind farm with a total capacity of 50 MW and to deliver the electricity generated from the project to National Transmission & Despatch Company Limited (NTDC) through its Central Power Purchasing Agency(CPPA) on behalf of Water and Power Development Authority (WAPDA) distribution companies. By replacing the electricity supplied by the WAPDA grid, which is heavily dominated by fossil fuel fired power plants, with electricity generated from wind power the proposed project activity will achieve obvious greenhouse gas (GHG) emission reductions by avoiding CO_2 emissions.

The purpose of the proposed project is to generate zero-emission wind power and deliver it to the WAPDA grid. For the proposed project,

(a) Prior to the start of implementation of the project activity, there is no power generation unit at the site of the proposed project. The WAPDA electricity grid is dominated by fossil fuel-fired power plants.
(b) The project scenario is the implementation of the proposed project, the installation and operation of wind turbines with a total capacity of 50 MW, which will supply an average annual generation of 144,500 MWh to the WAPDA grid and thereby reduce the baseline grid emissions by an annual 89,214 tCO_2e.
(c) The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

The proposed project activity will contribute to a local sustainable development with the following effects:

Economic development:
Pakistan is passing through an acute energy crisis. The proposed project will generate an estimated amount of 144,500 MWh per year and will therefore contribute to a reduction in the number of black-outs and brown-outs experienced by other grid users, which can help to improve the economic performance of other businesses connected to the grid.

Social development:
The conducting of the proposed project will offer job opportunities for local people during the construction phase and the operational period, and thus achieve economic growth in the region.

Environmental development:
By resulting in a significant reduction of greenhouse gas emissions, the project contributes to a sustainable development of the local environment.

Technological development:
The project activity is the first of its kind in Pakistan. By adopting foreign manufacturer wind turbines, the project activity will promote important transfer of technical know-how to Pakistan, and can act as a pioneer in promoting the spread of this technology to other wind power projects.

Project owner: Foundation Wind Energy-I Limited (formerly Beacon Energy Limited)
Foundation Wind Energy-I Limited (formerly Beacon Energy Limited) (FWEL-I) is a subsidiary

company and Special Purpose Vehicle (SPV) of Fauji Foundation, Pakistan, and is the project proponent for establishing a wind farm in Gharo. FWEL-I will develop, own and operate a 50 MW wind farm independent power project (IPP) in Sindh.

CER buyer: UPM Umwelt-Projekt-Management GmbH
UPM Umwelt-Projekt-Management GmbH (UPM) was originally founded at the beginning of the 1990s to provide project management and consulting services in the field of lean gas utilization projects. Today, UPM today is mainly working in the field of Clean Development Mechanism (CDM) within the framework of the Kyoto Protocol.

A.2. Location of project activity
A.2.1. Host Party(ies)
>>
Islamic Republic of Pakistan

A.2.2. Region/State/Province etc.
>>
Sindh Province

A.2.3. City/Town/Community etc.
>>
Kutti Kun New Island in Taluka Mirpur Sakro District Thatta

A.2.4. Physical/Geographical location
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The project is located in the area of Gharo, Kutti Kun New Island in Taluka Mirpur Sakro District Thatta, Province of Sindh, Pakistan within a narrow corridor, spanned by the following coordinates:

	Latitude	Longitude
1.	24º 36’ 49.52” N	67º 24’ 49.76” E
2.	24º 36’ 47.39” N	67º 24’ 41.36” E
3.	24 º37’ 05.22” N	67º 24’ 21.75” E
4.	24 º37’ 14.56” N	67 º23’ 52.80” E
5.	24 º37’ 15.40” N	67 º23’ 37.86” E
6.	24 º37’ 10.34” N	67 º23’ 23.85” E
7.	24º 36’ 50.36” N	67 º23’ 24.32” E
8.	24º 36’ 29.99” N	67 º23’ 38.34” E
9.	24 º35’ 47.12” N	67 º23’ 38.35” E
10.	24 º35’ 27.60” N	67 º23’ 51.89” E
11.	24 º35’ 47.55” N	67º 24’ 20.82” E
12.	24º 36’ 07.93” N	67º 24’ 20.35” E
13.	24º 36’ 23.63” N	67º 24’ 34.82” E
14.	24º 36’ 20.24” N	67º 24’ 50.70” E

The maps below illustrate the project location.

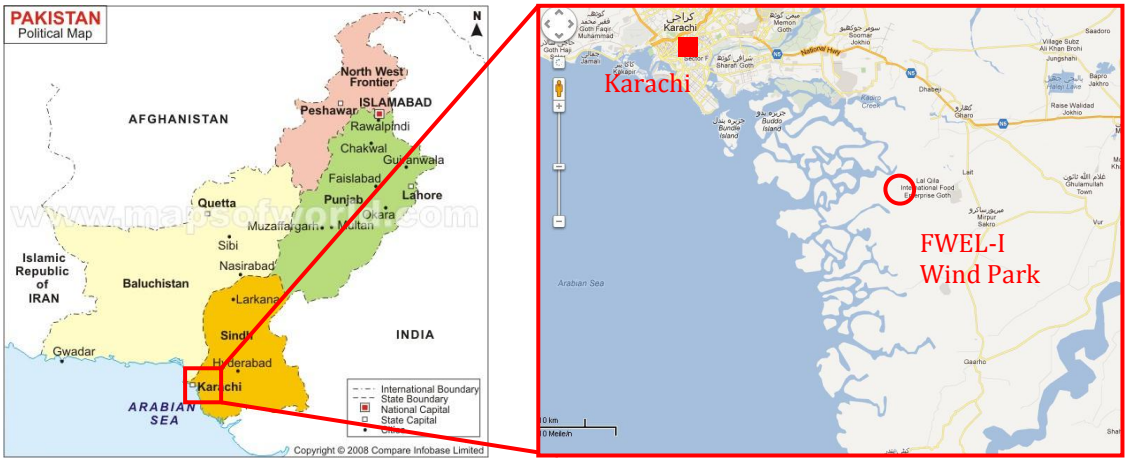

Figure 1: Map of the project location

Figure 2: Map of the project location

A.3. Technologies and/or measures

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Prior to the start of implementation of the project activity, there is no power generation unit at the site of the proposed project. The electricity that will be provided by the project was previously provided by the power plants physically connected to the WAPDA electricity grid. This grid is dominated by fossil fuel-fired power plants. Since this scenario does not face any barriers, this pre-project scenario is also the baseline scenario, in which the electricity will be continued to be provided to the WAPDA grid by mostly fossil fuel intensive power plants. Therefore, the WAPDA grid is the source of carbon dioxide emissions in the baseline scenario.

During the project implementation, 20 N100/2500 Gamma version wind turbine generators (WTG) by the German company Nordex will be installed. Nordex has production facilities in Germany, China and U.S.A. The equipment and know-how for the proposed project will therefore be transferred from abroad to Pakistan.

The following equipment is being provided by the contractor[1]:

- WTG Transformers 0.66kV/22kV
- Main Transformers OLTC (On-Load Tap Changer) 132kV/22kV
- Grounding Transformers
- Auxiliary Transformer
- 132kV Indoor GIS (Gas Insulated Substation) comprising of five (5) bays including two (2) overhead line bays, two(2) transformer bays and one (1) bus section bay along with Local Control Cabinets (LCCs).
- 132 kV outdoor Surge Arresters
- 132 kV outdoor Coupling Capacitive Voltage Transformers (CCVTs) with carrier accessories for phase to phase coupling.
- 132 kV outdoor dedicated Voltage Transformers (VTs), single pole and Current Transformers (CTs) single pole, of accuracy class 0.2 FS<5 for NTDC (National Transmission And Despatch Company Limited) metering.
- 400V AC (Alternate Current) Auxiliary Switchgear, 24/0.4kV, 10kA
- 2x300kVA Auxiliary Transformers
- 1x300KVA, 415V,0.8 power factor, 3 phase, 4 wire Standby Diesel Generator
- Protection & Metering equipment
- Substation SCADA (Supervisory Control and Data Acquisition)
- MV (22 kV) Collection System:
    - Generator step up (GSU) transformers 0.660/22 kV, 2700KVA
    - 24kV Ring Main Units (RMUs),
- Telecommunication
    - Line traps 132kV, 2000A, 0.5mH, 2 phase to be mounted on top of coupling capacitor voltage transformers
    - Coupling devices for phase to phase coupling
    - Single channel Power Line Carrier (PLC)
    - Protection Signaling Equipment (PSE)
    - Cabinet for PLC
    - 48 V DC (Direct Current) battery and Automatic Dual Battery charger 50A continuous rating
    - PABX (Private Automatic Branch Exchange) with fax facility at least 10 extensions.
- Control, Communication, PLC (Power Line Carrier) Equipment
- Emergency Diesel Generator Set 150 kVA
- Power, Control and Fiber Optic Cables
- Supply of Tower: Tubular Steel Towers

The Nordex N100/2500 WTG has a capacity of 2.5 MW at a nominal voltage of 660 V and a frequency of 50 Hz. Its rotor diameter measures 99.8m. The project owner will install 20 units of the Nordex N100/2500 WTGs.

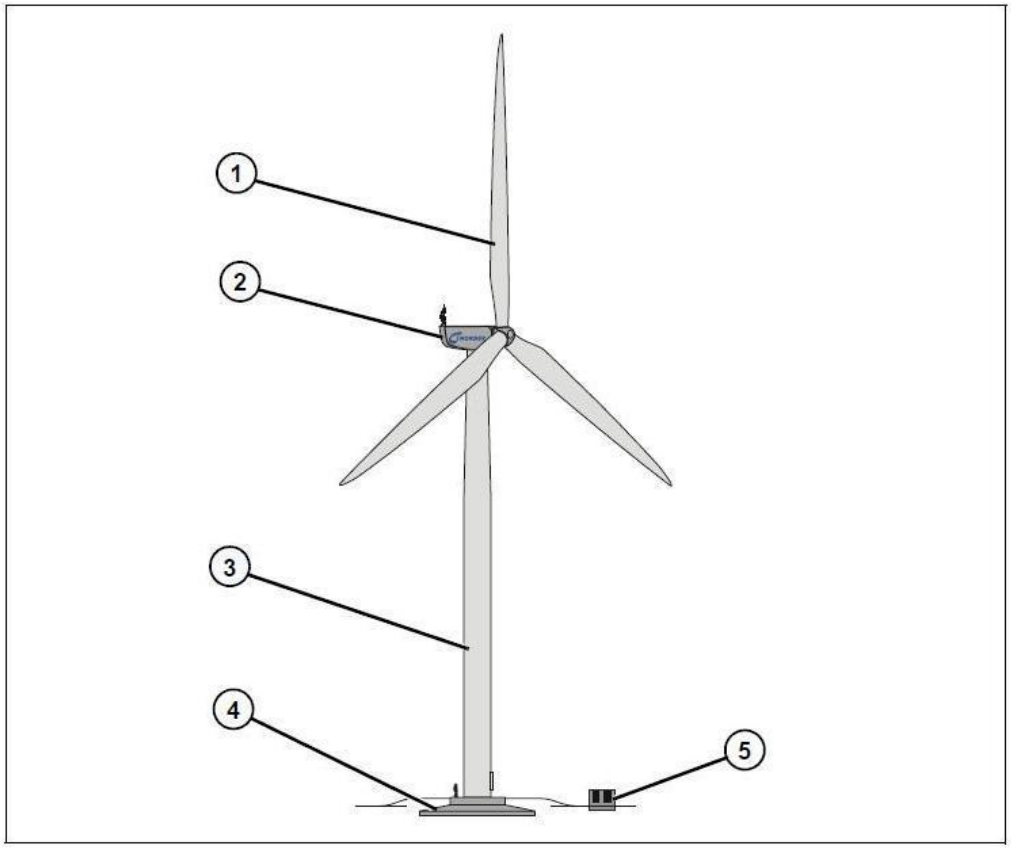
The generator for the Nordex N100/2500 WTG is designed as double fed induction generator with slip ring rotor and leads into a converter to recover the slip power. Independent of the rotor speed, voltage and frequency are kept at constant rate. This enables a speed-variable operation and at the same time low grid perturbation.

The WTGs are 3-bladed, upwind, horizontal-axis WTGs and are equipped with a SCADA (Supervisory Control and Data Acquisition) system for monitoring.

[1] As referenced in EPC contract , Schedule 35

A wind turbine consists of the following main components:

- Rotor, consisting of rotor hub, three rotor blades and the pitch system
- Nacelle with drive train, generator and yaw system
- Tubular tower with foundation
- Transformer and medium-voltage switchgear



Main components of a wind turbine

1. Rotor
2. Nacelle
3. Tower
4. Foundation
5. Transformer substation (optional)

Figure 3: General WTG schematic

The 20 turbines will have a combined capacity of 50 MW and generate an annual estimated amount of electricity of 144,500 MWh as confirmed by AEDB. This electricity will replace electricity previously delivered by the fossil-fuel intensive WAPDA grid and thereby reduce carbon emissions.
Emission sources and GHG involved in the proposed project are CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.

All equipment to be installed is new and has an estimated lifetime of 20 years.

A.4. Parties and project participants

Party involved (host) indicates a 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)
Islamic Republic of Pakistan (host)	Foundation Wind Energy-I Limited (Private)	No
United Kingdom of Great Britain and Northern Ireland	UPM Umwelt-Projekt-Management GmbH (Private)	No

A.5. Public funding of project activity

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There is no public funding involved in the proposed project activity.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

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Title of the baseline methodology:
Consolidated Baseline Methodology for grid-connected electricity generation from renewable sources (Version 13.0.0).

Reference:
ACM0002, Version 13.0.0 (EB 67 Annex 13)

Furthermore, the following tools have been applied:
Tool to calculate the emission factor for an electricity system, Version 2.2.1 (EB63, Annex 19)
Tool for the demonstration and assessment of additionality, Version 6.0.0 (EB65, Annex 21)

B.2. Applicability of methodology

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The approved methodology ACM0002 is applicable to grid-connected renewable power generation project activities that[2]

a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant);
b) involve a capacity addition;
c) involve a retrofit of (an) existing plant(s); or
d) involve a replacement of (an) existing plant(s).

The methodology is applicable under the following conditions:

- *The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;*

(…)

[2] Cited from ACM0002, v.13.0.0

The methodology is not applicable to the following:

- *Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;*
- *Biomass fired power plants;*
- *A hydro power plant that results in the new creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2.*

Since the proposed project comprises the installation of a new wind power plant at a site where no power plant was operated before, the criteria for the applicability of methodology ACM0002 are met. Since no switching of fossil fuels, biomass or hydropower is involved in the project activity, none of the no-applicability criteria does hinder the project implementation using ACM0002. Other applicability conditions mentioned in the methodology are not applicable to the project activity.

The planned wind power plant will generate electricity for the grid of the *Water and Power Development Authority (WAPDA)*. The geographic and system boundaries for this electricity grid can be clearly identified and information on the characteristics of the grid is available from the Pakistan Energy Yearbook[3] published annually by the Government of Pakistan, Ministry of Petroleum and Natural Resources.

Therefore, ACM0002 is applicable to the proposed project activity.

B.3. Project boundary

Gases and emission sources included

Following the methodology gases and emission sources to be included in the baseline scenario applies to CO_2 from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. Although the CO_2 emissions in the grid-connected power plants only arise from fossil fuel fired power plants (gas, oil), other types of power plants (hydel, nuclear) are also used in the WAPDA grid to generate the electricity, which is being replaced due to the project activity, and are thus included in the calculation of the grid emission factor. The possible project emissions that are listed in the methodology do not apply for wind power plants. Therefore, the emissions from the proposed project activity can be neglected. A list with all relevant gases and emission sources are listed in below table.

Source		Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal	CO_2	No	As the proposed project activity is a wind power project and no geothermal power plants are involved, these emissions are therefore not applicable and thus not included.

[3] The latest available Pakistan Energy Yearbook is for the year 2011, published in February 2012.

	steam	CH_4	No	As the proposed project activity is a wind power project and no geothermal power plants are involved, these emissions are therefore not applicable and thus not included.
		N_2O	No	As the proposed project activity is a wind power project and no geothermal power plants are involved, these emissions are therefore not applicable and thus not included.
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	As the proposed project activity is a wind power project and no solar thermal power plants or geothermal power plants are involved, these emissions are therefore not applicable and thus not included.
		CH_4	No	As the proposed project activity is a wind power project and no solar thermal power plants or geothermal power plants are involved, these emissions are therefore not applicable and thus not included.
		N_2O	No	As the proposed project activity is a wind power project and no solar thermal power plants or geothermal power plants are involved, these emissions are therefore not applicable and thus not included.
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	As the proposed project activity is a wind power project and no hydro power plants are involved, these emissions are therefore not applicable and thus not included.
		CH_4	No	As the proposed project activity is a wind power project and no hydro power plants are involved, these emissions are therefore not applicable and thus not included.
		N_2O	No	As the proposed project activity is a wind power project and no hydro power plants are involved, these emissions are therefore not applicable and thus not included.

Table 1: Emissions sources included in or excluded from the project boundary

Project boundary
According to ACM0002, Version 13.0.0, the project boundary is defined as[4]:

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.
The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table 1.

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

[4] Cited from ACM0002, v.13.0.0

Following this definition, the project boundary is drawn as follows:

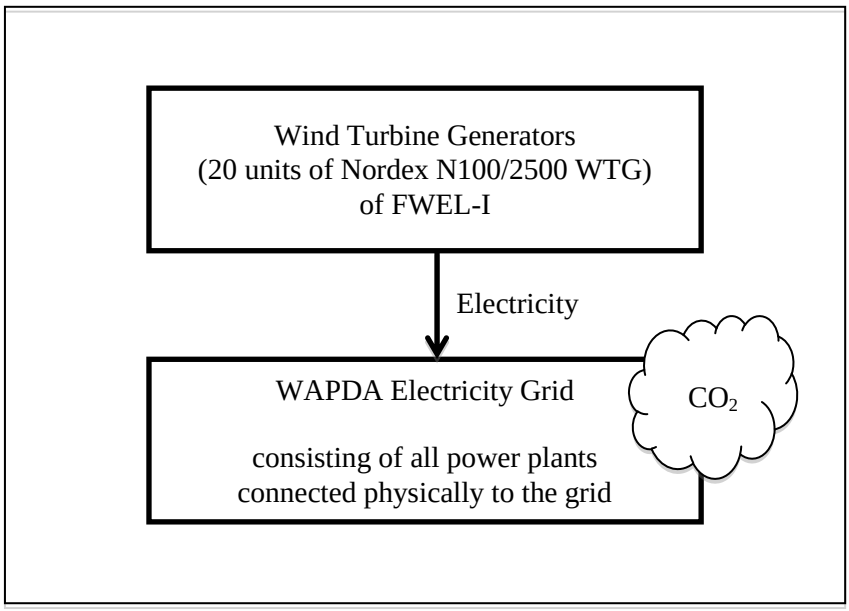

Figure 4: project boundary

B.4. Establishment and description of baseline scenario

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According to methodology ACM0002, Version 13.0.0, the baseline scenario for a new grid connected renewable power plant can easily be identified[5]:

> *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".*

The proposed project comprises the installation of a new wind power plant, connected to the WAPDA grid. Therefore, the baseline scenario is the generation of electricity by grid-connected power plants. The baseline emissions can be calculated using the *"Tool to calculate the emission factor for an electricity system"*.

The baseline emissions would be the emissions resulting from the generation of 144,500 MWh in the WAPDA grid.

B.5. Demonstration of additionality

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Date	Milestone	Document
LOI (Letter of Intent) issued by AEDB (Alternate Energy Development Board)	25/04/2005	LOI
Technical Feasibility approved by	11/10/2006	AEDB Letter

[5] Cited from ACM0002, v.13.0.0

AEDB		
Agreement to Lease for Land signed with AEDB	13/03/2008	Agreement to Lease
Decision to start negotiations with Nordex (investment decision)	12/07/2011	Board resolution
EPC (Engineering Procurement Construction) contract (start date of the project)	23/08/2011	EPC contract
Submission of Tariff Petition to NEPRA (National Electric Power Regulatory Authority)	30/08/2011	Cover Letter
IEE (Initial Environmental Examination)	27/10/2011	IEE Report
Application for Generation License	12/01/2011	Application Letter
Approval of Generation License by NEPRA	22/12/2011	NEPRA Letter
CDM Prior Consideration Note	22/02/2012	UNFCCC (United Nations Framework Convention on Climate Change) website
IEE accepted by SEPA (Sindh Environmental Protection Agency)	02/03/2012	SEPA Letter
Final Tariff Determination by NEPRA	16/03/2012	NEPRA Letter
CDM Local Stakeholder Consultation (LSC)	23/04/2012	LSC Report
Consultancy contract with UPM GmbH (CDM developer)	07/05/2012	UPM Contract
LOA (Letter of Approval) Host Country issued by DNA (Designated National Authority) of Pakistan	23/10/2012	LOA of DNA Pakistan
LOA issued by DNA of Annex-I country	02/11/2012	LOA of DNA United Kingdom of Great Britain and Northern Ireland
Financial Close	January 2013 (expected)	
Tentative date of commissioning of the wind farm	Mid 2013	

Table 2: Timeline

At the time of investment decision, the project owner had been aware the CDM and the revenues of CDM have been seriously considered to overcome the barriers of the project installation.
The Renewable Energy Policy 2006 of the Government of Pakistan mentions in chapter 8.3.3: *"All qualifying RE power projects (initially wind and small hydro IPPs) eligible for financing under the Clean Development Mechanism (CDM) shall be encouraged to register for Certified Emission Reduction (CER) credits with the CDM Executive Board, either collectively or individually."*

The former project owner Beacon Energy Limited conducted a Feasibility Study in 2006, in which CDM was discussed and suggested to be applied for the project. When Fauji Foundation acquired the project, from Beacon Energy Limited on 05/06/2010, the Feasibility Study of the project had been provided to Fauji Foundation. Consequently, the Fauji Foundation continued to pursue CDM in its project planning.

Furthermore, UPM and Fauji Foundation met in Islamabad in December 2010 to discuss CDM development. A letter delineating the CDM development process that was written shortly after this meeting is provided to the DOE.

All these evidences took place before the start date of the project on 23/08/2011 (Finalisation of EPC contract) and thus demonstrate FWEL-I's seriousness about CDM.

The notes for Prior Consideration of the CDM have been submitted to UNFCCC and the Host Country DNA within 6 months.

As the PDD was submitted to the DOE (Designated Operational Entity) for publishing on the website of UNFCCC for Global Stakeholder Consultation after the project starting date (EPC contract signature), which was on 23/08/2011, a Notification on Prior Consideration of the CDM to the UNFCCC and the Host Country DNA was necessary and has been received by the UNFCCC on 22/02/2012[6] This is within the required period of 6 months.

A prior consideration is therefore demonstrated.

Additionality

To assess and demonstrate the additionality, the guidance in the methodology is followed. The following steps are carried out along the descriptions in the *Tool for the demonstration and assessment of additionality (Version 6.0.0)*:

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

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

In this step, in line with the methodology, two possible options are discussed:

P1: The project activity not implemented as a CDM project;

P2: The continuation of the current situation, i.e. to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance. The additional power generated under the project would be generated in existing and new grid-connected power plants in the electricity system;

A third option – the methodology refers to different levels of replacement and/or retrofit – is not applicable for this project scenario.

Outcome of Step 1a: Identified realistic and credible alternative scenario(s) to the project activity:

P1: The project activity not implemented as a CDM project;

P2: The continuation of the current situation, i.e. to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance. The additional power generated under the project would be generated in existing and new grid-connected power plants in the electricity system;

[6] According to EB65, Annex 32

As the Sindh Environmental Protection Agency approved the IEE (Initial Environmental Examination) of the proposed project and AEDB (Alternative Energy Developing Board) issued an LOI (Letter of Intent) and approved the Feasibility Study, it can be concluded that both scenarios are consistent with mandatory laws and regulations and will further be discussed.

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

Both possible alternatives are compliant with mandatory laws and regulations and are legally appropriate alternatives.

Outcome of Step 1b: Consistency with mandatory laws and regulations:

P1: The project activity not implemented as a CDM project;

P2: The continuation of the current situation, i.e. to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance. The additional power generated under the project would be generated in existing and new grid-connected power plants in the electricity system;

The proposed CDM project is voluntary action and not legally binding.

Step 2: Investment analysis

For the proposed project, the barrier analysis is performed; therefore, the investment analysis is not applied and will be skipped.

Step 3: Barrier analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:

During an analysis of the existing barriers, the barrier of prevailing practice has been identified:
The project activity is the "first of its kind".

As per *Tool for the demonstration and assessment of additionality (Version 6.0.0)* the project activity is the First-of-its-kind in the applicable geographical area if :

(a) The project is the first in the applicable geographical area that applies a technology that is different from any other technologies able to deliver the same output and that have started commercial operation in the applicable geographical area before the start date of the project; and
(b) Project participants selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal.;

The technology referred here is the wind power based power generation in the area of Gharo, Kutti Kun new island in Taluka Mirpur Sakro District Thatta in the province Sindh of the Islamic Republic of Pakistan (geographical area[7]). The National Transmission and Despatch Company (NTDC) issued a letter of 05/11/2012 saying that no wind farm in Pakistan has reached the COD (Commercial Operation Date) by 05/11/2012. Further issued the DNA Pakistan a letter of 14/11/2012 also saying that no wind farm in Pakistan has reached the COD by 05/11/2012. As a cross-verification there is no wind power export at

[7] As per Tool for the demonstration and assessment of additionality (Version 06.0.0) (EB65 Annex21) the applicable geographical area covers the entire host country as a default.

132 kV to the national grid mentioned in the latest Pakistan Energy Yearbook of 2011. Therefore, it can be concluded, that there is no commercial operation yet.
The project participants selected a fixed crediting period of 10 years, as mandatory by the aforementioned guideline.
As both conditions are fulfilled, it can be concluded, that the Project activity is the first of its kind in Pakistan and the barriers due to prevailing practice exist.

As the first project of its kind in Pakistan, the project can expect to face a number of potential difficulties:

- Lack of experience among local engineers regarding operation of the technology to be used. This can lead to difficulties in both the construction and maintenance phases. The technical challenges will also be greater as in other countries/areas, because most of the equipment will be imported, and know-how from outside will be required for the installation and initial operation of the project. Errors, which may stem from this lack of experience, could significantly reduce the performance and viability of the project;

- Lack of infrastructure for maintenance and spare part supply. This means that any breakdown will take longer to correct, when compared to a country, where such technology is common practice. Alternatively, the project owner would need to keep a larger inventory of spare parts, which increases costs.

- Greater perception of risk on the part of managers and investors. With no comparable projects occurring in Pakistan, it is difficult for decision-makers to quantify the financial viability of such an investment with any certainty. As a result, decision-makers will naturally hesitate to risk their company's resources in an untried area, which is outside of their core area of experience.

Outcome of Step 3a: Identified barriers that may prevent one or more alternative scenarios to occur

The barrier of prevailing practice has been identified: the project activity is the "first of its kind", as per *Tool for the demonstration and assessment of additionality (Version 6.0.0)*.

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

The identified barrier of prevailing practice applies to the scenario P1, as this is the first of its kind. Therefore, scenario P1 is excluded from the possible alternatives.

Obviously, the continuation of the existing situation - the generation of electricity by the grid (P2) - is not prevented by the barrier of prevailing practice.

Step 4: Common practice analysis
As the project is first of its kind in Pakistan, as concluded in Sub-step 3a, the common practice analysis does not have to be carried out.[8]

From the four steps performed above, it can be concluded, that the proposed project is additional.

B.6. Emission reductions
B.6.1. Explanation of methodological choices
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[8] All relevant documentation has been provided to the DOE during the validation.

The calculation of the estimated emission reduction that is described in the methodology consists of the following four steps:

1. Project emissions
2. Baseline emissions
3. Leakage
4. Emission reductions

Project emissions
Methodology ACM0002 gives the following formula for the calculation of the project emission:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad (1)$$

With:

PE_y	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

However, in this equation, the factor PE_y is only valid for geothermal and solar thermal projects, $PE_{GP,y}$ is applicable for geothermal projects and $PE_{HP,y}$ refers to CH_4 and CO_2 emissions from hydropower plants. Furthermore, this project is a wind power plant and as such does not plan the combustion of fossil fuels and according to the methodology the use of fossil fuels for the back up or emergency purposes (e.g. diesel generators) can be neglected.
Therefore also $PE_{FF,y}$ is considered 0. This leads to:

$$PE_y = 0. \quad (2)$$

Baseline emissions
The baseline emissions can be calculated according to the methodology that uses the following approach[9]:

> *Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants.*

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad (3)$$

Where:

BE_y	Baseline emission in year *y* (tCO_2/MWh)
$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project 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 *"Tool to calculate the emission factor for an electricity system"* (tCO_2/MWh)

[9] Cited from ACM0002, v.13.0.0

The calculation of the first factor, $EG_{PJ,y}$ is simple for so-called greenfield projects, which are defined as power plants at a site where no renewable power plant was operated prior to the implementation of the project activity. Following this definition, the project qualifies as a greenfield project and the following method can be applied:

$$EG_{PJ,y} = EG_{facility,y} \quad (4)$$

Where:

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

For the second factor of equation 3, the *Tool to calculate the emission factor for an electricity system* has to be used. Following the tool, this factor is calculated as a combined margin (CM), consisting of the simple average of the operating margin emission factor (OM) and the build margin (BM) emission factor by utilizing an ex-ante 3-year data period:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM} \quad (5)$$

With the input values:

$EF_{grid,CM,y}$	Combined margin grid emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	Operation margin grid emission factor in year *y* (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin grid emission factor in year *y* (tCO_2/MWh)
w_{OM}	Weighting of operation margin factor (%)
w_{BM}	Weighting of build margin factor (%)

Leakage

In the methodology, leakage is described as follows[10]:

> *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, following the methodology, leakage is neglected.

Emission reductions

The emission reduction can be calculated as difference of the baseline emission, the project emission:

$$ER_y = BE_y - PE_y \quad (6)$$

With the input values calculated before:

ER_y	Emission Reductions in year *y* (tCO_2e/yr)
BE_y	Baseline emissions in year *y* (tCO_2e/yr)
PE_y	Project emissions in year *y* (tCO_2e/yr)

[10] Cited from ACM0002, v.13.0.0

B.6.2. Data and parameters fixed ex ante

>>

As all parameters available at validation are also parameters, which need to be monitored, they are included in section B.7.1 instead of section B.6.2.

B.6.3. Ex ante calculation of emission reductions

>>

The proposed project plans to reduce carbon dioxide emissions by replacing grid electricity generated in fossil fuel fired power plants with renewable electricity. According to Section B.6.1, the emission reduction can be calculated with following formula:

$$ER_y = BE_y - PE_y \quad (7)$$

With the input values calculated before:

ER_y Emission Reductions in year *y* (tCO_2e/yr)

BE_y Baseline emissions in year *y* (tCO_2e/yr)

PE_y Project emissions in year *y* (tCO_2e/yr)

According to Section B.6.1 the project emission is 0. That leads to:

$$ER_y = BE_y - 0 \quad (8)$$

$$ER_y = BE_y \quad (9)$$

According to Section B.6.1 the baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad (10)$$

Where:

BE_y Baseline emission in year *y* (tCO_2/MWh)

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project 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 *"Tool to calculate the emission factor for an electricity system"* (tCO_2/MWh)

The grid emission factor for 2011 has been calculated in Appendix 4:

$$EF_{grid,CM,2011} = 0.6174 \frac{tCO_2e}{MWh} \quad (11)$$

And the quantity of net electricity supplied to the grid is estimated (see Secton B.7.1):

$$EG_{facility,y} = 144{,}500\ MWh \quad (12)$$

With these two values, the emission reduction for the first year can be calculated:

$$ER_y = 144{,}500\ MWh \cdot 0.6174 \frac{tCO_2e}{MWh} \quad (13)$$

$= 89{,}214\ tCO_2e$

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)
2014	89,214	0	0	89,214
2015	89,214	0	0	89,214
2016	89,214	0	0	89,214
2017	89,214	0	0	89,214
2018	89,214	0	0	89,214
2019	89,214	0	0	89,214
2020	89,214	0	0	89,214
2021	89,214	0	0	89,214
2022	89,214	0	0	89,214
2023	89,214	0	0	89,214
Total	892,140		0	892,140
Total number of crediting years	10			
Annual average over the crediting period	89,214	0	0	89,214

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{facility,y}$
Unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Measured by energy meters. The ex-ante value is taken from the Feasibility Study Report.
Value(s) applied	144,500
Measurement methods and procedures	Continuous measurement and at least monthly recording. The following parameters will be measured: (i) The quantity of electricity supplied by the project plant/unit to the grid; and (ii) The quantity of electricity delivered to the project plant/unit from the grid
Monitoring frequency	Measured continuously, read monthly, value applied is the measured quantity in one year
QA/QC procedures	As per Standard Draft Energy Purchase Agreement (EPA)[11] of AEDB, the method of calibration and frequency of tests will be agreed between FWEL-I and NTDC (grid company) based on knowledge of the performance and the design of the installed meters and the manufacturer's recommendations. The metering points to record net electricity exported to grid shall be at the high voltage side (132kV) of the power transformer of the wind farm. An exclusive set of current and voltage transformers (0.2FS5 & 0.2 % accuracy class respectively) to feed the current and voltage to the Metering System shall be provided by FWEL-I. The metering system shall have an accuracy class of 0.2S and will be located within the substation. Besides the Metering System, which is used for billing purposes, there will be a Back-Up Metering System installed by FWEL-I, which will be of identical type and accuracy class. Both metering systems are not procured yet and shall be procured later near the time of commissioning. The Metering System and the Back-Up Metering System shall be jointly sealed by NTDC and FWEL-I. The metering system will be under the custody of NTDC (grid company) and FWEL-I will have no authority to test and calibrate the metering system. Testing and calibration of the Metering System shall be carried out by NTDC (grid company) after giving appropriate notice to FWEL-I in line with the agreed frequency of testing or in the event of either Party having reasonable cause to believe the meters are outside the specified limits. Testing and calibration of Back-Up Metering System will be performed by FWEL-I based on agreements with NTDC (grid company), knowledge of the performance and the design of the installed meters and the manufacturer's recommendations. In case the Metering System has a failure, the data from the Back-Up Metering System shall be used for emission reduction calculation.
Purpose of data	Calculation of baseline emissions
Additional comment	

[11] Available on the AEBD website http://www.aedb.org/downloads.htm

Data / Parameter	EFgrid,y
Unit	tCO2/MWh
Description	Emission factor of the WAPDA grid
Source of data	Pakistan Energy Yearbook, Ministry of Petroleum & Natural Resources
Value(s) applied	0.6174
Measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system" Version 2.2.1 . For the detailed way of calculation, see Annex 3.
Monitoring frequency	Calculated annually based on the latest data available from the Pakistan Energy Yearbook, Ministry of Ministry & Natural Resources
QA/QC procedures	Appropriateness of the data is reviewed and changes are applied annually by the PO. It will be recalculated annually.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$FC_{i,y}$
Unit	Mass unit
Description	Amount of fossil fuel type *i* consumed in the project electricity system in year **y**
Source of data	Pakistan Energy Yearbook, Ministry of Petroleum & Natural Resources
Value(s) applied	Refer to the provided excel sheet WAPDA EF calculation 2011
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	-
Additional comment	-

Data / Parameter	$NCV_{i,y}$
Unit	GJ/mass unit
Description	Net calorific value (energy content) of fossil fuel type i in year y
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	Refer to the provided excel sheet WAPDA EF calculation 2011
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	-
Additional comment	-

Data / Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type i used in power unit m in year y
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	Refer to the provided excel sheet WAPDA EF calculation 2011
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	-
Additional comment	-

Data / Parameter	EG_y
Unit	MWh
Description	Net electricity generated by the project electricity system in year y
Source of data	Pakistan Energy Yearbook, Ministry of Petroleum & Natural Resources
Value(s) applied	Refer to the provided excel sheet WAPDA EF calculation 2011
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	-
Additional comment	-

Data / Parameter	$\eta_{m,y}$
Unit	-
Description	Average net energy conversion efficiency of power unit m in year y
Source of data	The default values provided in the table in Annex 1 of the Tool to calculate the emission factor of an electricity system.
Value(s) applied	Refer to the provided excel sheet WAPDA EF calculation 2011
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	-
Additional comment	-

B.7.2. Sampling plan

>>

Not applicable.

B.7.3. Other elements of monitoring plan

>>

The purpose of the monitoring plan is to ensure the completeness, consistency and accuracy of the monitoring system as well as the calculation of the emission reductions. The personnel appointed by the project owner will be in charge of the monitoring plan.

1. Monitoring objects

The main monitoring objects are the electricity delivered to the grid and the grid emission factor.

2. Management structure

A CDM department set up by the project owner will appoint personnel to carry out the monitoring plan. The personnel structure is as follows:

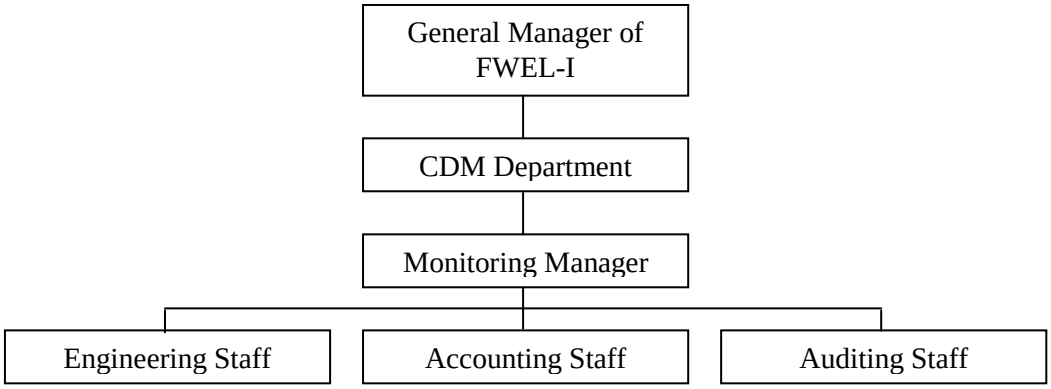

Figure 5: Monitoring organogram

A monitoring manager will be appointed to supervise the implementation of the monitoring plan, while further staff , including engineering staff, accounting staff and (internal) auditing staff, will be appointed to carry out the monitoring plan. The engineering staff is responsible for data collection (such as meter readings), daily maintenance of equipment and the emission reduction calculation. The accounting staff is responsible for the process of power transactions with the power grid company and power sale receipts keeping. The auditing staff is responsible for reviewing the data and receipt collected, ensuring the veracity and transparency of them.

3. Monitoring equipment and installation

The meters will be installed at the interconnection point to the grid for monitoring the electricity delivered to the grid. The accuracy of the meters and the calibration is according to National standards.

4. Data collection

The project owner and the grid company are responsible for checking the meters. They will ensure that the meters are sealed and without damages.

5. Meters maintenance and calibration

The periodical calibration and maintenance of the meters should comply with the related standards and regulations of the national power sector, so as to ensure the precision of the meters. The meters must be sealed after calibration. Neither the project owner nor the power grid company could unseal or change the meters without the presence of the other party.

After the occurrence either of the conditions below, the meters shall be tested by the designated institute commissioned by the project owner and the power grid company together:

a. the error of the meter is out of the permissible limits

b. maintenance of the meters due to faults of the meters' components

6. Data management system

The data management system describes how the collected data are recorded and kept, which is also the core of the monitoring plan.
Every month, the monitored data should be archived electronically, at the same time the paper document should be archived. The project owner should keep the receipts of power sales/purchase. The monitoring plan will be carried out mainly by the CDM department and conducted by the appointed personnel. All key documents will be kept collectively. For convenience of auditing, the project owner should provide the index of project document and monitoring report. The project owner will have a copy of all the paper documents. The monitored data will be kept during the whole crediting period and 2 years after the end of the crediting period or until the last issuance of CERs, whichever occurs later.

SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity
>>
The start date of the project activity is 23/08/2011, as it is the earliest date on which the implementation of the project activity has begun. On this date, the EPC contract has been signed. This is considered the start date of the project activity, as on this date, the PO (project owner) has finally committed to the full project costs. This can be validated with the EPC contract that has been provided during the validation.

C.1.2. Expected operational lifetime of project activity
>>
20 years, 0 months

C.2. Crediting period of project activity
C.2.1. Type of crediting period
>>
A fixed crediting period of 10 years, 0 months is chosen.

C.2.2. Start date of crediting period
>>
01/01/2014 or the date of registration, depending on whatever is later.

C.2.3. Length of crediting period
>>
10 year, 0 months

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts
>>
A local consultant company was awarded the contract to conduct the Initial Environmental Examination (IEE) study for the proposed project activity.

In the Section 7 of IEE, environmental consultant identified all environmental risks which are associated with the project and classifies into Design phase impacts, Construction phase impact and Operation phase impact with their significances. In the screening of environmental impact they uses following matrix (Section 7.1.1).

- High negative (adverse) impact
- Low negative impact
- Insignificant impact
- High positive (beneficial) impact
- Low positive impact, and
- No impact.

All potential impact were characterized on following basis

- Nature (direct/indirect)
- Duration of impact (short term, medium term, long term)
- Geographical extent (local, regional)
- Timing (project phase: before, during and after construction)
- Reversibility of impact (reversible/irreversible)
- Likelihood of the impact (certain, likely, unlikely, rare)
- Impact consequence severity (severe, moderate, mild).

Each environmental impact of the proposed project identified during the screening stage. During the study of environment, it takes into considerations that all impacts should be discussed and those having with ''high'' significance should be brought down to ''medium'' or ''low'' significance through appropriate mitigation measures. An attempt is also made to bring the impacts with ''medium'' significance to ''low'' significance; environmental monitoring is necessary for such impacts to ensure that these do not transform to ''high'' significance impacts. The impacts with ''low'' significance do not usually need any mitigation (Section 7.1.3).

The hierarchy of the mitigation measures used during the study is as follows. First, an attempt is made to altogether avoid the adverse impact through change in design, location or method of carrying out the proposed activity. If this is not possible, the significance of the impact is reduced through appropriate mitigation measures. As a last resort, compensatory measures are taken to minimize the adverse impacts of the proposed activities (Section 7.1.4).

If some impacts remains as residual after taken mitigation measures discusses as residual impacts. These residual impacts are monitored during the project execution, in order to ensure that these remain within acceptable limits (Section 7.1.5).

To reduce any significant impact from the project, the environmental management and monitoring plan discussed in the Section 8 of IEE. Management and monitoring plan defines the roles and responsibilities of various persons which are associates with this project in different phases.

Resulting from the investigation of the baseline conditions and the site evaluation and the mitigation measures adopted by FWEL-I, the consultants are of the opinion that the wind farm should be developed, constructed and operated without any significant and permanent environment impacts. (Section 9.2).
The consultant company that conducted the environmental examination came to the result, that the environmental impacts are not significant.

D.2. Environmental impact assessment

>>

The consultant company that conducted the environmental examination, as described in section D.1 of the PDD, came to the result, that the environmental impacts are not significant. (Section 9.2) Therefore no further assessment has to be made.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

The opinion of stakeholders was obtained by two methods: visits of selected stakeholders at their offices and one general stakeholder meeting conducted at FWEL-I Wind Farm, Gharo.

Stakeholder meeting at stakeholder offices

The stakeholder meeting was conducted at their offices. The following departments/stakeholders were identified and meetings were conducted from 19/04/2012 to 21/04/2012:

- District Officer Agriculture
- Deputy General Manager NCHD (National Commission for Human Development)
- Site Manager SCOPE (Society for Conservation & Protection Environment)
- SRO (Sindh Radiant Organization)
- WWF (World Wide Fund for Indus)

The consultation process was carried out in Urdu language. During these meetings a simple, non-detailed technical, description of the project was given, with an overview of the project's likely human and environmental impact. This was followed by an open discussion allowing participants to voice their concerns and opinions. After the meeting feedback from stakeholders were documented on feedback forms.

General Public Consultation Meeting at Gharo (Proposed Area)

A general stakeholder meeting was held at FWEL-I, Gharo. In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders/villagers and to analyze their capacity and willingness to be involved in some or all parts of the project and its planning processes. It is also important to examine how community skills, resources, and 'local knowledge' can be applied to improve the project design and implementation.

The announcement for a formal stakeholder meeting was made on 16/04/2012. Participants were invited by the display of notices at different locations in the area near the project as well as by sending invitation letters and calling stakeholders. Feedback from individual villagers was collected during 16/04/2012 – 18/04/2012.

The formal stakeholders meeting was conducted on 23/04/2012 at 11:00am at the project site at the FWEL-I Wind Power Project at Gharo. The meeting was attended by groups related to government or private agencies, people living nearby the project area and local farmers.

M/S Arch Associates – the consulting company for the Environment Assessment of the proposed project activity - explained to the participants the project and its technical details, the process of IEE study (Initial Environmental Examination), environmental aspects and impacts associated with this project, the environmental management and monitoring plan as well as an introduction to CDM.

Furthermore the baseline scenario and alternatives were explained to the participants. The stakeholder meeting was carried out in Urdu language supported by native Sindhi language.

After the briefing participants were encouraged to ask their questions and detailed response was provided to their queries.

A formal feedback regarding the project and its outcomes was collected at the end of the meeting.

The queries as well as the result from all questionnaires are included in chapters E.2. and E.3.

E.2. Summary of comments received

>>

The questionnaires comprised ten questions. A total number of 29 questionnaires have been returned by the stakeholder meeting participants. The overall results are displayed in the following tables:

Summary of responses from government and private agencies during individual meeting
Total questions = 10
Total respondents =4

Number	Question	Yes	No
1	Do you understand the nature of this project?	4	0
2	Do you understand the positive impact of this project?	4	0
3	Do you understand the negative impact of this project?	4	0
4	Do you think this project is beneficial for the common man?	4	0
5	What do you think are the disadvantages of this project?	Dust emission during construction	
		3	1
6	Do you think, advantages are more than disadvantages?	4	0
7	What is your impression regarding this meeting?	All respondents welcome that such a meeting or gathering has been arranged.	
8	What do you like about this project?	All respondents think that the current energy crises will be mitigated and employment opportunities will be improved through the project. These are basic needs in the area.	
9	What do you not like about this project?	Noise might be created.	
		4	0
10	Do you think this project should be initiated?	4	0

Summary of responses from stakeholder in general meeting
Total questions = 10
Total respondents = 25

Number	Question	Yes	No
1	Do you understand the nature of this project?	25	0
2	Do you understand the positive impact of this project?	25	0
3	Do you understand the negative impact of this project?	25	0
4	Do you think this project is beneficial for the common man?	25	0
5	What do you think are the disadvantages of this project?	Dust emissions, Noise pollution, Shadows	
		8	17
6	Do you think, advantages are more than disadvantages?	22	3
7	What is your impression regarding this meeting?	All respondents welcome that such a meeting or gathering has been arranged.	
8	What do you like about this project?	All respondents think that the current energy crises will be mitigated and employment opportunities	

		will be improved through the project. These are basic needs in the area.	
9	What do you not like about this project?	8 people think that noise might be created and think that the villagers might not directly benefit from the wind farm, while 17 people did not see any issues.	
10	Do you think this project should be initiated?	20	0
		5 people did not respond	

E.3. Report on consideration of comments received

>>

The following lists questions of the stakeholders during the office and village visits and the general stakeholder meeting at FWEL-I Wind Farm, Gharo, and the answers given:

1. Question, asked by Mr. Usman Dhari, unknown local village
Question: How will the electricity be provided to the local community from the wind farm?
Answer: The consultant replied that the electricity will be sold to the National grid company and they are in charge of providing the electricity through their electricity grid to the people.

SECTION F. Approval and authorization

>>

The host country Letter of Approval (LOA) was issued by the DNA of Pakistan on 23/10/2012.
The LOA issued by the DNA of an Annex-I country was issued on 02/11/2012 by the DNA of United Kingdom of Great Britain and Northern Ireland.

Appendix 1: Contact information of project participants

Organization name	Foundation Wind Energy-I Limited
Street/P.O. Box	Fauji Foundation Head Office ,Fauji Towers, 68-Tipu Road, Chaklala Cantt
Building	
City	Rawalpindi
State/Region	Punjab
Postcode	46000
Country	Islamic Republic of Pakistan
Telephone	92-51-5951821-40, ext 1430, 1417
Fax	92-51-5951732
E-mail	Imran.shafiq@fauji.org.pk , muhammad.shaukat@fauji.org.pk
Website	www.fauji.org.pk
Contact person	Imran Shafiq
Title	Project Coordinator (Wind Projects)
Salutation	Mr
Last name	Shafiq
Middle name	
First name	Imran
Department	Planning & Developemnt Division
Mobile	92-336-5556366, 92-321-5818569
Direct fax	92-51-5951732
Direct tel.	92-51-5599427
Personal e-mail	Imran.shafiq@fauji.org.pk

Organization name	UPM Umwelt-Projekt-Management GmbH
Street/P.O. Box	Lamontstrasse 11
Building	
City	Munich
State/Region	
Postcode	81679
Country	Germany
Telephone	+49 89 41419690
Fax	+49 89 41419692
E-mail	ngarbers@upm-cdm.eu
Website	www.upm-cdm.eu
Contact person	Norbert Garbers
Title	Managing Partner
Salutation	Mr.
Last name	Garbers
Middle name	
First name	Norbert
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	ngarbers@upm-cdm.eu

Appendix 2: Affirmation regarding public funding

No public funding is involved in the project.

Appendix 3: Applicability of selected methodology

The applicability of the methodology has been discussed in chapter B.2. No further discussion is deemed necessary.

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

Calculation of the grid emission factor

As described above to calculate the second factor of equation to calculate the baseline emissions, the *Tool to calculate the emission factor for an electricity system* has to be used. Following the tool, this factor is calculated as a combined margin (CM), consisting of the simple average of the operating margin emission factor (OM) by utilizing an ex-ante 3-year data period and the build margin (BM) emission factor:

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

With the input values:

$EF_{grid,CM,y}$	Combined margin grid emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	Operation margin grid emission factor in year *y* (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin grid emission factor in year *y* (tCO_2/MWh)
w_{OM}	Weighting of operation margin factor (%)
w_{BM}	Weighting of build margin factor (%)

For the calculation of these input values, the *Tool to calculate the emission factor for an electricity system* describes six steps:

STEP 1. Identify the relevant electricity systems.
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3. Select a method to determine the operating margin (OM).
STEP 4. Calculate the operating margin emission factor according to the selected method.
STEP 5. Calculate the build margin (BM) emission factor.
STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electricity systems

The Pakistani DNA has not published any delineation of the project electricity system and a connected electricity system. Moreover, the criteria provided in the "Tool to calculate the emission factor for an electricity system" under Step 1 do not result in a clear grid boundary as

1) there is no official data for market prices for electricity over periods of time in Pakistan
2) there is no official data available with regard to the operation of the transmission line between different electricity systems.

In such cases, the "Tool to calculate the emission factor for an electricity system" suggests "to use a regional grid definition in the case of large countries with layered dispatch systems (e.g. provincial/regional/national)" to distinguish a connected electricity system. As a provincial grid definition may be too narrow, the national grid definition should be used by default, as per the tool.

Pakistan comprises two electricity grids, the Karachi Electricity Supply Company (KESC) grid, which supplies Karachi city and adjoining areas of Sindh and Balochistan, and the national electricity grid, managed by the *Water and Power Development Authority (WAPDA).* The national grid covers the whole of Pakistan, except the city of Karachi, which is supplied by the KESC grid.

The Pakistan Energy Yearbook, which is annually published by the Government of Pakistan, Ministry of Petroleum and Natural Resources, provides the official data for energy generation in Pakistan for KESC

and WAPDA. Further does it mention the IPPs (Independent Power Producers), which deliver their generated power either to WAPDA or KESC.[12]

The proposed project will be connected to the national electricity grid (WAPDA). According to the *Tool to calculate the emission factor for an electricity system,* the project electricity system can be identified as the national grid by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.

Although the two grids are interconnected for occasional supply from the national grid to the smaller KESC grid, electricity imports and exports are not foreseen during standard operation. According to the definitions in the above-mentioned tool, the KESC grid can be identified as connected electricity system. Since none of the two grids is physically connected to foreign grids, electricity imports to the national grid can therefore be excluded.

Electricity exports are not subtracted from the electricity generation data, as advised in the *Tool to calculate the emission factor for an electricity system.*

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)
According to Option I of step 2, off-grid power plants are not included in the calculation.

Step 3: Select a method to determine the operating margin (OM)
Four alternatives for the calculation of OM are given in the tool:

a) Simple OM; or
b) Simple adjusted OM; or
c) Dispatch data analysis OM; or
d) Average OM.

The simple OM method (option a) can only be used if low-cost/must-run resources[13] constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

As calculated with the data available from the Pakistan Energy Yearbooks published by the Government of Pakistan, Ministry of Petroleum & Natural Resources, the share of low-cost/must-run resources has constituted less than 50% of total grid generation in average of the five most recent years:

2006/07	38.71%
2007/08	37.13%

[12] On the website of the Private Power & Infrastructure Board, Government of Pakistan, Ministry of Water & Power (http://www.ppib.gov.pk/N_commissioned_ipps.htm) it is mentioned which IPPs deliver their generated power to which electricity system (WAPDA or KESC). Currently only two IPPs (Gul Ahmed, Karachi, and Tapal Energy, Karachi) deliver to KESC, while the other IPPs deliver to WAPDA. In 1998, as part of the government's privatization policy, the National Transmission & Despatch Company (NTDC) "was organized to take over all the properties, rights and assets obligations and liabilities of 220 KV and 500KV Grid Stations and Transmission Lines/Network Transmission Lines/Network owned by Pakistan Water and Power Development Authority (WAPDA) (See http://www.ntdc.com.pk). IPPs commissioned under the 2002 power policy are therefore mentioned as delivering their generated power to NTDC.

[13] Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

2008/09	35.76%
2009/10	35.98%
2010/11	41.46%
Average of the five most recent year (2006/07 – 2010/11)	37.81%

As this requirement is met according to the Energy Yearbooks of 2007 - 2011, the simple OM method (option a) is applicable.

Two ways of calculating the operating margin can be applied according to the EB guidance[14]:

> Ex ante *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 emissions 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 5 most recent calendar years prior to the time of submission of the CDM-PDD for validation.*
>
> 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.*

For the proposed project, the *ex post* option is chosen. This means, that each monitoring report would have to include the latest calculation of the operation margin emission factor. Since the latest data is usually not available earlier than eighteen months after the end of year *y*, the factor for the year proceeding the previous year (*y-1*) will be used for the calculations. Therefore, the operation margin that is calculated for the first year (2014) will be the one for 2013.

However, since the data is obviously not available at the moment, the estimated emission reductions shown in Section B.6.4 are calculated using the *ex ante* option.

Step 4: Calculate the operating margin emission factor according to the selected method
The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

Two ways of calculation are described in the tool[15]:

> *Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or*
> *Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.*

Whereas Option B can only be applied if:

> *a) The necessary data for Option A is not available; and*

[14] Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1
[15] Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1

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 (i.e., if Option I has been chosen in Step 2).

The exact operation and emission factor data is not available for all connected power plants, only nuclear and hydro power have been considered as low-cost/must-run resources in Step 3 and Option I has been chosen in Step 2. Option B can therefore be chosen to calculate the OM emission factor using the total net electricity generation, emission and utilization data for each fuel type. The necessary data can be found in the present Pakistan Energy Yearbooks.

The calculation of the OM emission factor is based on the net electricity supplied to the grid by all power plants serving the system, not including the above mentioned low-cost/must-run power plants. To carry out the calculation, the tool provides the following formula:

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}\right)}{EG_y}$$

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* (GJ/mass or volume unit)
$EF_{CO_2,i,y}$	CO_2 emission factor of fossil fuel type i in year *y* (tCO_2/GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/most-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 relevant year as per the data vintage chosen in Step 3.

As a result of this calculation[16], the simple operation margin for the year 2011 is:

$$EF_{grid,OMsimple,2011} = 0.7184 \frac{tCO_2e}{MWh}$$

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

For the terms of data vintage, the tool offers two options[17]:

> ***Option 1:*** *For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be 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. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.*

[16] All relevant input values and calculations will be provided to the DOE(s) during validation and verification.
[17] Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1.

Option 2: *For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.*

The option chosen should be documented in the CDM-PDD.

For the proposed project, option 2 is chosen and the build margin will updated every year of the first crediting period. Therefore, the latest figures will be calculated in each monitoring report.

However, since the data is obviously not available at the moment, the estimated emission reductions shown in Section B.6.4 are calculated using option 1.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

The sample group of power units *m* used to calculate the build margin should be determined as per the following procedure from the *Tool to calculate the emission factor for an electricity system*[18], consistent with the data vintage selected above:

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

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

(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}); Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore steps (d), (e) and (f).

Otherwise:

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

[18] Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1

Otherwise:

(*e) Include in the sample group $SET_{sample-CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);*

(f) The sample group of power units m used to calculate the build margin is the resulting set ($SETsample-CDM->10yrs$).

Step (a)

The five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and for which official data about their annual electricity generation is available, are:

$SET_{5\text{-units:}}$

No.	Power Unit	Commission Date	Electricity generation 2010-2011 (MWh)[19]
1	CHASNUPP-II	27/01/2011	468,000.00
2	NISHAT CHUNIAN LTD	21/07/2010	1,416,580.00
3	ORIENT POWER LTD	24/05/2010	1,000,680.00
4	ENGRO ENERGY LTD	27/03/2010	1,566,210.00
5	ATLAS POWER LTD	18/12/2009	1,483,760.00

$AEG_{SET\text{-}5\text{-}units}$ = 5,935,230 MWh

Step (b)

According to Pakistan Energy Yearbook 2011, Ministry of Petroleum & Natural Resources, the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}) has been calculated as:

AEG_{total} = 83,988,611 MWh

The set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} and for which official data about their annual electricity generation is available, are:

$SET_{\geq 20\%}$:

No.	Power Unit	Commission Date	Electricity generation 2010-2011 (MWh)[20]
1	CHASNUPP-II	27/01/2011	468,000.00
2	NISHAT CHUNIAN LTD	21/07/2010	1,416,580.00
3	ORIENT POWER LTD	24/05/2010	1,000,680.00

[19] Pakistan Energy Yearbook 2011, Ministry of Petroleum & Natural Resources
[20] Pakistan Energy Yearbook 2011, Ministry of Petroleum & Natural Resources

4	ENGRO ENERGY LTD	27/03/2010	1,566,210.00
5	ATLAS POWER LTD	18/12/2009	1,483,760.00
6	GHAZI BAROTHA	01/07/2003	7,434,791.00
7	TNB LIBERTY POWER	10/09/2001	1,333,120.00
8	CHASHMA	01/06/2001	915,750.00
9	UCH POWER	18/10/2000	4,221,140.00

$AEG_{SET-\geq 20\%}$, = 19,840,031 MWh

Step (c)
$SET_{\geq 20\%}$ comprises the larger annual electricity generation and is therefore SET_{sample}.
SET_{sample}. Started to supply electricity on 18/10/2000 – more than 10 years ago – therefore it will be proceeded with step (d).

Step (d)
As no power units registered as CDM project activities could be included, after excluding power units which started to supply electricity to the grid more than 10 years ago, the resulting set $SET_{sample-CDM}$

$SET_{sample-CDM}$:

No.	Power Unit	Commission Date	Electricity generation 2010-2011 (MWh)[21]
1	CHASNUPP-II	27/01/2011	468,000.00
2	NISHAT CHUNIAN LTD	21/07/2010	1,416,580.00
3	ORIENT POWER LTD	24/05/2010	1,000,680.00
4	ENGRO ENERGY LTD	27/03/2010	1,566,210.00
5	ATLAS POWER LTD	18/12/2009	1,483,760.00
6	GHAZI BAROTHA	01/07/2003	7,434,791.00

$AEG_{SET-sample-CDM}$ = 13,370,021 MWh

The annual electricity generation of $SET_{sample-CDM}$ does not comprise at least 20% of AEG_{total}. Therefore it will be proceeded with steps (e) and (f).

Step (e) & (f)
Step (e) and (f) result in following set:

$SET_{sample-CDM->10yrs}$:

No.	Power Unit	Commission Date	Electricity generation 2010-2011 (MWh)[22]
1	CHASNUPP-II	27/01/2011	468,000.00
2	NISHAT CHUNIAN LTD	21/07/2010	1,416,580.00
3	ORIENT POWER LTD	24/05/2010	1,000,680.00
4	ENGRO ENERGY LTD	27/03/2010	1,566,210.00
5	ATLAS POWER LTD	18/12/2009	1,483,760.00

[21] Pakistan Energy Yearbook 2011, Ministry of Petroleum & Natural Resources
[22] Pakistan Energy Yearbook 2011, Ministry of Petroleum & Natural Resources

6	GHAZI BAROTHA	01/07/2003	7,434,791.00
7	TNB LIBERTY POWER	10/09/2001	1,333,120.00
8	CHASHMA	01/06/2001	915,750.00
9	UCH POWER	18/10/2000	4,221,140.00

For the calculation of the operation margin, the latest available data is the average data from 2009 to 2011. For new plants, data that is more accurate is available. Therefore, the build margin that will be used in the first year of the crediting period will be from 2011.

According to the *Tool to calculate the emission factor for an electricity system*, the build margin emissions factor is the generation-weighted average emission factor of all power units *m* during the most recent year *y*, for which electricity generation data is available. It can be calculated using the following formula:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

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

Whereas[23]:

The CO_2 emission factor of each power unit m ($FE_{EL,m,y}$) should be determined as per the guidance in Step 4 (a) for the simple OM, using options A1, A2 or A3, using for y the most recent historical year for which electricity generation data is available, and using for m the power units included in the build margin.

As a result of this calculation[24], the build margin for 2011 is:

$$EF_{grid,BM,2011} = 0.3145 \ \frac{tCO_2e}{MWh}$$

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

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

(a) Weighted average CM; or
(b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option.

Weighted average CM has been selected, as evident from the grid emission factor calculation sheet provided to DOE.

[23] Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1
[24] All relevant input values will be provided to the DOE(s) during validation and verification.

As described above, the combined margin emission factor for an electricity system is calculated using the following formula:

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

The weighting factors w_{OM} and w_{BM} are defined by the *Tool to calculate the emission factor for an electricity system*[25]*:*

> *Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;*
>
> *All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period , and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.*

Therefore, the combined emission factor for the national grid in Pakistan is:

$$EF_{grid,CM,2011} = 0.7184 \frac{tCO_2e}{MWh} \cdot 0.75 + 0.3145 \frac{tCO_2e}{MWh} \cdot 0.25 = 0.6174 \frac{tCO_2e}{MWh}$$

[25] Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1

Appendix 5: Further background information on monitoring plan

The monitoring plan has been discussed in chapter B.7. No further background information is deemed necessary.

Appendix 6: Summary of post registration changes

Not applicable.

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03	EB 25, Annex 15 26 July 2006	
02	EB 14, Annex 06b 14 June 2004	
01	EB 05, Paragraph 12 03 August 2002	Initial adoption.
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