



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

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Power Generation through Wind Energy at Gul Ahmed Wind Power Limited
Version number of the PDD	1.3
Completion date of the PDD	21/12/2012
Project participant(s)	• Gul Ahmed Wind Power Limited • UPM Umwelt-Projekt-Management GmbH
Host Party(ies)	Islamic Republic of Pakistan
Sectoral scope and selected methodology(ies)	Sectoral Scope: 1 Methodology: ACM0002, Version 13.0.0 (EB 67 Annex 13)
Estimated amount of annual average GHG emission reductions	93,783 tCO ₂ e

SECTION A. Description of project activity**A.1. Purpose and general description of project activity**

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The Power Generation through Wind Energy at Gul Ahmed Wind Power Limited project is located approx. 90 km east-northeast from the city of Karachi, Pakistan. The project owner is Gul Ahmed Wind Power Limited (hereinafter “GAWPL”).

The purpose of the Power Generation through Wind Energy at Gul Ahmed Wind Power Limited 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 CO₂ 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 151,900 MWh to the WAPDA grid and thereby reduce the baseline grid emissions by an annual 93,783 tCO₂e.
- (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 151,900 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.

A.2. Location of project activity**A.2.1. Host Party(ies)**

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Islamic Republic of Pakistan

A.2.2. Region/State/Province etc.

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Sindh Province

A.2.3. City/Town/Community etc.

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Jhimpir, District Thatta

A.2.4. Physical/Geographical location

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The project is located in Pakistan, Sindh Province, Thatta District, northeast of Jhimpir City, Deh Kohistan, within a narrow corridor, spanned by the following coordinates:

	Latitude	Longitude
1.	25 °10' 12.09" N	67° 54' 25.15" E
2.	25 °10' 19.86" N	67° 54' 25.98" E
3.	25 °08' 30.78" N	68 °00' 44.76" E
4.	25 °08' 28.99" N	68 °00' 46.29" E
5.	25 °08' 23.36" N	68° 00' 42.72" E
6.	25 °10' 12.09" N	67 °54' 25.15" E

The maps below illustrate the project location.

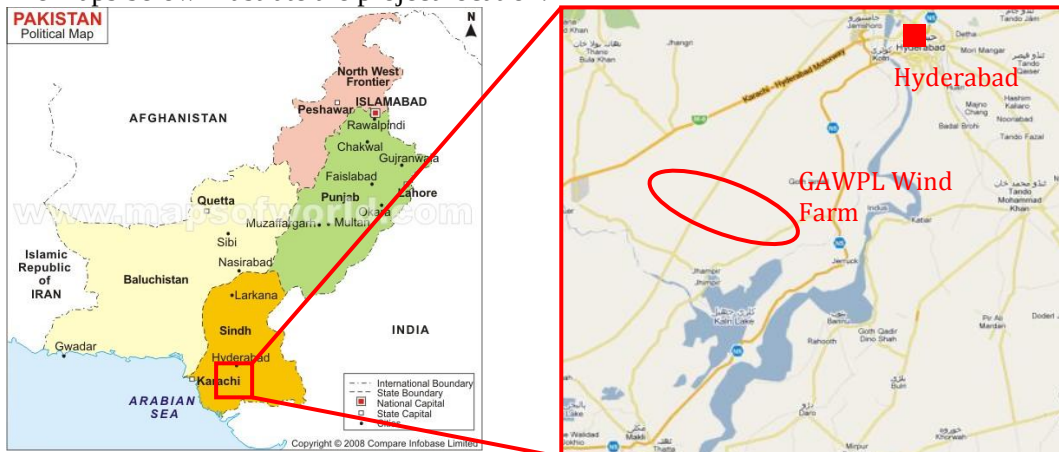


Figure 1: Map of the project location

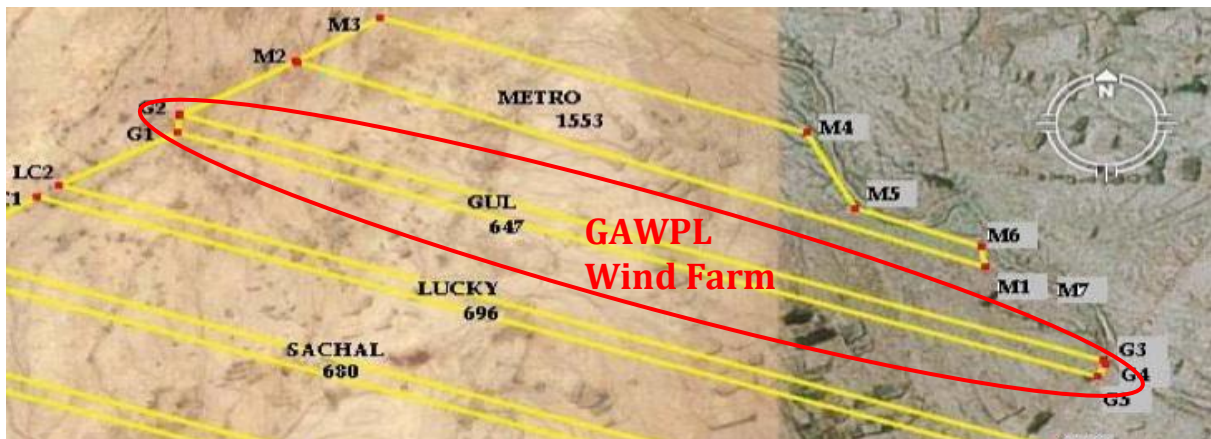


Figure 2: Map of the project location

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. Therefore, 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 units of 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 construction work will be carried out by the Pakistani company Descon in collaboration with Nordex. The following equipment will be delivered by Descon:

- 1) WTG Towers with service lifts (20 No., 80 m height in 4 sections for each WTG)
- 2) HV/MV (132/22 kV) Transformers
 - i) 22/132 KV step up Transformers (2 No's), 50 MVA ONAN/ONAF each
 - ii) Grounding Transformer (2 No's), 22 KV, 125 KV_p BIL / 50 KV each
 - iii) Auxiliary Transformers 22 KV/ 0.4 KV (2 No's)
- 3) HV Switchyard
 - i) 132 KV outdoor Hybrid GIS
 - ii) 132 KV outdoor surge arrestors
 - iii) 132 KV outdoor CCVTs
 - iv) Protection & Metering system
- 4) 22 KV MV System
 - i) Metal clad Switchgear
 - ii) MV collection system
 - iii) GSU transformers 0.660/22 kV, 2700 KVA, ONAN, Oil immersed, outdoor type
 - iv) 22 kV RMUs
- 5) Underground Cables (UGC)
 - i) 24 kV XLPE insulated single core cables
 - ii) LV Power Cables
 - iii) Fiber Optic Cables
- 6) Telecommunication Equipments
 - i) Line traps 132 KV, 2000 A, 0.5 mH, 2 phase
 - ii) Coupling devices
 - iii) HF co-axial cables
 - iv) Single Channel Power Line Carrier, 40 W
 - v) Protection Signaling Equipment
 - vi) 48 VDC battery & automatic dual battery charger 30 A
 - vii) PABX system (10 extension)
- 7) Shunt Compensation
 - i) 2 x 10/2.5 x 8 MVAR outdoor shunt capacitor
- 8) CCTV for substation & collection system
- 9) Telephone System
 - i) PABX (6 input lines + 20 Outgoing lines)
- 10) Satellite communication (VSAT connection on temporary basis for 2 years)
- 11) Communication for Tariff Metering
- 12) Emergency standby diesel generator 200 KVA and 100 KVA

- 13) 110 VDC Battery System,
 - i) 110 V DC NiCad Battery
 - ii) 2 x 110V DC Charger
 - iii) 110V DC Switchgear
- 14) Fire detection and fighting system etc

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.

The 20 turbines will have a combined capacity of 50 MW and generate an annual estimated amount of electricity of 151,900 MWh at 132 kV at a capacity factor of 34.7% as per Feasibility Study. 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 CO₂ 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)	Gul Ahmed Wind Power 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)

Tool for the demonstration and assessment of additionality, Version 6.0.0 (EB 65 Annex 21)

Tool to calculate the emission factor for an electricity system, Version 2.2.1 (EB 63 Annex 19)

B.2. Applicability of methodology

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The approved methodology ACM0002 is applicable to grid-connected renewable power generation project activities that¹

- 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;*

(...)

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/m².*

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*² published annually by the Government of Pakistan, Ministry of Petroleum and Natural Resources.

Therefore, ACM0002 is applicable to the proposed project activity.

¹ Cited from ACM0002, v.13.0.0

² The latest available Pakistan Energy Yearbook is for the year 2011, published in February 2012.

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 CO₂ from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. Although the CO₂ 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 ₂ O	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 steam	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.
		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 ₂ O	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 ₂ O	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 ₂ O	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 as³:

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.

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

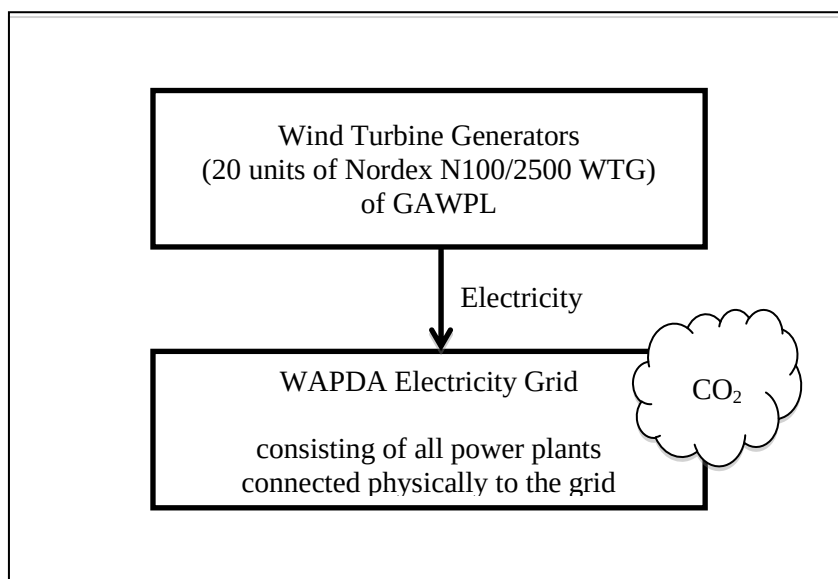


Figure 3: project boundary

B.4. Establishment and description of baseline scenario

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³ Cited from ACM0002, v.13.0.0

According to methodology ACM0002, Version 13.0.0, the baseline scenario for a new grid connected renewable power plant can easily be identified⁴:

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 151,900 MWh in the WAPDA grid.

B.5. Demonstration of additionality

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Date	Milestone	Document
LOI (Letter of Intent) issued by AEDB (Alternative Energy Development Board)	13/05/2006	LOI
Board decision to found GAWPL in order to proceed with the wind farm project (investment decision)	22/09/2007	Extract of Board Resolution
Agreement to Lease for Land signed with AEDB	28/03/2008	Agreement to Lease
Leased Land taken over by company	28/04/2008	Taking over document
IEE (Initial Environmental Examination) report completed	20/04/2009	IEE report
IEE report submitted to EPA (Environmental Protection Agency)	14/05/2009	Copy of covering letter
NOC (No Objection Certificate) issued by SEPA (Sindh Environmental Protection Agency)	01/06/2009	NOC
Grid interconnection study approval by NTDC (National Transmission and Despatch Company) received	04/12/2010	NTDC approval letter
Technical Feasibility submitted to AEDB	08/12/2010	Copy of covering letter
Finalisation of EPC (Engineering, Procurement Construction) contractor (start date of the project)	08/09/2011	EPC contract
Application for Generation License	15/09/2011	Generation License
Submission of Tariff Petition to	19/09/2011	Copy of cover Letter

⁴ Cited from ACM0002, v.13.0.0

NEPRA (National Electric Power Regulatory Authority)		
Approval of Generation License by NEPRA	26/12/2011	NEPRA Letter
Technical Feasibility approved by AEDB	17/01/2012	AEDB Letter
CDM (Clean Development Mechanism) Prior Consideration Note	27/02/2012	UNFCCC (United Nations Framework Convention on Climate Change) website
CDM Local Stakeholder Consultation (LSC)	05/05/2012	LSC Report
Final Tariff Determination by NEPRA	08/05/2012	NEPRA Letter
Consultancy contract with UPM (Umwelt-Projekt-Management) GmbH (CDM developer)	16/07/2012	UPM Contract
Host Country LOA (Letter of Approval) issued by host country DNA (Designated National Authority)	07/08/2012	LOA of DNA Pakistan
LOA Sponsor Country issued by UK (United Kingdom of Great Britain and Northern Ireland) DNA	16/10/2012	LOA of DNA United Kingdom of Great Britain and Northern Ireland
Financial Close	In progress	
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 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 for publishing on the website of UNFCCC for Global Stakeholder Consultation after the project starting date (EPC contractor decision), which was on 08/09/2011, 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 27/02/2012⁵ This is within the required period of 6 months.

A prior consideration is therefore demonstrated.

Additionality

⁵ According to EB65, Annex 32

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;

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

As the Sindh Environmental Protection Agency approved the Initial Environmental Examination (IEE) 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.

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

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

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;

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 Thatta District, northeast of Jhimpir City, in the province Sindh of the Islamic Republic of Pakistan (geographical area⁶). 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 132 kV to Grid as evident from 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.

⁶ 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.

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.⁷

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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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 ₂ e/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 ₂ e/yr)
$PE_{HP,y}$	Project emissions from water reservoirs of hydro power plants in year y (tCO ₂ e/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 CH₄ and CO₂ 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.

⁷ All relevant documentation has been provided to the DOE during the validation.

Therefore also $PE_{FF,y}$ is considered 0. This leads to:

$$PE_y = 0. \quad (1.1)$$

Baseline emissions

The baseline emissions can be calculated according to the methodology that uses the following approach⁸:

Baseline emissions include only CO₂ 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.

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad (2)$$

Where:

BE_y Baseline emission in year y (tCO₂/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 CO₂ emission factor for grid connected power generation in year y calculated using the “*Tool to calculate the emission factor for an electricity system*” (tCO₂/MWh)

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:

$$EG_{PJ,y} = EG_{facility,y} \quad (2.1)$$

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 (2), 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:

That leads to:

$$BE_y = EG_{facility,y} \cdot EF_{grid,CM,y} \quad (2.2)$$

Leakage

In the methodology, leakage is described as follows⁹:

⁸ Cited from ACM0002, v.13.0.0

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

Therefore, following the methodology, leakage is neglected.

Emission reductions

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

$$ER_y = BE_y - PE_y \quad (3)$$

With the input values calculated before:

ER_y	Emission Reductions in year y (tCO ₂ e/yr)
BE_y	Baseline emissions in year y (tCO ₂ e/yr)
PE_y	Project emissions in year y (tCO ₂ e/yr)

B.6.2. Data and parameters fixed ex ante

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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

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Project emissions

Project Emissions have been determined as 0 in Section B.6.1.

$$PE_y = 0 \quad (1.1)$$

Baseline emissions

As mentioned in Section B.6.1, the baseline emissions are calculated as

$$BE_y = EG_{facility,y} \cdot EF_{grid,CM,y} \quad (2.2)$$

Where:

BE_y	Baseline emission in year y (tCO ₂ /MWh)
$EG_{facility,y}$	Quantity of net electricity generation supplied by the project plant/unit to the grid 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:

⁹ Cited from ACM0002, v.13.0.0

$$EF_{grid,CM,2011} = 0.6174 \frac{tCO_2e}{MWh} \quad (4)$$

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

$$EG_{facility,y} = 151,900 \text{ MWh} \quad (5)$$

With these two values, the baseline emissions for the first year can be calculated:

$$\begin{aligned} BE_y &= 151,900 \text{ MWh} \cdot 0.6174 \frac{tCO_2e}{MWh} \\ &= 93,783 \text{ tCO}_2e \end{aligned} \quad (2.3)$$

Leakage

Leakage is neglected, as mentioned in Section B.6.1.

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:

$$ER_y = BE_y - PE_y \quad (3)$$

With the input values calculated before:

ER_y	Emission Reductions in year y (tCO ₂ e/yr)
BE_y	Baseline emissions in year y (tCO ₂ e/yr)
PE_y	Project emissions in year y (tCO ₂ e/yr)

According to equations (1.1) and (2.3), that leads to:

$$ER_y = 93,783 \text{ tCO}_2e - 0 \quad (3.1)$$

$$ER_y = 93,783 \text{ tCO}_2e \quad (3.2)$$

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

A fixed crediting period of 10 years, 0 months is chosen.
Starting date of the crediting period shall be 01/01/2014.



Year	Baseline emissions (t CO ₂ e)	Project emissions (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions (t CO ₂ e)
2014	93,783	0	0	93,783
2015	93,783	0	0	93,783
2016	93,783	0	0	93,783
2017	93,783	0	0	93,783
2018	93,783	0	0	93,783
2019	93,783	0	0	93,783
2020	93,783	0	0	93,783
2021	93,783	0	0	93,783
2022	93,783	0	0	93,783
2023	93,783	0	0	93,783
Total	937,830		0	937,830
Total number of crediting years	10			
Annual average over the crediting period	93,783	0	0	93,783

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 has been calculated by Garrad Hassan at P50
Value(s) applied	151,900
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)¹⁰ of AEDB, the method of calibration and frequency of tests will be agreed between GAWPL 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 GAWPL. 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 GAWPL, 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 GAWPL. The metering system will be under the custody of NTDC (grid company) and GAWPL 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 GAWPL 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 GAWPL 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	

¹⁰ Available on the AEDB website <http://www.aedb.org/downloads.htm>



Data / Parameter	EF _{grid,y}
Unit	tCO ₂ /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 Appendix 4.
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>i</i> consumed in the project electricity system in year <i>y</i>
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>i</i> in year <i>y</i>
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	$EF_{CO_2,i,y}$
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:

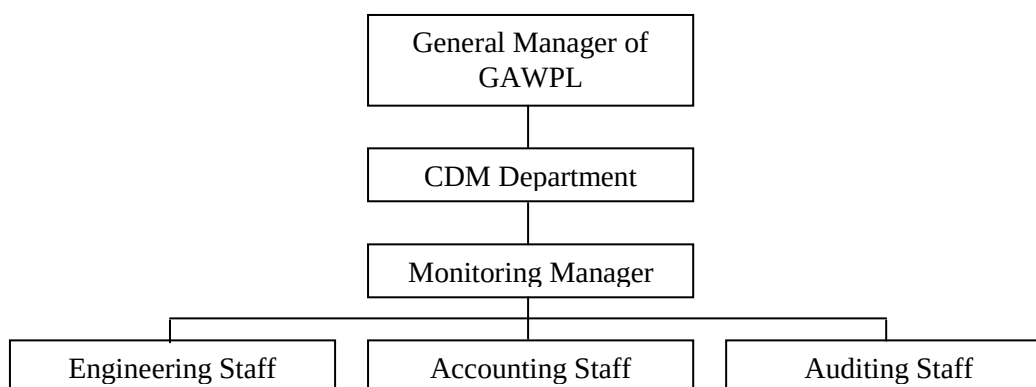


Figure 4: Monitoring organogram

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 08/09/2011, 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

>>

The Initial Environmental Examination (IEE) study for the proposed project activity was conducted by Dr. Mirza Arshad Ali Beg Research & Development Consultants, Karachi, Pakistan.

Overall assessment of the environmental aspects and screening of potential impacts of the proposed project finds that:

- Site of the Project in the Jhimpir Wind Corridor is the preferred alternative for establishment of the GAWPL WPGC.
- An appropriate number of wind turbines will be sited along the 11 km x 0.2 km strip of land, with each WTG spaced at optimum distances apart following the annual maximum wind direction.
- There are no issues on land acquisition, loss of land, or loss of business, and no involuntary resettlement will be required
- Noise emissions from the wind turbines at GAWPL wind farm site will have a high level at the top and will attenuate with distance. The noise level at the living areas at more than 1.5 km or three times the safe distance of seven rotor diameter equivalents will be within acceptable limits of the World Bank Guidelines and the limits recently proposed by Federal EPA.
- Visual effect, Noise effect, EMI effect, Flicker effect induced by operation of the wind turbines will have no significant impact on the living area, located 1.5 km or in excess of one rotor diameter equivalents outside the sub-leased land in Deh Kohistan.
- Detailed design will give due consideration to location of the WTG close to the clusters of settlements at Haji Wallo Goth, Murad Ali Chang Goth and Haji Lakhano Goth and site them to maintain a distance of about 1.6 km. At this distance, the noise from the wind turbine attenuates to acceptable levels, while the visibility, shadow flicker and shadow effects are viewed as curiosity and not annoyance.
- The induced impact on operation of the wind turbines on the microenvironment will be monitored through environmental management plan, environmental monitoring plan and the IFC's HSE Guidelines, and mitigated, if necessary by adoption of suitable measures at the site.
- Piles for the foundations of WTG towers would be laid, if required at depth of bedrock which are hard and pose minimum risk to the liquefaction threat during major (> 7 on Richter Scale) earthquake.
- Precious ecology of the microenvironment of GAWPL-WPGC will be protected. The land being stony wasteland has no worthwhile vegetation. A few patches of dead wood and dried up shrubs may have to be removed towards land clearance but the same will have only minor impact on the environment.
- There are no cultural heritage, recognized archaeological sites, endangered species of flora, wildlife reserve, or potential tourism sites that may need protection and hence no mitigation measures need to be taken. Mitigation measures have been proposed for the protection of the spiny-tailed lizard (*Uromastix hardwickii*) Sandha and the straying high flying birds. The number of the few Houbara bustard and high flying eagles and falcons still around will be recorded during the pre-construction period. Mitigation measures such as hiring the services of sharp shooters will be in place to stupefy the high-flying stray birds and later on release them to safe environment.
- Due diligence will be kept for protecting the wildlife that may still be there.
- Adoption of mitigation measures identified for different stages of the project will be keenly monitored to further enhance the environmental performance of the proposed project.

Detailed description of the IEE can be obtained from the IEE report.

D.2. Environmental impact assessment

>>

The consultant company that conducted the IEE, as described in section D.1 of the PDD, came to the result, that the environmental impacts are not significant.

Assessment of impact of activities during construction processes at the GAWPL site shows that the impacts will be of temporary nature and small order. They are not expected to have any significant adverse impacts on the microenvironment and macroenvironment of the Project. The minor impacts resulting from said activities or operation of facilities would be mitigated.

Therefore no further assessment has to be made.

After careful review and analysis of the IEE, the Sindh Environmental Protection Agency (SEPA) has decided to accord its approval on 01/06/2009.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

The Local Stakeholder Consultation (LSC) for the proposed project activity was conducted by Dr. Mirza Arshad Ali Beg Research & Development Consultants, Karachi, Pakistan.

The Report is based on the EIA and stakeholder consultations held to fulfil the requirement under the CDM Framework. Accordingly, the Report is presented in three parts:

- Part 1 describes the Findings of the consultation meetings held with the stakeholders following the Consultation Framework suggested by the World Bank Sourcebook and is a component of the environmental and social soundness assessment process which requires information disclosure and sharing at the grassroots level for the scoping process of Environmental Impact study. Part 1 forms part of the IEE Study which has been approved by the major stakeholders and in concurrence thereof, Gul Ahmed Wind Power Limited (GAWPL), the Proponent has been granted the No Objection Certificate, meaning that GAWPL has the permission from the Environmental Protection Agency to go ahead with the implementation of its Wind Power Generation Project.
- Part 2 includes the Findings of the consultation meetings held on May 05, 2012, carried out as part of the CDM Project Development, with primary stakeholders i.e. those directly concerned with the implementation of the GAWPL Project.
- Part 3 includes the Findings of the Final Consultation meeting held on May 17, 2012, carried out as part of the CDM Project Development, with primary and secondary stakeholders i.e. those directly as well as indirectly concerned with the implementation of the GAWPL Project.

Part 1: Public Consultation & Information Disclosure (Part of IEE Study)

The stakeholders were briefed during scoping sessions about the objectives of the wind power project in Deh Kohistan 7/1 in Jhimpir Wind Corridor, the GAWPL's Wind Power Generation (WPG) Project, and the necessity of introducing the IEE process. Observations of the participants were incorporated into the IEE study. At the last public consultation, stakeholders and village representatives were informed that the Wind Power Project will, in the detailed design, site the wind turbine generators (WTGs) that may be nearest to the village at least 1.5 km outside the corridor of impact of visibility, flicker and shadow effect, noise, and air emissions. Power Project shall be designed as to site the wind turbine generators (WTGs) nearest to the village taking clear account of typical impact of visibility, flicker and shadow effect, noise, and air emissions clearly outside the neighbouring village.

They were also briefed on the process of monitoring through the Environmental Management Plan as the tool to monitor the environmental performance throughout the lifecycle of the Project.

Scoping meetings were conducted with Institutional stakeholders and grassroots stakeholders, including communities in neighbourhood while conducting the IEE. Institutional stakeholders included the following:

- Sindh Environmental Protection Agency
- Ministry of Environment and Alternative Energy Government of Sindh
- SUPARCO
- IUCN – Pakistan

- WWF – Pakistan
- Sindh Wildlife Department
- Ministry of Local Government & Rural Development
- Department of Archaeology, Government of Pakistan
- Meteorology Department

The grassroots stakeholders included the inhabitants of the goths in the neighbourhood of GAWPL Project site. A list of stakeholders contacted is included in the LSC report.

The Institutional stakeholders contacted during the scoping sessions had a positive view on the project. Although they thought that there would be very little direct benefit of the project for the local community, the area may in the long run gain in terms of increased commercial activity, expanded infrastructure and improved quality of life. A complete list of the observations/suggestions raised during the formal consultation meetings with different officials is included in the LSC report.

At the scoping sessions with communities around the proposed site, groups and individuals were first provided the salient information about the proposed project. Some of the resident communities already knew about the project, but did not know the specific details, particularly about the environmental issues involved. The communities generally welcomed the plans to establish the proposed power project in the area. Since the project would not directly affect them, the villagers generally did not have any apprehension or reservation about the project. They nevertheless viewed the project as one that would create employment opportunities and small business/trade opportunities for the local population. Participatory and consultative approach was employed for information dissemination and data collection. The summary of consultations, major opinions and concerns of the stakeholders identified during scoping meetings is included in the LSC report.

The consultation meetings did not show concerns about establishment of the project or about installation of large turbines in an otherwise quiet neighbourhood or about loss of business, community owned assets and trees, increase in dust and noise emission, congestion in construction areas, disruption of communication during improvement of roads, loss of land due to road improvement, inconvenience during construction, and potential increase of hunting wildlife. The stakeholders were informed that such concerns have been addressed through project design as well as environmental management and monitoring plan, besides IFC's HSE Guidelines (2007).

Part 2: CDM Consultation with Primary Stakeholders

This consultation meeting was held on May 05, 2012, with the Primary Stakeholders who are resident in the villages in the microenvironment of the proposed project and would be directly concerned during the different phases of the project.

Details of the Scoping Session:

- Brief description of the proposed project that was shared with Stakeholders
- Brief description of comments received from local stakeholders and the responses offered
- Report on how due account will be taken on comments received

Part 3: CDM Consultation with Primary & Secondary Stakeholders

This meeting was held on May 17, 2012, with all Stakeholders, both Primary and Secondary, who are resident in the villages in the microenvironment and also those who are residents in the macroenvironment of the GAWPL Project and would be directly and indirectly concerned during the different phases of the Project.

Details of the Scoping Session:

- Brief description of the proposed project that was also shared with Primary Stakeholders held on May 05, 2012
- Brief description of comments received from local stakeholders and the responses offered
- Report on how due account will be taken by the project proponent on comments received

Detailed description on the whole process of the Local Stakeholder Consultation can be obtained from the LSC report.

E.2. Summary of comments received

>>

Public Consultation & Information Disclosure (Part of IEE Study):

- The consultation meeting had the following expectations:
- Drinking water should be made available to the villages in Deh Kohistan on top priority basis.
- Schools should be provided with all the infrastructure and teachers
- Native species of bushes/trees should be encouraged in case there are plans to replace felled trees;
- Contractors must adopt standard procedures in all their works and it should be mandatory on them to follow the Environmental Management and Monitoring Plan as well as IFC's HSE Guidelines on employment of local labor and child labor;
- Sites used for labor camps and quarrying of construction materials should be rehabilitated and/or leveled;
- Spoiled dumps should be leveled so that adjacent community/farmers may use them for crops/tree planting;
- Dust and noise pollution should be minimized during construction work;
- Labor camps should not be established too close to local villages; and
- Leftover construction materials must be disposed off before leaving.

Meeting on May 05, 2012, with the Primary Stakeholders who are resident in the villages:

The Scoping Session was held at the site of the proposed project. All residents of the villages in the surrounding of the project site had been informed of the meeting one week in advance.

Information about the project, its (micro-)environmental impacts and benefits was shared with the community members. The Information sharing process was immediately followed by a question/answer session and recording of stakeholders views in a questionnaire:

- All Participants had a good understanding of the proposed project
- All Participants were in agreement with siting the project in their locality.
- All Participants appreciated the initiative of giving due consideration to the environmental issues, and also incorporating mitigation measures and separating the provision of facilities such as water supply for construction, and provision of safe drinking water to the construction crew at the campsite from the local supplies.
- All Participants were expecting that the facilities such as drinking water and wastewater disposal system would be handed over to the village residents at the end of construction period.
- All Participants seemed to be aware of the positive and negative consequences of the wind power project.
- All Participants agreed that the advantages were more than disadvantages
- All of them were expecting the benefits of employment in the proposed project
- The general consensus was that the Project was acceptable to them all but the acceptability is with the condition that mitigation measures as described will be in place and that benefit of employment will reach the local residents.

In the remarks column there were following observations:

- There were observations on impoverishment of the environment resulting from inattention to improve the general condition of the area and maintaining it.
- Establishment of the project will take away the free movement of their livestock
- Poverty was the main issue confronting the stakeholders in particular the residents of villages at great distances from the site.
- There were observations that ecological resources were being depleted at a rapid rate while subsistence farming was unable to meet the day-to-day needs of the local population.
- Others observed that poverty level in the district was almost the same, if not lower than the average in the rural areas of Sindh and the household income of at least 50% population was about Rs 6000 per month/household. Each village cluster had at least 50 goats and sheep and was also engaged in subsistence farming
- Employment opportunities were low and the younger generation was not prepared to remain in poverty; leading to considerable migration to Karachi in search of jobs.
- Poverty has mostly been caused by the following factors:
 - Scarcity of water
 - Recurring drought
 - Low return from crop but not livestock farming
 - Low wages from stone cutting
 - Low literacy rate
 - Lack of training
 - High population growth
 - Lack of access to employment in industrial area
 - Increasing unemployment
 - High cost of healthcare

Community Expectations from GAWPL:

- All respondents i.e. males as well as females expect the following from the proposed project:
- Employment and provision of Job Opportunity
- Safe drinking water
- Healthcare centers particularly for women and children
- Schools
- Vocational training
- Black top link roads
- Poverty alleviation schemes

The resident population was found expecting that the proposed wind power project would change their lifestyle and they will enjoy better quality of life while their young and future generation will not live in poverty.

The comments were of general nature and pertained mainly to i) displacement of population, ii) loss of free movement, iii) employment opportunity that the project will offer.

The stakeholders were informed that the project plan is well accommodating. Nevertheless the points raised here at this meeting have been taken note of and all concerns will be addressed as far as possible by adopting suitable mitigation measures. Employment will be provided as per the practice adopted so far and in future also there will be provision for training to groom local talents.

Meeting on May 17, 2012, with the Primary and Secondary Stakeholders:

Stakeholder Consultation meeting was arranged, as part of CDM Framework, to address both primary and secondary stakeholders. To ensure broad participation of stakeholders, oral invitations were conveyed ten days ahead of the meeting scheduled for May 17, 2012. Views expressed by the participants were recorded. At the end of the Q/A session the participants were read out a questionnaire and asked to reply on the floor and also to fill the questionnaire:

1. Do you understand the nature of this Project?
2. Do you understand the positive impact of this Project?
3. Do you understand the negative impact of this Project?
4. Do you understand this Project is beneficial for common man?
5. Do you think there are disadvantages only?
6. Do you think advantages are more than disadvantages?
7. What is your impression about this meeting?
8. What do you like about this Project?
9. What do you not like about this Project?
10. Do you think this project should be initiated?

The Participants were unanimous in loudly expressing their views. It became apparent from their expressions that:

- All Participants had a good understanding of the GAWPL Wind Power Project
- All Participants were in agreement with siting the Project in Deh Kohistan 7/1 near their locality in Jhimpir.
- All Participants replied yes to the questions on understanding positive and negative impacts of the Project.
- All Participants seemed to be aware of the positive and negative consequences of the wind power project.
- All Participants thought that this Project is beneficial to the common man.
- None of the Participants thought that there are disadvantages only
- All Participants thought that advantages of the Project were more than disadvantages.
- All Participants thought that were carrying good impression about this meeting
- All Participants appreciated the initiative of providing drinking water facility at their villages. They also appreciated the due consideration being given to the environmental issues, and also incorporating mitigation measures and separating the provision of facilities such as water supply for construction, and provision of safe drinking water to the construction crew at the campsite from the local supplies.
- All Participants were expecting that the facilities such as water supply and wastewater disposal system would be handed over to the village residents at the end of construction period.
- All of them were expecting the benefits of employment in the proposed project.
- The general consensus was that the project was acceptable to them all but the acceptability is with the condition that mitigation measures as described to them will be in place and that benefit of employment will reach the local residents.
- Some participants were very vocal about commitments being not fulfilled.

The above views were recorded in the questionnaire. There were following observations in the Remarks column of the questionnaire:

- Impoverishment of the environment resulting from inattention to improve the general condition of the area and maintaining it.
- Establishment of the Project will take away the free movement of their livestock
- Poverty was the main issue confronting the stakeholders in particular the residents of villages at great distances from the site.
- The ecological resources were being depleted at a rapid rate while subsistence farming was unable to meet the day-to-day needs of the local population.

- Others observed that poverty level in the district was almost the same, if not lower than the average in the rural areas of Sindh and the household income of at least 50% population was about Rs 6000 per month/household. Each village cluster had at least 50 goats and sheep and was also engaged in subsistence farming
- Employment opportunities were low and the younger generation was not prepared to remain in poverty; leading to considerable migration to Karachi in search of jobs.
- Commitment made at such public meetings generally remain unfulfilled.
- Poverty has mostly been caused by the following factors:
 - Scarcity of water
 - Recurring drought
 - Low return from crop but not livestock farming
 - Low wages from stone cutting
 - Low literacy rate
 - Lack of training
 - High population growth
 - Lack of access to employment in industrial area
 - Increasing unemployment
 - High cost of healthcare

The primary as well as secondary stakeholders were found expecting that the proposed wind power project would change their lifestyle and they will enjoy better quality of life while their young and future generation will not live in poverty.

Detailed description on the whole process of the Local Stakeholder Consultation can be obtained from the LSC report.

E.3. Report on consideration of comments received

>>

Meeting on May 17, 2012, with the Primary and Secondary Stakeholders:

The primary as well as secondary stakeholders were found expecting that the proposed wind power project would change their lifestyle and they will enjoy better quality of life while their young and future generation will not live in poverty.

The comments were of general nature as outlined in the LSC report. They pertained mainly to i) displacement of population, ii) loss of free movement, iii) employment opportunity that the proposed project will offer.

Response

The stakeholders were informed that the Project Plan is well accommodating. Nevertheless the points raised here at this meeting have been taken note of and all concerns will be addressed as far as possible by adopting suitable mitigation measures. Employment will be provided as per the practice adopted so far and in future also there will be provision for training to groom local talents.

Meeting on May 17, 2012, with the Primary and Secondary Stakeholders:

The comments were of general nature as outlined in the LSC report. They pertained mainly to i) displacement of population, ii) loss of free movement, iii) employment opportunity that the proposed project will offer.

Response

In response the stakeholders were informed that:



- No displacement of population is expected and no loss of assets is envisaged.
- The freedom of movement is not likely to be an issue
- The points raised here at this meeting have been taken note of and all concerns will be addressed as far as possible.
- Employment will be provided as per the practice adopted so far and in future also there will be provision for training to groom local talents.
- Provision of facilities like drinking water and establishment of educational institutions will continue as at present.
- The IEE Study carries an Environmental management Plan (EMP) which has been included to ensure that the commitments made in the submission are duly implemented, and to ensure the implementation of EMP, a monitoring plan has also been included.

All participants at the stakeholder meeting were in favour of the project, as they were convinced with the responses/explanations provided to their queries by the project proponent and consultants. The meeting concluded with a satisfactory note.

Detailed description on the whole process of the Local Stakeholder Consultation can be obtained from the LSC report.

SECTION F. Approval and authorization

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The host country Letter of Approval (LOA) was issued by the DNA of Pakistan on 07/08/2012.

The LOA issued by the DNA of an Annex-I country was issued on 16/10/2012 by the DNA of United Kingdom of Great Britain and Northern Ireland.

**Appendix 1: Contact information of project participants**

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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.¹¹

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 resources¹² 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%

¹¹ 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.

¹² 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 guidance¹³:

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.

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 based on the latest data, which is available at the start of validation.

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

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

Two ways of calculation are described in the tool¹⁴:

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

Whereas Option B can only be applied if:

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

¹³ Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1

¹⁴ 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:

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

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>i</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>i</i> in year y (GJ/mass or volume unit)
$EF_{CO_2,i,y}$	CO ₂ emission factor of fossil fuel type <i>i</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>i</i>	All fossil fuel types combusted in power sources in the project electricity system in year y
<i>y</i>	The relevant year as per the data vintage chosen in Step 3.

As a result of this calculation¹⁵, 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 options¹⁶:

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

¹⁵ All relevant input values and calculations will be provided to the DOE(s) during validation and verification.

¹⁶ Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1.

should be used. This option does not require monitoring the emission factor during the crediting period.

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 be 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*¹⁷, 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 ($SET_{5-units}$) and determine their annual electricity generation ($AEG_{SET-5-units}$, 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 ($AEG_{SET-\geq 20\%}$, in MWh);

(c) From $SET_{5-units}$ 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 ($SET_{sample-CDM}$) the annual electricity generation ($AEG_{SET-sample-CDM}$, in MWh);

¹⁷ Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1

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. $AE_{SET-sample-CDM} \geq 0.2 \times AE_{total}$), then use the sample group $SET_{sample-CDM}$ to calculate the build margin. Ignore steps (e) and (f).

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 ($SET_{sample-CDM} > 10yrs$).

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:

$SET_{5-units}$:

No.	Power Unit	Commission Date	Electricity generation 2010-2011 (MWh) ¹⁸
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

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

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 (AE_{total}) has been calculated as:

$$AE_{total} = 83,988,611 \text{ MWh}$$

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 AE_{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) ¹⁹
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¹⁸ Pakistan Energy Yearbook 2011, Ministry of Petroleum & Natural Resources

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

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
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

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

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 $SET_{\text{sample-CDM}}$

$SET_{\text{sample-CDM}}$:

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
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

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

The annual electricity generation of $SET_{\text{sample-CDM}}$ 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:

$SET_{\text{sample-CDM} \rightarrow 10\text{yrs}}$:

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

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

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

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
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 grid emission factor the latest available data is the average data at the start of validation is the data from the Pakistan Energy Yearbook 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 CO₂ emission factor in year y (tCO₂/MWh).

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

$EF_{EL,m,y}$ CO₂ emission factor of power unit m in year y (tCO₂/MWh).

m Power units included in the build margin.

y Most recent historical year for which electricity generation data is available.

Whereas²²:

The CO₂ emission factor of each power unit m ($EF_{EL,m,y}$) 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 calculation²³, the build margin for 2011 is:

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

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

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

- Weighted average CM; or
- Simplified CM.

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

²² Cited from *Tool to calculate the emission factor for an electricity system*, v.2.2.1

²³ All relevant input values will be provided to the DOE(s) during validation and verification.

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

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*²⁴:

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:

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

²⁴ 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.



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.
Decision Document Business Function: Registration		Class: Type: Regulatory Form