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

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Grid connected combined cycle power plant project in Qadirpur utilizing permeate gas, previously flared
Version number of the PDD	06
Completion date of the PDD	15/10/2012
Project participant(s)	Private entity: Engro Corporation Limited
Host Party(ies)	Islamic Republic of Pakistan
Sectoral scope and selected methodology(ies)	Sector 1: Energy Industries (renewable - / non-renewable sources) AM0074 "Methodology for new grid connected power plants using permeate gas previously flared and/or vented (Version 03.0.0)
Estimated amount of annual average GHG emission reductions	467,041 tCO_2

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

The "Grid connected combined cycle power plant project in Qadirpur utilizing permeate gas, previously flared" (hereinafter referred to as the "Project Activity") is to be implemented by Engro Powergen[1] Qadirpur Limited (hereinafter referred to as "Engro") in order to reduce Carbon Dioxide (CO_2) emissions associated with the utilization of permeate gas, previously flared.

The purpose of the Project Activity is the implementation of a new combined cycle power plant (CCPP) with a gross plant capacity of 223.8 MW and a net output capacity of 216.8 MW at Qadirpur in the Ghotki district of Sindh, Pakistan. The CCPP will utilize permeate gas, which is supplied from the nearby located Qadirpur gas field, owned by the Pakistan Oil & Gas Development Company Limited (OGDCL). Electricity generated by the CCPP is supplied to the national electricity grid. The permeate gas has a net calorific value of around 700 Btu/scf[2] (26.08 MJ/Nm^3)[3] and a methane content of 67%[4].

In the absence of the Project Activity (pre-project scenario) the permeate gas would have been flared and electricity been generated by the operation of grid-connected power plants and by the addition of new generation sources[5].

The Project Activity is categorized in the sectoral scope 1 - Energy Industries (renewable - / non-renewable sources) and realizes greenhouse gas emission reductions by the substitution of carbon intensive grid electricity by means of less carbon intensive permeate gas based electricity production. The total estimated emission reductions associated with the Project Activity over the crediting period (10 years) are 4,670,410 tCO_2, with an annual average of 467,041 tCO_2 /yr.

The description and identification of the applicable baseline scenario for the utilization of permeate and power generation is outlined under SECTION B.

Contribution to sustainable development

The Project Activity contributes to sustainable development by the following means:

- The CCPP will help the government in coping with the increasing demand for electricity in the country without increasing greenhouse gas emissions. The erection of the CCPP will further enhance the power supply to the local area, making power supply more reliable and therefore improve the quality of services.
- The Project Activity will also create additional jobs during the construction period of the CCPP, which will strengthen the regional development. It is expected that during the peak construction period up to 3,000 people will be working on site, out of which 1,500 are Pakistanis and more than half of them are employed from the local community. During normal operation of the CCPP, after the construction period, approximately 175 are expected to be employed.
- Moreover the Project Activity introduces a state of the art technology to a country with development needs. It will strongly contribute to the local capacity building, and it will facilitate possible replications of this type of projects.
- The ´No-Action´ option, if chosen, would prevent the country from exploring the potential to increase its power production by means of utilizing a waste gas product (permeate gas otherwise flared) and instead using more carbon intensive fuels such as residual fuel oil or in the future, coal for electricity generation.

[1] Engro Powergen is a fully owned subsidiary of Engro Corporation Limited, to develop power projects in Pakistan
[2] The net calorific value of the permeate gas supplied from the gas processing plant has a variation range between 675 Btu/scf – 725 Btu/scf. In the following an average value of 700 Btu/scf is assumed (comp. OGDCL, Letter in reference to the gas sale agreement)
[3] conversion: 1 Btu/scf = 0.037259 MJ/m³ (1 Btu = 0.0010550559 MJ, 1 scf = 0.028316846592 m^3 (http://www.onlineconversion.com)
[4] comp. OGDCL, Gas analysis
[5] The baseline scenario is the same as the scenario existing prior to the implementation of the Project Activity

A.2. Location of project activity

A.2.1. Host Party(ies)

Islamic Republic of Pakistan

A.2.2. Region/State/Province etc.

District Ghotki, Province of Sindh

A.2.3. City/Town/Community etc.

Qadirpur

A.2.4. Physical/Geographical location

The Project Activity is located 0.7 km north of the National Highway N5.

The coordinates of the Project Activity are as follows:

28° 1’ 42” N / 69° 21’ 44.5” E

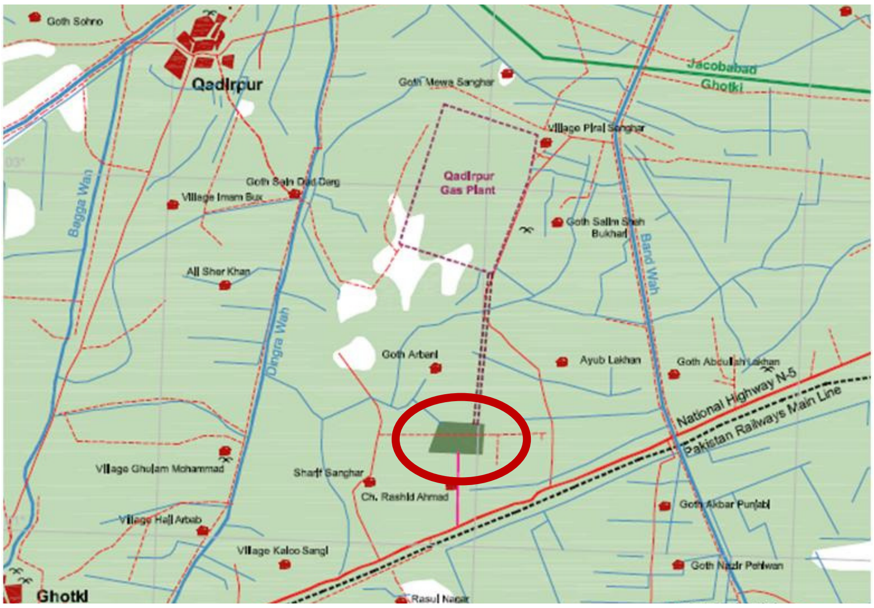

Figure 1: Location of Project Activity

A.3. Technologies and/or measures

Baseline scenario

The baseline scenario is the continuation of the current practice (scenario existing prior to the implementation of the Project Activity) where the permeate gas is flared and the corresponding amount of electricity supplied by the new CCPP to the national grid is generated by the operation of grid-connected power plants and by the addition of new generation sources (pre-project scenario).

Project Activity

The new CCPP is designed for a permeate gas quantity of 75 MMSCFD (2.12 Mio. Nm^3/d)[6], with a gross plant capacity of 223.8 MW and a net output capacity of 216.8 MW. The net calorific value of the

[6] conversion: 1 scfd = 0.03 m³/d (http://www.onlineconversion.com)

permeate gas is at around 700 Btu/scf[7] (26.08 MJ/Nm³)[8] and consists mainly of methane (67%), Carbon Dioxide (23%), Nitrogen (8%), Hydrogen Sulfide (up to approx. 200 ppm), and about 2% of other hydrocarbons[9].

The permeate gas will be supplied through a dedicated pipeline from the Qadipur gas field to the new CCPP.

In accordance with the permeate gas supply condition and power output demand, the CCPP design will be based on a 1+1+1 configuration [1 x gas turbine, 1 x double pressure, natural circulation, duct firing horizontal arranged heat recovery steam generator, 1 x condensing steam turbine] [10].

The main equipment that will be installed by the Project Activity is presented in the below table:

Turbines

	Gas turbine	**Steam turbine**
Installed capacity	116.7 MW[11]	107.1 MW[12]
Gross plant capacity	223.8[13]	
Net output capacity	216.8 MW[14]	
Load factor	60 %[15]	
Efficiency (net)	45.53 %[16]	
Lifetime	30 Years[17]	

Table 1: Turbine specifications

HRSG

Capacity	379.7 t/hr
Steam pressure	10 MPa
Steam temperature	557 °C
Lifetime	30 Years[18]

Table 2: HRSG specifications[19]

Pipeline

Length	3.30 km[20]
Lifetime	30 Years[21]

Table 3: Pipeline specifications

[7] comp. OGDCL, Letter in reference to the gas sale agreement, The net calorific value of the permeate gas supplied from the gas processing plant has a variation range between 675 Btu/scf – 725 Btu/scf. In the following an average value of 700 Btu/scf is assumed
[8] conversion: 1 Btu/scf = 37.26 MJ/m³ (http://www.onlineconversion.com)
[9] comp. OGDCL, Gas analysis
[10] comp. CNCEC, EPC contract
[11] comp. CNCEC, EPC contract
[12] comp. CNCEC, EPC contract
[13] comp. Engro, Tariff determination
[14] comp. Engro, Tariff determination
[15] comp. Engro, Tariff determination
[16] comp. Engro, Tariff determination
[17] comp. CNCEC, EPC contract
[18] comp. CNCEC, EPC contract
[19] comp. CNCEC, EPC contract
[20] comp. SNGPL, Pipeline specifications
[21] comp. CNCEC, EPC contract

The selection of main equipment was based on factors such as: approved and advanced technology, reliable and flexible operation, cost wise and easy maintenance.

The permeate gas will be fired in the combustion chamber and expanded in the gas turbine to convert heat energy into electrical energy. The waste heat will be directed to the heat recovery steam generator and the generated steam is supplied to the steam turbine for additional electricity generation. This last step enhances the efficiency of the electricity generation since the energy is utilized to the maximum extent. The overall gross electric efficiency of the CCPP is 47 % (net electric efficiency 45.53 %)[22].

The gas turbine will be ignited by high speed diesel (auxiliary), which is also used as back up fuel in case of permeate gas supply failure. The use of high speed diesel, however will not exceed 15% of the total annual fuel used in the CCPP on an energy basis, which is a requirement as per AM0074 (Version 03.0.0).

The below figure shows the process diagram with monitoring equipment associated with the Project Activity.

[22] comp. Engro, Tariff determination

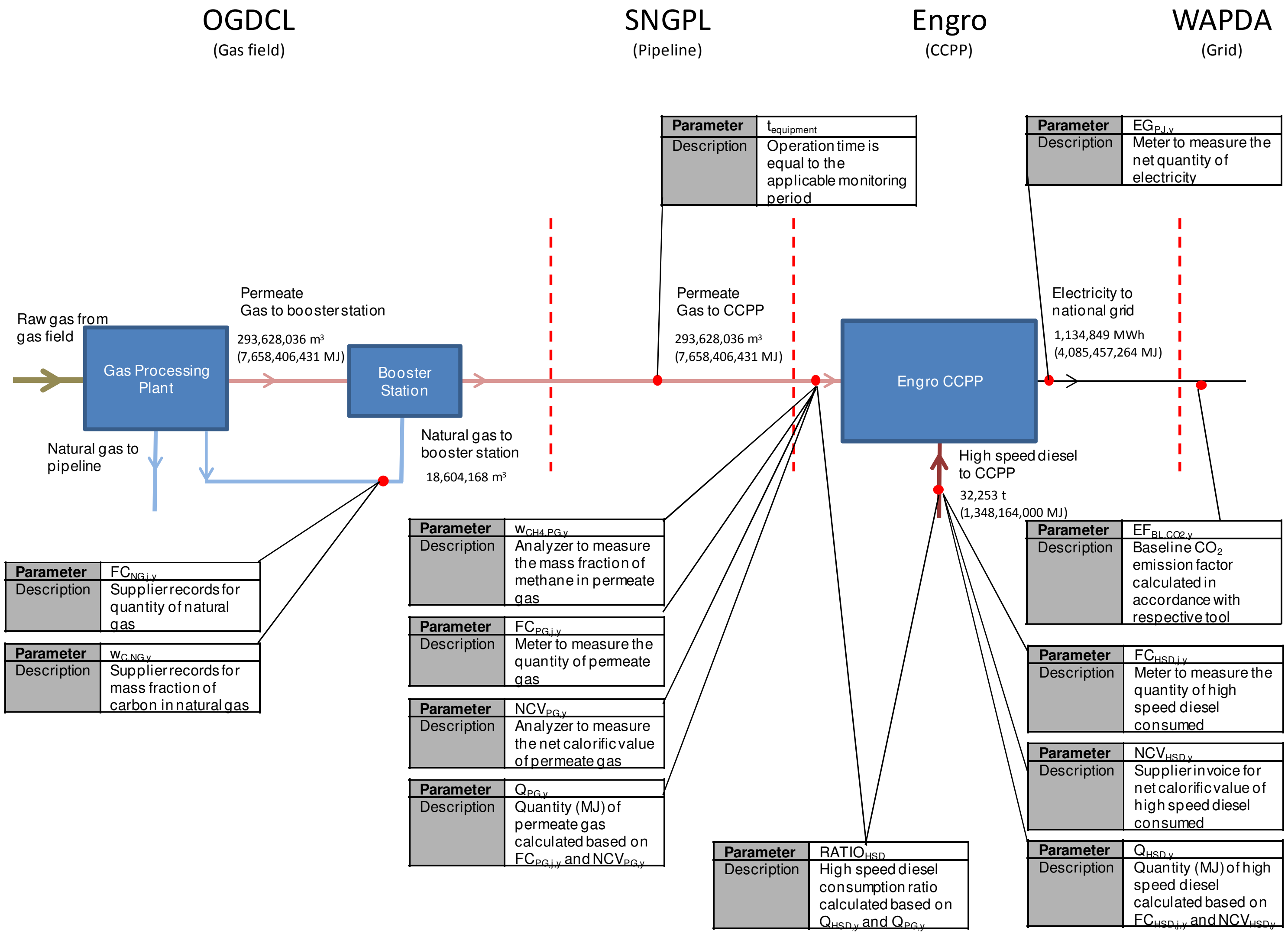

Figure 2: Process diagram with monitoring equipment and location

In the absence of the Project Activity (pre-project scenario) the following equipment was in operation:

A. Gas processing plant
B. Flare

With the implementation of the Project, Engro transfers to Pakistan high technology and the know-how required for the installation, operation and maintenance of the CCPP as well as providing training to its employees. Engro introduces a state of the art technology to a country with development needs. It will strongly contribute to the local capacity building, and it will facilitate possible replications of this type of projects.

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)	Engro Corporation Limited (private entity)	No

Contact details as listed in Appendix 1

A.5. Public funding of project activity

The Project Activity does not receive any public funding from Annex 1 Parties.

SECTION B. Application of selected approved baseline and monitoring methodology
B.1. Reference of methodology

The Project Activity applies the following approved baseline and monitoring methodology:

AM0074 "Methodology for new grid connected power plants using permeate gas previously flared and/or vented (Version 03.0.0)".

Further, AM0074 (Version 03.0.0) refers to the following tools, which are applied in context of the Project Activity:

- Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 2)
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 1)[23]
- Tool for the demonstration and assessment of additionality (Version 6.0.0)
- Tool to calculate the emission factor for an electricity system (version 02.2.1)

B.2. Applicability of methodology

The applicability criteria of AM0074 (Version 03.0.0) are met by the Project Activity, as follows:

Applicability Criteria	Project activity
The permeate gas, previously flared and/or vented at an existing natural gas processing facility is used as fuel in a new grid connected power plant	The permeate gas, previously flared at an existing natural gas processing facility is used as fuel in a new grid connected CCPP[24]. Criteria is met
Only the operator of the new power plant owns the CDM project activity, which is an independent legal entity not affiliated with the natural gas processing facility, or Both, the operator of the new power plant and the operator of the natural gas processing facility belong to the same legal entity	Engro is the operator of the new CCPP and owns the CDM Project Activity. Engro is an independent legal entity not affiliated with the natural gas processing facility[25]. Criteria is met
It can be verified that the total amount of permeate gas from the gas processing facility was flared for at least 3 years prior to the start of the project activity	The total amount of permeate gas from the gas processing facility was flared since the commissioning of the Qadirpur gas field in September 23rd, 1995[26]. Criteria is met
The transportation of the permeate gas from the natural gas processing facility to the new power plant occurs through a dedicated pipeline that is established as part of the project activity and not used for the transportation of any other gases	The transportation of the permeate gas from the natural gas processing facility located at Qadirpur gas field to the new CCPP occurs through a dedicated pipeline that is established as part of the Project Activity and not used for the transportation of any other gases[27]. Criteria is met
The new power plant is constructed for the purpose of the project activity and uses as fuel the permeate gas recovered from the natural gas processing facility from the start of its commercial operation. The use of other fuels for operating the power plant shall be limited to auxiliary and back-up purposes	The new CCPP is constructed for the purpose of the Project Activity and uses as fuel the permeate gas recovered from the natural gas processing facility from the start of its commercial operation[28]. The use of high speed diesel for auxiliary and back-up purposes will not exceed 15% of the total annual fuel used in the new CCPP on energy basis. For

[23] Project emissions associated with the consumption of electricity are not applicable, since the booster stations does not consume any electricity
[24] comp. OGDCL, confirmation letter
[25] comp. Engro, Tariff determination
[26] comp. OGDCL, confirmation letter
[27] comp. SNGPL, confirmation letter
[28] comp. Engro, Tariff determination

(e.g. starting-up and shutting-down of the power plant, disruptions in permeate gas supply) and shall not exceed 15% of the total annual fuel used in the project power plant on energy basis	demonstrating that the consumption of high speed diesel does not exceed the threshold of 15% of the energy of permeate gas fired in year y, $RATIO_{HSD}$ (High speed diesel consumption ratio), has been introduced as monitoring parameter (see also section B.7.1.). In case the use of HSD exceeds 15% of the total annual fuel used in the project power plant on energy basis, no emission reductions will be claimed for that year. Criteria is met
All power produced in the new power plant is exported to the power grid	All power produced in the new CCPP is exported to the power grid[29]. Criteria is met
The most plausible baseline scenario identified is the continuation of the current practice of flaring and/or venting of the permeate gas. The demonstration of the use of permeate gas in existing facilities, in the absence of the CDM project activity, shall be carried out as per the provisions in appendix 1 to this methodology	In accordance with Appendix 1 "Demonstration of use of permeate gas in the natural gas processing facility" to AM0074 (Version 03.0.0) and by means of the following method: *an on-site check by DOE prior to the implementation of the CDM Project Activity to confirm that no equipment for permeate gas recovery and utilization had been installed. This check should also confirm that such installation never existed in the past* it is demonstrated that all of the permeate gas produced by the natural gas processing facility was flared for at least 3 years prior to the implementation of the Project Activity[30]. Criteria is met

Table 4: Applicability criteria (AM0074, Version 03.0.0)

Further, the Project Activity meets all applicability conditions set forth by respective tools referred to as follows:

Applicability Criteria	**Project activity**
Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 2)	
This tool can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties.	In the context of the Project Activity, CO_2 emissions from fossil fuel combustion (e.g. natural gas, high speed diesel) are calculated based on the quantity of fuel combusted and its properties (comp. Section B.6.3. Ex-ante calculation of emission reductions). Criteria is met
Tool to calculate the emission factor for an electricity system (version 02.2.1)	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid.	The Project Activity supplies electricity to a grid that results in savings of electricity that would have been provided by the grid (comp. Section B.6.3. Ex-ante calculation of emission reductions). Criteria is met
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants.	In the context of the Project Activity, the emission factor is calculated for grid power plants only (comp. Section B.6.3. Ex-ante calculation of emission reductions). Criteria is met
In case of CDM projects the tool is not applicable if	Not applicable

[29] comp. Engro, Tariff determination
[30] Proof will be provided to the validating DOE

the project electricity system is located partially or totally in an Annex I country.	
Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)	
The tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: Scenario A: **Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any on-site captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption. Scenario B: **Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid. Scenario C: **Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants operate at the site of the electricity consumption source. The captive power plant(s) can provide electricity to the electricity consumption source. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumption source can be provided with electricity from the captive power plant(s) and the grid.	The booster station consumes small quantities of electricity supplied from the grid Scenario A: Electricity consumption from the grid is applicable in context of the Project Activity. Criteria is met

Table 5: Applicability criteria of tools

B.3. Project boundary

As per AM0074 (Version 03.0.0), the spatial extent of the project boundary encompasses the new CCPP, the booster station, the permeate gas transportation from the booster station to the new CCPP and the power grid. The table below provides an overview of emission sources included or excluded from the project boundary:

Source		**GHGs**	**Included?**	**Justification/Explanation**
Baseline scenario	Production of electricity in the baseline	CO_2	Yes	Main emission sources
		CH_4	No	Excluded (conservative approach)
		N_2O	No	
Project scenario	Combustion of other fossil fuels for auxiliary purposes in the new power plant	CO_2	Yes	Emission source
		CH_4	No	Assumed negligible
		N_2O	No	
	Operation of booster	CO_2	Yes	Emission source

	station	CH_4	No	Assumed negligible
		N_2O	No	
	Fugitive emissions from permeate gas transport	CO_2	No	Assumed negligible
		CH_4	Yes	Emission source
		N_2O	No	Assumed negligible

Table 6: Overview of emission reduction sources included or excluded from the project boundary

In accordance with AM0074 (Version 03.0.0) it is assumed that all carbon in the permeate gas both in the baseline and under the Project Activity is fully oxidised to CO_2. As a consequence, the use of the permeate gas under the Project Activity and its venting and/or flaring in the baseline is not included as emission source. This is a conservative simplification, as the permeate gas combustion in a power plant is considered to cause significantly lower CH_4 emissions than the flaring of permeate gas.

The figure below presents the project boundary of the Project Activity:

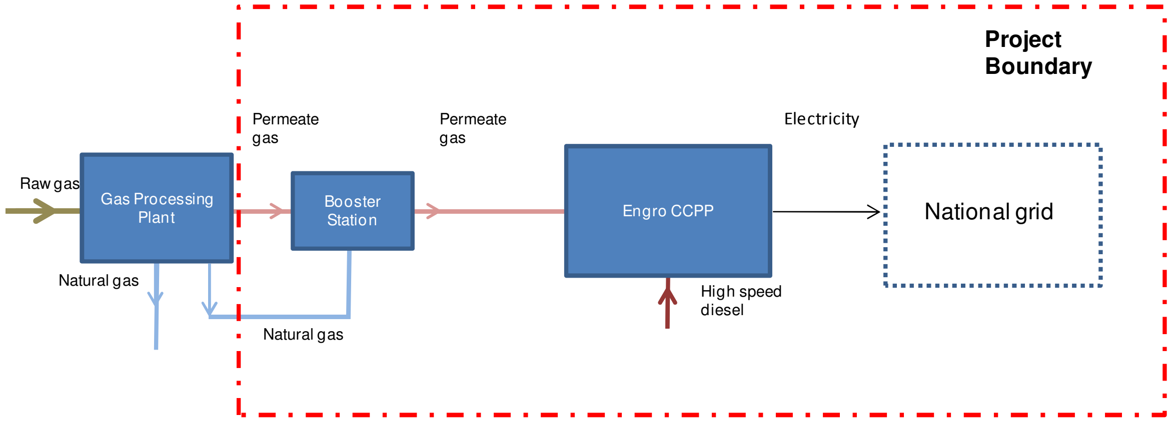

Figure 3: Illustration of Project Activity and project boundary

B.4. Establishment and description of baseline scenario

In accordance with AM0074 (Version 03.0.0), the baseline scenario is identified for the permeate gas and power generation components of the Project Activity as follows:

Baseline scenario for the utilization of permeate gas

In accordance with Appendix 1 "Demonstration of use of permeate gas in the natural gas processing facility" to AM0074 (Version 03.0.0) and by means of the following method:

> *an on-site check by DOE prior to the implementation of the CDM Project Activity to confirm that no equipment for permeate gas recovery and utilization had been installed. This check should also confirm that such installation never existed in the past*

it is demonstrated that all of the permeate gas produced by the natural gas processing facility was flared for at least 3 years prior to the implementation of the Project Activity.

Baseline scenarios for power generation

In accordance with AM0074 (Version 03.0.0), in the absence of CDM, electricity delivered to the grid by the Project Activity would have been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system (version 2.2.1)"

B.5. Demonstration of additionality

The starting date is marked by the date of when the EPC contract becomes effective with the first advance payment made on November 6th, 2007[31].

The table below shows the chronological chain of events:

Date	Event
20/10/2005	Board Decision for execution of feasibility study
09/08/2006	Feasibility study completed
13/04/2007	LoI signed with CDM Project Developer
25/05/2007	CDM contract signed with Project Developer
26/10/2007	Board decision that CDM is crucial for positive decision towards the implementation of the proposed Project Activity
06/11/2007	EPC contract becomes effective (The EPC contract was signed on 04/10/2007, however became effective only with the first advance payment
16/04/2008	Submission of new methodology to the UNFCCC
30/04/2008	Financial closure
07/10/2008	Informing DNA of Pakistan about Engro's intensions to develop a CDM Project Activity
28/11/2008	Approval of proposed new methodology
12/10/2008	Answer from DNA of Pakistan on letter sent on Oct 7th, 2008
15/05/2009	Submission of Project Activity for local country approval and validation (web-hosting)
06/06/2009	LOA obtained
20/08/2009	Prior consideration of CDM form sent to UNFCCC and DNA of Pakistan
04/12/2009	Revision to methodology AM0074 approved (Version 02) [submitted on September 7th, 2009]
11/05/2012	Revision to methodology AM0074 approved (Version 03.0.0),[submitted on August 18th, 2011]

Table 7: Chronological chain of events

Additionality

As per approved methodology AM0074 (Version 3) additionality is demonstrated using 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:

P1: The Project Activity undertaken without being registered as a CDM Project Activity

This is considered as realistic and credible scenario .

P2: Power generation using the permeate gas but employing other power generation technologies than the Project Activity

This is not considered as realistic and credible scenario for generating electricity with similar output characteristics. Single cycle power generation is not a state of the art technology and the overall plant efficiency of such systems is much lower than those of combined cycle systems[32].

P3: Power generation using the processed natural gas, from the gas processing facility that provides the permeate gas, with similar and other technologies than the Project Activity

[31] comp. Bank transfer
[32] comp. Fichtner, Feasibility Study for Engro Combined Cycle Power Plant

This is considered as realistic and credible scenario for generating electricity with similar output characteristics as the Project Activity.

P4: Power generation using other energy sources than the permeate gas and the natural gas from the gas processing facility that provides the permeate gas

1. Power generation using conventional thermal power plant based on fuel oil (RFO)

This is considered as realistic and credible scenario for generating electricity with similar output characteristics as the Project Activity.

a) Power generation using conventional thermal power plant based on coal

This is considered as realistic and credible scenario for generating electricity with similar output characteristics as the Project Activity.

b) Power generation using nuclear power plant

This is considered as realistic and credible scenario for generating electricity with similar output characteristics as the Project Activity.

c) Power generation using wind energy

This is not considered as realistic and credible scenario for generating electricity with similar output characteristics as wind power is of seasonable nature (dependent on the wind) with low plant load factors [33]. Since the proposed Project Activity is based on catering to the base-load and due to its inherent nature wind power generation will not qualify for base-load firm power.

At the same time large commercial wind power production is an undeveloped technology in Pakistan, and there are no large commercial wind power projects established at this point in time[34]. The "Sapphire 49.5 MW Wind Farm Project", developed under CDM as a first-of-it-s kind project will be one of the first wind parks to be developed with a commissioning date expected not before 2015[35].

d) Power generation using hydro power

This is not considered as realistic and credible scenario for generating electricity with similar output characteristics due to the following reasons:

The average plant load factor for hydro power plants in Pakistan in year 2010 was only 53%[36], where thermal IPPs in the same year were operated at 80%[37].

So far there is only one IPP[38], which is under construction, with an expected commissioning date in the end of 2012, the Laraib Energy Limited - 84 MW

[33] The "Sapphire 49.5 MW Wind Farm Project", developed under CDM and currently at the validation stage, assumes a PLF of only 30% (calculated based on total capacity of the wind park (49.5MW) and the expected annual electricity generation (129,400 MWh) (http://cdm.unfccc.int/UserManagement/FileStorage/B3IPCGMHWS04FOXJE7U9QVN168YZRT,)

[34] comp.AEDB (http://www.aedb.org/wind.htm)

[35] comp. "Sapphire 49.5 MW Wind Farm Project" (http://cdm.unfccc.int/UserManagement/FileStorage/B3IPCGMHWS04FOXJE7U9QVN168YZRT)

[36] comp. GoP, Pakistan Energy Yearbook 2010

[37] comp. GoP, Pakistan Energy Yearbook 2010

[38] comp. Laraib Energy Limited, Bong Escape Hydropower Project, Tariff determination, (www.nepra.org.pk/Tariff/IPPs/Laraib%20Energy/TRF-100%20LARAIB%20ENERGY%20Amended%20Decision.PDF)

New Bong Escape Hydropower Project, which is developed as a CDM project[39]. All other hydro power plants in Pakistan are state owned.

At the same time hydro power plants involve higher capital costs then thermal power plants. The total capital investment costs of the Laraib Energy Limited - 84 MW New Bong Escape Hydropower Project where 214.85 Mio US$[40], which is approx. 2.5 Mio US$/MW, compare to 1 Mio US$/MW for thermal power plants.

Although Pakistan has plans to develop additional hydroelectric generation capacity, infrastructural constraints such as access roads in mountainous regions, grid connectivity, and resettlement costs of affected populations increasingly make it difficult getting approval for new hydro power facilities and/or providing grid connection.

e) Power generation using solar power

This is not considered as realistic and credible scenario for generating electricity with similar output characteristics as solar power, similar to wind power is of seasonable nature (dependent on solar radiation) with low plant load factors[41]. Since the Project Activity is based on catering to the base-load and due to its inherent nature solar power generation will not qualify for "base-load firm power".

At the same time large commercial solar power production is also an undeveloped technology in Pakistan, and there are no such projects established at this point in time[42].

From the above assessment the following scenarios are considered plausible alternatives to the Project Activity. These scenarios include all realistic and credible alternatives that deliver similar services to the Project Activity.

P1	The Project Activity undertaken without being registered as a CDM Project Activity
P3	Power generation using the processed natural gas, from the gas processing facility that provides the permeate gas, with similar and other technologies than the Project Activity
P4a	Power generation using conventional thermal power plant based on fuel oil (RFO)
P4b	Power generation using conventional thermal power plant based on coal
P4c	Power generation using nuclear power plant

Table 8: Realistic and credible alternative scenarios to the Project Activity

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

The following Policies related to the energy sector in Pakistan have been identified:

- Power Policy 1994[43]
- Hydropower Policy 1995[44]:
- Transmission Policy 1995[45]:

[39] comp. Laraib Energy Limited, Bong Escape Hydropower Project, (www.cdm.unfccc.int/Projects/DB/DNV-CUK1218539340.1/view)

[40] comp. Laraib Energy Limited, Bong Escape Hydropower Project, Tariff determination , (www.nepra.org.pk/Tariff/IPPs/Laraib%20Energy/TRF-100%20LARAIB%20ENERGY%20Amended%20Decision.PDF)

[41] The "5 MW Solar PV Power Project in Sivagangai Village, Sivaganga District, Tamil Nadu, India", registered under the CDM assumes a PLF of only 19% , p. 16, (www.cdm.unfccc.int/UserManagement/FileStorage/JYCKTX8MRB09AG143I567OLWNVFUZS)

[42] comp. AEDB, (www.aedb.org/SolarPV.htm)

[43] comp..www.ppib.gov.pk/Power%20Policy%201994.pdf

[44] comp. www.ppib.gov.pk/PowerPolicy1995.pdf

- Power Policy 1998[46]:
- Power Policy 2002[47]:
- National Policy for Power Co-generation by Sugar Industry 2008[48]:

P1: The Project Activity undertaken without being registered as a CDM Project Activity

This is consistent with mandatory laws and regulations.

P2: Power generation using the permeate gas but employing other power generation technologies than the Project Activity

This is consistent with mandatory laws and regulations.

P3: Power generation using the processed natural gas, from the gas processing facility that provides the permeate gas, with similar and other technologies than the Project Activity

This is consistent with mandatory laws and regulations.

P4: Power generation using other energy sources than the permeate gas and the natural gas from the gas processing facility that provides the permeate gas

a) Power generation using conventional thermal power plant based on fuel oil (RFO)

This is consistent with mandatory laws and regulations.

b) Power generation using conventional thermal power plant based on coal

This is consistent with mandatory laws and regulations

c) Power generation using nuclear power plant

The national policy does not allow private sector (IPP) power generation based on potential baseline scenario. Thus this alternative is not consistent with mandatory laws and regulations

d) Power generation using wind energy

This is consistent with mandatory laws and regulations

e) Power generation using hydro power

This is consistent with mandatory laws and regulations

f) Power generation using solar power

This is consistent with mandatory laws and regulations

From the above assessment the following scenarios are consistent with mandatory laws and regulations, and are feasible options for generating electricity with similar output characteristics as the Project Activity.

P1	The proposed Project Activity undertaken without being registered as a CDM Project Activity
P3	Power generation using the processed natural gas, from the gas processing facility that

[45] comp. www.ppib.gov.pk/Transmission%20Line%20Policy%20-%20March%201995.pdf
[46] comp. www.ppib.gov.pk/PowerPolicy1998.pdf
[47] comp. www.ppib.gov.pk/PowerPolicy2002.pdf (currently in use)
[48] comp. www.ppib.gov.pk/Co-Generation%20Policy%202008.pdf

	provides the permeate gas, with similar and other technologies than the Project Activity
P4a	Power generation using conventional thermal power plant based on fuel oil (RFO)
P4b	Power generation using conventional thermal power plant based on coal

Table 9: Alternative scenarios consistent with mandatory laws and regulations

Step 2: Investment analysis

In accordance with AM0074 (Version 03.0.0), Step 3: Barrier analysis is chosen. This is eligible as the lower heating value of the permeate gas is below 30,000 kJ/Nm[3].

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.

In accordance with the "Tool for the demonstration and assessment of additionality (Version 6.0.0)", for measures[49], identified under paragraph 6 of the "Tool for the demonstration and assessment of additionality (Version 6.0.0)", the Project Activity is a first-of-its-kind activity in the applicable geographical area, if the following requirements are met:

Requirement 1: The Project Activity 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

Requirement 2: The project participants selected a crediting period for the Project Activity that is "a maximum of 10 years with no option of renewal".

The Project Activity meets both requirements as follows:

Requirement 1

In Pakistan (applicable geographical area) there are no regulations which would regulate the recovery of permeate gas from gas fields[50] and there is no incentives provided from the Government of Pakistan on utilizing permeate gas for energy production.

Permeate gas is an off take from the membranes installed at the purification plant for converting the raw gas to pipeline quality standard gas. The permeate gas is a low heating value gas and from economical point of view it is not feasible to purify this gas for use as pipeline gas.

There are 119 operational gas fields in Pakistan[51] of which there is only one other gas field apart from the Qadirpur gas field, which uses membrane technology for natural gas purification, resulting in the generation of permeate gas, the Kadanwari gas field[52], operated by OMV. The permeate gas generated at Kadanwari is currently flared and has been flared in the past[53].

[49] Applicable measure a) Fuel and feedstock switch
[50] comp. GoP, Quality standards, (www.environment.gov.pk/NEQS/SRO549%20I2000-NEQS.pdf.)
[51] comp. GoP, Pakistan Energy Yearbook 2009, p. 63
[52] comp. GoP confirmation letter
[53] comp. OMV confirmation letter

Accordingly, the prevailing practice for the use of permeate gas in Pakistan is flaring of the gas in an incinerator/flare without its utilization for energy purposes as it is done at Kadanwari gas field and previously has been done at Qadirpur gas field, before the CCPP was implemented.

The Project Activity 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 as shown in the following:

- The permeate gas, previously flared is a low BTU gas with up to 200 ppm content of hydrogen sulphide. Hydrogen sulphide is a gas which may cause corrosion in gas-contacting plant components (pipes, equipment etc.) already in concentrations of above 10 ppm[54]. Metallic materials can be damaged by contact with hydrogen sulphide gas in the presence of free water or humidity. The type and extent of damage to materials are dependent on the material, the microstructure and the distribution of non-metallic inclusions in the matrix structure of the material[55].

  As indicated within the feasibility study prepared by Fichtner, typical forms of damage are sulphide stress corrosion cracking, Hydrogen-induced cracking, stepwise cracking and Stress-oriented hydrogen-induced cracking[56].

  The pipeline and gas facilities had to be designed to cater for the corrosive and hazardous nature of the gas (in accordance to NACE standards for sour gas). Moreover special gas leakage detection and alarm systems had be provided as well as plans and procedures for dealing with gas leaks were put in place including a public warning and evacuation plan[57].¨

- Because of the high hydrogen sulphide content in the permeate gas, the back-end temperature of the flue gases must be maintained at high level to avoid corrosion due to acid formation (high dew point). This results in loss of efficiency which has been partly covered in the power purchase agreement. Though the harmful effects of H_2S have been negated by raising the temperature of outgoing gases, it should be noted that temperature controls can never completely eliminate the chances of damage that could be caused by acid condensation, hence the heat recovery steam generation elements in the colder side of the flue gas path will have to be replaced periodically causing cost of material, work and forced outages.

- Duct burning in HRSG is not a common design and leads to a non conventional design of a plant. Chinese based Hangzhou Boiler Group, the supplier f the HRSG has a long reference for the supply of heat recovery boilers. However only limited experience with supplementary firing, thus it was recommended that Hangzhou Boiler Group seeks the support of Nooter Eriksen, its licensor, for the design of the boiler[58]. It was the first time that Hangzhou Boiler Group has supplied such HRSG to Pakistan[59].

  Due to the complexity of the Project Activity out of 13 companies who had been asked for EPC bids, only 1 company finally submitted an offer for this unique Project Activity[60].The contractor which was left, had extensive experience in the chemical

[54] comp. Fichtner Feasibility Study, p. 185
[55] comp. Fichtner Feasibility Study, p. 186
[56] comp. Fichtner Feasibility Study, p. 185
[57] comp. ESBI Due Diligence Report, p. 25
[58] comp. ESBI Due Diligence Report, p. 11
[59] comp. Hangzhou Boiler Group, Confirmation letter
[60] comp. ESBI Due Diligence Report, p.7

industry but had little competence in commercial power plants. In essence Engro was left with an inexperienced EPC contractor and a boiler supplier with limited qualifications in duct fired HRSG. Other CCPPs being installed in Pakistan do not carry this risk.

- The permeate gas based CCPP is dependent on only one gas field and that too on 'Permeate Gas'. For this Engro is dependent on two contracts, one of Engro with the permeate gas supplier Sui Nothern Gas Pipeline Limited (SNGPL) and anther between SNGPL and the gas field operator Oil and Gas Development Company Limited (OGDCL). Both these organizations are known for their bureaucracy, making sure that both of these stay on course as per the supply agreements simply doubles the risk, Engro has to bear.
- The gas turbine had to be equipped with special burners in order to cater for the relatively low heating value of the permeate gas[61].

Requirement 2

Engro, the project participant has chosen a crediting period for the Project Activity that is "a maximum of 10 years with no option of renewal".

Outcome of Step 3a: **Identify barriers that would prevent the implementation of the proposed CDM Project Activity**

The Barrier of prevailing practice has been identified and 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 3b: **Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed Project Activity)**

In accordance with paragraph 40/2(b) of the "Tool for the demonstration and assessment of additionality (Version 6.0.0)", since the Project Activity is identified as a First-of-its-kind Project Activity, and thus additional, Sub-step 3b does not apply.

Step 4: **Common Practice analysis**

As per paragraph 43 of the "Tool for the demonstration and assessment of additionality (Version 6.0.0), since the Project Activity has demonstrated to be First of its kind, Step 4 is not required.

From the steps performed above it can be concluded that the Project Activity is **additional**.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

The methodological choice for calculating project emissions, baseline emissions, leakage emissions as well as emission reductions is in accordance with AM0074 (Version 03.0.0) and the referred tools.

Project emissions

In accordance with AM0074 (Version 03.0.0) project emissions consist of emissions from power generation in the CCPP, the operation of the permeate gas booster station, the permeate gas transportation and are calculated as follows:

$$PE_y = PE_{FC,elec,y} + PE_{BS,y} + PE_{TR,y}$$

[61] comp. ESBI Due Diligence Report, p. 16

Where:

PE_y	Project emissions in year y	t CO_2
$PE_{FC,elec,y}$	Project emissions from firing fossil fuel for auxiliary and back-up purposes in the CCPP in year y	t CO_2
$PE_{BS,y}$	Project emissions from the operation of the permeate gas booster station in year y	tCO_2
$PE_{TR,y}$	Project fugitive emissions from permeate gas transportation in year y	tCO_2

Project emissions from firing fossil fuels for auxiliary and back-up purposes in the CCPP ($PE_{FC,elec,y}$)

In accordance with AM0074 (Version 03.0.0) project emissions from firing fossil fuels for auxiliary and back up purposes in the CCPP are calculated as per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 2)".

In the context of the Project Activity high speed diesel is used as auxiliary and back up fuel. Project emissions are calculated using Option B[62] from the tool as follows:

$PE_{FC,elec,y} = SUM[FC_{HSD,y} * COEF_{HSD,y}]$

Where:

$PE_{FC,elec,y}$[63]	Project emissions from firing fossil fuel for auxiliary and back-up purposes in the CCPP in year y	t CO_2
$FC_{HSD,y}$	Quantity of high speed diesel combusted in process during the year y	t
$COEF_{HSD,y}$	CO2 emission coefficient of high speed diesel in year y	tCO_2/t

The CO_2 emission coefficient of high speed diesel is calculated as follows:

$COEF_{HSD,y} = NCV_{HSD,y} * EF_{CO2,HSD,y}$

Where:

$COEF_{HSD,y}$	CO2 emission coefficient of high speed diesel in year y	t CO_2/t
$NCV_{HSD,y}$	Weighted average net calorific value of high speed diesel in year y	MJ/kg
$EF_{CO2,HSD,y}$	Weighted average CO2 emission factor of high speed diesel in year y	tCO2/GJ

Project emissions from the operation of the booster station ($PE_{BS,y}$)

In accordance with AM0074 (Version 03.0.0) project emissions from the operation of the booster station are calculated as per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 2)".

In the context of the Project Activity natural gas is utilized for the operation of the booster station. Project emissions are calculated as follows:

$PE_{BS,y} = PE_{BS,NG,y} + PE_{BS,EL,y}$

Where:

[62] As per the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02) Option A should be the preferred approach, if the necessary data is available. In the context of the Project Activity the weighted average mass fraction of carbon in the high speed diesel as required under Option A cannot be obtained from the supplier, as this is no requirement under Pakistani regulations (as e.g. ash content). Due to the lack of data availability, option B is chosen.

[63] The term $PE_{FC,elec,y}$ corresponds to the term $PE_{FC,j,y}$ in the tool

$PE_{BS,y}$	Project emissions from the operation of the booster station in year y	t CO_2
$PE_{BS,NG,y}$	Project emissions from the use of natural gas in the booster station in year y	t CO_2
$PE_{BS,EL,y}$	Project emission from the use of electricity in the booster station in year y	t CO_2

Project emissions from the utilization of natural gas in the booster station are calculated using Option A from the tool as follows:

$$PE_{BS,NG,y} = SUM[FC_{NG,j,y} * COEF_{NG,y}]$$

Where:

$PE_{BS,NG,y}$	Project emissions from firing natural gas in the booster station in year y	t CO_2
$FC_{NG,j,y}$	Quantity of natural gas combusted in process during the year y	m^3
$COEF_{NG,y}$	CO_2 emission coefficient of natural gas in year y	t CO_2/m^3

The CO_2 emission coefficient of natural gas is calculated as follows:

$$COEF_{NG,y} = w_{C,NG,y} * 44/12$$

Where:

$COEF_{NG,y}$	CO_2 emission coefficient of natural gas in year y	t CO_2/m^3
$w_{C,NG,y}$	Weighted average mass fraction of carbon in natural gas in year y	tC/m^3

Project emissions associated with the consumption of electricity by the booster station are calculated in accordance with the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)" as follows:

$$PE_{BS,EL,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

Where:

$PE_{BS,EL,y}$	Project emissions from electricity consumption in year *y*	t CO_2
$EC_{PJ,j,y}$	Quantity of electricity consumed by the booster station in year *y*	MWh
$EF_{EL,j,y}$	Emission factor for electricity generation in year *y*	t CO_2/MWh
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to the booster station in year *y*	%

Project fugitive emissions from permeate gas transportation ($PE_{TR,y}$)

In accordance with AM0074 (Version 03.0.0) project fugitive emissions from permeate gas transportation are calculated as follows:

$$PE_{TR,y} = 1/1{,}000 * GWP_{CH4} * w_{CH4,PG,y} * SUM[EF_{equipment} * t_{equipment})$$

where:

$PE_{TR,y}$	Project fugitive emissions from permeate gas transportation in year y	tCO_2
GWP_{CH4}	Global warming potential of methane	tCO_{2-eq}/tCH_4
$w_{CH4,PG,y}$	Average mass fraction of methane in the permeate gas in year y	Kg tCH_4/kg permeate gas
$EF_{equipment}$	The emission factor for the relevant equipment type, taken from Table 8 below	Kg TOC /hour/equip.
$t_{equipment}$	The operation time of the equipment in hours per applicable monitoring period	h

The emission factors are taken from the 1995 Protocol for Equipment Leak Emission Estimates, published by U.S. EPA[64].

Equipment Type	Service	Emission Factor (kg / hour / equipment item) for TOC
Valves	Gas	4.5E-03
Pump seals	Gas	2.4E-03
Others*	Gas	8.8E-03
Connectors	Gas	2.0E-04
Flanges	Gas	3.9E-04
Open-ended lines	Gas	2.0E-03

Table 10: Emission factors

Baseline Emissions

In accordance with AM0074 (Version 03.0.0), baseline emissions are calculated by multiplying the net quantity of electricity generated in the CCPP ($EG_{PJ,y,eligible}$) with the baseline CO_2 emission factor for project electricity system in year *y* ($EF_{BL,CO2,y}$) as follows:

$$BE_y = EG_{PJ,y,eligible} \text{ x } EF_{BL,CO2,y}$$

Where:

BE_y	Baseline emissions in year y	t CO_2
$EG_{PJ,y,eligible}$	Electricity generated in the CCPP in year y that is eligible for emission reductions	MWh
$EF_{BL,CO2,y}$	Baseline CO_2 emission factor for the project electricity system in year y	tCO_2/MWh

It should be noted that in accordance with AM0074 (Version 03.0.0) for the ex-post calculation of emission reductions based on monitored data, the electricity generated in the CCPP in year y that is eligible for emission reductions ($EG_{PJ,y,eligible}$) will be calculated as follows:

$$EG_{PJ,y,eligible} = minimum(\frac{Q_{PG,BL}}{Q_{PG,y}}, 1) \times_{EG_{PJ,y}}$$

Where:

$EG_{PJ,y,eligible}$	Electricity generated in the CCPP in year y that is eligible for emission reductions	MWh
$Q_{PG,BL}$	Average annual quantity of permeate gas flared in the 3 years prior to the start of the project activity	MJ
$Q_{PG,y}$	Quantity of permeate gas used for electricity generation in the Project Activity during year y	MJ
$EG_{PJ,y}$	Net quantity of electricity generated in the CCPP in year y	MWh

For the purpose of ex-ante calculation of emission reductions the net quantity of electricity generated in the CCPP in year y ($EG_{PJ,y}$) is equal to the electricity generated in the CCPP in year y that is eligible for emission reductions ($EG_{PJ,y,eligible}$).

Determination of $EF_{BL,CO2,y}$

As per AM0074 (Version Version 03.0.0) $EF_{BL,CO2,y}$ is equal to the combined margin, which is calculated in accordance with the "Tool to calculate the emission factor for an electricity system (version 2.2.1)", using a 50/50 OM/BM weight.

The following steps are applied:

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[64] comp. EPA-453/R-95-017 (www.epa.gov/ttn/chief/efdocs/equiplks.pdf)

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 emission factor

Leakage

In accordance with AM0074 (Version 03.0.0) no leakage emissions are considered.

Emission reductions

In accordance with AM0074 (Version 03.0.0) emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	Emission reductions in year *y*	t CO_2
BE_y	Baseline emissions in year *y*	t CO_2
PE_y	Project emissions in year *y*	t CO_2

B.6.2. Data and parameters fixed ex ante

From: AM0074 (Version 03.0.0)

Data / Parameter	$EF_{equipment}$
Unit	kg gas / hour
Description	Emission factor of relevant equipment type
Source of data	EPA-453/R-95-017
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	Specified in AM0074 (Version 03.0.0)
Purpose of data	Calculation of project emissions
Additional comment	Not applicable

Equipment Type	Service	Emission Factor (kg / hour / equipment item) for TOC
Valves	Gas	4.5E-03
Pump seals	Gas	2.4E-03
Others*	Gas	8.8E-03
Connectors	Gas	2.0E-04
Flanges	Gas	3.9E-04
Open-ended lines	Gas	2.0E-03

Data / Parameter	GWP_{CH4}
Unit	tCO_{2-eq}/tCH_4
Description	Global warming potential for CH_4 valid for the commitment period
Source of data	Relevant decisions by the CMP
Value(s) applied	21
Choice of data or Measurement methods	Decision 2/CP.3 Methodological issues related to the Kyoto protocol (FCCC/CP/1997/7/Add.1)

and procedures	
Purpose of data	Calculation of project emissions
Additional comment	Not applicable

Data / Parameter	Low heating value of permeate gas
Unit	kJ/Nm^3
Description	-
Source of data	Measurements taken by the permeate gas supplier
Value(s) applied	26,277
Choice of data or Measurement methods and procedures	Actual measurements provided by the operator of the natural gas processing facility in accordance with standard practice for calculating heat value, compressibility factor, and relative density of gaseous fuels [ASTM 3588] Average of 23 measurements of permeate spread over an 8th month period (11/03/2010-15/03/2010, 18/03/2010-22/03/2010, 19/10/2010-23/10/2010, 01/06/2011-04/06/2011, 25/06/2011-28/06/2011))
Purpose of data	The value is used to determine whether the barriers can be applied for the demonstration of additionality
Additional comment	Not applicable

Data / Parameter	$Q_{PG,BL}$
Unit	MJ
Description	Average annual quantity of permeate gas flared in the three years prior to the start of the Project Activity
Source of data	-
Value(s) applied	12,681,378,752
Choice of data or Measurement methods and procedures	As Specified in AM0074 (Version 03.0.0) determined by: Energy/ Mass balance based on information provided by gas processing facility
Purpose of data	Calculation of project emissions and baseline emissions
Additional comment	Energy/ Mass balance based on information provided by gas processing facility

From: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 2)

Data / Parameter	$EF_{CO2,HSD,y}$
Unit	tCO2/GJ
Description	Emission coefficient for high speed diesel
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value(s) applied	0.0748
Choice of data or Measurement methods and procedures	Specified in Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 2)
Purpose of data	Calculation of project emissions
Additional comment	Not applicable

From: Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)

Data / Parameter	$EC_{PJ,j,y}$
Unit	MWh
Description	Quantity of electricity consumed by the booster station in year *y*
Source of data	Calculated based on total capacity of electric consumers (326.417 kW) and annual operation duration of electric consumers (8,760 hrs/yr)
Value(s) applied	2,859 MWh
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of project emissions
Additional comment	Fixed ex-ante

Data / Parameter	$EF_{EL,j,y}$
Unit	t CO_2/MWh
Description	Emission factor for electricity generation in year *y*
Source of data	Fixed default parameters as per Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)
Value(s) applied	1.3
Choice of data or Measurement methods and procedures	Conservative default value as per Scenario A: Electricity consumption from the grid, Option A2 within the Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)
Purpose of data	Calculation of project emissions
Additional comment	Fixed ex-ante

Data / Parameter	$TDL_{j,y}$
Unit	%
Description	Average technical transmission and distribution losses for providing electricity to the booster station in year *y*
Source of data	20
Value(s) applied	Fixed default parameters as per Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)
Choice of data or Measurement methods and procedures	Conservative default parameters as per Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)
Purpose of data	Calculation of project emissions
Additional comment	Fixed ex-ante

B.6.3. Ex ante calculation of emission reductions

<u>Project emissions</u>

In accordance with AM0074 (Version 03.0.0) the project emissions are calculated as follows:

$PE_y = PE_{FC,elec,y} + PE_{BS,y} + PE_{TR,y}$

Where:

PE_y	Project emissions in year y	137,834	t CO_2
$PE_{FC,elec,y}$	Project emissions from firing fossil fuel for auxiliary and back-up purposes in the CCPP in year y	100,635	t CO_2

$PE_{BS,y}$	Project emissions from the operation of the permeate gas booster station in year y	35,635	tCO_2
$PE_{TR,y}$	Project fugitive emissions from permeate gas transportation in year y	1,356	tCO_2

Project emissions from firing fossil fuels for auxiliary and back-up purposes in the CCPP ($PE_{FC,elec,y}$)

Project emissions from firing high speed diesel are calculated using Option B from the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 2)" as follows:

$$PE_{FC,elec,y} = SUM[FC_{HSD,y} * COEF_{HSD,y}]$$

Where:

$PE_{FC,elec,y}$	Project emissions from firing fossil fuel for auxiliary and back-up purposes in the CCPP in year y	100,843	t CO_2
$FC_{HSD,y}$	Quantity of high speed diesel combusted in process during the year y	32,253[65]	t
$COEF_{HSD,y}$	CO_2 emission coefficient of high speed diesel in year y	3.13	tCO_2/t

The CO_2 emission coefficient of high speed diesel is calculated as follows:

$$COEF_{HSD,y} = NCV_{HSD,y} * EF_{CO2,HSD,y}$$

Where:

$COEF_{HSD,y}$	CO_2 emission coefficient of high speed diesel in year y	3.13	t CO_2/t
$NCV_{HSD,y}$	Weighted average net calorific value of high speed diesel in year y	41.8	MJ/kg
$EF_{CO2,HSD,y}$	Weighted average CO_2 emission factor of high speed diesel in year y	0.0748	tCO2/GJ

Project emissions from the operation of the booster station ($PE_{BS,y}$)

Project emissions from the operation of the booster station are calculated in accordance with the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 2)" as follows:

$$PE_{BS,y} = PE_{BS,NG,y} + PE_{BS,EL,y}$$

The term $PE_{BS,FF,y}$ corresponds to the term $PE_{FC,j,y}$ in the tool.

Where:

$PE_{BS,y}$	Project emissions from the operation of the booster station in year y	35,635	t CO_2
$PE_{BS,NG,y}$	Project emissions from the use of natural gas in the booster station in year y	31,174	t CO_2
$PE_{BS,EL,y}$	Project emission from the use of electricity in the booster station in year y	4,461	t CO_2

The project emissions from the operation of the booster station are calculated using Option A from the tool as follows:

$$PE_{BS,NG,y} = SUM[FC_{NG,j,y} * COEF_{NG,y}]$$

[65] Quantity represents the maximum permitted high speed diesel consumption as per AM0074 (Version 03.0.0) e.g. 15% of total annual fuel used on energy basis

Where:

$PE_{BS,NG,y}$	Project emissions from firing natural gas in the booster station in year y	31,174	t CO_2
$FC_{NG,j,y}$	Quantity of natural gas combusted in process during the year y	18,604,168	m^3
$COEF_{NG,y}$	CO_2 emission coefficient of natural gas in year y	0.00167567	t CO_2/m^3

CO2 emission coefficient of natural gas is calculated as follows

$COEF_{NG,y} = w_{C,NG,y} * 44/12$

Where:

$COEF_{NG,y}$	CO_2 emission coefficient of natural gas in year y	0.00167567	t CO_2/m^3
$w_{C,NG,y}$	Weighted average mass fraction of carbon in natural gas in year y	0.000457	tC/m^3

Project emissions associated with the consumption of electricity by the booster station are calculated in accordance with the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)” as follows:

$$PE_{BS,EL,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

Where:

$PE_{BS,EL,y}$	Project emissions from electricity consumption in year *y*	4,461	t CO_2
$EC_{PJ,j,y}$	Quantity of electricity consumed by the booster station in year *y*	2,859	MWh
$EF_{EL,j,y}$	Emission factor for electricity generation in year *y*	1.3	t CO_2/MWh
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to the booster station in year *y*	20	%

It should be noted that it is estimated that the emissions associated with the electricity consumption of the booster station will not exceed 1% of the total annual emission reductions, thus in order to avoid the monitoring of the respective electricity consumption the following conservative approach is applied:

The maximum amount of emissions associated with the consumption of electricity by the booster station is calculated based on:

- List of electrical consumers (fans, motors, valves etc.)
- Operation duration of 8,760 hrs/yr
- A conservative CO2 grid emission factor of 1.3 tCO2/MWh in accordance with the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)

The calculated maximum emissions associated with the electricity consumption of the booster station is deducted from the total annual emission reductions associated with the project activity throughout the crediting period. This is deemed conservative.

Project fugitive emissions from permeate gas transportation ($PE_{TR,y}$)

The overall fugitive emissions from transportation of the permeate gas are calculated as follows:

$PE_{TR,y} = 1/1,000 * GWP_{CH4} * w_{CH4,PG,y} * SUM[EF_{equipment} * t_{equipment})$

where:

$PE_{TR,y}$	Project fugitive emissions from permeate gas transportation in year y	1,356	tCO_2
GWP_{CH4}	Global warming potential of methane	21	tCO_{2-eq}/tCH_4
$w_{CH4,PG,y}$	Average mass fraction of methane in the permeate gas in year y	0.455	Kg tCH_4/kg permeate gas
$EF_{equipment}$	The emission factor for the relevant equipment type, taken from the Table 9	See table below	Kg TOC /hour/equip.
$t_{equipment}$	The operation time of the equipment in hours per applicable monitoring period	5,256[66]	h

Equipment type	Emissions factor (kg/hour/equipment item) for TOC	No
Valves	4.5E-03	3
Flanges	3.9E-04	24

Table 11: Emission factors[67]

Baseline Emissions

In accordance with AM0074 (Version 03.0.0), baseline emissions are calculated as follows:

$BE_y = EG_{PJ,y,eligible} \times EF_{BL,CO2,y}$

Where:

BE_y	Baseline emissions in year y	604,875	t CO_2
$EG_{PJ,y,eligible}$	Electricity generated in the CCPP in year y that is eligible for emission reductions	1,134,849[68]	MWh
$EF_{BL,CO2,y}$	Baseline CO_2 emission factor for the project electricity system in year y	0.533	tCO_2/MWh

For the purpose of ex-post calculation of emission reductions the net quantity of electricity generated in the CCPP in year y ($EG_{PJ,y}$) is equal to the electricity generated in the CCPP in year y that is eligible for emission reductions ($EG_{PJ,y,eligible}$).

Determination of $EF_{BL,CO2,y}$

As per AM0074 (Version Version 03.0.0) $EF_{BL,CO2,y}$ is equal to the combined margin, which is calculated in accordance with the "Tool to calculate the emission factor for an electricity system (version 2.2.1)", using a 50/50 OM/BM weight as follows:

Step 1. Identify the relevant electricity systems

For the purpose of determining the electricity emission factors (BM and CM), the respective project electricity system was defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity. In the actual case this is true for the whole of the WAPDA[69] power grid including all connected power plants.

[66] Assumes a Plant Load Factor of 60%

[67] comp. EPA-453/R-95-017 (www.epa.gov/ttn/chief/efdocs/equiplks.pdf)

[68] Assumes a Plant Load Factor of 60%

[69] Note in this context that there exist two power grids in Pakistan, of which one is supplying the Karachi area (KESC grid) and the other one covering most of the remaining part of the country (WAPDA grid). There has not been any export of electricity in the past years. In fact, Pakistan does face a severe shortage in power supply which is also indicated by several "rental" power plant projects currently being implemented. This shortage is especially severe within the Karachi area, resulting in electricity transfers usually occurring in one direction only, from the WAPDA grid to the KESC grid.

Step 2. Choose whether to include off grid power plants in the project electricity system (optional)

The project participant has chosen to include only grid connected power plants for the calculation of operating margin and build margin emission factor.

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

Since low-cost/must-run resources in Pakistan as well as in the WAPDA grid constitute less than 50% of total grid generation in both the average of the five most recent years and based on long-term averages for hydroelectricity production, the simple OM method was chosen for determination of the Operating Margin (OM) grid emission factor.

Yearbook[70]	Total Generation (A)	KESC Generation (B)	WAPDA (incl IPPs) (A-B)	WAPDA Hydro	WAPDA
Year	GWh	GWh	GWh	GWh	% Hydro
2004-05	85,629	9,304	76,325	25,671	33.63%
2005-06	93,629	9,130	84,499	30,862	36.52%
2006-07	98,213	8,169	90,044	31,953	35.49%
2007-08	95,661	8,219	87,442	28,707	32.83%
2008-09	91,616	8,262	83,354	27,784	33.33%
2009-10	95,358	7,964	87,394	28,093	32.15%

Table 12: Energy Generation data

It should be noted that for the purpose of calculating the emission reduction potential of the project activity the data vintage “Ex ante option” consisting of 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, without requirement to monitor and recalculate the emissions factor during the crediting period was used, since this approach is backed by currently existing real generation data.

However, for the calculation of actual emission reductions throughout the real crediting period the “**Ex-post option**” according to which actual data for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring is chosen.

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

(A) Simple OM

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. Due to the fact that no individual fuel consumption data for each power plant / generation unit or respective average efficiency values are publicly available option B is used, while considering only nuclear and renewable power generation (including hydro power) as low-cost / must-run power sources. The quantity of electricity supplied to the grid by these low cost / must run sources is available through the Pakistan Energy Yearbooks, which presents a comprehensive national statistic on power and energy issues on the national level and have been available for several years now, providing a reliable source of official data made available to the public.

[70] comp. GoP Pakistan Energy Yearbook, 2008-2010

For using Option B the tool requires data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system. The Energy Yearbooks provide data on the total net electricity generation of all power plants serving the both grids in Pakistan as well as the total fuel consumption for national power generation, both distinguished by type of fuel.

Option B

Determination of the operating margin grid emission factor under Option B following the tool is to be performed according to the below formula:

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

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	All fossil fuel types combusted in power sources in the project electricity system in year y
y	The relevant year as per the data vintage chosen in step 3.

Due to the fact that the used data source (Pakistan Energy Yearbooks 2008-2010) provides respective information on “Fuel consumption for thermal power generation” in TOE (ton of oil equivalent) a unit of energy, which can directly be converted into GJ or TJ (conversion factor = 41.868 TOE/GJ) and thus being equivalent to the term $FC_{i,y}$ x $NVC_{i,y}$ in the original formula, the relevant formula is reduced to:

$EF_{grid,OMsimple,y} = EC_{i,y} * EF_{CO2,I,y} / EG_y$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EC_{i,y}$	Energy Consumption (primary) of fossil fuel type i consumed in the project electricity system in year *y* (TJ)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type i in year *y* (tCO_2/TJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y* (MWh)
i	All fossil fuel types combusted in power sources in the project electricity system in year *y*
y	The relevant year as per the data vintage chosen in step 3.

As to provide for a conservative approach the following Emission Factors were chosen for Coal, Oil and Gas, as the representative fossil fuels for power generation in Pakistan:

Coking Coal	87,300 kg/TJ
Residual Fuel Oil	75,500 kg/TJ

Natural Gas	54,300 kg/TJ

Table 13:Emission factors[71]

Since the primary energy consumption figures for thermal power generation per fuel type as well as total electricity generation numbers are given for the whole of Pakistan, these were adjusted in order to be representative for the WAPDA grid. For this purpose individual power plant data on electricity generation distinguished by fuel types along with default values for average power plant efficiencies as provided in Annex I of the "Tool to calculate the emission factor for an electricity system (version 2.2)" were used as to back-calculate the amount of fuel energy consumed by those power plants supplying to the KESC grid. Both, the total electricity generation of the KESC power plants as well as the respective primary energy consumption distinguished by fuel types were deducted from the overall numbers for the whole of Pakistan, resulting in representative figures for the WAPDA grid.

Based on this proceeding the following operating margin emission factors were calculated for the three most recent years for which respective data is available:

$EF_{grid,OMsimple,2008}$	0.665 tCO2/MWh
$EF_{grid,OMsimple,2009}$	0.690 tCO2/MWh
$EF_{grid,OMsimple,2010}$	0.700 tCO2/MWh

Table 14: OM Emission factors

The three year average operating margin emission factor ($EF_{grid,OMsimple,2006-2008)}$ amounts to: 0.685 tCO2/MWh.

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

For the purpose of calculating the emission reduction potential of the project activity the data vintage "Ex ante option (Option 1)" is used since due to its nature relevant data for option 2 is not yet available.

However, for the calculation of actual emission reductions throughout the real crediting period of the project the "**Ex-post option (Option 2)**", requiring annual determination of the build margin during monitoring of the project activity is chosen.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, 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 (SET5-units) and determine their annual electricity generation (AEGSET-5-units, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEGtotal, 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 AEGtotal (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET≥20%) and determine their annual electricity generation (AEGSET-≥20%, in MWh)

(c) From SET5-units and SET≥20% select the set of power units that comprises the larger annual electricity generation (SETsample);

[71] The CO_2 Emission Factors ($EF_{grid,OMsimple,y}$) for respective fossil fuel types are chosen according to the "2006 IPCC Guidelines on National GHG Inventories" lower end of 95% confidence interval from Table 1.4, Chapter1, Vol. 2 (Energy).

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

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

Where:

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

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) should be determined following the guidance in the tool under step 3 (a) for the simple OM, using options A1, A2 or A3, using for y the most recent historical year for which power generation data is available, and using for m the power units included in the build margin.

The build margin emission factor for 2010 was determined accordingly, based on the information provided through the Pakistan Energy Yearbooks 2008 to 2010. Individual power plant data on electricity generation and auxiliary electricity consumption, resulting in NET electricity supplied to the grid, was used for determining the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently, since this represents the set of power units that comprises the larger annual generation compared to the set of five power units that have been built most recently.

Based on the individual NET electricity supply to the grid and using the respective default values for average power plant efficiencies as provided in Annex I of the "Tool to calculate the emission factor for an electricity system (version 02.2.1)" the amount of fuel energy consumed by each power plant / unit is calculated. Applying the same CO_2 emission factors as determined under step 3 for the respective fuel type(s) used by each power unit results in the individual CO_2 emissions related to its NET electricity supply to the grid.

Based on this proceeding, build margin emission factor ($EF_{grid,BM,2010}$) amount to 0.381 tCO2/MWh.

Step 6. Calculate the combined margin emissions factor

As per "Tool to calculate the emission factor for an electricity system (Version 02.2.1)" the combined margin (CM) emission factor is calculated in accordance with Option (a) weighted average CM as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \text{ x } w_{OM} \text{ x } EF_{grid,BM,y} \text{ x } w_{BM}$$

Where:

$EF_{grid,CM,y}$	Combined margin emission factor	0.533	tCO2/MWh
$EF_{grid,OM,y}$	Operating margin emission factor	0.685	tCO2/MWh
w_{OM}	Weighted average	0.5	-
$EF_{grid,BM,y}$	Build margin emission factor	0.381	tCO2/MWh

w_{BM}	Weighted average	0.5	-

Leakage

As per AM0074 (Version 03.0.0) no leakage emissions are considered.

Emission reductions

As per AM0074 (Version 03.0.0) the emission reductions are calculated as follows:

$ER_y = BE_y - PE_y$

Where:

ER_y	Emission reductions in year y	467,041	t CO_2/yr
BE_y	Baseline emissions in year y	604,875	t CO_2/yr
PE_y	Project emissions in year y	137,834	t CO_2/yr

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2012	125,203	28,530	-	96,672
2013	604,875	137,834	-	467,041
2014	604,875	137,834	-	467,041
2015	604,875	137,834	-	467,041
2016	604,875	137,834	-	467,041
2017	604,875	137,834	-	467,041
2018	604,875	137,834	-	467,041
2019	604,875	137,834	-	467,041
2020	604,875	137,834	-	467,041
2021	604,875	137,834	-	467,041
2022	479,672	109,304	-	370,368
Total	6,048,750	1,378,340		4,670,410
Total number of crediting years	10			
Annual average over the crediting period	604,875	137,834		467,041

Table 15: Summary of ex ante estimation of emission reductions

B.7. Monitoring plan
B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{PJ,y}$
Unit	MWh
Description	Net quantity of electricity generated in the project plant in year *y*
Source of data	Electricity meter
Value(s) applied	1,134,849
Measurement methods and procedures	Calibration frequency: In accordance with local/national standards or as per manufacturers specifications Accuracy class of meter: < 1%

	Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Continuous
QA/QC procedures	Net quantity of electricity generated will be cross checked with receipts from sales Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of baseline emissions
Additional comment	Not applicable

Data / Parameter	$EF_{BL,CO2,y}$
Unit	tCO_2/MWh
Description	Baseline CO_2 emissions factor for project electricity system in year *y*
Source of data	Calculated in accordance with "Tool to calculate the emission factor for an electricity system (Version 02.2.1)" Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Value(s) applied	0.533
Measurement methods and procedures	Specified in Tool to calculate the emission factor for an electricity system (Version 02.2.1), utilizing oofficial and public available data (e.g. Pakistan Energy Yearbooks)
Monitoring frequency	Annually
QA/QC procedures	Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of baseline emissions
Additional comment	Not applicable

Data / Parameter	$w_{CH4,PG,y}$
Unit	kg tCH_4/kg permeate gas
Description	Average mass fraction of methane in the permeate gas in year *y*
Source of data	Calculated based on measurements on molar basis (Project participants and production reports/logs)
Value(s) applied	0.455
Measurement methods and procedures	Monitoring instrument: gas analyser Calibration frequency: In accordance with local/national standards or as per manufacturers specifications Accuracy class of meter: < 1% Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Weekly
QA/QC procedures	Methane content of gas will be cross checked against data from previous months and purchase receipts or against lab records from the owners of the oil and gas processing plant Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of project emissions
Additional comment	Not applicable

Data / Parameter	$t_{equipment}$
Unit	Time (hours of use)
Description	The operation time of the equipment (in absence of further information, the

	monitoring period could be considered as a conservative approach)
Source of data	Plant records
Value(s) applied	5,256
Measurement methods and procedures	Measurements by project participants through appropriate metering devices as specified in AM0074 (Version 03.0.0) Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Continuously and aggregated annually
QA/QC procedures	Measurement devices will be calibrated as often as required by manufacturing recommendations Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of project emissions
Additional comment	Monitoring period is used as conservative approach

Data / Parameter	$Q_{PG,y}$
Unit	MJ
Description	Quantity of permeate gas used for energy generation in the Project Activity during year y
Source of data	Project participant
Value(s) applied	7,658,406,431
Measurement methods and procedures	As specified in AM0074 (Version 03.0.0) based on direct measurements by project participants based on: (a) the volume flow measurements of the permeate gas ($FC_{PG,j,y}$); and (b) The net calorific value of the permeate gas ($NCV_{PG,y}$) Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Continuously and aggregated annually
QA/QC procedures	Measuring equipment will be calibrated on regular appropriate intervals. During the time of calibration and maintenance, alternative equipment will be used for monitoring. Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of baseline emissions
Additional comment	Since the volume flow meter measures the normalized flow of the permeate gas, volume flow ($FC_{PG,j,y}$) and calorific value ($NCV_{PG,y}$) of the permeate gas are sufficient in order to calculate the energy unit of the permeate gas. Hence, monitoring of the permeate gas density is not required for respective calculations.

Data / Parameter	$Q_{HSD,y}$
Unit	MJ
Description	Quantity of high speed diesel combusted as auxiliary and back up fuel in CCPP in year *y*
Source of data	Calculated based on mass flow ($FC_{HSD,j,y}$) and calorific value ($NCV_{HSD,y}$[72]) of high speed diesel
Value(s) applied	1,348,164,000
Measurement methods and procedures	Equal to Quantity of permeate gas used for energy generation in the Project Activity during year y ($Q_{PG,y}$)

[72] $NCV_{HSD,y}$ corresponds with $E_{OF,I,y}$ of AM0074 (Version 03.0.0)

	Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Annually
QA/QC procedures	Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	For demonstrating that the consumption of high speed diesel do not exceed the threshold of 15% of the energy of permeate gas fired in year y
Additional comment	Not applicable

Data / Parameter	$FC_{HSD,j,y}$
Unit	t
Description	Quantity of high speed diesel combusted as back up fuel in CCPP
Source of data	Measurements by project participants and production reports/logs
Value(s) applied	32,253
Measurement methods and procedures	Monitoring instrument: mass flow meter Calibration frequency: In accordance with local/national standards or as per manufacturers specifications Accuracy class of meter: < 1% Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Continuous
QA/QC procedures	Quantity of high speed diesel will be cross checked against data from previous months Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of project emissions and for demonstrating that the consumption of high speed diesel do not exceed the threshold of 15% of the energy of permeate gas fired in year y
Additional comment	Not applicable

Data / Parameter	$NCV_{HSD,y}$[73]
Unit	MJ/kg
Description	Weighted average net calorific value of high speed diesel used as back up fuel in power plant
Source of data	Supplier invoice
Value(s) applied	41.8
Measurement methods and procedures	In line with national and international fuel standards Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Obtained for each fuel delivery
QA/QC procedures	It is verified that the values are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range additional information is collected from the testing laboratory to justify the outcome or alternatively additional measurements are conducted Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of project emissions and for demonstrating that the consumption of high speed diesel do not exceed the threshold of 15% of

[73] $NCV_{HSD,y}$ corresponds with $E_{OF,I,y}$ of AM0074 (Version 03.0.0)

	the energy of permeate gas fired in year y
Additional comment	Not applicable

Data / Parameter	$FC_{PG,j,y}$
Unit	Nm^3
Description	Quantity of permeate gas utilized in the CCPP
Source of data	Measurements by project participants and production reports/logs
Value(s) applied	293,628,036
Measurement methods and procedures	Monitoring instrument: volume flow meter Calibration frequency: In accordance with local/national standards or as per manufacturers specifications Accuracy class of meter: < 1% Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Continuous
QA/QC procedures	Quantity of permeate gas consumption will be cross checked against data from previous months Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of project emissions and for demonstrating that the consumption of high speed diesel do not exceed the threshold of 15% of the energy of permeate gas fired in year y
Additional comment	Not applicable

Data / Parameter	$NCV_{PG,y}$
Unit	MJ/m^3
Description	Weighted average net calorific value of permeate gas utilized in the CCPP
Source of data	Measurements by project participants and production reports/logs
Value(s) applied	26.08
Measurement methods and procedures	Monitoring instrument: gas analyser Calibration frequency: In accordance with local/national standards or as per manufacturers specifications Accuracy class of meter: < 1% Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Weekly
QA/QC procedures	Net calorific value will be cross checked against data from previous records Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of project emissions and for demonstrating that the consumption of high speed diesel do not exceed the threshold of 15% of the energy of permeate gas fired in year y
Additional comment	Not applicable

Data / Parameter	$RATIO_{HSD}$
Unit	%
Description	High speed diesel consumption ratio (on energy basis)
Source of data	Calculated based on: Quantity of high speed diesel combusted as back up fuel in CCPP in year y ($Q_{HSD,y}$)

	and Quantity of permeate gas used for energy generation in the Project Activity during year *y* ($Q_{PG,y}$)
Value(s) applied	15%
Measurement methods and procedures	$RATIO_{HSD} = (Q_{HSD,y})/(Q_{HSD,y} + Q_{PG,y}) \leq 15\%$ Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Annual
QA/QC procedures	Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	For demonstrating that the consumption of high speed diesel do not exceed the threshold of 15% of the energy of permeate gas fired in year y
Additional comment	In case the use of HSD exceeds 15% of the total annual fuel used in the project power plant on energy basis, no emission reductions will be claimed for that year.

Data / Parameter	$FC_{NG,j,y}$
Unit	m^3
Description	Quantity of natural gas combusted in booster station
Source of data	Consumption records
Value(s) applied	18,604,168
Measurement methods and procedures	Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Obtained on a quarterly basis from supplier
QA/QC procedures	Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of project emissions
Additional comment	Not applicable

Data / Parameter	$w_{C,NG,y}$
Unit	t/m^3
Description	Weighted average mass fraction of carbon in natural gas in year *y*
Source of data	Lab analysis records
Value(s) applied	0.000457
Measurement methods and procedures	Archiving procedure: Electronic & paper during the crediting period and up to 2 years after
Monitoring frequency	Obtained on a quarterly basis from supplier
QA/QC procedures	Monitoring Management and Quality Assurance procedures will be followed in recording and handling of parameter
Purpose of data	Calculation of project emissions
Additional comment	Not applicable

B.7.2. Sampling plan

Not applicable as per AM0074 (Version 03.0.0) or referred tools.

B.7.3. Other elements of monitoring plan

The proposed Monitoring Plan describes the Management System and Procedures to be developed and implemented by Engro for the project activity entitled "Grid connected combined cycle power plant project in Qadirpur utilizing permeate gas, previously flared" in order to ensure consistency with the approved Methodology AM0074 "Methodology for new grid connected power plants using permeate gas previously flared and/or vented" (Version 03.0.0), which is applied in the context of the project activity.

The developed monitoring plan contains the following sections:

1. Monitoring parameters
2. Monitoring Points
3. Monitoring equipment
4. Management structure
5. Monitoring guidelines, procedures and documentation
6. Regular staff training

All data required for the calculation of emissions reductions associated with the project activity will be monitored in accordance with the approved methodology AM0074 (Version 03.0.0) and will be archived electronically and on paper throughout the crediting period and up to 2 years after.

A Monitoring Management and Quality Assurance System (MMQAS) will be developed and implemented to ensure that the results from the project activity are reliable and transparent.

The complete MMQAS, including data and documents from project operation, will be open for review to the DOEs contracted for verification.

Monitoring Parameters

The tables under section B.7.1 provide information on the required monitoring parameters as per approved methodology AM0074 (Version 03.0.0) and referred tools, required for the ex-post calculation of project emissions associated with the project activity.

Monitoring Points

Please refer to Figure 2.

Monitoring equipment

The physical monitoring system consists of the following meter equipment:

Engro CCPP

Actual Measurements:

1. Gas analyser, mass fraction of methane in permeate gas, $w_{CH4,PG,y}$
2. Gas analyser, net calorific value of permeate gas, $NCV_{PG,y}$
3. Volume flow meter, quantity of permeate gas, $FC_{PG,j,y}$
4. Electricity meter, net electricity supply to the grid, $EG_{PJ,y}$
5. Mass flow meter, high speed diesel consumption, $FC_{HSD,j,y}$
6. Operation time of equipment corresponds to monitoring period, $t_{equipmtn}$

Calculations:

1. Quantity of high speed diesel combusted as back up fuel in CCPP based on consumption ($FC_{HSD,j,y}$) and calorific value ($NCV_{HSD,y}$), $Q_{HSD,y}$
2. Quantity of permeate gas used for energy generation in the Project Activity during based on consumption ($FC_{PG,j,y}$) and calorific value ($NCV_{PG,y}$), $Q_{PG,y}$
3. Baseline CO_2 emissions factor for project electricity system calculated in accordance with Tool to calculate the emission factor for an electricity system (Version 02.2.1), $EF_{BL,CO2,y}$

4. High speed diesel consumption ratio (on energy basis) based on Quantity of high speed diesel combusted as back up fuel in CCPP in year y ($Q_{HSD,y}$) and Quantity of permeate gas used for energy generation in the Project Activity during year y ($Q_{PG,y}$), $RATIO_{HSD}$

Third party:

1. Supplier invoice, net calorific value of high speed diesel, $NCV_{HSD,y}$

OGDCL

1. Consumption records, natural gas consumption at booster station, $FC_{NG,j,y}$
2. Lab analysis records, mass fraction of carbon in natural gas, $w_{C,NG,y}$

Management structure

Engro will designate a CDM team to be responsible for carrying out all relevant tasks related to the Project. Both management people and technical workers will be present in the CDM team. All members of the team must have passed various internal and external training, as required by the plant, for qualification.

The management structure consists of 3 levels to guarantee a step by step management of the project which will cast concrete responsibilities on the appointed person who will be actually in charge of a specific task.

The 3 levels refer to the:

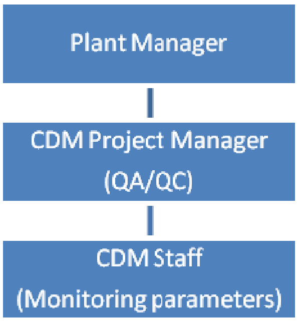

Figure 4: CDM Monitoring Management Structure

Before the start of the crediting period, clear roles and responsibilities will be assigned to all staff involved in the project activity. Engro will appoint a CDM Manager who will be responsible for monitoring activities and data management associated with the CDM project. All operators involved in the collection of data and records will be coordinated by the CDM Manager.

Monitoring guidelines, procedures and documentation

The introduced Monitoring Management and Quality Assurance System is building on written guidelines and procedures provided to the operational CDM team staff and to the local CDM management.

The procedures will be developed by the external consultant according to the requirements of the approved methodology AM0074 (version 2) and related tools as well as the Validation and Verification Manual. All tasks under the monitoring plan will be carried out strictly according to the provided guidelines and procedures.

The Monitoring Management and Quality Assurance System documentation is designed to enable CDM staff members to performing the required tasks following the given guidelines and procedures. Providing documentation designed specifically for the required tasks will strongly benefit availability and transparency of data streams and processes which are relevant for the CDM project.

The CDM Project Manager will carry out frequent performance and data cross-checking, to ensure that staff is following the Monitoring Management and Quality Assurance System.

All documents filled out and data acquired during the project will be archived separately in two locations for backup.

Regular Staff Training

The Monitoring Management and Quality Assurance System is implemented and will be maintained by an external consultant. In order to qualify local operational staff to carry out required regular tasks external consultant will provide professional training, both in class and practical application, to the designated CDM team staff before the start of the crediting period and ongoing regular training at least once a year for the duration of the project. Only trained staff will be members of the CDM team and only trained CDM staff members will be allowed to perform any tasks related to monitoring activities. The CDM Manager is permitted to train new staff. By this it will be ensured that operational CDM staffs are qualified to carry out the relevant tasks under the Monitoring Management and Quality Assurance System.

Based on the annual monitoring results CDM staff will prepare the annual Monitoring Report. An overall AQ/QC on the Monitoring Spreadsheet and Monitoring Report will be carried out by an external Consultant before the documents are submitted to a verifying DOE.

SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity

06/11/2007, the date of when the EPC contract becomes effective with the first advance payment made

C.1.2. Expected operational lifetime of project activity

30 years and 0 months

C.2. Crediting period of project activity
C.2.1. Type of crediting period

The fixed crediting period is chose for the Project Activity

C.2.2. Start date of crediting period

16/10/2012 or the date of registration, whichever is later

C.2.3. Length of crediting period

10 years and 0 months

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts

The project activity obtained all environmental clearances as applicable in Pakistan. An environmental impact assessment (EIA) was carried out for this project activity for submission to regulatory agencies.

The study has been carried out using a standard environmental assessment methodology, in accordance with national and international environmental guidelines. The contents of the assessment report is conform to the environmental guidelines of the Pakistan Environmental Protection Agency (Pak-EPA).

Description of the Environment

The project area is located in the sedimentary Southern Indus Basin south of the Sukkur Rift—the divide between the Central and Southern Indus Basins. The project location is surrounded by cultivated land. Soil types range from dark brown sandy loam in most places to light-brown sand in others. The area's land mass is generally flat, with parcels of some minor undulations in some places.

The proposed plant site is on the left bank of the Indus River. The main canals in the area are the Ghotki Feeder Canal. Other smaller canals include the Band Wah and Dingra Wah.

The groundwater aquifers in the project area are described as moderately thick and extensive with a potential yield of between 100 and 150 m^3/h (Survey of Pakistan, 1997, Atlas of Pakistan). Because of their proximity to the Indus River, salinity in the groundwater is low (less than 1,000 mg/l). The water table in the project area is shallow (less than 2 m). The depth of the water table varies significantly during the year with the field irrigation regime and changes in flow in the Indus River and the canals (Nazir, Y J, and A R Rubina, 1995, Wild Flowers of Pakistan, Oxford University Press).

The climate of the project area is broadly described as hot and arid. The project area receives approximately 88 mm of rain annually (Pakistan Meteorological Department, 1992, Climatic Normals of Pakistan 1961-1990). Most of the rain is concentrated in the monsoon months of July and August.

The OGDCL's existing gas processing plant is the only significant source of gaseous emissions in the project area, other sources include highway traffic, and the limited farm equipment. Emissions from the vent consist of methane, nitrogen, and carbon dioxide. All these gases are non-hazardous. The combustion of gases in the flare releases combustion products, which consist mainly of carbon dioxide and nitrogen oxides into the atmosphere.

The plant site does not support any rare or threatened plant species. All the species described are cultivated and the non-woody herbaceous flora is widely distributed.

Due to the high level of human disturbance, and the absence of suitable habitats, the area has very little native wildlife present. As a consequence, the animals found there are predominantly common species that are highly adaptable and able to co-exist with people.

Socioeconomic Environment

For the socioeconomic study, the project area includes an area lying within 3 km radius of the proposed site for the combined cycle power plant. Administratively, the project area falls in Ghotki taluka of the Ghotki district of Sindh province.

As per the survey conducted for the EIA, there are 16 villages or settlements in the project area. The size of the villages ranges from 8 to 1,300 houses. The average household size in the study area is 6.1 as compared to the average household size of 5.5 in the Ghotki district (Population Census Organization, 1999, District Census Report of Ghotki 2000).

The total population of the villages surveyed numbers is about 15,000. According to the data collected, there is currently a potential workforce of 3,860 men in the project area. There are about 8,000 persons in the project area above the age of 15 and about 7,000 below. While the census results for the Ghotki district reports 46.72 % of total population are below the age of 15.

The data collected indicates that the male-female ratio is around 111:100, i.e., the males in the project area outnumber the females. While the 1998 population census report for the Ghotki district indicates the male-female ratio as 111:100. This implies that the population pattern of the project area is similar to that of the Ghotki district.

The field survey reveals that there are approximately 2,433 houses in the project area. Out of which about 1,464 (60%) are pakka while 969 (40%) are kacha (made of clay).

Most residents of the study area speak Sindhi and Siraiki. The major tribes of the area are Bhutto, Samejo, Soomroo, Shaikh, Buraro, Senghar, Lakhan, Sawand, Jiskan, Drigh, Khoso, Kolachi, Sangi, Baloch, Arain, and Syed.

The survey of the project area revealed that 50% of the workforce is involved in agriculture and related activities; 40% are involved in labor in Ghotki, Hyderabad, and other cities of the country; 5% are government servants and 5% have their own businesses. Majority of the people area engaged in agriculture. Their condition on the whole is not very encouraging. Only a few persons own big holdings. The rest are either landless haris or petty khatedars who live from hand to mouth. The principal crops of the district are sugarcane, wheat, cotton, rice, maize, jawar, bajra, gram, barley, tobacco etc. Cultivation must always depend on canals. In the district main source of irrigation is Ghotki feeder which flows from river Indus at Guddu Barrage and radiates several small canals irrigating the agriculture lands. The other means of irrigation are a few wells and dug wells. The agricultural land in the project area is irrigated by both irrigation channels and tube wells.

Groundwater is an important source of drinking water in the project area. Almost every house in the area has a hand pump. It was observed that drinking water from most of these sources is sweet and of good quality.

Major health problems in the area are gastroenteritis, acute respiratory infection (ARI), malnutrition, anemia, eczema, fever, and general aches and pains. There are one Basic Health Units (BHU) and one dispensary in the project area. Due to the proximity of the project area to the city of Ghotki, the residents of the study area have access to public as well as private health care.

The field survey revealed that the male literacy rate is 24% and the female literacy rate is 6% in the project area, compared to Ghotki where 44.21% of the men and 11.85% of the women are educated (Population Census Organization, 1999, District Census Report of Ghotki 2000).

All the villages in the project area have electricity and are accessible by blacktop roads. Vans, pickups, and buses provide regular transport service in the area. Telephone facilities are available in all the villages, but there is no gas supply except few villages.

No archaeological sites were observed in the study area during the field survey.

D.2. Environmental impact assessment

The EIA did not indicate any significant environmental impacts. However, mitigation measures were taken up for lesser impacts.

Construction Phase

Potential impact	Criteria for determining significance	Key mitigation measures
Environmental Issues		
Construction Noise Disturbance to surrounding communities	The World Bank guidelines for noise.	Pre-construction noise survey; Reduce noise at source; Take noise levels in

of the proposed combined cycle power plant due to operation of construction machinery on the plant site		consideration during detailed design and construction planning; Reduce traffic noise; Use of noise abatement devices where ever practicable
Dust Emission Particulate matter emitted during construction activities can result in deterioration of ambient air quality in the vicinity of the source, and be a nuisance to the community.	An increase in visible dust beyond the boundaries of the construction site; or diverse impact on community assets, or community complaints; or Concentration of PM_{10} in excess of 150 $\mu g/m^3$	Sprinkling of water on unsealed surfaces; Use of wind shield around stockpiles; Vehicle speed restrictions; transportation of material in covered trucks; minimizing constructional activities near the settlements; ensuring that no stockpile is within 250 m of the community
Vegetation Loss Loss of vegetation as a result of land clearance for the combined cycle power plant	Unnecessary or excessive removal of trees and shrubs	Preparation of a Reinstatement Plan; Minimization of the felling of trees and clearing of vegetation; and avoidance of the use of fuel wood
Water Resources The extraction of water for the plant construction activities can affect the groundwater availability for the project area communities	Water extracted for the project has directly affected the ability of the community to meet their water needs	Use of dedicated deep wells Initiation of a water conservation program The water can also be supplied from the nearby canal
Soil Contamination Oil and chemical spills can contaminate the soil	Presence of visible amount of hydrocarbon in soil	Provision of spill prevention and control kits; Use of impermeable surfaces in workshops, and storage areas; Contaminated soil will be collected and incinerated.
Hazardous and Non-Hazardous Waste Management Improper waste management may lead to health and aesthetic issues	Exposure to potentially hazardous waste; Generation of excessive waste; Recyclable waste and reusable waste is discarded; Littering; Improper disposal.	Development of a waste management plan; Separation at source of the recyclable material; Regular audits; Maintenance of a Waste Tracking Register; Separation hazardous waste from nonhazardous waste; On-site storage facility for hazardous waste; Recyclable waste to be disposed via approved waste contractors; Dumping of non-hazardous, nonrecyclable waste either to landfill or municipal disposal; Emergency response plan; Trainings; Labeling and avoidance use of asbestos, polychlorinated biphenyls (PCBs), and ozone depleting substances (ODSs)
Socioeconomic Issues		
Community Safety Safety hazards associated with the construction activity, particularly with the increase in traffic on the project access road.	No specific guidelines exist. A significant impact will be interpreted if there are complaints from the community or the occurrence of any injury or loss	Speed limit of 10 km/h will be maintained on the access road; Traffic controller will be stationed on the access road; night driving will be kept to a minimum
Employment Conflicts The project will create a small job opportunity compared to potentially available labor. This is likely to create conflicts between the 'locals' and non-locals and also within the community	Maximum unskilled jobs to the locals	Maximum number of unskilled and semi-skilled jobs for the local communities; Nearest communities to be given the first preference for jobs

regarding the distribution of jobs		
Project and Community Interface Inter-cultural differences between the project staff from other areas and the local community	No community complaints	Training of the non-local project staff on local culture and norms; Avoidance of unnecessary interaction of local population with the non-local project staff; Non-local staff to stay in camps; Prior notice to residents of the area before project activities

Table 16: Potential environmental impacts during the construction phase

Operation Phase

Potential impact	Criteria for determining significance	Key mitigation measures
Environmental Issues		
Plant Noise Disturbance due to plant noise	The World Bank guidelines for noise	Turbines will be acoustically hielded and then placed inside a concrete building; Design will ensure maximum possible distance is kept from the community; Probation will be kept for noise abatement devices such as noise walls and mufflers if required
Emission Emission from the plant can potentially affect air quality.	NEQS and World Banks ambient air quality guidelines	No specific mitigation measures required
Accidental Release of H2S The release of gas from the pipeline containing H2S can be a major health and safety risk for the nearby community	Acceptable Eight-Hour Time Weighted Average (TWA), Short Term Exposure Limit (STEL), and the Acceptable Ceiling Concentration as per the physiological responses to H2S	Emergency Response Plan for H2S release will be developed; the community will be educated and trained towards the risk of a release and to react in line with the response plan; cutoff valves will be installed at the EEL plant, Gas plant, and in between on the pipeline; Wind direction indicators will be installed, no cultivation will be allowed on the right-of-way, no traffic will be allowed on the pipeline right-of way
Groundwater The increased withdrawal of groundwater for the combined cycle power plant operation will affect the groundwater resources of the project area	Water extracted for the project has directly affected the ability of the community to meet their water needs	Canal water will be used to fulfill the water requirements of the project; Use of designated deep well(s) only during the annual canal closure period; Initiation of a water conservation program. No impact on the community groundwater needs is envisaged as a result of the project.

Table 17: Potential environmental impacts during the operation phase

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

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Three separate rounds of public consultation were held during the feasibility assessment of the proposed project activity.

1. The initial round of public consultation covering socioeconomic data gathering was undertaken from 16th – 19th January, 2006
2. The second round of consultations was held between April 14th - 15th, 2006
3. The third round of consultation was held from February 1st - 3rd, 2007

Apart from consultations with the local community, consultations with relevant government and non-government organizations and associations and separate consultations with the women of the nearby settlements were also held in these rounds. A female sociologist was brought in to conduct these consultations.

The overall objectives of the public consultation process are as follows:

- To inform stakeholders about project activities
- To gather feedback from stakeholders on project
- To identify potential issues including the socioeconomic impact of the project and corresponding mitigation measures

The government organizations that were consulted include the Irrigation and Power Department Ghotki and the Social Welfare Community Development Department. Two NGOs, Al-Qadir Social Welfare Association and Nojwan Sangath were also consulted. The local farmer's association called the Farmers Organization Council could not be consulted as their office remained closed and their members could not be contacted.

The consultants held meetings to assess any potential gender issues that could be raised due to the Project Activity. The survey team visited sixteen villages in total that may be affected from the activities of the proposed project. Out of the sixteen villages stakeholder consultation was undertaken at six villages.

During these consultations a simple, non-technical description of the project was given, along with an overview of the project's likely human and environmental impact. Following the project description, a discussion was held so that the participants can voice their concerns and opinions; these are indicated in the environmental impact assessment.

E.2. Summary of comments received

Community Safety

The participants of the public consultations expressed concern over the safety hazard that could result from the increase in the roadside traffic particularly during the construction phase of the project. They suggested that the single unpaved road leading to the project site from the national highway will be widened and regularly sprinkled with water in order to decrease the risk of dust related hazards. Community members demanded reduced number of vehicular movement on the ground of health and safety and noise menace as the access road passes through the village Chaudhry Rasheed Ahmed. For this purpose EEL intends to employ a traffic controller stationed on the access road to ensure that no safety violations occur and also enforce a speed limit of 10 km/h when passing through the section of the road that is next to the community.

Employment

The participants of the public consultation meetings emphasized the need to ensure the appointment of locals in all non-technical and support services through a transparent process. They also insisted that all salary payments should be made directly to them and that the employment should be given on permanent basis not on short-term contract.

Project Benefits

Local community also expressed the opinion that the project should be designed in a manner that all people including the poor should benefit from the project equally. The benefits should not be limited to the rich and influential families. They were particularly vocal about the women and children of the project area being the beneficiaries.

Community Nuisance

Some members of the community expressed concern over nuisance created by construction noise and dust. They expressed the apprehensions that constant movement of heavy traffic during the construction phase can expose the community to health and safety hazards.

Community Health

Educated persons from the local community expressed the concern that emissions from the combined cycle power plant during operational phase will affect the ambient air quality in the area. The participants of the village Ayub Lakhan were eager to report the bad condition of the existing Basic Health Unit (BHU) and suggested that efforts should be made to bring the BHU into a working condition. In general the lack of health facilities has caused an increased number of deaths which would otherwise be prevented had there been health centers in the most part of the project area.

Cooperation with the Community

The participants expressed that the project proponents should maintain and encourage a cooperative attitude towards the community.

Outcomes of Consultations with the Women of the Project Area

Consultations with the females of the project area were taken simultaneously but separately to get both the male and female perspective and to ensure to the community that both males and females are being consulted and neither of them was left alone. Some of the additional points highlighted in the consultations with the females are discussed below.

Employment

Wherever the females were not educated and bound to their homes, they emphasized the need to provide employment to their male members as it directly affects them. In the Ali Sher Khan Jiskani village where the ratio of educated women was higher the women stated that they should be considered for jobs and should be provided pick and drop facility, if hired.

Community Health

The women of the project area were very vocal about the lack of health facilities. In the six villages where consultations were held only one had Lady Health Workers. The Basic Health Unit and the hospital were not in good condition. Due to this, patients and pregnant women at times need to travel 2-3 km on foot in order to get medical help.

Trainings

To cope with the economic as well as health problems that the communities face, the women requested provision of training facilities. They suggested that trainings regarding health (Lady Health Worker trainings), sanitation, livestock and agriculture management, and the modernization and marketing of the local handicrafts could be very useful in reducing the vulnerability of women and the alleviation of poverty in the community.

Security

There are existing security concerns for the community and the women in particular. They welcomed the combined cycle power plant that due to it the night-time illumination in the area would increase, thus reducing the security risks.

Availability of Gas

The women stated that collecting fire wood for domestic purposes is a very cumbersome job and is only undertaken by the women and children of the project area. They complained that gas is available less than a kilometer from their houses and is still not supplied to them.

Irrigation and Power Department

Meeting with the SDO Abdul Sattar Sario was held at his office. He welcomed projects like the proposed combined cycle power plant and considered them good for the development of the project area in particular and the country, in general. He, however, insisted that environmental degradation associated with such activities should also be taken into account while designing the project. He also clarified that the Irrigation Department would allow the project to use the water from the irrigation canals after due permission from the department.

Social Welfare Community Development Department

A meeting was held with the district officer at his office. He expressed no concern over the proposed project and stated that industrial activities in the area support their social welfare programs.

Consolations with NGOs

Two NGOs the Al Qadir Social Welfare Association and Nojwan Sangath were consulted. They expressed concern over the impacts to air quality that can occur due to the air emissions from the combined cycle power plant. They also suggested that EEL should initiate some social welfare programs for the community.

E.3. Report on consideration of comments received

Area of concern	Observation of the community/Concern expressed	Expressed by	Proposed mitigation
Community safety	Local traffic may be disturbed and local community may become exposed to the safety hazards associated with project traffic and construction equipments.	Participants of the public consultation meeting	A public safety plan will be developed. Community will be briefed on traffic safety, especially women who are main care providers to children. Traffic safety awareness programs will be considered at schools,if deemed necessary. Work areas outside the proposed plant site, especially where machinery is involved will be roped off and will be constantly monitored to ensure that local people, especially children stay away.
Employment	Technical jobs for which local labor can compete may not be given to people from outside the project area	Participants of the public consultation meeting	Maximum number of unskilled and semi-skilled jobs will be reserved for the local communities. A local labor selection criterion will be developed in consultation with the community
Project benefits	The project should not provide benefits to influential families only and overlook the poor.	Participants of the public consultation meeting	A local labor selection criterion will be developed in consultation with the community. Community welfare programs will be initiated.

Community Nuisance	Construction activities may cause noise and dust in the area	Participants of the public consultation meeting	Noise control plan will be developed. Water will be sprinkled daily or when there is an obvious dust problem on all exposed surfaces to suppress emission of dust.
Community health	Emissions from the power plant during operational phase, may affect the ambient air quality in the area.	NGOs consulted	An emission monitoring system is installed at the stack of the CCPP for continuous monitoring of emissions and to ensure that emission levels are kept below the NEQS standards[74].

Table 18: Proposed mitigation measures

[74] comp. National Environmental Quality Standards (NEQS)

SECTION F. Approval and authorization

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A letter of approval has been obtained from the Designated National Authority (DNA) in Pakistan

Tel: 92-51-9245528
Fax: 92-51-9245533

F. No. (255)-CDM/ 2012

GOVERNMENT OF PAKISTAN
MINISTRY OF ENVIRONMENT
4th Floor, Local Government Building,
Sector G-5/2, Islamabad, PAKISTAN
****

Director General
(Environment)

Islamabad, the 26th June 2012

Subject: **Grant of Host Country Approval to CDM Project Titled "Grid connected combined cycle power plant project in Qadirpur utilizing permeate gas, previously flared".**

This is to inform you that the Clean Development Mechanism (CDM), Project Design Document (PDD) for ***"Grid connected combined cycle power plant project in Qadirpur utilizing permeate gas, previously flared"*** of Engro Corporation Limited, (Project Participant), was considered by the Designated National Authority (DNA) in the Ministry of Environment.

2. The DNA hereby approves the above mentioned project as:

a. The project aim is to operate a Combined Cycle Power Plant for utilizing the permeate gas at Qadirpur to generate 223.8 MW (gross) of electricity, which will help to improve the power availability in the surrounding areas without taxing the countries fossil fuel sources as the plant will be fueled with permeate gas that would otherwise be flared at the gas field.

b. The project will contribute to sustainable development and improvement of local environmental conditions in Pakistan.

c. This approval is for the voluntary participation in the proposed CDM project activity.

3. It may further be noted that Government of Pakistan has got accession to the Kyoto Protocol on 11th January, 2005.

(Jawed Ali Khan)
D.G (Environment)

Mr. Ruhail Mohammed
Director,
Engro Corporation Limited.
Karachi, Pakistan

Appendix 1: Contact information of project participants

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Appendix 2: Affirmation regarding public funding

The Project Activity does not receive any public funding from Annex 1 Parties.

Appendix 3: Applicability of selected methodology

Please refer to SECTION B.2.

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

Please refer to SECTION B.6.3. and Emission reduction calculation EXCEL Spreadsheet

Appendix 5: Further background information on monitoring plan

Please refer to SECTION B.7.1. and B.7.2

Appendix 6: Summary of post registration changes

Not applicable, the Project Activity is being proposed for registration

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History of the document

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