CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

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Annexes

Appendix

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Abohar Branch Canal Based Small Hydro Project in Punjab, India.
Version: 06
Date: 01/07/2011

A.2. Description of the small-scale project activity:

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Abohar Power Generation Private Limited (APGPL) proposes to implement 5 independent low head, canal drop based mini hydel schemes with a combined installed capacity totaling 5.30 MW located on the Abohar branch canal at Khanpur, Sudhar, Akhara, Gholian and Channowal villages in the state of Punjab. The details of the mini hydel schemes are depicted below:

MHPs	MHP Khanpur	MHP Sudhar	MHP Akhara	MHP Gholian	MHP Channowal
Installed Capacity (kW)	2 x 550	2 x 700	2 x 550	1 x 800	1 x 900
Site Location	Right bank of Abohar Branch Canal near Khanpur fall	Right bank of Abohar Branch Canal near Sudhar fall	Right bank of Abohar Branch Canal near Akhara fall	Left bank of Abohar Branch Canal near Gholian fall	Right bank of Abohar Branch Canal near Channowal fall

The project activity has been contemplated to utilize the flow of water in the existing canal system to generate electricity. In the absence of the proposed project activity, the electricity generation potential in the flowing water would have remained unutilized and similar quantum of electricity would have been generated in the fossil fuel based power plants connected to the grid.

Being a canal (with no storage facility) based mini hydel project, they do not necessitate displacement (rehabilitation & resettlement) of human population. Electricity can be generated whenever water is available in the canal (which depends upon the crop requirement, as the water supply in the canal is controlled by the state irrigation department). Water for the project will be drawn from the Abohar Branch Canal and let back into the canal after passing through the vertical axis Kaplan turbines. There will be no direct consumption of canal water and no disturbance to the irrigation regime.

All the five projects have been commissioned and the date of commissioning is tabulated as below:

S. No.	Project	Capacity (MW)	Date of Commissioning
1	MHP Khanpur	1.1	22/04/2010
2	MHP Sudhar	1.4	03/05/2010
3	MHP Akhara	1.1	25/03/2010
4	MHP Gholian	0.8	04/10/2009
5	MHP Channowal	0.9	30/09/2009
6	**Total**	**5.3**	**-**

View of the project participants on the contribution of the project activity to sustainable development

Ministry of Environment and Forests, Govt. of India has stipulated the following indicators for sustainable development in the interim approval guidelines for CDM projects:

A > Social well being – *The CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contribution to provision of basic amenities to people leading to improvement in quality of life of people.*

The CDM project activity would lead to alleviation of poverty by generating additional employment i.e. the project activity would raise medium term employment opportunities for the local people during construction phase as well as during life time of the project for operation and maintenance of the project.

The proposed project activity thus leads to:

- Alleviation of poverty through employment generation
- Improved economic activities and business opportunities
- Improvement in electricity quality, frequency and availability
- Improved infrastructure in and around the project area
- Most of the population in the nearby villages is dependent upon agriculture. The electrification of the villages will lead to industrial growth and boost agro based industry

B > Economic well-being - *The CDM project activity should bring in additional investment consistent with the needs of the people.*

As the project results in additional investment in the region consistent with the needs of the people, which would not have taken place in the absence of the project activity, the CDM project activity leads to:

- Economic utilization of available resources which have remained unexploited for the past many decades
- Strengthening of the local grid
- Diversification of the national energy supply
- Reduction in demand-supply gap in the power deficit state grid
- Provision of electricity with minimum transmission losses due to close load points

C > Environmental well being - *This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general.*

There would be a positive impact on resource sustainability and resource degradation, as well as reduction of pollution levels in general due to the proposed activity.
The hydro energy project leads to:

- Reduction in GHG emissions arising as a result of fuel combustion in conventional power plants
- Reduction in specific emissions of pollutants, particulate matter and toxic gases
- Resource conservation
- Overall environmental well-being and stability

D > Technological well being - *The CDM project activity should lead to transfer of environmentally safe and sound technologies with a priority to the renewable sector or energy efficiency projects that are comparable to best practices in order to assist in up-gradation of technological base.*

The CDM project activity employs environmentally safe and sound technology comparable to best practices in order to assist in up gradation of technological base.
The project activity leads to:

- Demonstration of clean renewable power project in Punjab

- Increase in energy availability and improvement in the quality of power in the region.
- Overall technological well-being and development of the emission-free energy sector.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host party)	Private and/or public entity (ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
Government of India (Host Country)	Abohar Power Generation Private Limited (Private)	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

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Country: India

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

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State: Punjab

A.4.1.3. City/Town/Community etc:

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Location	MHP Khanpur	MHP Sudhar	MHP Akhara	MHP Gholian	MHP Channowal
District	Ludhiana	Ludhiana	Ludhiana	Moga	Moga
Village	Khanpur	Sudhar	Akhara	Gholian	Channowal

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

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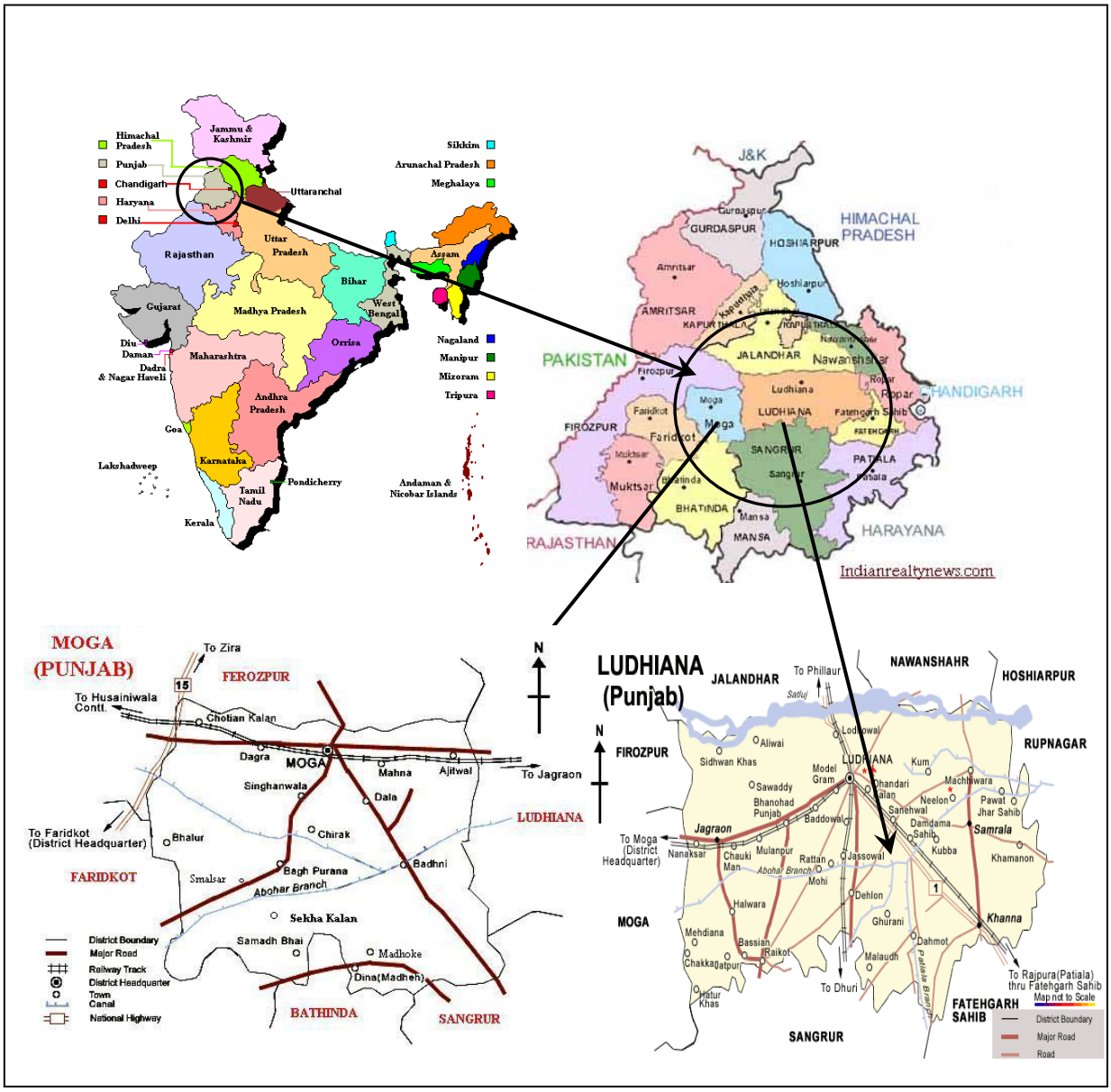
The proposed Project is located on the Abohar Branch Canal. The site locations of different sub-projects along the Abohar Branch Canal are given in the following table:

Location	MHP Khanpur	MHP Sudhar	MHP Akhara	MHP Gholian	MHP Channowal
Site Location	9 km from Doraha on Ludhiana-Ambala main road	60 km from Doraha on Ludhiana-Ambala main road	45 km from Doraha on Ludhiana-Ambala main road	75 km from Doraha on Ludhiana-Ambala main road	95 km from Doraha on Ludhiana-Ambala main road
Latitude	30.7859˚ N	30.7675˚ N	30.7612˚ N	30.6608˚ N	30.6439˚ N

Longitude	75.9073˚ E	75.6469˚ E	75.4931˚ E	75.2147˚ E	75.1055˚ E

All the project sites are connected to Doraha with an all weather metalled service road along the Abohar Branch Canal. The nearest major town as well as the major rail head is at Ludhiana and the nearest airport is at Chandigarh.



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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The project activity meets the applicability criteria of small scale CDM project activity category, Type I, Renewable energy projects (D: Grid connected renewable electricity generation) of the 'Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories'.

***Main Category: Type* I –Renewable Energy Projects**
***Sub Category:* D - Grid connected renewable electricity generation**
***Reference:* AMS.I.D, version 16, EB 54**

Technology:

The technology employed for power generation in the mini hydroelectric plant consists of hydro turbines, which will convert the potential energy available in the water flow into mechanical energy, and alternators which will convert the mechanical energy into electrical energy. The generated power will be transformed to match the nearest grid substation for proper interconnection and smooth evacuation of power. Since, the technology employed by the project proponent does not result in GHG emissions, the project does not have any negative effects on the environment. Hence, the technology used for the project activities does not pose significant threat to the environment in comparison to fossil fuel-fired power plants.

Technical Details of the Project:

	Khanpur	**Sudhar**	**Akhara**	**Gholian**	**Channowal**
Low Head/ Canal Scheme					
Shape	Trapezoidal Section	Trapezoidal Section	Trapezoidal Section	Trapezoidal Section	Trapezoidal Section
Lining details	Unlined Canal	Unlined Canal	Unlined Canal	Unlined Canal	Unlined Canal
Fall Structure	Reinforced Brick	Reinforced Brick	Reinforced Brick	Reinforced Brick	Reinforced Brick
Rated Head (m)	1.860	2.443	2.460	2.872	3.709
Rated Discharge (cumec)	36.044	34.678	26.500	33.178	28.836
Forebay and Intake					
Shape	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal
Length(m)	75	70	70	55	50
Power House					
Type	Semi outdoor	Semi outdoor	Semi outdoor	Semi outdoor	Semi outdoor
Turbine Type:	Vertical axis Semi Kaplan turbines	Vertical axis Semi Kaplan turbines	Vertical axis Semi Kaplan turbines	Vertical axis Full Kaplan turbines	Vertical axis Full Kaplan turbines
Number	2	2	2	1	1
Capacity(each, KW)[1]	550	700	550	800	900
Runner Discharge Diameter (mm)	3500	3250	3250	3250	2900
Type of Generator	Induction	Induction	Induction	Induction	Induction
Tailrace					
Shape	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal
Length	70	75	75	60	60

[1] Capacity in kW with suitable overload

Switchyard					
Voltage Level(V)/Basic undulation level(KV)	415 V/11 KV	415 V/11KV	415 V/11KV	415 V/11KV	415 V/11 KV
No. of Bays	1	1	1	1	1

Technology Transfer

There is no transfer of technology from any of the Annex-1 countries for this project since the technology is available locally.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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The crediting period chosen for the proposed project activity is 10 years. Annual estimation of emission reductions by the project activity during the above crediting period are furnished below:

Year	Estimation of annual emission reductions in tonnes of CO_2e
Year 1	23,527
Year 2	23,527
Year 3	23,527
Year 4	23,527
Year 5	23,527
Year 6	23,527
Year 7	23,527
Year 8	23,527
Year 9	23,527
Year 10	23,527
Total estimated reductions (tonnes of CO_2e)	**235,270**
Total number of crediting years	**10**
Annual average of the estimated reductions over the crediting period (tCO_2 e)	**23,527**

A.4.4. Public funding of the small-scale project activity:

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There is no recourse to any public funding and the project proponent hereby confirms that no Official Development Assistance (ODA) has been made available to the project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/Add.3), a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

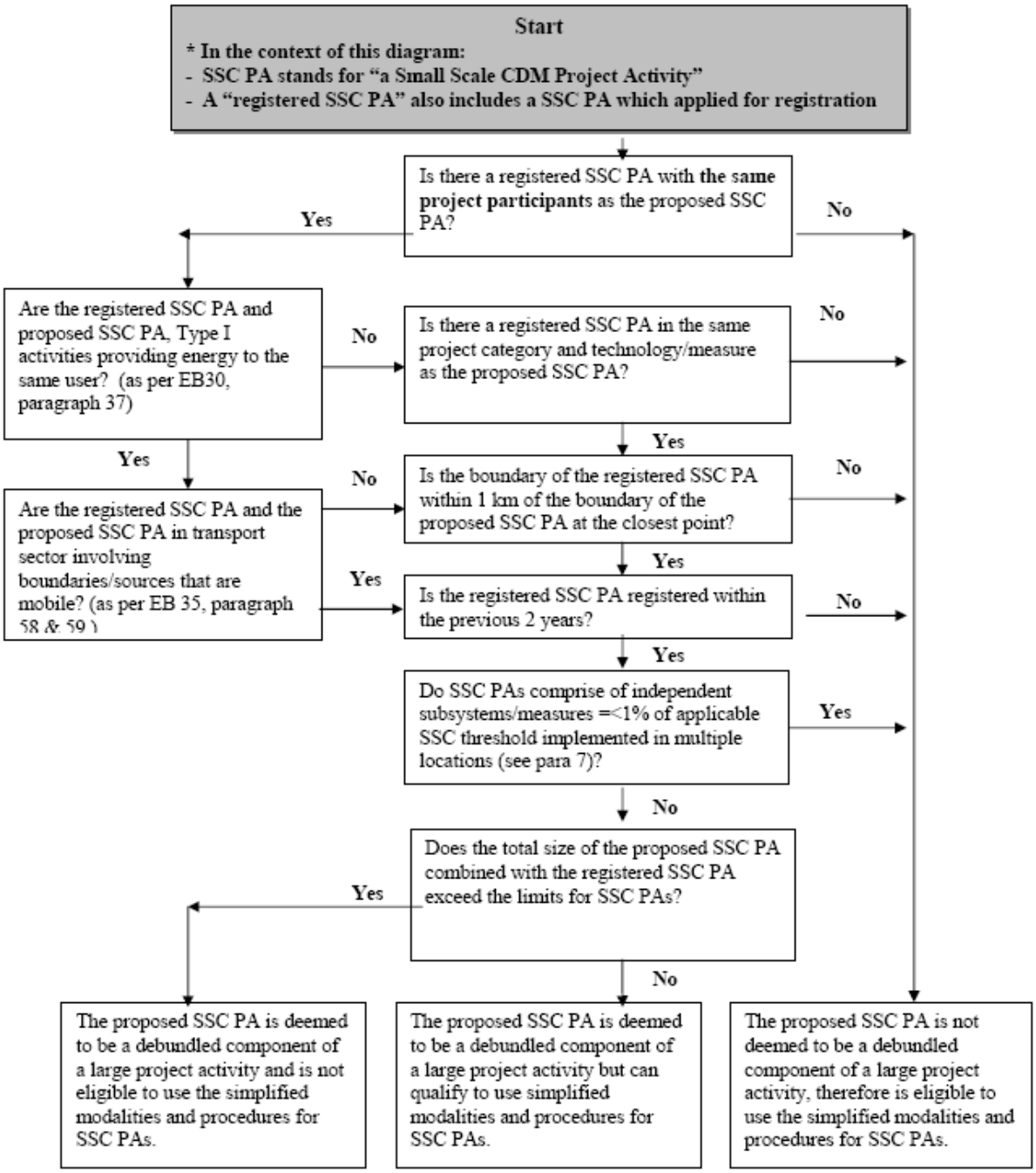
- With the same project participants
- In the same project category and technology
- Registered within the previous two years; and

- Whose project boundary is within 1km of the project boundary of the proposed small scale activity

This Project proponent does not have any other project in the same project category registered within the previous two years within 1 km of the project boundary of the proposed sub-projects. Further, none of the sub-projects are located within 1 km of each other and the combined capacity of the sub-projects is lower than the eligible SSC limit of 15 MW. Thus, the project is not a debundled component of a large scale project activity.

As per "Compendium of guidance on the debundling for SSC project activities" Version 03 (EB 54, Annex 13), the procedure for determining occurrence of bundling is as given below:

I. DETERMINING THE OCCURRENCE OF DEBUNDLING



- Is there a registered SSC Project Activity with **the same project participants** as the proposed SSC PA?
    - No. APGPL does not have any other proposed SSC PA, however the project promoters have two registered projects (Project Ref. No. 327 "Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects" and Project Ref. No. 328 "Dolowal, Salar and Bhanubhura Mini

Hydroelectric Project"). However, these are both located more than 1 km from the APGPL sub- projects)

Hence, the proposed SSC PA is not deemed to be a debundled component of a large project activity, therefore is eligible to use the simplified modalities and procedures for SSC PAs.

SECTION B. Application of a baseline and monitoring methodology

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

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As per the Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, approved small scale baseline methodology Type-I D-Version 16 has been used.

Title: "Grid connected renewable electricity generation".
Reference: AMS I D, Version 16, EB 54

It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC/CDM (http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html) website.
The approved methodology uses the "Tool to calculate the emission factor for an electricity system", Version number 02 for determination of the baseline scenario and also draws upon Appendix B of the simplified modalities and procedures for small-scale CDM project activities "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories".

B.2 Justification of the choice of the project category:

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Justification of the choice of methodology

The project activity is Grid connected renewable power generation and meets the applicability conditions of the chosen methodology as follows:

Conditions in the methodology	Applicability
This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to a national or a regional grid. Project activities that displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit shall apply AMS I.F.	The project activity consists of renewable energy generation units that supply electricity to the NEWNE Grid that is primarily being supplied by fossil fuel based power plants. Thus, the project activity satisfies the given applicability condition.
This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	The project activity is installation of new power plants at a site where there was no renewable energy power plants operating prior to the implementation of the project activity (Greenfield plant). Thus, the project activity satisfies the given applicability condition.

Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	The project activity consists of canal based small hydro projects that do not result in formation of reservoirs. Hence, this applicability criterion is satisfied.
In the case of biomass power plants, no other biomass types than renewable biomass are to be used in the project plant.	The project activity is not a biomass power plant.
If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	The project activity consists of renewable components of total capacity 5.3 MW which is below the eligibility limit of 15 MW. Hence, this criterion is satisfied.
Combined heat and power (co-generation) systems are not eligible under this category.	The project activity is not a combined heat and power (co – generation) system. Thus, this criteria is not applicable to the project activity.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The project activity consists of Greenfield hydro power generation facilities and does not involve addition of any hydro power generation unit at an existing hydro power generation facility.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The project activity consists of Greenfield hydro power generation facilities and does not seek to modify / retrofit an existing renewable energy generation facility.

B.3. Description of the project boundary:

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In accordance with AMS I.D, the physical, geographical site of the renewable generation source delineates the project boundary.

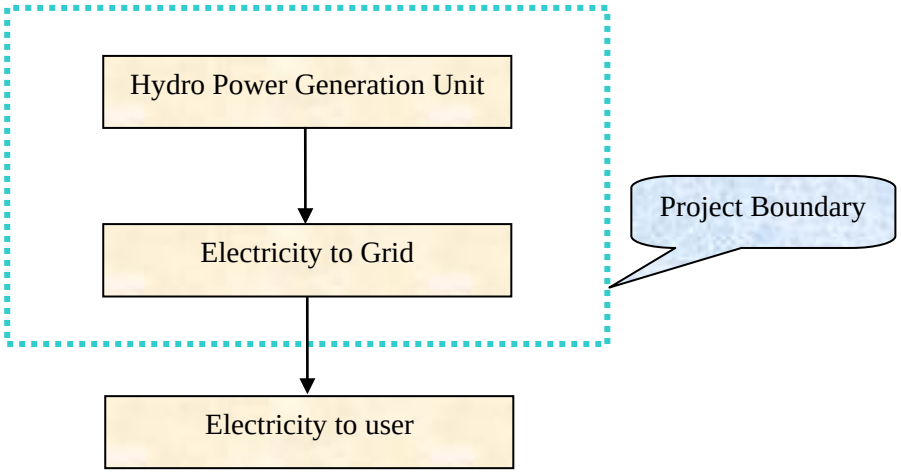
The project activity i.e. all five projects at Khanpur, Sudhar, Gholian, Channowal and Akhara is located on various falls downstream on the Abohar Branch Canal.

Areas of influence

The project activity has been divided into two areas of influence, which is the direct area of influence and the indirect area of influence briefly described as follows:

1. **Direct area of influence:** The direct area of influence of the project comprises the area where the civil works for the project is done i.e. from the forebay to switchyard where the project proponent has full control. Thus the boundary covers forebay, intake, trash rack, power house, draft tube on downstream of turbine, tailrace, switchyard and other accessory equipments.
2. **Indirect area of influence:** The area of indirect influence comprises of about 1 km stretch of the Abohar Branch canal downstream and upstream of the project activity.

For the purpose of calculation of the baseline emissions, NEWNE grid is included in the system boundary.



B.4. Details of baseline and its development:

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The baseline of the project activity is established using paragraph 10 which states that "*If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources*".

According to paragraph 11, the baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year y (t CO_2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,grid,y}$	=	CO_2 Emission Factor in year y (tCO_2/kWh)

The Emission Factor can be calculated in a transparent and conservative manner as follows:

(a) A combined margin (CM), consisting of the combination of Operating Margin (OM) and Build Margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system' Version 02.

OR

(b) The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations must be based on data from official source (where available) and made publicly available.

The project activity by intending to supply to the regional grid attempts to reduce the Greenhouse gas emissions which would have been generated to produce equivalent amount of electricity in the primarily fossil fuel based grid electricity system.

A database for the purpose of ensuring authentic and consistent quantification of CO_2 emissions in the baseline has been provided by Central Electricity Authority of India (CEA) which is an official publication of the Government of India. Based on the most recent data available on all the grid connected power stations in India, CEA has provided the database to facilitate calculation of emission factors for the two regional grids according to the 'Tool to calculate the emission factor for an electricity system'- version 02. All underlying calculations and assumptions used to prepare the CO_2 database has been provided in the website[2].

The Indian power system is divided into two independent regional grids, namely NEWNE and Southern grid. Many Indian states are covered under the geographical scope of the NEWNE grid which is of concern to the proposed project activity. The state of Punjab is also covered under this grid.

The emission factor has been calculated ex-ante as a combined margin which is the weighted average of the operating margin and the build margin. This approach takes into account the trends of future capacity additions. Thus, it is the most realistic representation of the anthropogenic emissions that would occur in absence of the project activity. The operating margin has further been calculated ex-ante as Simple OM since the low-cost/must run resources constitute 17.94% (which is less than 50%) of total grid generation in the average of five most recent years.

In accordance with "Guidelines for the reporting and Validation of Plant Load Factors", Version 01 (EB48, Annex 11), the Plant Load Factor (PLF) has been defined ex-ante in the PDD according to option II Para 3 (b), stating, 'The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company)'. The PLF has thus been sourced from the feasibility report that has been prepared by a reputed third party engineering consultancy, Pentaflo Hydro Engineers that was contracted by APGPL.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

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In accordance with the "Guidance on the demonstration and assessment of prior consideration of the CDM" (EB49, Annex 22), for project activities with a start date before 2 August 2008, for which the start date is prior to the date of publication of the PDD for global stakeholder consultation, the serious consideration of CDM in the decision to proceed with the implementation of the project activity is demonstrated below:

[2] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

a) The promoters of APGPL were already aware of CDM, having registered two projects (Project Ref. No. 327 "Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects"[3] and Project Ref. No. 328 "Dolowal, Salar and Bhanubhura Mini Hydroelectric Project"[4]) under the mechanism. In the meeting of the Board of Directors, the decision to implement the project was taken on the basis of a feasibility report by Pentaflo Hydro Engineers which also indicated that CDM was necessary to make the project a viable proposition. It was resolved thereafter that the project activity must be taken forward with CDM and immediate steps to achieve CDM registration must be undertaken. The Board further authorized its key personnel to pursue tasks related to CDM.

b) The following timeline of implementation of the project activity and timeline of events and actions taken to achieve CDM registration clearly indicate that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation:

Timeline of project activity

S. No.	Event	Date				
		Khanpur	Sudhar	Akhara	Gholian	Channowal
1	Preparation of Feasibility Report considering CDM benefits	January 2006	January 2006	January 2006	January 2006	January 2006
2	Meeting of the Board of Directors approving investment in the said project (considering CDM revenues)	03/02/2006	03/02/2006	03/02/2006	03/02/2006	03/02/2006
3	Communications/ Negotiations with CDM consultants	15/03/2007	15/03/2007	15/03/2007	15/03/2007	15/03/2007
4	Novation of Implementation Agreement in favour of APGPL	27/04/2007	27/04/2007	27/04/2007	27/04/2007	27/04/2007
5	Letter of Acceptance (LOA) for Electro-Mechanical (E&M) Contract	26/11/2007	26/11/2007	26/11/2007	26/11/2007	26/11/2007
6	Letter of Acceptance for Hydro-Mechanical (H&M) Contract	06/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007
7	Supply contract for E&M Works	21/12/2007	21/12/2007	21/12/2007	21/12/2007	21/12/2007

[3] http://cdm.unfccc.int/Projects/DB/TUEV-SUED1142612177.68/view

[4] http://cdm.unfccc.int/Projects/DB/TUEV-SUED1142615287.88/view

8	Novation of Tripartite Agreement in favour of APGPL	15/01/2008	15/01/2008	15/01/2008	15/01/2008	15/01/2008
9	NOC from Punjab Pollution Control Board	12/02/2008	12/02/2008	12/02/2008	26/02/2008	26/02/2008
10	IEM	07/03/2008	07/03/2008	25/04/2008	28/04/2008	28/04/2008
11	Loan rejection from IREDA	13/03/2008		13/03/2008		
12	Lease deed between Governor of Punjab / PEDA	26/03/2008	26/03/2008	04/03/2008	03/03/2008	03/03/2008
13	Lease deed between PEDA / APGPL	26/03/2008	04/03/2008	04/03/2008	03/03/2008	03/03/2008
14	Axis bank – Sanction Letter	05/04/2008	05/04/2008	05/04/2008	05/04/2008	05/04/2008
15	Appointment of CDM consultant	28/07/2008	28/07/2008	28/07/2008	28/07/2008	28/07/2008
16	Civil work LOA - Change order	05/08/2008	05/08/2008	05/08/2008	05/08/2008	05/08/2008
17	Invitation of quotations from DOE	18/12/2008	18/12/2008	18/12/2008	18/12/2008	18/12/2008
18	Stakeholder consultation meeting	16/01/2009	16/01/2009	16/01/2009	16/01/2009	16/01/2009
19	Submission of Documents for Host Country Approval	21/04/2009	21/04/2009	21/04/2009	21/04/2009	21/04/2009
20	Appointment of DOE for validation	09/06/2009	09/06/2009	09/06/2009	09/06/2009	09/06/2009
21	Meeting with the DNA for HCA	26/06/2009	26/06/2009	26/06/2009	26/06/2009	26/06/2009

Thus, it can be seen that a gap of 2 years has never been exceeded between documented evidence in accordance with paragraph 8 of "Guidelines on the demonstration and assessment of prior consideration of the CDM", Version 03 (EB49, Annex 22).

Explanation of how and why the project activity is additional in accordance with the baseline methodology

In accordance with paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in appendix B may be used for a small-scale CDM project activity if project participants are able to demonstrate that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in ***attachment A of Appendix B*** as stated below:

"Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) *Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher."*

The implementation of the hydropower based project activity is voluntary step undertaken by APGPL with no direct or indirect mandate by law. The project proponent was well aware of the various barriers associated with the implementation of the project. But it was felt that the availability of CDM revenues against a sale consideration of carbon credits generated due to project activity would help in overcoming these barriers. Some of the key barriers of significance are discussed below:

Investment barrier

Unlike fossil-fuel based power generating units, construction of a hydroelectric plant requires a long lead-time for site studies, hydrological studies, and environmental impact assessment. In the context of resource shortages and continuing power shortages, thermal projects (coal, liquid fuel and gas), which need a relatively short gestation period, have been getting priority in fund allotments. Further, the typical capital costs of installation for hydro power plants per MW of capacity is even higher in comparison with other forms of renewable energy generation e.g. from wind or biomass[5].

The project activity calls for an investment of around INR 568.5 million which translates to expenditure of around INR 107.27 million per MW of capacity installation. This figure is substantially high in comparison with the typical costs incurred for similar small hydro projects in the country i.e. INR 50-60 million/MW[6]. The capital intensive nature of the projects can be attributed to the necessity of overcoming problems such as lack of infrastructure, access to civil material like cement and steel, problems of transportation of material, and high cost of equipment and machinery due to low head available at site among others.

A large part of this exceptionally high cost of project activity can be attributed to the significantly higher cost of equipment and machinery being used. The low hydraulic head and high water discharge at the site has necessitated the employment of Kaplan turbines instead of the more economical options like Francis/Pelton turbines for power production. This fact has significant contribution in rendering the project cost inordinately high.

Due to greater flow of water, large diameter turbines are being employed in order to accommodate the huge amount of water through it. The cost of ancillaries increases proportionally with larger machines, as larger diameter turbines require bigger Draft Tubes, big runner chamber etc. This has resulted in increased steel requirements which has in turn led to increased estimated capital expenditure. Comparing Kaplan turbines to traditional Francis turbines, the diameter of 1 MW Kaplan turbine is approx 3500 mm for the water head in the range of 2 to 3 m, whereas the diameter of a 10 MW Francis Turbine is approx 1200 mm for the water head of 200 m. Hence the turbine cost per MW is relatively very high in the case of the proposed project activity.

[5] http://www.indiapower.org/images/finalpaper.pdf

[6] http://www.indiapower.org/images/finalpaper.pdf, http://www.indianwindpower.com/fin_benefit.html

Further, the speed of Kaplan machines is very low i.e. in the range of 60 to 100 rpm. Because of this an additional component, a speed increaser i.e. Gear Box is required which will further hike the project cost. The cost of electrical systems like Protection Systems, SCADA Systems, NGT, LAVT, RTCC panel for various turbines are standard and are not correlated with machine size. Thus the presence of greater number of such machines irrespective of the size of the units further enhances the per MW project cost. Investment in dedicated transmission lines for transmission of the generated energy also had to be made which also contributed to increased upfront investment.

Due to the high cost of the project, the project proponent has had to undergo considerable struggle while arranging for debt funding for the project activity. Initially, the company approached Indian Renewable Energy Development Agency Limited (IREDA) for the funding of the project. IREDA is a Public Limited Government Company under the administrative control of Ministry of New and Renewable Energy (MNRE) to promote, develop and extend financial assistance for renewable energy and energy efficiency/conservation projects. In a sense, IREDA is the main instrument for achieving the objectives of the government in renewable energy. IREDA operates a revolving fund for development and deployment of New and Renewable Sources of Energy and aims to give financial support to projects and schemes for generating electricity through these sources. It was a serious setback for the project proponent when IREDA, the leading organization providing efficient and effective financing in Renewable Energy and Energy conservation projects rejected the proposal for the project in accordance with their financing guidelines. IREDA evaluated the project and rejected the proposal citing the reason that the project cost was on the higher side. It may be worthwhile to mention that IREDA had been associated with the group in their past canal based renewal energy projects in the State of Punjab that are also registered under the Clean Development Mechanism[7].

In line with its continued efforts to arrange funds for the project, the project proponent approached Axis bank around March 2008. When Axis bank expressed its concern over the viability of the project, the project proponent cited his experience in realisation of CDM revenues for the other projects in Punjab, thereby emphasizing that due effort was going to be made to procure CDM revenues for the said project activity as well. The project proponent put forth his argument that CDM revenues would also aid in mitigating the constraints on cash flows from the project that may adversely impact the ability of APGPL to service debt. Subsequently, the Bank considered the issue of CDM benefits for working out the debt service capability and agreed to underwrite the term loan for the project. Without CDM revenues, it would not have been possible for APGPL to convince the bankers and arrange for the loan in order to achieve financial closure for the project activity.

Further Investment barrier has also been demonstrated in accordance with the guidance provided by CDM EB in its 35th Meeting (Annex 34 - Non-binding best practice examples to demonstrate additionality for SSC project activities), which states under investment barrier, "*Best practice examples include but are not limited to, the application of investment comparison analysis using a relevant financial indicator, application of a benchmark analysis or a simple cost analysis (where CDM is the only revenue stream such as end-use energy efficiency)*". From the above three best practice options under Investment Barrier, the project proponent has chosen to demonstrate additionality using benchmark analysis. This analysis has been selected and conducted in accordance with the 'Guidance on the Assessment of Investment Analysis' (Version 03). For this purpose, the post-tax Equity IRR has been chosen as the financial indicator and the Cost of Equity as the benchmark. The suitability of this indicator and benchmark is described below.

[7] http://cdm.unfccc.int/Projects/DB/TUEV-SUED1142612177.68/view and http://cdm.unfccc.int/Projects/DB/TUEV-SUED1142615287.88/view

The equity IRR has been chosen as the appropriate indicator in light of the fact that it represents the returns on investment from the point of view of the project proponent. Returns from a project activity need to be adequate enough to to provide substantial returns to shareholders i.e. it has to be worthy enough from the point of view of its investors, even after meeting the debt repayment requirements. Thus, in assessing the viability of a project, a potential invester should invest in the project only if the equity IRR is greater than the cost of equity as a benchmark.

As per guidance, the *financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer.* Thus, satisfying the above mentioned criteria, the project proponent has identified *Cost of Equity* as the benchmark which has been computed based on standard market parameters following the Capital Asset Pricing Model which also considers and incorporates the risk of the specific sector in its calculations.

Benchmark Analysis

The methodology for calculation of Cost of Equity, as described below, is a widely accepted method for calculating the cost of capital by both the finance community and the industry. The benchmark chosen for the project is the cost of equity financing representing the required return on capital by investors.

"Guidance on the Assessment of Investment Analysis" (EB 51, Annex 58), paragraph 13, states, "*In the cases of projects which could be developed by an entity other than the project participant, the benchmark should be based on publicly available data sources which can be clearly validated by the DOE. Such data sources may include local lending and borrowing rates, equity indices, or benchmarks determined by relevant national authorities"*. In accordance with this guidance, the benchmark Cost of Equity has been calculated taking values from publically available data sources, namely the websites of Reserve Bank of India, Bombay Stock Exchange and Bloomberg. Cost of equity has been calculated based on historical market returns of BSE Sensex, beta values for the sector have been referred from Bloomberg and Interest Rates on Central and State Government Dated Securities have been referred from Reserve bank of India records. Thus, all the data sources utilized for benchmark computation are publically available and can easily be validated by the DOE.

<u>*Cost of equity*</u>

"Guidance on the Assessment of Investment Analysis" (EB 51, Annex 58) Paragraph 14, states "*Internal company benchmarks/expected returns (including those used as the expected return on equity in the calculation of a weighted average cost of capital - WACC), should only be applied in cases where there is only one possible project developer and should be demonstrated to have been used for similar projects with similar risks, developed by the same company or, if the company is brand new, would have been used for similar projects in the same sector in the country/region."* As the project activity could have been implemented by more than one project developer, in accordance with this guidance, expected rate of return on equity **has not been taken** as an internal company benchmark, instead, it has been calculated based on standard market parameters considering the specific characters of the project type (using Capital Asset Pricing Model).

The Capital Asset Pricing Model (CAPM) approach having a clear theoretical foundation is a widely used methodology for determining the cost of equity and has come to dominate modern financial theory[8]. It asserts that the required rate of return on a risky asset is a function of the risk free rate of return (R_f) plus a risk premium that reflects the return on a well-diversified portfolio of risky assets over the risk free rate

[8] http://www.investopedia.com/articles/06/CAPM.asp?viewed=1

($R_m - R_f$), scaled by the "beta" of the risky asset which is a measure of the systematic risk of the risky asset relative to the market risk as shown below.

$$K_e = R_f + \beta \times (R_m - R_f)$$

Where:

K_e	=	Rate of return on equity capital
R_f	=	Risk-free rate of return
β	=	Beta
R_m-R_f	=	Market risk premium

The risk-free rate is the interest rate that is assumed can be obtained by investing in financial instruments with no default risk. The average yield on 10-year Government Securities has been taken to represent the risk free return. The risk free rate of return in the month of January 2006 has been considered and is taken as 7.15%[9].

Stock Index (BSE Sensex) has been used to represent the market return. The BSE SENSEX (SENSitive indEX), also called the "BSE 30", is a widely used market index in India and Asia. It consists of the largest and most actively traded stocks, representative of various sectors, on the Bombay Stock Exchange. The Bombay Stock Exchange (BSE) authorities review and modify its composition to make sure it reflects current market conditions. Prior to investment decision, the historical returns generated by BSE Sensex were studied and found to yield a return of 18.69%.

As per the "Guidance on the Assessment of Investment Analysis" (EB51, Annex 58) paragraph 15, "*Risk premiums applied in the determination of required returns on equity shall reflect the risk profile of the project activity being assessed, established according to national/international accounting principles. It is not considered reasonable to apply the rate general stock market returns as a risk premium for project activities that face a different risk profile than an investment in such indices*". In line with this guidance, general stock market returns have not been taken as a risk premium for the project activity as the risk profile of the project activity being assessed is different from the risk of the market portfolio represented by stock market indices. In order to incorporate the risk of the project activity sector in the calculation of risk premium, beta (β) value appropriate to the project activity has been chosen as described below. This beta, by accounting for the systematic risk by quantifying the sensitivity of the stocks of the companies representing a particular project type/sector with the market portfolio, incorporates the risk of a specific sector in the calculation of the risk premium.

Beta describes how the expected return of a stock is correlated to the return of the financial market and reflects the sensitivity of the company to market risk factors. For companies that are not listed, beta values of publically traded firms whose operations and risk profiles are as similar as possible to the project activity can be considered and used as a measure of the project activity's systematic risk. Therefore, beta values of the listed private companies engaged in similar business as the project activity (i.e. the power sector) at the start of the project activity estimated by regressing weekly returns on stock against local index, using 5 years of data if available, or otherwise the data since incorporation of the company have been utilized. The group of companies considered for determination of beta includes renewable as well as conventional power generating companies. From the perspective of a private investor, investments in thermal power plants are a safer option owing to easy availability of conventional fuel, experience in technology, ease of expansion of generating capacity, assured return on investment, and easy availability of finances. A study of the baseline scenario, indicating that over 79% of the power

[9] RBI Annual Report 2005-06 Page 68 Table 1.51 (http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/72286.pdf)

generation in the country is from non-renewable sources excluding nuclear energy[10], also reinforces the fact that generation from non-renewable sources provides a more attractive and assured source of return as compared to investments in renewable energy sources. Hence it is assumed that such private companies with significant investments in non-renewable energy projects face lower risk as compared to renewable energy based power projects and hence the value of beta for such companies should also be lower. Thus, as the use of the beta value for companies with significant investment in non renewable power projects is representative of the returns generated in the baseline scenario and is also conservative, inclusion of the same has been considered appropriate for the analysis.

However, at the time that APGPL took the decision to invest in the project, there were some power companies that were recently listed and hence did not have sufficient historical data for calculation of Beta. The following companies have thus been excluded due to lack of sufficient historical data as they were listed close to or after 03rd February 2006 (date of investment decision):

S. No.	Company	Date of Listing	Remarks
1.	Jaiprakash Hydro	18th April, 2005	Insufficient trading data available
2.	NTPC	5th November, 2004	Insufficient trading data available
3.	GVK Power	27th February, 2006	Listed post investment decision
4.	LITL	27th November, 2006	Listed post investment decision
5.	Torrent Power	28th November, 2006	Listed post investment decision

The equity betas for the power sector companies (having sufficient historical data) considered provide an estimated beta for the power sector. Beta values of individual companies have been sourced from Bloomberg and all the companies are listed on the Bombay Stock Exchange. The table below summarizes the equity beta values:

Company Name	Equity Beta
Tata Power	1.098
Reliance Infrastructure	0.765
BF Utilities	1.316
Neyveli Lignite	1.240
CESC	1.299
Gujarat Inds Power Co Ltd	1.234
Average	**1.159**

Source: Bloomberg[11]

The measured equity beta for a particular firm relates to the unique capital structure of that firm and that a change in the capital structure will change the degree of financial risk borne by the equity holders and hence the equity beta. Since financial leverage can vary across industries, countries and firms, and, furthermore, financial leverage is a determinant of beta, it is common to de-lever (i.e. stripping out the gearing component) comparable betas to arrive at an un-levered beta then to re-lever at the target financial leverage considered appropriate for the business in question. The asset beta (which is the equity beta that would apply if the assets were financed entirely with equity) is obtained with the following formula:

[10] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

[11] The beta value used, are the regression betas calculated by Bloomberg based on periodic stock returns

Modigliani - Miller Formula: $\beta_{asset} = \frac{\beta_{equity}}{\left(1+(1-t)\cdot\frac{D}{E}\right)}$

Where β_{asset} corresponds to the un-levered β and the β_{equity} to the levered β.

The following table illustrates the asset beta values of the companies estimated using the above formula:

Company Name	Asset Beta (Unlevered)
Tata Power	0.78
Reliance Infrastructure	0.51
BF Utilities	Company had net loss for the year 2006[12]
Neyveli Lignite	1.11
CESC	0.88
Gujarat Inds Power Co Ltd	0.86
Average	**0.828**

The average asset beta of companies engaged in power sector is thus 0.828 and the same has been used to estimate the benchmark cost of equity. Since the un-levered or asset beta is the least and most conservative beta (as opposed to re-levered beta and equity beta), the same has been chosen as a conservative estimate of the risk for the power sector.

Market Risk Premium
= 18.69% - 7.15%
= 11.54%

Rate of return on equity or cost of equity benchmark is

$$K_e = R_f + \beta \times (R_m - R_f)$$
= 7.15% + 0.828 x 11.54%
= 16.70%

Hence the benchmark Cost of equity for companies engaged in similar business as that of the project activity is 16.70%.

IRR Analysis

The IRR analysis has been carried out in accordance with the "Guidance on the Assessment of Investment Analysis" (EB 51, Annex 58) Paragraph 3, which states that for carrying out IRR analysis, "*Both project IRR and equity IRR calculations shall as a preference reflect the period of expected operation of the underlying project activity (technical lifetime), or - if a shorter period is chosen - include the fair value of the project activity assets at the end of the assessment period*". The equity IRR without CDM revenue has thus been computed in accordance with this guideline by considering a fair value of the assets as well as recovery of the working capital at the end of the assessment period. It was found that the Internal Rate of Return (IRR) of the project activity is lower than what would make the project investment worthwhile. Further, it is to be noted that at the time of investment decision, the tariff available to the project proponent was INR 3.49 per kWh with no escalation as per the old NRSE Policy of 2001. The same was also considered in the feasibility report prepared by Pentaflo Hydro Engineers which was the basis for

[12] http://www.moneycontrol.com/stocks/company_info/directors_report.php?sc_did=BFU

investment decision. However, the new tariff structure (as per NRSE policy 2006) has been taken into consideration while calculating IRR so as to result in a more conservative estimate.

The following assumptions have been taken for IRR computation:

Project Cost

As per Feasibility Report dated January 2006

Particulars	Khanpur	Sudhar	Akhara	Gholian	Chanowal	APGPL
Land & Site Development	11	10	15	8	7	52
Civil works	303	341	341	217	217	1418
Electro-Mechanical Works	619	637	566	436	420	2678
Hydro-Mechanical Works	38	38	38	38	38	190
Transmission line Works	19	15	23	11	12	80
Engineering and Consultancy	17	17	18	18	18	87
Project Management Costs	88	90	89	83	83	433
Contingency	82	86	82	61	60	370
Interest During construction	84	88	83	62	61	378
Total Costs	**1261**	**1322**	**1254**	**934**	**914**	**5685**

Assumptions for IRR Computation								
Particulars	**Units**	**Khanpur**	**Sudhar**	**Akhara**	**Gholian**	**Chanowal**	**APGPL**	**Source**
Installed Capacity	MW	1.10	1.40	1.10	0.80	0.90	5.30	Feasibility Report dated January 2006
No. of Sites		1	1	1	1	1	5	
Design Energy	x 100,000 kWh	68.30	85.90	67.80	52.40	51.10	325.30	
Capacity Index Achieved	%	90%	90%	90%	90%	90%	90%	
Net Saleable Energy	x 100,000 kWh	61.47	77.31	61.02	47.16	45.99	292.95	Calculated
Effective Plant Load Factor	%	63.79%	63.04%	63.33%	67.29%	58.33%	63.10%	Calculated
Capital Cost	x INR 100,000	1261	1322	1254	934	914	5685	Feasibility report dated January 2006
Tariff								
- Tariff for 2010-11	INR/kWh	3.92	3.92	3.92	3.92	3.92	3.92	PSERC directive dated 13/12/2007 (http://www.pserc.nic.in/pages/NRSE_orders.html)
- Tariff for 2011-12 onwards	INR/kWh	4.04	4.04	4.04	4.04	4.04	4.04	
O&M Expenses								
- O&M Charges (% of project cost)	%	4%	4%	4%	4%	4%	4%	Feasibility Report dated January 2006 (O&M expenses are conservative as compared to 5% of project cost considered in the UERC Tariff Regulations, 2008[13])
- Escalation on O&M	%	5%	5%	5%	5%	5%	5%	
- Insurance (% of project cost)	%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	
- Annual Mill Channel Compensation	x INR 100,000	10.35	10.35	10.35	10.35	10.35	51.74	
- Cess on Water	INR/kWh	0.02	0.02	0.02	0.02	0.02	0.02	
Debt Parameters								
- Quantum of Debt financing	%	75%	75%	75%	75%	75%	75%	Feasibility Report dated January 2006 and IREDA booklet
- Amount of Debt	x INR 100,000	946	992	941	700	685	4264	
- Repayment Period	years	10	10	10	10	10	10	
- Interest on term loan	%	12.25%	12.25%	12.25%	12.25%	12.25%	12.25%	

[13] UERC (Tariff and Other Terms for Supply of Electricity from Non-conventional and Renewable Energy Sources) Regulations, 2008 Page 22 Para 26 (http://www.uerc.in/Rules%20and%20regulation/UERCRegulations/Regulations2008/English%20Regulations%202008/UERC_%20non%20conventional%20&%20Renewable%20Energy%20Sources_%20Regulation08.pdf)

Working Capital								
- O&M Expenses	month	1	1	1	1	1	1	Feasibility Report dated January 2006
- Receivables	month	2	2	2	2	2	2	
- Interest on working capital	%	13.25%	13.25%	13.25%	13.25%	13.25%	13.25%	
Taxation								
- Fringe Benefit Tax								
O&M expenses in the ambit of FBT	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	Feasibility Report dated January 2006
O&M expenses subject to FBT	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	
Rate of FBT	33.66%	33.66%	33.66%	33.66%	33.66%	33.66%	33.66%	Income Tax (IT) Act
- MAT	8.42%	8.42%	8.42%	8.42%	8.42%	8.42%	8.42%	
- Corporate Tax	33.66%	33.66%	33.66%	33.66%	33.66%	33.66%	33.66%	
Depreciation Rates								
Companies Act	%	3.40%	3.40%	3.40%	3.40%	3.40%	3.40%	Feasibility Report dated January 2006
IT Act	**%**	3.70%	3.70%	3.70%	3.70%	3.70%	3.70%	

Using the assumptions in the table above, the post-tax equity IRR for the project activity works out to be **10.25%** which is considerably lower than the benchmark rate of **16.70%** adopted by the project. This clearly demonstrates that the project activity is not very attractive as an investment option as the Equity IRR is even lower than the cost of equity adopted which is the bare minimum rate of return an investor would expect from a similar project. Thus, the project proponent is seeking CDM funding for the project to improve the viability of the project activity and justify investment in such an initiative.

Sensitivity analysis

In order to ascertain the magnitude of risk associated with the project activity a sensitivity analysis has been carried out, by varying the critical parameters of the project activity. In accordance with the "Guidance on Assessment of Investment Analysis" Version 03, Paragraph 17, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues have been subjected to reasonable variation. In accordance with Paragraph 18 of the same guidance, a range of +10% to -10% has been considered as the range of variation.

Base case	**10.25%**		***Comments***
	Decrease	***Increase***	
Variable Parameter	**10%**	**10%**	
Energy Generation	6.42%	14.44%	The energy generation figures for each sub-project has been determined in accordance with "Guidelines for the reporting and Validation of Plant Load Factors", Version 01 (EB48, Annex 11), option II Para 3 (b) which states that 'The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company)'. The PLF has thus been sourced from the feasibility report that has been prepared by a reputed third party engineering consultancy, Pentaflo Hydro Engineers that was contracted by APGPL. Hence, any increase in the energy generation figure beyond these values is considered unlikely.
Tariff	6.36%	14.43%	The tariff considered in the analysis has been determined based on PSERC directive related to the NRSE Policy 2006 which states that the tariff for the Mini/Micro Hydel Projects shall be INR 3.49 per kWh (Base year 2006-2007) with an annual escalation at the rate of 3% on yearly basis upto five years. Thereafter, no escalation will be allowed. Also, it may be noted that at the of investment decision the tariff available to the project proponent was INR 3.49 per kWh with no escalation as per the old NRSE Policy of 2001. The same was also considered in the feasibility report prepared by Pentaflo Hydro Engineers at the same time. However, the new tariff structure has been taken into consideration for a more conservative estimate

Base case	**10.25%**		***Comments***
	Decrease	***Increase***	
Variable Parameter	**10%**	**10%**	
			of the IRR. Any further enhancement in tariff for the project proponent is a remote possibility. If the project proponent approaches the commission individually for revision and escalation in tariff for the project activity, the probability of the same being granted is very low as by the end of escalation period, the project proponent would already have paid back substantial loan amount and would thus need to pay lower interest amounts to the bank. Thus, in view of the lessened financial burden on the project proponent, the commission is not likely to approve the plea for greater enhancement in tariff as an individual entity. Thus, an increase of 10% in tariff rate is considered a highly improbable scenario.
Capital Cost	14.71%	6.91%	The capital cost primarily comprises of the cost of plant and machinery, land and civil works. The cost of civil, hydro-mechanical and electro-mechanical works together constitute more than 75% of the total project cost. Since the contracts for these works have already been placed, therefore no variation in their price can be expected. Further, the cost of land and civil works is also only expected to increase due to the rising inflation in the country as well as the upward trend in prices of Iron and Steel. Thus, taking these factors into consideration, a decrease of 10% in capital cost is not a plausible scenario.
O&M Cost	11.36%	9.13%	It can be observed that even with a decrease of O&M costs by 10% the IRR does not cross the benchmark.

The results of the sensitivity analysis clearly illustrate that even with variation in critical parameters of the project activity, the equity IRR remains lower than the benchmark cost of equity of 16.70%.

The above discussion clearly demonstrates that the project activity faces investment barrier and would not have been undertaken without CDM. In the absence of the project activity, equivalent amount of electricity would have been generated in the regional electricity grid which is fossil fuel dominated which would have led to higher greenhouse gas emissions. Hence, according to attachment A of Appendix B of the simplified modalities and procedures for small scale CDM project activities, the project activity is additional.

Other Barriers:

Availability of water in the proposed canal is directly dependent on the requirements of irrigation and drinking water demand of the local populace as these demands dictate the quantum of releases from the

Bhakra Dam which feeds the Abohar canal. The water in the canal falls under the jurisdiction of the irrigation department of the state of Punjab and hence its availability is under the absolute control of this department. As a custom, the water in the canal is only made available against the availability of water at the dam site and the irrigation requirements of the farmers. Following the path from the dam upstream of the project site up till the project site, there are several branch canals which divert water for irrigation purposes in the region. In case irrigation patterns upstream of the project site change due to local pressures, water availability at the project site for power generation will be affected. Thus, the project activity faces the risk of reduced water availability and restriction in the generation capacity of the Plant. From the available irrigation records and measurements carried out by the Promoter, the discharge data for each of the five sites was computed for a period of five years (1995-1999). It was seen and confirmed from the records that the discharge pattern of the canal changes gradually over a period of time due to the change in cropping pattern.

Apart from irrigation demand patterns, hydro electric project performance in the canal is also dependent on the rainfall in the catchment area of the dam. Citing from past experience, rainfall in the catchment area of dam is not consistent, which can be expected to affect power generation from the project. Although sufficient head is available for power generation, due to uncertainty in the hydrology, the power projections may not represent the true situation, which is a barrier for private investors.

Additionally, during the monsoons, the water upstream of the parent stream gets diverted for electricity generation at the dam itself. Adding to that, the water requirement of the farmers also reduces during good showers, which drastically reduces water discharge into the canal. This was a grave issue for the investor and could not be ignored during project conceptualization. Maintenance and repair work in the canal necessitating shutdowns and reduced water discharge, further increases risk associated with the generation of adequate returns to justify investment in such an initiative.

In view of the above described critical issues surrounding the success of the HPP, equipped with prior experience and awareness related to realization of CDM revenue, the project proponent decided to implement the project activity after considering CDM revenue as a decisive input to establish viability and offset losses to be incurred by the HPP due to the aforementioned risks,.

Risks anticipated during construction

Critical civil and mechanical works to commission the project include (a) dismantling of canal banks and join bypass with canal, (b) Installation of Main Canal Gates, (c) Remodeling of canal gates and reinstallation of the gates after incorporation of automation, (d) Bed and side lining of the canal on the upstream (head race side) and downstream (tail race side) and (e) Construction of new fall and gate structure requires. The aforesaid works normally require almost 2-3 months time to be completed during which the canal is required to be free of water. This is termed as canal closure period.

The control of discharge in the canal is administered by Punjab Irrigation Department and the developers have to submit and application to avail the canal closure to carry out aforesaid works. Since, the canal is primarily designed for irrigation and drinking water supply purposes, it is difficult to avail canal closure for such prolonged period. Punjab Irrigation Department while according approval to canal closure applications assigns the highest priority to the concerns of the local population. Normally, the canal closure is awarded for a period of 21-30 days. The developers have to carry out the aforesaid works during this short period. This involves outlay of additional cost and resources. The contractors are requested to carry out work round the clock to ensure that the work is completed in time for which they charge higher than usual prices. If the developer fails to complete all the aforesaid critical activities during the stipulated canal closure period, the commissioning of the projects get delayed by about 4-6 months till the time a fresh canal closure is obtained. Thus, clearly, the project proponent is having to

contend with considerable risks during project construction which may delay the commissioning of the project and result in cost overruns, which would further strain the financials of the project.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Baseline emissions

$$BE_y = EG_{BL,y} * EF_{CO_2}$$

Where:

BE_y	=	Baseline Emissions in year y (tCO_2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,grid,y}$	=	CO_2 Emission Factor in year y (t CO_2e/kWh)

According to the methodology AMS.I.D, baseline emissions for the project activity is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2e/kWh) calculated in a transparent and conservative manner as:

A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodological "Tool to calculate the emission factor for an electricity system" – Annex 12, version 02.

Each step that is followed to determine the baseline emissions is explained as per the "**Tool to calculate the emission factor for an electricity system**".

Step 1: **Identify the relevant electric power system**

As explained in Step 2 of Section B.4 above, NEWNE Regional Grid has been identified as the relevant electric power system in this case.

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

The project participant has chosen Option I for the calculation of the operating and build margin emission factor i.e. off-grid power plants are not being included in the calculation.

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

Version 02 of "Tool to calculate the emission factor for an electricity system" provides four options for calculating the operating margin emission factor ($EF_{grid, OM, y}$), and guidance for choosing the option for the corresponding project activity. The options are:

a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch Data Analysis OM, or
d) Average OM.

The tool does not rely on any one method as a preferable methodological choice and states that any of four methods can be used. In this case, simple OM method has been chosen to calculate the operating margin emission factor ($EF_{grid, OM, y}$).

The choice of using this option for calculating the operating margin emission factor depends on the generation of electricity from low cost/must run sources. Simple OM method (option a) can be used only if low-cost/must-run resources constitute less than 50% of total grid generation in:

1) Average of the five most recent years, or
2) Based on long-term averages for hydroelectricity production.

In the context of Version 02 of the "Tool to calculate the emission factor for an electricity system", low cost/must run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

	2003-04	**2004-05**	**2005-06**	**2006-07**	**2007-08**
NEWNE	17.4%	16.8%	18.0%	18.5%	19.0%
South	16.2%	21.6%	27.0%	28.3%	27.1%
India	17.1%	18.0%	20.1%	20.9%	21.0%

Ref: CO_2 Baseline Database for the Indian Power Sector – CEA, Version 3 & 4

Percentage of total grid generation by low cost/must run plants in the NEWNE grid (on the basis of average of five most recent years) = 17.94 %

The calculation above shows that the generation from low-cost/must-run resources constitutes less than 50% of total grid generation; hence usage of the Simple OM method for the project activity is justified.

In terms of data vintage, the Simple OM emission factor can be calculated using either of the two following data vintages for years(s) y:

- *Ex ante option: 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,*

Or

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

In this case, *Ex ante* option has been chosen for estimating the simple OM emission factor wherein as described above, 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) during the crediting period will be undertaken, without requirement to monitor and recalculate the emission factor.

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

Among the aforesaid four options, the **Simple Operating Margin** is used for the project activity as justified above. The simple OM emission factor is calculated based on the net electricity generation of each power unit and a CO_2 emission factor for each power unit, as follows:

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

Where:

$EF_{grid,OMsimple,,y}$	=	Simple operating margin CO_2 emission factor of in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	=	All power units serving the grid in year y except low-cost / must-run power units
y	=	The relevant year as per the data vintage chosen in step 3 i.e. the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

Determination of $EF_{EL,m,y}$

The emission factor of each power unit m has been determined as follows:

$$EF_{EL,m,y} = \frac{\sum_m FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}}$$

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power unit m 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)
$EG_{m,y}$	=	Net electricity generated and delivered to the grid by power unit m in year y (MWh)
m	=	All power units serving the grid in year y except low-cost / must-run power units
i	=	All fossil fuel types combusted in power plant / unit m in year y
y	=	The relevant year as per the data vintage chosen in step 3 i.e. the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

Determination of $EG_{m,y}$

Since, the calculations consider only grid power plants, $EG_{m,y}$ should has been determined as per the data provided by the Central Electricity Authority (CEA) CO_2 Baseline Database for the Indian Power Sector.

In India, the Central Electricity Authority (CEA) has estimated the baseline emission factor for the power sector. This data has also been endorsed by the DNA and is the most authentic information available in the public domain. The details of same can be found on CEA website at http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm.

Operating Margin Estimation for NEWNE Grid (tCO_2 / MWh)		
Year	**Operating Margin**	**Net Generation excluding low-**

	(tCO_2/MWh)	cost/must-run (GWh)
2005-06	1.0195	359,271
2006-07	1.0083	379,471
2007-08	0.9992	401,642
Generation Weighted Average OM	**1.0086 tCO_2/MWh**	

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

The sample group of power units m used to calculate the build margin consists of either:

a) The set of five power plants that have been built most recently, or
b) The set of power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

From these two options, the sample group that comprises the larger annual generation should be chosen.

Since in India, the installed capacity and corresponding annual generation from power plants is quite high, the sample group containing 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 comprise the sample group with the larger annual generation. Thus, the sample group *m* consisting of option (b) is used for the estimation of build margin.

In terms of vintage of data, project participants can choose between one of the following two options:

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

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

Option 1 has been chosen in this case.

Step 6: Calculate the build margin emission factor

The Build Margin emission factor ($EF_{gid,\ BM,\ y}$) is calculated as 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:

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

Where:

$EF_{grid,\ BM,\ y}$ = Build margin CO_2 emission factor in year y (tCO_2 / MWh)

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

Central Electricity Authority (CEA) has estimated the Build Margin emission factor $EF_{grid, BM, y}$ is based on the most recent information available on the plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20 % of the system generation and that have been built most recently. In this case, CEA data has been used as:

Build Margin Estimation for NEWNE Grid (tCO_2 / MWh)	
BM ($EF_{grid, BM, y}$), 2007-08	0.5977

Step 7: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as the weighted average of the Operating Margin emission factor ($EF_{grid, OM, y}$) and the Build Margin emission factor ($EF_{grid, BM, y}$):

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

Where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{grid, OM, y}$ and $EF_{grid, BM, y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh.

For wind and solar projects, the default weights are as follows: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature).

As aforesaid, Central Electricity Authority (CEA) has calculated the baseline emission factors for the various regional grids in India according to the formulas specified above. As this is the most authentic information available in the public domain, the baseline emission factor used in the calculation of baseline emissions for the proposed project activity is being referred from the same for transparency and conservativeness[14].

Combined Margin Estimation for NEWNE Grid (tCO_2 / MWh)	
Average OM ($EF_{grid, OM,y}$)	**1.0086**
BM, 2007-08 ($EF_{grid, BM, y}$)	**0.5977**
Combined Margin ($EF_{grid, CM,y}$)	**0.8031**

Project emissions

Since the project is a renewable energy power project, emissions due to the project activity within the project boundary are not envisaged. Since the project activity is a canal based scheme, no reservoirs would be created leading to methane emissions. Further, according to Paragraph 77 of the "Clean Development Mechanism Validation And Verification Manual" Version 01.2, EB 55, greenhouse gas emissions occurring within the proposed CDM project activity boundary as a result of the implementation of the proposed CDM project activity which do not contribute more than 1% of the overall expected average annual emissions reductions and are not addressed by the applied methodology do not have to be considered.

Thus, $PE_y = 0$

[14] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Leakage estimations

As per the Paragraph 20 of the methodology AMS I.D. (Version 16), *"If the energy generating equipment is transferred from another activity, leakage is to be considered."* Since the project activity does not involve either the transfer of energy generating equipment from another activity or the transfer of the existing equipment to another activity, hence there are no emissions due to leakages in the project activity.

Emission Reductions

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (LE_y), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/y).
BE_y = Baseline Emissions in year y (t CO_2e/y).
PE_y = Project emissions in year y (t CO_2/y).
LE_y = Leakage emissions in year y (t CO_2/y).

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

Data / Parameter:	**EF_{grid}/EF_{CM}**
Data unit:	tCO_2/MWh
Description:	Ex- ante CO_2 emission factor for the NEWNE regional grid
Source of data used:	Baseline Carbon Dioxide Emission Database, version 4.0, given by Central Electricity Authority, CEA
Value applied:	0.8031
Justification of the choice of data or description of measurement methods and procedures actually applied :	The ex-ante emission factor is calculated as combined margin using the "Tool to calculate the emission factor for an electricity system" Version 02 and the data provided by CEA which is a statutory organisation under Ministry of Power which collects and records the data concerning the generation, transmission, trading, distribution and utilization of electricity.
Any comment:	This value has been fixed ex-ante. Reference: www.cea.nic.in

Data / Parameter:	**EF_{OM}**
Data unit:	tCO_2/MWh
Description:	Ex-ante Simple operating margin for calculation of grid emission factor
Source of data used:	Baseline Carbon Dioxide Emission Database, version 4.0, given by Central Electricity Authority, CEA
Value applied:	1.0086
Justification of the choice of data or description of measurement methods and procedures actually applied :	The ex-ante simple operating margin has been calculated as the full generation weighted average for most recent three years using the "Tool to calculate the emission factor for an electricity system" Version 02 and the data provided by CEA which is a statutory organisation under Ministry of Power which collects and records the data concerning the generation, transmission, trading, distribution and utilization of electricity.

Any comment:	This value has been fixed ex-ante. Reference: www.cea.nic.in

Data / Parameter:	**EF_{BM}**
Data unit:	tCO_2/MWh
Description:	Ex-ante Build margin for calculation of ex-ante grid emission factor
Source of data used:	Baseline Carbon Dioxide Emission Database, version 4.0, given by Central Electricity Authority, CEA
Value applied:	0.5977
Justification of the choice of data or description of measurement methods and procedures actually applied :	The ex-ante build margin has been calculated based on the most recent information available on plants using using the "Tool to calculate the emission factor for an electricity system" Version 02 and the data provided by CEA which is a statutory organisation under Ministry of Power which collects and records the data concerning the generation, transmission, trading, distribution and utilization of electricity.
Any comment:	This value has been fixed ex-ante. Reference: www.cea.nic.in

B.6.3 Ex-ante calculation of emission reductions:

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Baseline emissions

The Feasibility Report for the project activity mentions the following net electricity exported values in accordance with the hydrological studies of the respective locations:

Net saleable electricity generation from all the projects= 29,295 MWh

Grid Emission factor = 0.8031 tCO_2/MWh

BE_y = 23,527 tCO_2

Project Emissions: There will be no project emissions as the project is using renewable hydroelectric power.

Leakages: As per the Paragraph 20 of the methodology AMS I.D (Version 16) leakages is to be considered if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity. This does not apply to the project activity.

Emission reductions

$ER_y = BE_y - PE_y - LE_y$
$ER_y = BE_y$
ER_y = 23,527 tCO_2

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

>>

Year	Estimation of Project activity emissions (tCO_2e)	Estimation of Baseline emissions (tCO_2e)	Estimation of Leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
Year 1	0	23,527	0	23,527
Year 2	0	23,527	0	23,527
Year 3	0	23,527	0	23,527

Year 4	0	23,527	0	23,527
Year 5	0	23,527	0	23,527
Year 6	0	23,527	0	23,527
Year 7	0	23,527	0	23,527
Year 8	0	23,527	0	23,527
Year 9	0	23,527	0	23,527
Year 10	0	23,527	0	23,527
TOTAL	**0**	**235,270**	**0**	**235,270**

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

B.7.1 Data and parameters monitored:

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Data / Parameter:	**$EG_{export,y}$**
Data unit:	MWh
Description:	Electricity exported by the project activity in year y
Source of data to be used:	Energy Meters at MHP Khanpur, Sudhar, Akhara, Gholian and Channowal
Value of data	The same shall be monitored ex-post
Description of measurement methods and procedures to be applied:	Monitoring frequency: Reading: Continuous Recording: Monthly The electricity exported by the project activity would be monitored through monthly joint meter readings of energy meters, each of accuracy class 0.5 or better installed at grid interconnection point of each of the five projects i.e. MHP Khanpur, Sudhar, Akhara, Gholian and Channowal.
QA/QC procedures to be applied:	The energy meters would be checked for accuracy and calibrated once in two years as per the applicable Punjab State Grid Code[15]. This is in accordance with the general guidance on monitoring in the Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity categories which states that monitoring equipment must be calibrated at least once in 3 years[16].
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**$EG_{Import,y}$**
Data unit:	MWh
Description:	Electricity imported by the project activity in year y
Source of data to be used:	Energy Meters at MHP Khanpur, Sudhar, Akhara, Gholian and Channowal
Value of data	The same shall be monitored ex-post
Description of measurement methods and procedures to be	Monitoring frequency: Reading: Continuous Recording: Monthly

[15] Punjab State Grid Code: Section 17.8 (iii) (http://pserc.nic.in/pages/state_grid_code.html#section_17)

[16] https://cdm.unfccc.int/Panels/ssc_wg/SSCWG04_Repan_17_monitoring_guidelines.pdf

applied:	The electricity imported by the project activity would be monitored through monthly joint meter readings of energy meters, each of accuracy class 0.5 or better installed at grid interconnection point of each of the five sub-projects i.e. MHP Khanpur, Sudhar, Akhara, Gholian and Channowal.
QA/QC procedures to be applied:	The energy meters would be checked for accuracy and calibrated once in two years as per the applicable Punjab State Grid Code. This is in accordance with the general guidance on monitoring in the Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity categories which states that monitoring equipment must be calibrated at least once in 3 years.
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**$EG_{Net,y}$**
Data unit:	MWh
Description:	Net electricity exported to the Grid/Licencee in year y
Source of data to be used:	Monthly bills for net saleable electricity raised by APGPL for MHP Khanpur, Sudhar, Akhara, Gholian and Channowal.
Value of data	(Based on actual generation data). The same shall be calculated ex-post and CERs will be calculated at actual.
Description of measurement methods and procedures to be applied:	The net electricity exported to the grid/licencee would be calculated as the difference between the Energy exported and Energy imported from the Grid. These are monitored by joint meter readings by meters installed at the grid interconnection point every month and would be recorded monthly for each MHP Khanpur, Sudhar, Akhara, Gholian and Channowal. Based on the data recorded, monthly bills would be raised for payments against net saleable electricity. The same shall be considered as net electricity exported (EG_y) by the project activity, as mentioned in the monthly bills for calculation of emission reductions by the project activity.
QA/QC procedures to be applied:	The energy meters would be checked for accuracy and calibrated once in two years as per the applicable Punjab State Grid Code. This is in accordance with the general guidance on monitoring in the Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity categories which states that monitoring equipment must be calibrated at least once in 3 years.
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**$EG_{Gross,y}$**
Data unit:	MWh
Description:	Gross electricity generation by the project activity in year y
Source of data to be used:	Log books and plant records of MHP Khanpur, Sudhar, Akhara, Gholian and Channowal.
Value of data	The same shall be monitored ex-post
Description of measurement methods and procedures to be applied:	Monitoring frequency: Reading: Continuous Recording: Hourly The gross electricity generated by the project activity would be monitored

	through energy meters of accuracy class 0.5 or better installed in the plant and recorded in the plant log books by the supervisor (energy) on an hourly basis for each of the five sub-projects i.e. MHP Khanpur, Sudhar, Akhara, Gholian and Channowal. The recorded data would be signed and compiled by the shift in-charge at the end of each shift. A monthly report would be compiled by the CDM coordinator and forwarded to the senior management. This data is used for the purpose of cross verification of metered electricity export and import data.
QA/QC procedures to be applied:	The energy meters would be calibrated annually.
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**$EG_{Aux,y}$**
Data unit:	MWh
Description:	Auxiliary electricity consumption in year y
Source of data to be used:	Log books and plant records of MHP Khanpur, Sudhar, Akhara, Gholian and Channowal
Value of data	The same shall be monitored ex-post.
Description of measurement methods and procedures to be applied:	Monitoring frequency: Reading: Continuous Recording: Hourly The Auxiliary electricity consumption by the project activity would be monitored through energy meters of accuracy class 0.5 or better installed in the plant and recorded in the plant log books by the supervisor (energy) on an hourly basis for each of the five sub-projects i.e. MHP Khanpur, Sudhar, Akhara, Gholian and Channowal. The recorded data would be signed by the shift in-charge at the end of each shift. The compiled data would be forwarded to the CDM coordinator. A monthly report would be compiled by the CDM coordinator and forwarded to the senior management. This data is used for the purpose of cross verification of metered electricity export and import data.
QA/QC procedures to be applied:	The energy meters would be calibrated annually.
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

B.7.2 Description of the monitoring plan:

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Key project parameters affecting emission reductions:

Net Electricity supplied

The net electricity supplied to the grid/Licensee is the main parameter that affects the emission reduction calculations. The net electricity supplied to the grid/Licensee would be calculated as the difference between the electricity exported and electricity imported from the grid/Licensee. Electricity imported and exported would be monitored by meters installed at the grid interconnection point. Joint meter readings would be taken by representatives of grid/Licensee and APGPL every month and the same would be recorded. Based on this monitored data, monthly bills would be raised for payments to the state electricity utility/Licensee. The plant in-charge would maintain records of joint meter readings. The monthly bills

raised for payments against net saleable electricity to the grid would be archived and used for calculation of emission reductions.

Gross Electricity Generation

The gross electricity generated will be measured continuously by APGPL with energy meters installed at the power house.

Auxiliary consumption

The auxiliary consumption will be measured continuously by APGPL with energy meters installed at the power house.

The following principles would ensure the reliability of the monitoring parameters:

For calculating the net energy exported to the grid/Licensee, one main meter and one check meter will be maintained. For the purpose of billing and emission reduction calculations, the main meter reading would be used so long as the meter is found to be within prescribed limits of accuracy. In case the main meter is found to be outside the prescribed limits of accuracy, the check meter would be used for the purpose of billing and emission reduction calculations. Monthly joint meter reading of main meters would be taken and signed by authorized officials of APGPL and grid/Licensee every month. Records of this joint meter reading will be maintained by APGPL.

For the cross verification of the net electricity exported data used for emission reduction calculations, gross electricity generation and auxiliary consumption will be monitored and recorded continuously by the energy meters installed in the power house. The difference of the gross electricity generation and auxiliary consumption would be comparable with the net electricity exported after considering the transformation and transmission losses. At the end of each shift the recorded data would be reviewed and compiled by the shift in-charge. In case any irregularity is observed, the same would be reported to the concerned authority immediately.

The responsibility of reviewing, storing and archiving of information in a suitable manner lies with the plant in-charge who is also the CDM Team Leader. The plant in-charge (CDM Team Leader) will undertake periodic verifications and onsite inspections to ensure the quality and reliability of the data collected and would take necessary steps in case any abnormality is observed. The CDM Team Leader will be assisted by the Heads of Commercial & Finance, Civil Works and Electrical & Mechanical Department. The heads would in turn be assisted by the shift engineers in monitoring and archiving of data. The plant in charge will also review the data collected and suggest corrective actions wherever required to the CDM Coordinator who is the final reporting authority for the CDM Team.

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

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Date of completion of base line: DD/MM/YY: 21/04/2009

Name of person/entity determining the baseline: Abohar Power Generation Private Limited

(The entity is also a project participant listed in Annex 1 of this document)

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

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21/12/2007

According to EB 41, "*the start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity. This, for example, can be the date on which contracts have been signed for equipment or construction/operation services required for the project activity*". In accordance with this definition the date of execution of contract for supply of electromechanical works for the project activity has been taken as the start date of the project.

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

>>

35 years

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

C.2.1. Renewable crediting period

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

>>

NA

C.2.1.2. Length of the first crediting period:

>>

NA

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

01/06/2011
APGPL hereby confirms that the crediting period will not commence prior to the date of registration.

C.2.2.2. Length:

>>

10 years

SECTION D. Environmental impacts

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D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

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As per the recent notification[17] dated 14th September, 2006 of the Ministry of Environment and Forests (MoEF), Government of India regarding the requirement of Environmental Impact assessment (EIA), the hydro power projects with an installed capacity of less than 25 MW does not require to conduct an EIA. Hence EIA for the proposed project activity was not conducted. Further there are no negative impacts associated with the project activity since it uses the unutilised water in the canal to generate renewable electricity and does not involve any rehabilitation of local residents.

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

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Not applicable, refer D.1 above.

[17] http://envfor.nic.in/legis/eia/so1533.pdf

SECTION E. Stakeholders' comments

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

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The local stakeholders are defined as the public, including individuals, groups or communities, affected, or likely to be affected, by the proposed CDM project activity. APGPL identified the following stakeholders who are directly/indirectly affected:

- Local villagers and representative of village governing bodies
- Punjab State Electricity Board (PSEB)
- Punjab Energy Development Agency (PEDA)
- Punjab Pollution Control Board (PPCB)
- Department of Irrigation – Government of Punjab
- Financial institution
- Ministry of Environment & Forests (MoEF)

A description of roles of the stakeholders identified above is provided below:

Local villagers and representatives of village governing body

The varied sections of the local population, village panchayat and the elected body of representatives administering the region are a true representative of the local population. Hence, their consents / permissions to set the project are necessary. APGPL organised a stakeholder consultation meeting on 16th January 2009 to apprise the local stakeholders on the environmental and social impacts of the project activity and discuss their concerns regarding the project activity.

Punjab Pollution Control Board

Punjab Pollution Control Board has been entrusted the task of implementation of environmental laws in the State of Punjab. A no objection certificate has been provided by PPCB to APGPL for setting up of the hydro power project.

Punjab Energy Development Agency (PEDA)

PEDA is a nodal agency for promotion and development of non-conventional and renewable energy programs or projects, Energy technologies programs/projects and Promotion and development of new and emerging technology areas such as co-generation in the State of Punjab.

APGPL's effort in implementing the hydro power project is in line with the goals and targets of the said agency and hence supported by them. APGPL and PEDA have entered into a tri partite agreement which allows APGPL to set up mini/micro hydel power generation projects.

Punjab state Electricity Board (PSEB)

PSEB is a statutory body formed under the Electricity Supply Act.1948, for constructing and maintaining the Transmission and Distribution system for providing services to the various categories of electricity consumers in the state of Punjab.

Department of Irrigation – Government of Punjab

The functions of the Irrigation and Power Department, as enunciated in the Punjab Government Rules of Business, are mainly operation and upkeep of the irrigation system of the province and planning, prioritization and implementation of maintenance works.

Ministry of Environment & Forests (MoEF)

The Ministry of Environment & Forests is the nodal agency in the administrative structure of the Central Government, for the planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. The principal activities undertaken by Ministry of Environment & Forests consist of conservation & survey of flora, fauna, forests and Wildlife, prevention & control of pollution, afforestation & regeneration of degraded areas and protection of environment, in the frame work of legislations. MoEF has provided approval for diversion of forest land to implement APGPL project activity.

Financial Institution

The financial institution which provides funding for the implementation of the project activity is directly involved and hence has been identified as a relevant stakeholder.

APGPL organized a stakeholder consultation meeting at Khanpur village on 16th January, 2009. A formal invitation letter (citing the date, time and venue of the said consultative meeting) was sent to the stakeholders identified above, to attend the meeting and communicate any suggestions / concerns regarding the project activity. Further, a specialised questionnaire was prepared and distributed among the attendees of the stakeholder consultation meeting to obtain their independent comments/views with respect to the proposed project activity. The attendance record of the stakeholders present in the meeting is provided in Appendix 1.

Thus APGPL had ensured involvement of all the stakeholders associated with the project activity well before the implementation of the proposed project activity. An account of the public stakeholder meeting is detailed in the sections below.

E.2. Summary of the comments received:

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On 16th January 2009, the meeting was met with a huge response from the stakeholders and more than a hundred participants attended the meeting. Among the participants were the representatives from the following:

a) Local inhabitants
b) Village governing bodies
c) Religious organisations
d) Punjab State Electricity Board (PSEB)
e) Regional educational institutions
f) Local political party
g) Punjab Energy Development Agency (PEDA)
h) Department of Irrigation – Government of Punjab
i) Financial institution – Axis Bank
j) Abohar Power Generation Private Limited (APGPL)

The meeting was presided over by Mr Pramod Arora of APGPL who described the project activity in detail along with its impact on the environment and development of local community. He also emphasised the importance of CDM for the proposed project activity and highlighted the impacts of climate change on various sectors. His views were corroborated by the representatives of PSEB, PEDA, local political party and Department of Irrigation among the others. They emphasised on utilisation of clean energy to

meet the ever increasing demand of energy in the region and the country as a whole. The development of a region is largely dependent on the availability of energy and hence development of a renewable source of energy supply ensures sustainable development of the region. It was clarified to the participants in the meeting that the utilisation of water from the canal to generate electricity would be non consumptive in nature and would not decrease the quality as well as availability of water for irrigation.

The stakeholders appreciated the sincere efforts of APGPL for the development of the region in and around the proposed project activity. The attendance record of the stakeholders present in the meeting is provided in Appendix 1. Detailed minutes of the meeting and photographs/video coverage are being provided separately.

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

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There were no adverse comments from the **s**takeholders.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Abohar Power Generation Private Limited
Street/P.O.Box:	--
Building:	B 37, Sector 1
City:	Noida
State/Region:	Uttar Pradesh
Postfix/ZIP:	201301
Country:	India
Telephone:	+91-95120-4621300
FAX:	+91-95120-4621333
E-Mail:	akagarwal@polyplex.com
URL:	--
Represented by:	--
Title:	Manager
Salutation:	Mr.
Last Name:	Agarwal
Middle Name:	Kumar
First Name:	Amit
Department:	Hydro
Mobile:	+91-9910107544
Direct FAX:	+91-95120-4621333
Direct tel:	--
Personal E-Mail:	akagarwal@polyplex.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no recourse to any public funding for the proposed project activity. The project proponent hereby confirms that there is no divergence of official development assistance to the proposed project activity.

Annex 3

BASELINE INFORMATION

Baseline Emission Factor (Combined Margin)

The Central Electricity Authority (CEA) under the Ministry of Power, Government of India, has estimated the Combined Margin emission factor for the NEWNE grid, the details of which (as explained in the PDD, section B.6.1) are available at the following website.
http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Combined Margin Estimation for NEWNE Grid (tCO_2 / MWh)	
Average OM ($EF_{grid, OM,y}$)	**1.0086**
BM, 2007-08 ($EF_{grid, BM, y}$**)**	**0.5977**
Combined Margin ($EF_{grid, CM,y}$)	**0.8031**

Annex 4

MONITORING INFORMATION

Monitoring plan has been detailed in section B.7.2

ABRAHA POWER GENERATION (P) LTD.
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STAKE HOLDER CONSULTATION MEETING

ABOHAR POWER GENERATION (P) LTD.

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ADDRESS	SIGNATURE
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3870 AD C(D) Ludhiana	[illegible] 16/1/09
AXIS BANK LTD., PHULLANWAL	[illegible]
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Kaddonwal	[illegible]
Dhum	[illegible]
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STAKEHOLDER CONSULTATION MEETING
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	Rulbeep, Sudhar	Ruldeep
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