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

CONTENTS

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:

>>
Abohar Branch Canal Based Small Hydro Project in Punjab, India.
Version: 01
Date: April 21, 2009

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.

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
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the party (ies) involved is required.		
Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party (ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

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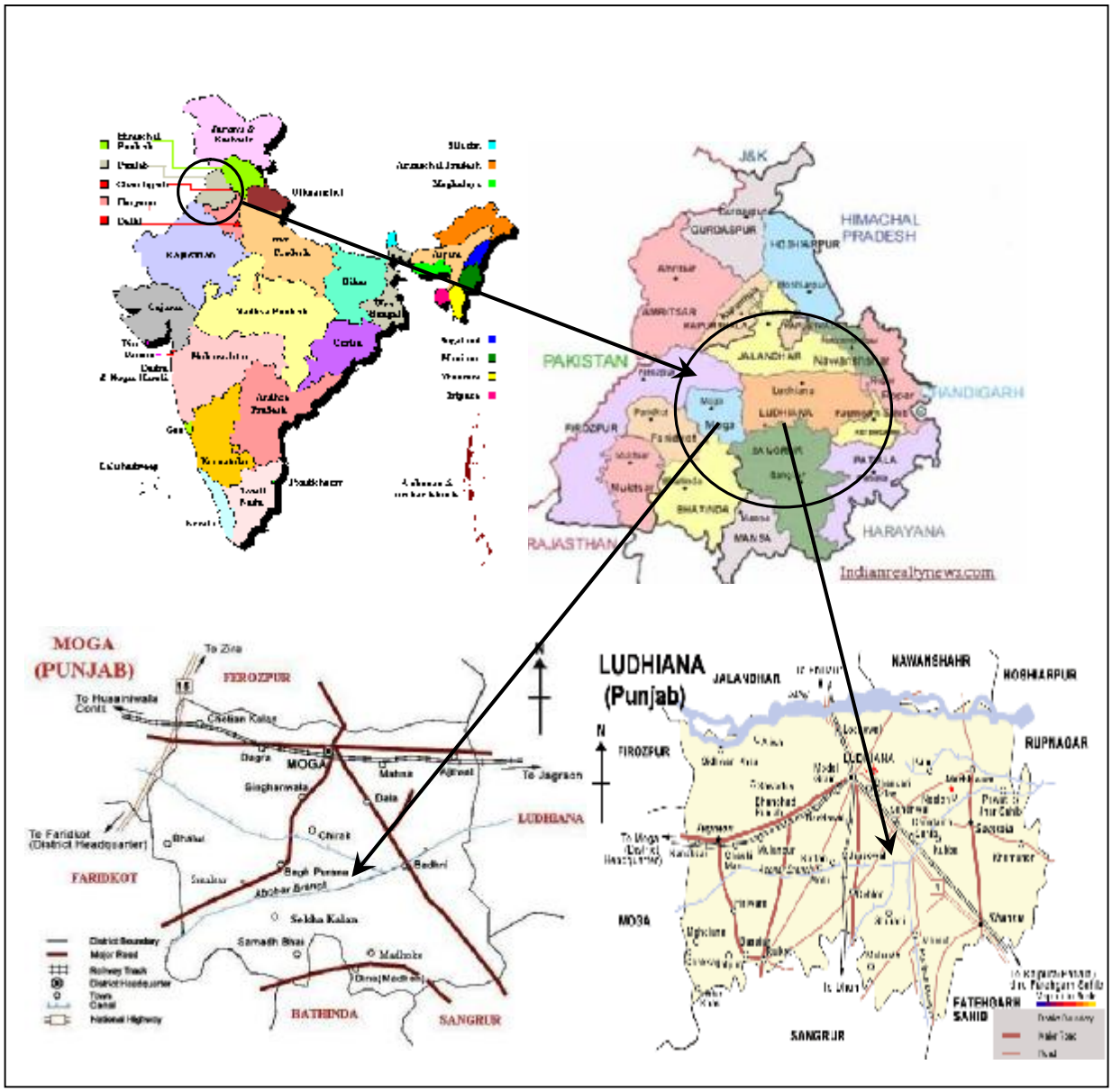
The proposed Project is located on the Abohar Branch Canal. The site locations of different sub-projects along the Abohar Branch Canal are given in the following table:

	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 **Longitude**	30˚ 57' N 75˚ 56' E	30˚ 57' N 75˚ 56' E	30˚ 57' N 75˚ 56' E	30˚ 57' N 75˚ 56' E	30˚ 57' N 75˚ 56' 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.


J&K
HIMACHAL PRADESH
PAKISTAN
CHANDIGARH
HARAYANA
RAJASTHAN
GURDASPUR
HOSHIARPUR
AMRITSAR
JALANDHAR
LUDHIANA
FIROZPUR
BHATINDA
MANSA
PATIALA
Indianrealtynews.com
MOGA
(PUNJAB)
FIROZPUR
FARIDKOT
LUDHIANA
BATHINDA
SANGRUR
To Jagraon
To Faridkot
(District Headquarter)
To Zira
LUDHIANA
(Punjab)
JALANDHAR
NAWANSHAHR
HOSHIARPUR
RUPNAGAR
FIROZPUR
MOGA
SANGRUR
FATEHGARH
SAHIB

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 14, EB 48**

Technology:

The technology employed for power generation in the mini hydroelectric plant consisting 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
Size(m)	Width 39.2 Depth 2.44	Width 36.73 Depth 2.26	Width 34.13 Depth 2.16	Width 28.35 Depth 1.94	Width 23.77 Depth 1.83
Lining details	Unlined Canal	Unlined Canal	Unlined Canal	Unlined Canal	Unlined Canal
Fall Structure	Reinforced Brick	Reinforced Brick	Reinforced Brick	Reinforced Brick	Reinforced Brick
Height of Fall(m)	2.01	2.56	2.07	2.62	3.20
Forebay and Intake					
Shape	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal
Size(m)	Width 20.6 Depth 2.44	Width 19.50 Depth 2.26	Width 19.16 Depth 2.16	Width 15 m Depth 1.94	Width 12 Depth 1.83
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)	550 +10 % overload	700 +10 % overload	550 +10 % overload	800 +10 % overload	900 +10 % overload

Type of Generator	Induction	Induction	Induction	Induction	Induction
Tailrace					
Shape	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal
Size	Width 20.6 Depth 2.29	Width 19.50 Depth 2.26	Width 19.16 Depth 2.06	Width 15 Depth 1.83	Width 12 Depth 1.524
Length	70	75	75	60	60
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
Size: Length(m) Width(m)	 10 8	 10 8	 10 8	 10 7	 10 7

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**
2010-11	23,307
2011-12	23,307
2012-13	23,307
2013-14	23,307
2014-15	23,307
2015-16	23,307
2016-17	23,307
2017-18	23,307
2018-19	23,307
2019-20	23,307
Total estimated reductions (tonnes of CO_2e)	**233,070**
Total number of crediting years	**10**
Annual average of the estimated reductions over the crediting period (tCO_2 e)	**23,307**

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 there is no divergence of Official Development Assistance (ODA) 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 another project in the same project category registered within the previous two years within 1 km of the project boundary of the proposed project activity. Thus, the project is not a debundled component of a large scale project activity. The project is unique and this is the only project owned by the investor on Abohar Branch canal.

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 14 has been used.

Title: "Grid connected renewable electricity generation".
Reference: AMS I D, Version 14, EB 48

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" 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 and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	The project activity is a renewable energy generation unit (a hydro electric power project) that supplies 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.
If the unit added has both renewable and non-renewable components (e.g.. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel1, the capacity of the entire unit shall not exceed the limit of 15MW.	The Proposed Project comprises of a number of canal based mini hydro units with installed capacity totaling to 5.30 MW and does not include any non renewable components. Further, being a hydro power project it does not involve any co-firing of fossil fuel. Thus, the project activity satisfies the given applicability condition.
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 is a Greenfield hydro power generation facility and does not involve addition of any hydro power generation unit at an existing hydro power generation facility.
Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	The project activity is a Greenfield hydro power generation facility 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.

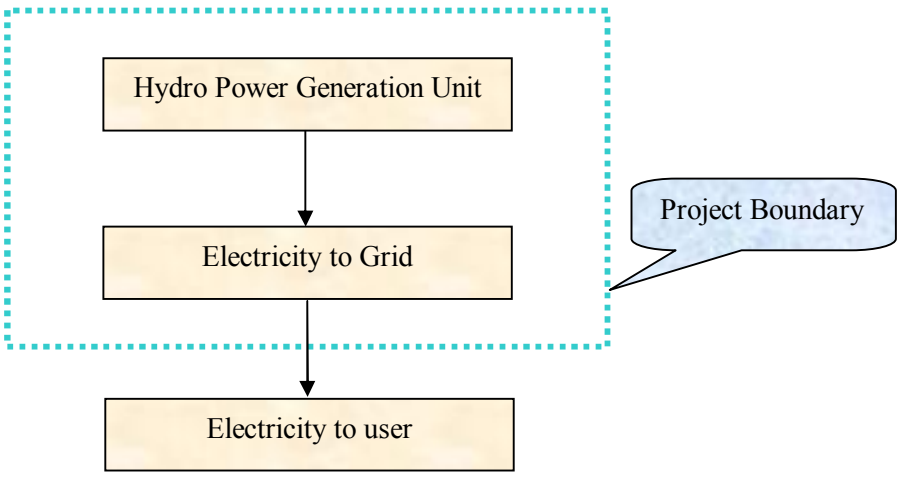
The project activity i.e. all five projects at Khanpur, Sudhar, Gholian, Channowal and Akhara is located on various falls downstream on the Abohar irrigation Branch Canal.

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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"Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories" Type I.D, version 14, EB 36 details the baseline for projects applicable under this category in paragraphs 7, 8, 9, 10 and 11.

Paragraphs 7, 8, 10 & 11 of category I.D. are not applicable to the proposed CDM project activity because:

- → The project activity in consideration is not a landfill gas, waste gas, wastewater treatment or agro-industries project. No methane would be recovered to be used for heat or electricity generation.
- → The project activity intends to supply power to the existing fossil fuel based regional (NEWNE grid) electricity system and does not displace electricity generation from diesel generating units.
- → The project activity does not involve the addition of renewable energy generation units at an existing renewable power generation facility.
- → The project activity does not seek to retrofit or modify an existing facility for renewable energy generation

The baseline of the project activity is established using paragraph 9 which states that for all other systems not covered in paragraph 7 & 8, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient calculated in a transparent and conservative manner as:

(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'.

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 01.1. All underlying calculations and assumptions used to prepare the CO_2 database has been provided in the website[1].

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

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 18.5% (which is less than 50%) of total grid generation in average of the five most recent years.

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" (EB41, Annex 46), 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:

a) In the meeting of the Board of Directors, it was resolved that the project activity must be taken forward with CDM and immediate steps to achieve CDM registration must be completed before the project commissioning. 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	Novation of Implementation Agreement in favour of APGPL	27/04/2007	27/04/2007	27/04/2007	27/04/2007	27/04/2007
2	Letter of Acceptance (LOA) for E&M Contract	26/11/2007	26/11/2007	26/11/2007	26/11/2007	26/11/2007
3	Communications/ Negotiations with CDM consultants	29/11/2007	29/11/2007	29/11/2007	29/11/2007	29/11/2007
4	Letter of Acceptance for H&M Contract	06/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007
5	Novation of Tripartite	15/01/2008	15/01/2008	15/01/2008	15/01/2008	15/01/2008

	Agreement in favour of APGPL					
6	NOC from Punjab Pollution Board	12/02/2008	12/02/2008	12/02/2008	26/02/2008	26/02/2008
7	IEM	07/03/2008	07/03/2008	25/04/2008	28/04/2008	28/04/2008
8	Loan rejection from IREDA	13/03/2008		13/03/2008		
9	Lease deed between Governor of Punjab / PEDA	26/03/2008	26/03/2008	04/03/2008	03/03/2008	03/03/2008
10	Lease deed between PEDA / APGPL	26/03/2008	04/03/2008	04/03/2008	03/03/2008	03/03/2008
11	Axis bank – Sanction Letter	05/04/2008	05/04/2008	05/04/2008	05/04/2008	05/04/2008
12	Diversion of Forest land	04/01/2005	21/04/2008	04/01/2005	-	-
13	Appointment of CDM consultant	28/07/2008	28/07/2008	28/07/2008	28/07/2008	28/07/2008
14	Civil work LOA - Change order	05/08/2008	05/08/2008	05/08/2008	05/08/2008	05/08/2008
15	Invitation of quotations from DOE	18/12/2008	18/12/2008	18/12/2008	18/12/2008	18/12/2008
16	Stakeholder consultation meeting	16/01/2009	16/01/2009	16/01/2009	16/01/2009	16/01/2009
17	Submission of Documents for Host Country Approval	21/04/2009	21/04/2009	21/04/2009	21/04/2009	21/04/2009
18	Appointment of DOE for validation	09/06/2009	09/06/2009	09/06/2009	09/06/2009	09/06/2009
19	Meeting with the DNA for HCA	26/06/2009	26/06/2009	26/06/2009	26/06/2009	26/06/2009

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. In order to promote participation of the private sector in such projects in spite of perceived barriers, even the New and Renewable Sources of Energy (NRSE) Policy – 2006 acknowledges CDM as a necessary fiscal incentive for the renewable energy sector and has appointed Punjab Energy Development Agency (PEDA) as the state nodal agency for carbon credits under CDM. 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[2].

The project activity calls for an investment of around INR 570 million which translates to expenditure of around INR 107.55 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[3]. 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.

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

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

http://www.indianwindpower.com/fin_benefit.html

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.

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.

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 02). For this purpose, the post-tax Project IRR has been chosen as the financial indicator and the Weighted Average Cost of Capital (WACC) as the benchmark. The suitability of this indicator and benchmark is described below.

The project IRR has been chosen as the appropriate indicator in light of the fact that project IRR represents the overall cost of capital employed by the project proponent. Project IRR for a project activity will need to be adequate enough to service debt as well as provide a return to shareholders i.e. it has to be worthy enough from the point of view of both investors and creditors. In assessing the viability of a project, a potential financier should only invest in the project if the IRR is greater than the weighted cost of debt and equity. In order to utilize a benchmark comparable to the project IRR the Weighted Average Cost of Capital (WACC) has been chosen as the benchmark. This is consistent with the "Guidance on the Assessment of Investment analysis", (EB 41, Annex 45) Paragraph 11 which states "*Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR*".

The IRR analysis has been carried out in accordance with the "Guidance on the Assessment of Investment Analysis" (EB 41, Annex 45). 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 project IRR without CDM revenue has thus been computed in accordance with this guideline and it was found that the Internal Rate of Return (IRR) of the project activity is lower than what would make the project investment worthwhile.

The following assumptions have been taken for IRR computation.

Assumption	Value	Reference
Debt (% of total project cost)	75%	Term Loan Agreement
Loan repayment (years)	10	Term Loan Agreement
Interest rate (% pa)	11.75%	Term Loan Agreement
Tax rate (%)	33.99%	http://www.taxmann.com/DitTaxmann/IncomeTaxActs/2007ITAct/gr.htm
MAT rate (%)	11.22%	http://law.incometaxindia.gov.in/DitTaxmann/IncomeTaxActs/2007ITAct/section115jb.htm
Tax Holiday	10 years	http://law.incometaxindia.gov.in/DitTaxmann/IncomeTaxActs/2005ITAct/section80IA.htm
Total Project Cost	Rs. 5700 lakhs	Term Loan Agreement
Equity	Rs 1425 lakhs	Term Loan Agreement
Debt	Rs 4275 lakhs	Term Loan Agreement
Capacity of the plant (kW)	5300	Term Loan Agreement

Power Purchase Tariff (Rs/kWh) - First Year - Second Year - Third Year onwards	 Rs. 3.81 Rs. 3.93 Rs. 4.05	Punjab State Electricity Regulatory Commission Order Dated 13/12/2007 (http://www.pserc.nic.in/pages/NRSE_orders.html)

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,.

Barriers 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 Development 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

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 01.1.

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**".

Baseline Emissions:

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: **Selecting an Operating Margin (OM) method**
Version 01.1 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 01 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.

	2005-06	**2006-07**	**2007-08**
NEWNE	18.0%	18.5%	19.0%
North-East	27.0%	28.3%	27.1%
India	20.1%	20.9%	21.0%

Ref: CO_2 Baseline Database for the Indian Power Sector – CEA, Version 4, September 2008

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) = 18.5 %

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 3: **Calculating the Operating Margin emission factor ($EF_{grid, OM, y}$)**
Among the aforesaid four options, the **Simple Operating Margin** is used for the project activity as justified above.

Simple OM: The Simple OM emission factor ($EF_{grid, OMsimple, y}$) is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-operating cost and must-run power plants. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (Option C)

Option A is the preferred choice according to the "Tool to calculate the emission factor for an electricity system", version 01.1. However, 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. In calculation of the Simple OM emission factor, they have used **option B** i.e. based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit. Hence in this case, Option B has been used.

According to Option B, the simple OM emission factor is calculated as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_{m} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid, OMsimple, y}$ = Simple operating margin CO_2 emission factor 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 = Either 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) or theapplicable year during monitoring (ex-post option) following the guidance on data vintage in Step 2

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

Where:

$EF_{EL,m,y}$ = 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 quantity of 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 unit m in year y

y = Either 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) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

Since ex-ante option has been selected for data vintage, the Simple OM emission factor ($EF_{OM,simple,y}$) is taken for the most recent three years and an average value has been considered as the OM emission factor for the baseline ($EF_{grid, OM,y}$).

Operating Margin Estimation for NEWNE Grid (tCO_2 / MWh)	
OM, 2005-06	1.0195
OM, 2006-07	1.0083
OM, 2007-08	0.9992
Average OM ($EF_{grid, OM,y}$)	**1.0090**

Step 4: Identify the cohort 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 5: Calculation of the Build Margin Emission Factor $EF_{grid, BM,y}$

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:

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

Where:

$EF_{grid, BM, y}$ = Build margin CO_2 emission factor in year y (tCO_2 / MWh)
$EG_{m,y}$ = Net quantity of electricity 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 6. Calculation of Combined Margin Emission 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 ($EF_{grid, BM, y}$):

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

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[4].

Combined Margin Estimation for NEWNE Grid (tCO_2 / MWh)	
Combined Margin ($EF_{grid, CM,y}$)	**0.8033**

BEy = EFy x EGy

where

BEy Baseline emission for year y, t CO2 /year
EFy Baseline Emission factor t CO2 / MWh
EGy Grid electricity replaced due to the project (or net electricity fed to the grid in the project), GWh/year

Project emissions

Project emissions due to the project activity within the project boundary are not envisaged, the project being a renewable energy power project.
Thus , $PE_Y = 0$

Leakage estimations

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

As prescribed in AMS-I.D., leakage estimation is only required if renewable energy technology is equipment transferred from another activity, or if the existing equipment is transferred to another activity. As no equipment is transferred from another activity, neither is existing equipment being transferred to another activity, hence, leakage emissions need not be accounted.

Emission reductions

$$ER_Y = BE_Y - PE_Y - LE_Y$$

Where

ER_Y	Emission reduction during the year y
BE_Y	Baseline emissions during the year y
PE_Y	Project emissions during the year y
LE_Y	Emission due to the leakage during the year y

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

Data / Parameter:	**EF_{grid}**
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:	0.8033
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 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:	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:	1.0090
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 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:	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 option 1 of ACM0002 version 06, page 9, using 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:	Reference: www.cea.nic.in

B.6.3 Ex-ante calculation of emission reductions:

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Baseline emissions

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

Total electricity generation from all the projects= 29014 MWh

Grid Emission factor = 0.8033 tCO_2 /MWh

BE_y = 23,307 tCO_2

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

Leakages: As per the Paragraph 12 of the methodology AMS I.D (Version 14) 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 = 23,307 tCO_2

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

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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)
2010-2011	0	23,307	0	23,307
2011-2012	0	23,307	0	23,307
2012-2013	0	23,307	0	23,307
2013-2014	0	23,307	0	23,307
2014-2015	0	23,307	0	23,307
2015-2016	0	23,307	0	23,307
2016-2017	0	23,307	0	23,307
2017-2018	0	23,307	0	23,307
2018-2019	0	23,307	0	23,307
2019-2020	0	23,307	0	23,307
TOTAL	**0**	**233,070**	**0**	**233,070**

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
Value of data	The same shall be monitored ex-post
Description of measurement methods and procedures to be applied:	The electricity exported by the project activity would be monitored through energy meters of accuracy class 0.5.
QA/QC procedures to be applied:	The energy meters would be checked for accuracy and 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:	**$EG_{Import,y}$**
Data unit:	MWh
Description:	Electricity imported by the project activity in year y
Source of data to be used:	Energy Meters
Value of data	The same shall be monitored ex-post
Description of measurement methods and procedures to be applied:	The electricity imported by the project activity would be monitored through energy meters of accuracy class 0.5.

QA/QC procedures to be applied:	The energy meters would be checked for accuracy and 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:	**$EG_{Net,y}$**
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.
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 interconnection point every month and would be recorded monthly. 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 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:	**$EG_{Gross,y}$**
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.
Value of data	The same shall be monitored ex-post
Description of measurement methods and procedures to be applied:	The gross electricity generated by the project activity would be monitored through energy meters of accuracy class 0.5 and recorded in the plant log books by the supervisor (energy) on shift basis. 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.
QA/QC procedures to be applied:	The energy meters would be checked for accuracy and 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	Log books and plant records.

used:	
Value of data	The same shall be monitored ex-post.
Description of measurement methods and procedures to be applied:	The Auxiliary electricity consumption by the project activity would be monitored through energy meters of accuracy class 0.5 and recorded in the plant log books by the supervisor (energy) on a shift basis. 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 checked for accuracy and 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:

>>

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 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 during the yearly checks. 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. 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. The plant in-charge 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 plant in charge will also review the data collected and suggest corrective actions wherever required.

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

>> 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:

>>
05/08/2008

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 contract for starting the civil works related to the project activity.is 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:

>>
01/01/2010
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

>>

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

>>

As per the recent notification 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:

>>

Not applicable, refer D.1 above.

SECTION E. Stakeholders' comments

>>

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

>>

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.

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:

>>
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.

Detailed minutes of the meeting along with the attendance sheets and photographs/video coverage are being provided separately.

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

>>

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
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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)	
OM, 2005-06	1.0195
OM, 2006-07	1.0083
OM, 2007-08	0.9992
Average OM ($EF_{grid, OM,y}$)	**1.0090**
BM, 2007-08 ($EF_{grid, BM, y}$)	**0.5977**
Combined Margin ($EF_{grid, CM,y}$)	**0.8033**

Annex 4

MONITORING INFORMATION

As per section B.7.2

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