CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

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>.

SECTION A. General description of the small-scale project activity

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

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10 MW biomass based power project of Ind Power limited.
Version 01
12/12/2006

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

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Purpose

The proposed project activity is the installation of 10 MW biomass based power plant at village Mahapalli, Dist. Raigarh in Chhattisgarh. The purpose of the project activity is to consume waste biomass resource i.e. rice husk effectively for generation of electricity. Project proponent would export power to Chhattisgarh state electricity board (CSEB).

Project's contribution to sustainable development

The four pillars of sustainable development have been addressed as follows:

1. **Social Well-being:**

The project activity will utilize rice husk for power generation. The project activity would lead to direct as well as indirect employment which would provide boost to local economy. The project would help reduce this demand-supply gap in electricity. The project activity would involve rice husk to be transported from mills to project site, this will provide business opportunities for local transporters.

2. **Environmental Well being :**

The project will lead to reduction of carbon dioxide emissions into the atmosphere which would improve the local environment. The rice husk is an agro-waste and project activity would utilize this waste for generation of power. The project activity would produce clean power from non-conventional energy source, thus reducing the dependence on fossil fuel for power generation.

3. **Economic Well-being**:

As rice husk will be used for power generation; it would provide revenues for the rice husk suppliers and local farmers. The project would provide direct employment opportunity to the local community.

4. Technological Well Being:

The project activity will use advanced technology for rice husk based power generation. The project would lead to improvement in technical skills of the employees. The operators would be provided sufficient technical know-how to handle the plant efficiently.

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)
India	Ind Power Limited (IPL) (Private entity)	No

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

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

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Fig 1.1 Location map of project site

A.4.1.1. Host Party(ies):

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India

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

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Chhattisgarh

A.4.1.3. City/Town/Community etc:

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Village Mahapalli, District , Raigarh

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

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The project is proposed to be located at Mahapalli village area of Raigarh District, Chattisgarh State, India, which is situated at North Eastern part of the state of Chattisgarh. The project site is situated along Mumbai – Nagpur - Howarah electrified main rail route and nearest rail head Kotarlia railway station is approximate 2 kms away from Plant. The nearest airport is located at Raipur, 225 kms from the project area. The latitude and longitude of the area is 21° 55' 45" North to 21° 56' 02"East.

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

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The project meets the applicability criteria of the 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 Power project***

Sub Category: ***D – Grid connected renewable electricity generation -version no 09 (28th July 2006)***

As per the provisions of simplified modalities and procedures for small scale CDM project activities (version 09, 28 July, 2006), Type I. D "comprises renewable energy generation units, such as photovoltaics, 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. If the unit added 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 unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.

Project activity meets the applicability conditions of the methodology in following manner:

1. The project activity is a biomass (rice husk) based power generation system supplying electricity to state electrical grid.

2. The capacity of power generation is 10 MW which is less than the limit of small scale category i.e. 15 MW.

The baseline and emission reduction calculations from the project would therefore be based on paragraph 9 of I.D. The monitoring methodology would be based on guidance provided in paragraph 13 of I.D.

Project Activity with technology details

The proposed power plant is based on Rankine Cycle. The boiler type is dual fuel fired. The major installation would consist 40 tph, 65 kg/cm^2, 485 $\pm$ 5 °C high pressure fluidized bed boiler with 10 MW extraction cum condensing steam turbine generator. The project activity would have auxiliary system such as ash disposal system, demineralisation plant, and cooling water system. The technical parameters of the fluidized bed boiler are given below:

TECHNICAL PARAMETERS OF FLUIDISED BED BOILER

Parameters	Units	Values
Type	-	Single drum water tube boiler
Steam output at maximum continuous rating (MCR)	TPH	40
Steam output, nominal continuous Rating (NCR)	TPH	33
Steam pressure at super heater Outlet	Kg/Cm^2 (abs)	65
Steam temperature at super heater Outlet	°C	485 ± 5
Feed water temperature Economiser	°C	105
Exit temperature of waste gases	°C	150
Boiler Efficiency	%	81±1

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A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

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The power plant uses rice husk as primary fuel in combination with coal. The GHG emissions from the combustion of rice husk, mainly CO_2, are consumed by plant species, representing a cyclic process. The rice husk is CO_2 neutral and thus environmentally benign, limiting greenhouse effect.

The project activity will generate 10 MW renewable power that would displace the power from western regional electricity board (WREB) grid (Chhattisgarh state comes under WREB). Without project activity, the same energy load would have been taken up by regional electricity grid fed primarily of thermal power plants and corresponding emission of CO_2 would have occurred due to combustion of conventional fuels like coal / gas.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

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Year	Net CER Reductions (Tonnes CO_2)
2007-08	37537
2008-09	37537
2009-10	37537
2010-11	37537
2011-12	37537
2012-13	37537
2013-14	37537
2014-15	37537
2015-16	37537
2016-17	37537
Total estimated reductions (tonnes of CO_2 e)	375370
Total no of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	37537

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

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No public funding from parties included in Annex I to the UNFCCC, is available to the project

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

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According to appendix C of simplified modalities & procedures for small-scale CDM project activities, '***debundling'*** is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities.

According to para 2 of appendix C

A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small- scale activity at the closest point

According to above-mentioned points of de-bundling, proposed project activity is not a part of any of the above, so it should be considered as small scale CDM project activity.

SECTION B. Application of a baseline methodology:

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

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AMS I. D: Grid connected renewable electricity generation -version no 09 (28th July 2006)

Reference: www.unfccc.int As per Appendix B of the simplified M&P for small-scale CDM project activities.

B.2 Project category applicable to the small-scale project activity:

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As per Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website the project falls under Category I.D – Renewable electricity generation for a grid.

Baseline methodology for this category has been detailed in paragraph 9 under Category I.D of this document. It states that the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO2/kWh) calculated as under:

a) A combined margin (CM), consisting of the combination of operating margin (OM) and built margin (BM) are calculated according to the procedures prescribed in the approved methodology ACM0002 (version 06, 19-05-2006). Simple OM method is used to calculate operating margin.

The project activity would displace an equivalent amount of electricity that would have been drawn from the grid generation-mix. Since the displaced electricity generation is the element that is likely to affect both the operating margin in the short run and the build margin in the long run, electricity baselines should reflect a combination of these effects. Therefore the most appropriate approach for baseline methodology would be as described in paragraph 9 a under Category I.D of the simplified M&P for small-scale CDM project activities.

A complete analysis of western region electricity grid has been carried out along with the study of various related issues like technology scenario, policy matters, economic conditions, development of renewable energy projects etc. for preparation of baseline scenario and calculation of baseline emission factor of the grid.

B.3. 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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That the project activity qualifies to use simplified methodologies has been justified in Section A.4.2 where it has been shown to qualify as a small scale CDM project of Category I.D.

As per the decision 17/cp.7 para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

This project activity is a renewable energy project with net zero CO2 emission from rice husk combustion due to carbon sequestration. Paddy re-grown at the same rate as it is being harvested, acts as a sink for atmospheric carbon dioxide and the net flux of CO2 to the atmosphere is zero. An analysis of the regional grid generation mix gives the baseline emission factor in kgCO2/kWh for the credit period, and the CO2 certified emission reductions [CERs] that the project activity will reduce, by substituting an equivalent grid supply.

Barriers and Additionality

Investment Barrier

- Investment barriers: The cost of biomass during the preparation of detailed project report (DPR) (Date of DPR Preparation 1 August 2004) was INR 500/ton, which increased to than INR 1550 (current price) /ton. This escalation in the biomass prices was because of increase in demand of this fuel and transportation cost. Also with the successful operation of the project activity the supply of biomass would become an organized business for the suppliers. This increase in cost of biomass would be significantly compensated by the proposed carbon financing and will help to improve the sustainability of the project which will otherwise be rendered financially unstable.

Quantity of Rice husk to be used	72047
DPR Price (INR/ton)	500
Total fuel price as per DPR (INR)	36023500
Current Price (INR)	1550
Total fuel price as per current rate (INR)	111672850
Total price difference between current price and DPR price	**75649350**
CDM contribution @ 10 Euros/CER	16195760

- It is evident from the above table that the project sustainability depends on the price of rice husk. Rice husk handling and pricing is not done in an organised manner, so the prices cannot be ascertained and depends on demand-supply of the rice husk. Project activity is likely to increase the demand; therefore the price uncertainty of rice husk is envisaged. CDM fund will help the project proponent to bridge the gap between estimated price and actual price of rice husk.
- The IRR of the project without CDM revenues is 9.9 % and after considering CDM revenue flow, the IRR works out to be 12.91 %.(IRR sheet is attached in Annex.)

Technological barrier:

a) Availability of Rice Husk: Being a fuel of low calorific value, when rice husk is used as fuel in FBC boiler, the quantity of rice husk required to generate steam of desired temperature and pressure is very high. It becomes very difficult to arrange rice husk in such great quantum throughout the year on continuous basis because of price escalation and space requirement.

b) Clinker Formation: rice husk has low density. As a result of this the ash generated during rice husk burnings has low density due to which it has a tendency to adhere to the boiler tubes, thereby affecting the heat transfer and reducing thermal efficiency.

c) ESP Blockage: The rice husk ash being low density, gets clogged in the ESP chambers, thereby reducing the efficiency of operation

d) Ash Disposal: The rice husk ash has no puzzolinic properties and hence it cannot be used as fly ash brick manufacturing like conventional coal ash and being of low bulk density its disposal involves huge expenses

e) Blocking of Primary Air Lines: During rainy season whenever the rice husk gets wet, it blocks the Primary Air lines at the time of feeding and thereby the plant efficiency and profitability is badly affected

The associated CDM benefits with such a project activity played a key role in motivating the project proponent to invest in spite of the perceived technological risks.

Barriers due to prevailing practice:

Rice husk based power plants are not a prevailing practice in the Chattisgarh scenario. This is the only the third rice husk based power plant in the region. There are huge coal reserves in the vicinity, offering cheap pithead power generation opportunities and there is enough water from the State's largest reservoir of Hasdeo Bango. 84%[1] of India's coal is in Chhattisgarh and two other States. The business as usual (BAU)

[1] From DPR prepared for the project activity.

scenario in Chattisgarh may be considered as thermal power generation using coal as 85-90% of the power generation comes from such sources. In the similar project sector, socio-economic environment, geographic conditions and technological circumstances, the project activity uses a technology, which shows very limited penetration.

Other Barriers:

In addition to all the barriers mentioned above, project proponent would also be facing the following barriers once the project activity is implemented

- Rice husk has low specific gravity which requires proper handling and storage procedures of rice husk at project site. The specific gravity of rice husk being low, it requires a larger stocking area. This has increased the land procurement and site development cost by a significant amount. Compared to project activity a coal based power plant would have been a less technologically advanced alternative with lower risks associated with performance uncertainty, but would have led to higher GHG emissions.

- Since the project activity involves co-firing of rice husk and coal, the handling equipment (like screens, conveyors for stacking etc.) are required more in numbers than that required for a 100% coal based power plant. For the same reason, additional manpower is also required at the project site for handling both rice husk and coal.

- Regulatory Barrier: The project activity is not mandated by the law either from the Centre or the State. Although the MNES and the state government are promoting such renewable energy endeavours, there is no legal binding on either the state or the promoter to come up with such biomass based power plant.

It has been clearly established from the above discussion that the project activity faces many barriers in its implementation and successful operation. Some of these barriers have the potential to even disrupt the operation of the rice husk based power plant thereby damaging the commercial viability of the project activity. The management of project proponent considered all risk aspects associated with the implementation of the project activity during the project inception. They have also considered the following alternative means to generate power.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small –scale project activity:

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Project Boundaries

The project boundary as specified under Category I.D of small-scale CDM project activities in Appendix B of the simplified M&P for the same shall encompass the physical, geographical site of the renewable generation source.

For the project activity the project boundary is from the point of fuel supply to the point of power export to the grid. Thus, boundary covers fuel storage and processing, boiler, steam turbine generator and all other accessory equipments.

Individual power plants supplying to the state grid are considered in the baseline boundary for estimation of baseline emission rate. Since, the project would not have any impact on transmission and distribution losses it is not included in the project boundary. Using part of the available rice husk, being wasted earlier, in the project, will not affect current needs for other fuels and therefore the emissions from any other fuel-use are not included in the system boundary.

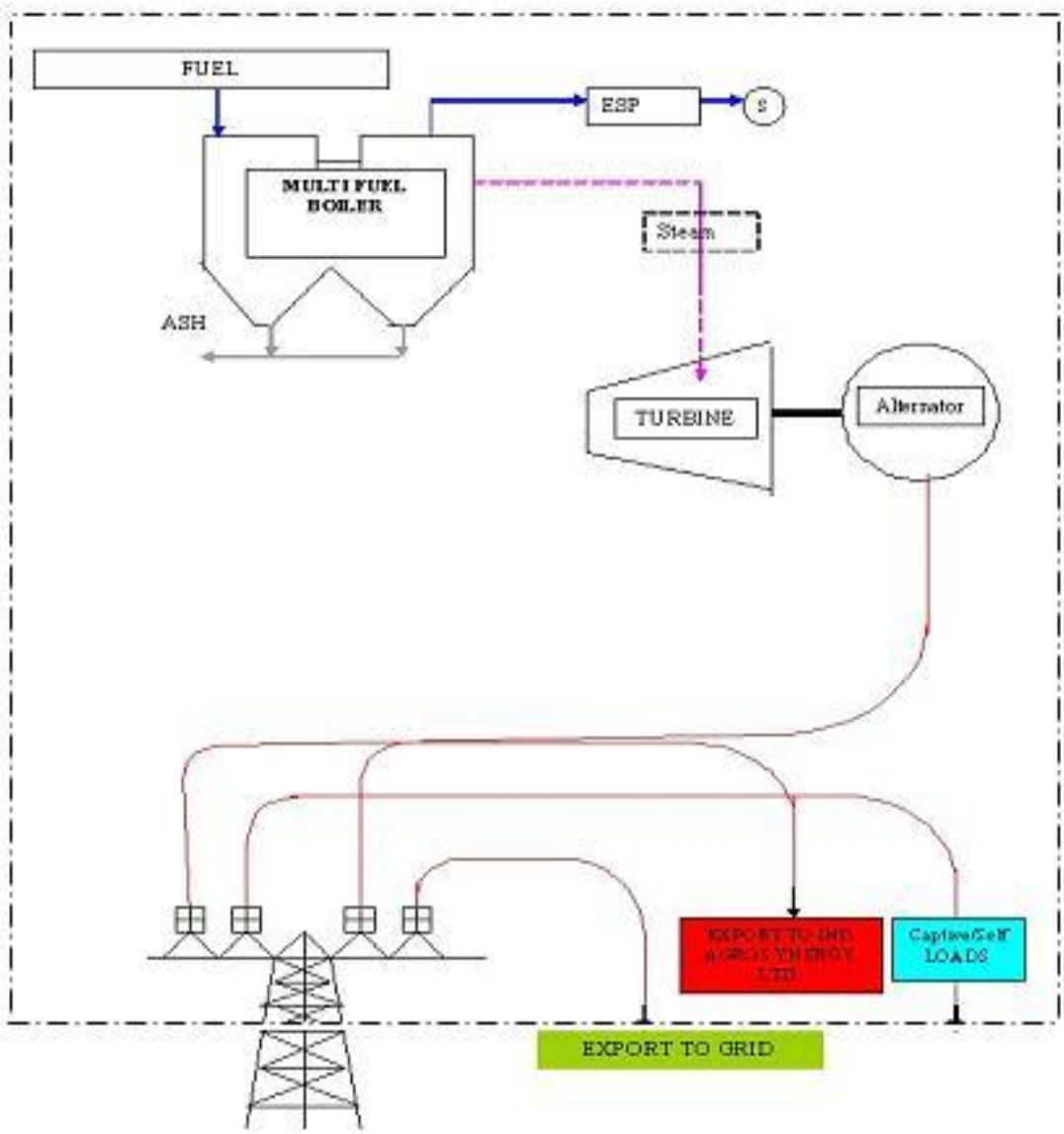

Figure B.1: Project Boundary

B.5. Details of the baseline and its development:

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The baseline methodology has followed the one specified under Project Category I.D. in Appendix B of the Simplified M&P for small scale CDM project activities.

The NET BASELINE EMISSION FACTOR as per CEA published data[2] (ACM002 Ver06)
(OM + BM)/2 = 0.89 kg CO_2/kWh

The baseline calculations are attached in annex 1.

Date of completing final draft of this baseline section:

11/12/2006

Name and person/entity determining the baseline:

Ind Power Ltd and their CDM consultants.

[2] Source:www.cea.nic.in (CDM Draft Carbon Dioxide Baseline Database). The combined margin emission factor calculation are done as per ACM002, Version 06)

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

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C.1.1. Starting date of the small-scale project activity:

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13/12/2004 (Construction start date)

C.1.2. Expected operational lifetime of the small-scale project activity:

>>

20 years 0 month

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

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C.2.1. Renewable crediting period:

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Not Applicable

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

>>

Not Applicable

C.2.1.2. Length of the first crediting period:

>>

Not Applicable

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>

01/04/2007

C.2.2.2. Length:

>>

10 years 0 months

SECTION D. Application of a monitoring methodology and plan:

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D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:

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***Title*: Monitoring methodology for category Type I.D – renewable electricity generation for a grid**

According to Appendix B of the simplified M&P for small-scale CDM project activities, the project has been identified to belong to Category I.D. Paragraph 13 under Category I.D of the same document specifies that for the said category of CDM project, 'Monitoring shall consist of metering the electricity generated by the renewable technology. In the case of co-fired plants, the amount of biomass and fossil fuel input shall be monitored'.

D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:

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The project generates power from a renewable energy source such as rice husk and co –fires with coal fines. The power generated would be exported to grid. The methodology covers the monitoring of net units generated and the other parameters affecting the quantity of power export and CO_2 emissions. The project co-fires rice husk and coal and hence, the methodology also includes monitoring the amount of rice husk input and the energy availability from the same. Thus the monitoring methodology under Category I.D of the Appendix B of the simplified M&P for small-scale CDM project activities is aptly applicable to the project activity. The net CERs will result from the units of power available from the rice husk. The methodology will additionally include monitoring of the coal co-fired with rice husk. The CO_2 emissions arising from coal co-firing, treated as project emissions, will be deducted from the baseline emissions arrived from the total kWh exported by the power plant and the baseline emission factor.

D.3 Data to be monitored:

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a) Parameters affecting emission reduction of project activity

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1	Power	Total electricity exported from plant	kWh	M	Continuous	Total	Electronic	2 years after issue of CERs	Measured in plant premises and monitored and recorded continuously through DCS. Manufacturers of equipments should be of repute.

b) Parameters affecting project emissions from project activity

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1	Quantity of Coal Consumed	Coal quantity	T	Measured	Daily	100%	Paper	2 years after issue of CER	
2	Fuel	% Carbon	%	Measured	Monthly	100 %	Paper	2 years after issue of CER	Through sample testing
3	Fuel Quantity transported	Type of fuel used - Biomass - Coal	T	Measured	Daily	100%	Paper	2 years after issue of CER	
4	Fuel Type	Net calorific value of fuel used	Kcal/Kg	Measured	Fortnightly	100%	Paper	2 years after issue of CER	Through sample testing
5	Distance	Distance from source to project site	Kms	Measured	Annually	100%	Paper	2 years after issue of CER	-
6	Vehicle Efficiency	Fuel consumption for vehicle per	Litres of fuel/Km	Estimated	Annually	100%	Paper	2 years after issue of CER	

		kilometre							
7	Vehicle Capacity	Quantity of fuel carried in one trip per vehicle	Tonnes of fuel/vehicle	measured	Per trip	100%	Paper	2 years after issue of CER	
8	Emission Factor	Emission Factor for transport fuel	Kg CO2/kg of fuel	estimated	Annually	100%	Paper	2 years after issue of CER	

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

>>

Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.3.a.1	Low	Yes, Quality Management System will be used and the same procedures would be available at the project site
D.3.b.1	Low	Yes, Quality Management System will be used and the same procedures would be available at the project site
D.3.b.2	Low	Yes, Quality Management System will be used and the same procedures would be available at the project site
D.3.b.3	Low	Yes, Quality Management System will be used and the same procedures would be available at the project site
D.3.b.4	Low	Yes, Quality Management System will be used and the same procedures would be available at the project site
D.3.b.5	Low	Yes, Quality Management System will be used and the same procedures would be available at the project site
D.3.b.6	Low	Yes, Quality Management System will be used and the same procedures would be available at the project site
D.3.b.7	Low	Yes, Quality Management System will be used and the same procedures would be available at the project site
D.3.b.8	Low	Yes, Quality Management System will be used and the same procedures would be available at the project site

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

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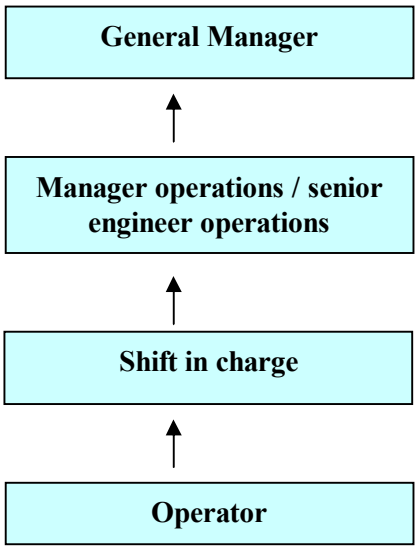
Although most of the parameters are monitored for the financial reports of the project proponent, like total power generated, and Power exported to the grid etc. For the adequate monitoring of the emission reduction project proponent proposes the following structure of monitoring and reporting.



Roles and responsibility:

1**. General Manager:** General Manger will have the following responsibilities

- Decision on the contents of the training program
- Ensuring implementation of monitoring procedures
- Internal audit and project conformance reviews

2. **Manager (Operations):** Manager will have the following responsibilities

- Organizing and conduct training programs,
- Implementing all monitoring control procedures
- Associating with the Manager (QA) towards maintenance and calibration of monitoring equipments
- Has the overall responsibility for record handling and maintenance.
- Reviewing of records and dealing with monitored data
- Organizing internal audit for checking the data recorded
- Has the overall responsibility for closing project non-conformances and implementing corrective actions before the verification

3. **Shift in change:** This officer will have the following responsibilities:

- Supervising and training the operators and maintaining training records.
- Has the overall responsibility of monitoring measurements and reporting
- Will assist the Manager (Operations) in record handling, records checks and review and during internal audit

- Check the data recorded by the operator in the individual sections as described in Section D.3 under tables 3a and 3b respectively.

4. Operator: The responsibility of operator to record appropriate data of the project activity represented in the monitoring tables (3a and 3b). Based on the monitoring frequency, the operator will measure and record the data in the logbook as per the instructions of his officer/ supervisor.
The operational procedures for training, emergency preparedness, maintenance and calibration of monitoring equipments, monitoring measurements and reporting, record handling and maintenance, reviewing monitored data, internal audit, project performance reviews and corrective actions are available at the plant.

Internal audit procedure

A special internal audit team (2-3 members) will be appointed by the General Manager to independently conduct internal audit of monitored data. The internal audit will be conducted once in 6 months. The audit timing will be at least 2 months prior to actual verification by external verifiers. The internal audit team will review all the records, check monitoring equipments for accuracy and whether calibration was performed. The Manager - operation in association with the Shift – in – charge shall answer all the queries raised by the internal audit team. The internal audit team will produce an audit report providing details of concerns that need to be attended to immediately before actual verification by the external verifier. Internal auditor will produce a report within 3 working days indicating non-conformances

D.6. Name of person/entity determining the monitoring methodology:

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Date of Completion: 11/12/2006.

Name of person/entity: Ind Power Limited and their CDM consultants

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

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E.1.1 Selected formulae as provided in appendix B:

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Not applicable.

E.1.2 Description of formulae when not provided in appendix B:

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E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

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If in the project activity only biomass fuel is used then the emissions from the project activity will be nil. If any supplementary fuel is used with biomass then the emissions will be calculated based on this formula:

CO_2 Emission (kg) = Stoichiometric CO_2 release from carbon content in coal (based on total carbon content

To have an estimate of the project CO_2 emission quantity due to combustion of coal along with the biomass, total carbon content of the coal should be known. Combustion reaction for CO_2 emission is as under.

$C + O_2 = CO_2$

Assuming complete combustion of coal, following formula can be used for conservative estimation of CO_2 emissions.

$$CE_c = (44/12) * C * Q$$

where,

CEc - Stoichiometric carbon-dioxide emission due to coal burning at project, MT

C - Carbon percentage in coal, %

Q - Quantity of coal burned, MT

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

>>

The leakage activity identified, which contributes for GHG emissions outside the project boundary is transportation of biomass from biomass collection centers to biomass power project site. The collection of biomass will be done through the farmers. They bring the biomass to these fuel processing centers in their own vehicles i.e. tractors. Calculation of leakage has been carried-out as under:

- Leakage = $\frac{Q_{bio} D_p N_y D_n C_v C_f E_f}{C_t M}$

  - Q_{bio} = Quantity of biomass transported (MT/day)
  - C_t = Capacity of truck/ vehicle carrying biomass (MT)
  - D_p = Distance of procurement including return journey of vehicle (km)
  - M = Mileage of vehicle (km/litre)
  - N_y = No of days in a year
  - D_n = Density of fuel (Kg/Litre)
  - C_v = Calorific value of fuel (Kcal/ kg)
  - C_f = Conversion factor from Kcal to Trillion Joules (TJ)
  - E_f = Emission factor of fuel (ton CO_2/ TJ)

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

>>

Net project emissions (NE_p) = (Leakage) tons/year (If only biomass is used in the project activity)

= (Leakage) + **(44/12) * (C_C*Q_f) (**if any supplementary fossil fuel used)

- C_C- Carbon content of fuel
- Q_f– Quantity of fuel combusted

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

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Electricity baseline emission factor of Western Regional Grid (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps. Calculations for this combined margin are based on data from official sources (where available) which is publicly available.

STEP 1. Calculation of the Operating Margin emission factor

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the weighted average emissions (in tCO_2equ/MWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} . COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

where

- $F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y,

- j refers to the power sources delivering electricity to the grid, not including low-operating cost and must run power plants, and including imports to the grid,

- $COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and

- $GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient COEFi is obtained as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i$$

where:

- NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i,
- $OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
- $EFCO_{2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

Where available, local values of NCV_i and $EFCO_{2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated separately for the most recent three years (2002-03, 2003-04 and 2004-05) and an average value has been considered as the OM emission factor for the baseline ($EF_{OM,y}$).

$$EF_{OM,y} = \sum_{y} EF_{OM,simple,y} / 3$$

Where y represents the years

STEP 2. Calculation of the Build Margin emission factor

The Build Margin emission factor ($EF_{BM,y}$) has been calculated as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants m of WREB. The sample group m consists of either

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

Project proponent should use from these two options that sample group that comprises the larger annual generation. The calculation for Build Margin emission factor is furnished below:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \otimes COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

where
Fi,m,y, COEFi,m and GENm,y - Are analogous to the variables described for the simple OM method above for plants m.

STEP 3. Calculation of the Emission Factor of the Grid (EFGrid)

The electricity baseline emission factor of Western Regonal Grid, EFy is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

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

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

Baseline Emission Calculations

The baseline emission is calculated as: $BE_y = EG_y * EF_y$

where,
BE_y = Baseline Emissions due to displacement of electricity during the year y (in tons of CO_2)
EG_y = Units of electricity exported due to project activity in year y (in MWh)
EF_y = Emission Factor of the grid (in tCO_2/ MWh) and y is any year within the crediting period of the project activity

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

>>

$$\mathbf{ER = BE - NE_P}$$

Where,

ER - CO_2 Emission reduction per annum by project activity (tones/year)

BE - Baseline Emissions per annum (tones/year)

NEp - Net project emissions (tones/year)

E.2 Table providing values obtained when applying formulae above:

>>

Year	Net Weighted average emission (tCO_2/ MWh)	Units exported from plant (MWh)	Baseline emissions	Project Emissions (tCO_2/year)	Leakage emissions (tCO_2/ year)	Net CER Reductions (Tonnes CO_2)
2007-08	0.89	65578	58364	20639	188	37537
2008-09	0.89	65578	58364	20639	188	37537
2009-10	0.89	65578	58364	20639	188	37537
2010-11	0.89	65578	58364	20639	188	37537
2011-12	0.89	65578	58364	20639	188	37537
2012-13	0.89	65578	58364	20639	188	37537
2013-14	0.89	65578	58364	20639	188	37537
2014-15	0.89	65578	58364	20639	188	37537
2015-16	0.89	65578	58364	20639	188	37537
2016-17s	0.89	65578	58364	20639	188	37537
					Total	**375370**

SECTION F.: Environmental impacts:

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

>>

The project been a renewable energy biomass based power project it does not fall under the purview of the Environmental Impact Assessment (EIA) notification of Ministry of Environment and Forest (MoEF). However, the assessment of environmental impact for the project activity has been carried out by project proponent.

Chhattisgarh Environment Conservation Board (CECB) have issued Consent To Establish (CTE) to project proponent under the provisions of Water (Prevention and Control of Pollution) Act, 1974 & Air (Prevention and Control of Pollution) Act, 1981, Environment Protection Act, 1986.

The treated effluent shall confirm to the limits of the general standards prescribed under the provisions of EP Act 1986 for discharge of effluent into inland surface water. Air emissions shall confirm to Emission Regulations issued by the Central Pollution Control Board (CPCB) and as adopted by the State Environment Conservation Board (SECB). The infrastructure facility for monitoring of stack emissions on each stack and flow measuring devices at each unit of effluent treatment plant shall be provided.

The impact of the project on the environment can occur at two stages:

1. Construction phase
2. Operational phase

Table E.1: Environmental Impacts due to Project Activity during Construction Phase

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	MITGATION MEASURES
A	CATEGORY– AIR ENVIRONMENT	
1.	The dust levels increases resulting into higher particulate concentration in the air atmosphere.	Proper mitigation measures like sprinkling of water have to be taken to keep the dust levels below acceptable limits. There has to be regular check of important air quality parameter and make sure that limits are not exceeded.

B	CATEGORY– WATER ENVIRONMENT	
1.	There will be consumption of water during construction activity. Domestic wastewater will also be generated because of sanitation.	The domestic sewage has to be appropriately treated.
	Wastewater generation due to construction activities.	The wastewater has to be sent to the treatment system. It has to be disposed off in appropriate manner.
C	CATEGORY-NOISE ENVIRONMENT	
1.	Construction activities involve excavation, digging, hammering etc which leads to increase in noise levels. There will be rise in movement of vehicles in the plant area during the construction phase that could lead to rise in noise levels in the vicinity.	The construction activity has to be scheduled such that most of the work gets completed during the daytime. The contractor has to make sure that construction does not take place during night time.
D	CATEGORY-LAND ENVIRONMENT	
1.	There will be lot of solid waste generation during construction phase. Improper disposal of waste on land environment will lead to changes in land environment. It could lead to changes in soil quality.	Proper measures are to be taken in disposal of solid waste on land.
E	CATEGORY-ECOLOGICAL ENVIRONMENT	
1.	No impact are envisaged during construction activity	-
F	CATEGORY-SOCIO-ECONOMIC ENVIRONMENT	
1.	Employment opportunity will be generated during the construction phase.	-

Table E.2: Environmental Impacts due to Project Activity during Operation Phase

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	MITGATION MEASURES
A	CATEGORY– AIR ENVIRONMENT	

1.	The emissions into air environment include SPM, SO_2, and NOx. The air emissions should not exceed the standard limits prescribed by the Pollution Control Board.	The stack height should be sufficiently high to enable proper dispersion of pollutant released in the atmosphere. The air quality parameters have to be monitored regularly and it has to be made sure that the ground level concentrations are below the standard limits. Appropriate air quality pollution control instruments have to be installed to limit the emissions.
B	CATEGORY– WATER ENVIRONMENT	
1.	The water requirement is only for indirect purposes like cooling and hence the pollution load in the wastewater is relatively less. Water percolation to ground should be avoided.	The wastewater generated should be treated in the treatment system. It should be made sure that only treated water is disposed to surface and ground water.
C	CATEGORY-NOISE ENVIRONMENT	
1.	During operation phase noise levels are expected from turbines, material handling, and boiler operations. The impact on ambient noise due to the project will be marginal at the plant boundary and remain within the stipulate criteria of noise standard prescribed.	It is proposed that personnel who have to work in the noise prone areas will be provided with earmuffs. The noise levels could be controlled by providing proper acoustic enclosures.
D	CATEGORY-LAND ENVIRONMENT	
1.	There will be ash generation due to the project activity. If this ash is disposed off on open land, it will have impact on the land environment.	As far as possible, Ash should be supplied to nearby brick manufactures, or in road preparation etc.
E	CATEGORY-ECOLOGICAL ENVIRONMENT	
1.	No impact are envisaged during construction activity	-
F	CATEGORY-SOCIO-ECONOMIC ENVIRONMENT	
1.	Employment opportunity will be generated during the construction phase.	-
2.	Operation of biomass-based plant will lead to cleaner environment conditions.	

SECTION G. Stakeholders' comments:

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

>>

Identification of Stakeholders

Project proponent has proposed to implement a 10 MW rice husk based power plant at Mahapalli village, Raigarh district. The project proposed to use biomass *i. e.* rice husk generated in the fields & located within a radius of 30 Km from the project site. The GHG emissions of the combustion process, mainly CO_2 are sequestered by paddy plantation, representing a cyclic process. So the project leads to zero net GHG on-site emissions.

The stakeholders identified for the project are as under.

- ✓ Elected body of representatives administering the local area (Village Panchayat)
- ✓ Chhatisgarh State Electricity Board (CSEB)
- ✓ Chhatisgarh Environment Conservation Board (CECB)
- ✓ Ministry of Environment & Forest (MoEF), Government of India
- ✓ Ministry of Non Conventional Energy Sources (MNES)
- ✓ Equipment Suppliers
- ✓ Biomass suppliers and farmers
- ✓ Contractors
- ✓ Ind Synergy Ltd., Village Kotmar, Raigarh

Stakeholder list includes the government and non-government parties, which are involved in the project at various stages. Project proponent has not only communicated with the relevant stakeholders under statutory obligations but also has engaged the other stakeholders in a proactive manner in expressing and accounting their opinions on the project.

Stakeholders Involvement

The village Panchayat /local elected body of representatives administering the local area are a true representative of the local population in a democracy like India. Hence, their consent / permission/NOC to set up the project are necessary.

Project proponent has obtained consent from the biomass collectors, suppliers and farmers and has already completed the necessary consultation and documented their approval for the project.

Local population comprises of the local people in and around the project area. The role of the local people is as a beneficiary of the project. They supply of raw material from agricultural fields for the power plant. In addition to this, it also includes local manpower working at the plant site. Since, the project will provide good direct and indirect employment opportunities the local populace is encouraging the project.

The project has not displaced any local population. In addition, the local population is also an indirect consumer of the power that is supplied from the power plant. This is essentially because the power sold to the grid has improved the stability in the local electricity network. Since, the distance between the electrical substation for power evacuation and the plant is not very high, installation of transmission lines did not create any inconvenience to the local population. Thus, the project has not caused any adverse social impacts on local population rather has helped in improving their quality of life.

Chhatisgarh Environment Conservation Board (CECB) has prescribed standards of environmental compliance and monitors the adherence to the standards. The project has already received Consent to Establish from CECB to start commissioning of the plant. Chattisgarh State Electricity Board (CSEB) is also a stakeholder in the project.

The Government of India, through Ministry of Non-conventional energy Sources (MNES), has been promoting energy conservation, demand side management and viable renewable energy projects including wind, small hydro, solar and biomass power generation projects.

Projects consultants are to be involved in the project to take care of the various pre contact and post contract issues / activities like preparation of DPR, preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project operation, implementation, successful commissioning and trial run.

G.2. Summary of the comments received:

>>

Stakeholder's Comments

Project proponent has received the necessary approvals and consents from various authorities prior to project implementation. The approvals include those from CECB, CSEB, Panchayat (Public and local people around Raigarh).

The relevant comments and important clauses mentioned in the project documents / clearances like DPR, environmental clearance, local clearances *etc,* were considered while preparing the CDM Project Design Document.

The Project proponent representative met with the local NGOs and apprised them about the project and sought their support for the project.

Comments were sort from the Local Regulatory Authority, Local People, Senior Citizens, Contractor, etc. Project proponent received comments from the Regional Officer, (Chhatisgarh Environment Conservation Board, Raigarh), President (Batmul Ashram Shiskshan Samiti Mahapalli), Senior Citizen (Village - Ghadumariya), Sarpanch (Village - Loing), Former Sarpanch (Village -Siyarpali), SKA Contractor (A-5

Class Govt. Contractor - PWD, PMGSY, WR) Chandani Chowk, Raigarh.and Executive Director (Ind Synergy Ltd., Village Kotmar, Raigarh) The brief on the comments have been described as follows:

1. Project proponent's initiative of utilizing rice husk for power generation was welcomed
2. The implementation of project will lead to reduction in consumption of coal which is fossil fuel
3. Reduction in emission of atmospheric emissions.
4. It will lead to less mining of coal. Coal mining leads to destruction of biodiversity and top soil. So the project will have positive impact on environment and thus achieve sustainable development in the area.
5. The project will set a example for other industries in and around the region to go for better technologies which will result in less pollution
6. The project will improve local economy, provide contract work & employment opportunities to the local people. It will help in reduction of local labour migration.
7. It will also help in reduction in noxious & green house gases emission.
8. Stakeholders requested to plant as many trees as possible.
9. Stakeholders are also requested to collection Bhadra (seedless rice) at local level and use as fuel for power generation.

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

>> No negative comments have been received to the project proponent.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Ind Power Limited
Street/P.O. Box:	10, Daga Layout, North Ambazari Road
Building:	201, Shri Krishnam Apartments
City:	Nagpur
State/Region:	Maharashtra
Postcode/ZIP:	440013
Country:	India
Telephone:	0712 – 2229700 to 08
FAX:	0712 – 2229709
E-Mail:	indsynergy@hathway.com
URL:	www.indsynergy.com
Represented by:	
Title:	Managing Director
Salutation:	Mr
Last Name:	Goel
Middle Name:	S
First Name:	Aditya
Department:	-
Mobile:	9823015150
Direct FAX:	022 - 26613221
Direct tel:	022 - 26613245
E-Mail:	adityagoel@indsynergy.com mumbai@indsynergy.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding available to the project activity

Appendix: I
BASELINE INFORMATION

Weighted Average Emission Rate (tCO2/MWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	0.71	0.73	0.74	0.71	0.72
East	1.10	1.04	1.09	1.07	1.06
South	0.75	0.75	0.83	0.84	0.78
West	0.93	1.02	0.94	0.90	0.92
North-East	0.37	0.37	0.34	0.36	0.45
India	0.83	0.86	0.87	0.85	0.84
Simple Operating Margin (tCO2/MWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	0.95	0.98	1.00	0.99	0.98
East	1.23	1.19	1.18	1.19	1.18
South	1.03	1.01	1.02	1.01	1.00
West	1.02	1.12	1.03	0.99	1.01
North-East	0.66	0.65	0.65	0.61	0.79
India	1.02	1.06	1.04	1.02	1.02
Build Margin (tCO2/MWh) (not adjusted for imports)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North					0.54
East					0.86
South					0.73
West					0.77
North-East					0.09
India					0.70
Combined Margin in tCO2/MWh (incl. Imports)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	0.74	0.76	0.77	0.76	0.76

East	1.05	1.03	1.02	1.03	1.02
South	0.88	0.87	0.88	0.87	0.86
West	0.90	0.94	0.90	0.88	0.89
North-East	0.38	0.37	0.37	0.35	0.44
India	0.86	0.88	0.87	0.86	0.86

Gross Generation Total (GWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	144,290	151,190	155,331	165,717	168,735
East	58,327	63,583	65,332	75,249	85,435
South	128,805	131,747	134,231	138,371	143,932
West	159,865	165,500	173,402	172,480	183,755
North-East	5,206	5,243	5,486	5,879	7,904
India	496,493	517,262	533,780	557,696	589,761
20% of Gross Generation (GWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	28,858	30,238	31,066	33,143	33,747
East	11,665	12,717	13,066	15,050	17,087
South	25,761	26,349	26,846	27,674	28,786
West	31,973	33,100	34,680	34,496	36,751
North-East	1,041	1,049	1,097	1,176	1,581
Net Generation Total (GWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	135,254	141,420	144,676	155,017	157,269
East	52,797	57,654	58,988	68,317	77,967
South	121,040	123,473	125,268	128,225	134,552
West	148,067	152,789	160,615	159,638	170,580
North-East	5,085	5,126	5,372	5,758	7,776
India	462,243	480,463	494,918	516,956	548,144
20% of Net Generation (GWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	27,051	28,284	28,935	31,003	31,454
East	10,559	11,531	11,798	13,663	15,593

South	24,208	24,695	25,054	25,645	26,910
West	29,613	30,558	32,123	31,928	34,116
North-East	1,017	1,025	1,074	1,152	1,555
Share of Must-Run (Hydro/Nuclear) (%)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	25.9%	25.7%	26.1%	28.1%	26.8%
East	10.9%	13.5%	7.6%	10.3%	10.5%
South	28.1%	25.5%	18.6%	16.2%	21.6%
West	8.3%	8.5%	8.4%	9.1%	8.8%
North-East	43.1%	42.4%	48.4%	41.8%	55.4%
Net Generation OM (GWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	100,214	105,082	106,875	111,424	115,129
East	47,017	49,865	54,523	61,267	69,745
South	86,996	91,946	101,928	107,456	105,445
West	135,726	139,838	147,056	145,122	155,586
North-East	2,892	2,952	2,774	3,350	3,469
India	372,845	389,683	413,156	428,619	449,374

IMPORT DATA					
Net Imports (GWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	0	0	0	0	3,616
East	489	555	357	1,689	0
South	1,162	1,357	518	0	0
West	321	0	797	962	285
North-East	0	0	0	0	2,099
Share of Net Imports (%)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	0.0%	0.0%	0.0%	0.0%	2.3%
East	0.9%	1.0%	0.6%	2.5%	0.0%
South	1.0%	1.1%	0.4%	0.0%	0.0%
West	0.2%	0.0%	0.5%	0.6%	0.2%
North-East	0.0%	0.0%	0.0%	0.0%	27.0%

Gross Generation BM (GWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North					34,283
East					17,394
South					30,091
West					40,286
North-East					2,067
India					124,121
Net Generation BM (GWh)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North					32,293
East					16,042
South					28,165
West					37,837
North-East					2,052
India					116,389

EMISSION DATA					
Absolute Emissions Total (tCO2)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	95,563,002	102,909,475	106,874,884	110,045,815	112,109,909
East	57,830,162	61,238,587	66,085,166	74,919,620	84,395,050
South	89,079,903	92,464,571	104,399,643	108,265,267	105,090,651
West	138,485,626	156,449,139	151,385,665	144,340,246	157,882,622
North-East	1,899,897	1,914,716	1,815,717	2,056,883	2,255,262
India	382,858,591	414,976,488	430,561,074	439,627,831	461,733,493
Absolute Emissions OM (tCO2)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North	95,563,002	102,909,475	106,874,884	110,045,815	112,109,909
East	57,830,162	61,238,587	66,085,166	74,919,620	84,395,050
South	89,079,903	92,464,571	104,399,643	108,265,267	105,090,651
West	138,485,626	156,449,139	151,385,665	144,340,246	157,882,622
North-East	1,899,897	1,914,716	1,815,717	2,056,883	2,255,262

India	382,858,591	414,976,488	430,561,074	439,627,831	461,733,493
Absolute Emissions BM (tCO2)					
	2000/01	2001/02	2002/03	2003/04	2004/05
North					17,287,345
East					13,828,319
South					20,491,417
West					29,193,210
North-East					191,174
India					80,991,465

Appendix: II

Table: IRR Calculations without CDM Revenues

YEARS	GROSS FIXED ASSETS	INVENT--ORIES	TOTAL INVEST--MENT	OPERATING PROFIT	INTER--EST	DEPREC--IATION	GROSS CASH INFLOW	NET CASH FLOW	DISCOUNTED VALUE AT
									20%
0	3235.00		3235.00					-3235.00	-3235.00
1		238.20	238.20	75.52	260.34	139.81	475.67	237.47	197.888
2		14.40	14.40	131.51	235.97	139.81	507.29	492.89	342.286
3		15.00	15.00	201.73	196.44	139.81	537.98	522.98	302.651
4		15.00	15.00	282.34	156.91	139.81	579.05	564.05	272.015
5		0.00	0.00	322.93	116.32	139.81	579.05	579.05	232.708
6		0.00	0.00	363.52	75.73	139.81	579.05	579.05	193.923
7				363.52	75.73	139.81	579.05	579.05	161.602
8				363.52	75.73	139.81	579.05	579.05	134.669
9				363.52	75.73	139.81	579.05	579.05	112.224
10				363.52	75.73	139.81	579.05	579.05	93.520
11				363.52	75.73	139.81	579.05	579.05	77.933
12				363.52	75.73	139.81	579.05	579.05	64.944
13				363.52	75.73	139.81	579.05	579.05	54.120
14				363.52	75.73	139.81	579.05	579.05	45.100
15				363.52	75.73	139.81	579.05	579.05	37.584
									-
									-911.83
								=	451.72
							I.R.R.	=	**9.91**

Table: IRR Calculations with CDM Revenues

YEARS	GROSS FIXED ASSETS	INVENT ORIES	TOTAL INVEST -MENT	OPERATING PROFIT	INTEREST	DEPREC -IATION	GROSS CASH INFLOW	NET CASH FLOW	CDM REVENUES	CASH FLOW WITH CDM REVENUES
0	3235.00		3235.00					-3235.00	0.00	-3235.00
1		238.20	238.20	75.52	260.34	139.81	475.67	237.47	24.00	261.47
2		14.40	14.40	131.51	235.97	139.81	507.29	492.89	24.00	516.89
3		15.00	15.00	201.73	196.44	139.81	537.98	522.98	24.00	546.98
4		15.00	15.00	282.34	156.91	139.81	579.05	564.05	24.00	588.05
5		0.00	0.00	322.93	116.32	139.81	579.05	579.05	24.00	603.05
6		0.00	0.00	363.52	75.73	139.81	579.05	579.05	24.00	603.05
7				363.52	75.73	139.81	579.05	579.05	24.00	603.05
8				363.52	75.73	139.81	579.05	579.05	24.00	603.05
9				363.52	75.73	139.81	579.05	579.05	24.00	603.05
10				363.52	75.73	139.81	579.05	579.05	24.00	603.05
11				363.52	75.73	139.81	579.05	579.05	24.00	603.05
12				363.52	75.73	139.81	579.05	579.05	24.00	603.05
13				363.52	75.73	139.81	579.05	579.05	24.00	603.05
14				363.52	75.73	139.81	579.05	579.05	24.00	603.05
15				363.52	75.73	139.81	579.05	579.05	24.00	603.05
							I.R.R.	=		**12.91**

Appendix: III

References

Sl. No.	Particulars of the references
1	Detailed project report (DPR) of 10 MW biomass based power plant of IPL
2	Appendix C to the simplified M&P for the small-scale CDM project activities.
3	UNFCCC, Clean Development Mechanism Simplified Project Design Document For Small Scale Project Activities (SSC-PDD) *[Version 02]*
4	Practical Baseline Recommendations for Green House Gas Mitigation Projects in the Electric Power Sector, OECD and IEA Information
5	Website of Central Electricity Authority (CEA), Ministry of Power, Govt. of India - **www.cea.nic.in**
6	Website of United Nations Framework Convention on Climate Change (UNFCCC), **http://unfccc.int**
7	UNFCCC Decision 17/CP.7: Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol.
8	Website of the Western Regional Electricity Board (WREB):http://www.wreb.nic.in

Appendix: IV

List of Abbreviations

%	Percentage
BAU	Business-as-usual
BM	Build Margin
CPCB	Central Pollution Control Board
IPL	Ind Power Limited
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CMM	Combined Margin Method
CO_2	Carbon di-oxide
CTE	Consent to Establish
DCS	Distributed Control System
DPR	Detailed Project Report
ESP	Electrostatic Precipitator
FBC	Fluidized Bed Combustion
GHG	Greenhouse Gas
IEA	International Energy Agency
IPCC	Intra-governmental Panel for Climate Change
km	Kilo meter
kWh	Kilo Watt Hour
MNES	Ministry of Non-conventional Energy Sources
NGO	Non Governmental Organization
OM	Operating Margin
PDD	Project Design Document
PPA	Power Purchase Agreement
SSC	Small Scale
TPD	Tons per day
TPH	Tons per hour
UNFCCC	United Nations Framework Convention on Climate Change