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

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Biomass based power plant in Mahendargarh, Haryana
Version number of the PDD	14
Completion date of the PDD	28/05/2014
Project participant(s)	Star Wire (India) Vidyut Pvt. Ltd. (SWIVPL)
Host Party(ies)	India
Sectoral scope(s) and selected methodology(ies)	Sectoral scope: I Applied methodology: AMS I.D. "Grid connected renewable electricity generation" (version 17/ scope 1/EB 61)
Estimated amount of annual average GHG emission reductions	52,453

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

Salient features of the Project Activity

The project activity was envisaged for the installation of a greenfield 10 MW biomass based power plant in village Khurawata of Mahendargarh District in Haryana, India by Star Wire (India) Vidyut Pvt. Ltd. (SWIVPL). The consent to establish was also awarded for 10 MW by the State Pollution Control Board (SPCB). However, Haryana Renewable Energy Development Authority (HAREDA) has provided an approval of 9.9 MW based on the assessment of biomass available in the area for the project activity. Therefore, a turbine of 9.9 MW is installed in the project activity. The project activity would generate clean power for export to the NEWNE grid (India has two national grids, i.e. NEWNE grid for North-east, West and North-east and the southern grid). The generated electricity would displace fossil fuel dominated grid based electricity with a renewable source of electricity thereby reducing GHG emissions. The project activity would involve generation of steam from the firing of renewable biomass in a 47.5 TPH capacity boiler, with outlet steam parameters at 67 kg/cm^2 (a) and 465 °C which in turn will drive the turbo-generator set with a capacity of 9.9 MW to produce electricity. The complete description of project technology is provided in the section A.4.2 and metering aspect is delineated in section B.7.2.The project construction is complete and the plant was synchronized with the grid for power supply in May 2013.

Purpose of the Project Activity

The purpose of the project activity is to utilize biomass fuel (Mustard crop residue (85%), Julia Flora (13%) and paddy waste (2%)), which is an agriculture waste, to generate electricity. The electricity thus produced will be exported to the NEWNE Grid and would contribute towards bridging the gap between demand and supply in the power-deficit electricity system from a renewable source which in turn will reduce the GHG emissions and conserve fossil fuels.

Project's contribution to Sustainable Development

The Designated National Authority (DNA) for India is Ministry of Environment and Forests (MoEF), called the National CDM Authority (NCDMA), has stipulated four indicators [1] for sustainable development in the interim approval guidelines for CDM projects. The contributions of project activity towards sustainable development are explained with indicators like contributions to socio-economic, environmental and technological aspects as follows:

Social well being:

- The project activity would contribute towards the local employment by employing skilled and un-skilled personnel for operation and maintenance of the equipment.
- During civil works, a lot of construction work is to be taken place, which will generate employment for local people around the plant site. This will result in the enhanced employment of the people.
- The project activity shall also generate employment opportunities for transporters who shall be engaged in transportation of biomass from nearby collection centre to the project site.
- Procurement of biomass shall open up an additional stream of revenue for the local farmers.

[1] http://www.cdmindia.gov.in/approval_process.php

Economic well being:

- The project will create a business opportunity during construction phase for local stakeholders such as suppliers, contractors, bankers etc. contributing to economic well-being aspects.
- The project would generate employment in the local area, hence leading to the economic prosperity of the local people.
- Procurement of biomass shall provide an additional revenue stream for the local farmers.

Environmental well being:

- The project activity will displace use of fossil fuel based power by renewable energy (biomass based power) and thereby result in reduction of greenhouse gas (GHG) emissions.
- It will also lead to conservation of non-renewable natural resources.
- The project would also reduce pollution in general such as NO_X and SO_X emissions that would have taken place in the baseline.

Technological well being:
The project activity utilizes biomass as fuel to generate steam, which further drives a solidly forged and machined turbine to generate power. The exhaust gas shall be treated with appropriate environmental control equipment in order to remove particulate matter before sending out to the atmosphere. The project activity utilizes environmentally safe technology for meeting the power and process steam requirements at the unit.

A.2. Location of project activity

A.2.1. Host Party(ies)

India

A.2.2. Region/State/Province etc.

Haryana

A.2.3. City/Town/Community etc.

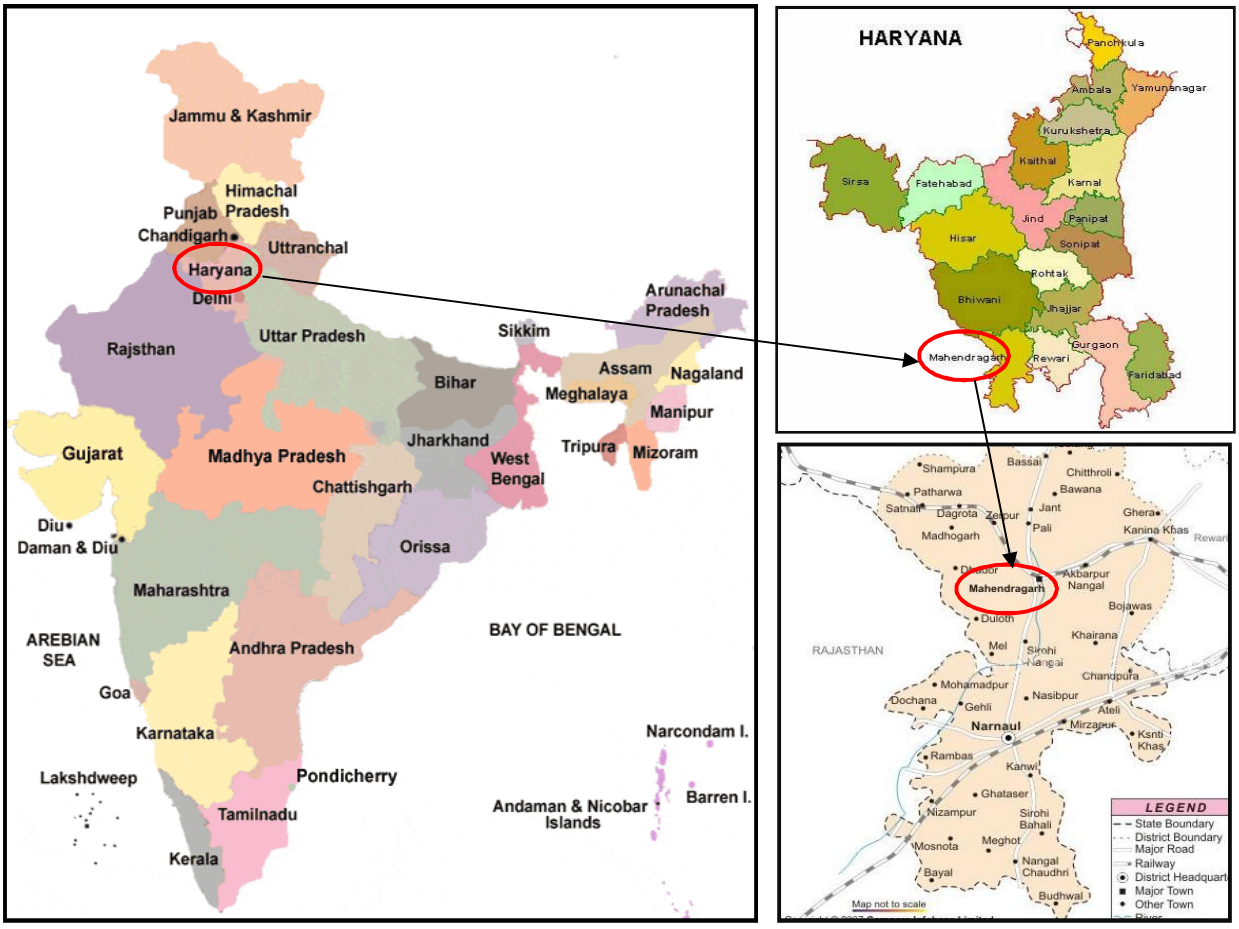
Village: Khurawata
District: Mahendargarh
State: Haryana

A.2.4. Physical/ Geographical location

The project activity is located at village Khurawata in Block-Mahendargarh on Mahendargarh – Zerpur Road in the District of Mahendargarh, Haryana, India. The nearest railway station is Mahendargarh and airport is New Delhi. The exact geographical coordinates of the project site are as follows:

Latitude: 28º 18’ 39” N
Longitude: 76º 5’ 23” E

The following map shows the exact location of the project activity:



A.3. Technologies and/or measures

The project activity is a Renewable energy project which utilizes biomass for production of electricity. The maximum output capacity of the project is 9.9 MW (which is ≤ 15 MW, the maximum allowed output for a small scale renewable energy CDM project) and hence qualifies as a CDM project activity. Following approved small scale methodology is referred for the project activity:

Technology of project activity

The power plant envisages the installation of one 47.5 TPH capacity biomass fired travelling grate type boiler with steam outlet parameters of 67 kg/cm^2 (a) and 465 °C to generate steam and one extraction cum condensing turbo generator of 9.9 MW capacity to generate power. The boiler and the turbo generator would be installed with all the necessary auxiliary plants and systems required for the efficient operation of the plant. The technical description of these systems is discussed below:

Boiler

The steam generating system for the power plant will consist of one multi fuel type biomass fired boiler of capacity 47.5 TPH with all the auxiliaries. The boiler shall be travelling grate type (Moving grate) semi-outdoor unit and shall be of bi-drum, natural circulation, balanced draft, membrane wall radiant furnace design with two stage super heaters and inter-stage desuperheater.

Steam Turbine

The steam generated in the boiler is fed to the 9.9 MW, extraction cum condensing, turbo-generator with the following operational parameters:

Type	: Extraction cum condensing
Rating of Turbine	: 9.9 MW
Inlet steam pressure	: 64 kg/cm^2 (a)
Inlet steam temperature	: 460 ^oC

Power evacuation

It is proposed to step up the generation voltage of 11 kV to 132 kV. The 132 kV transmission lines from the plant's switchyard will be connected to the existing sub-station at 132kV at Mahendergarh, which is about 6 kms from the power plant. The necessary equipment at the sub-station like the CTs, breakers, etc., will be added and adequate space is available at the sub-station for extending the 132 kV bay.

The technology employed is environmentally safe and sound. There will be no technology transfer to the host country for application in the project activity as all the equipment will be purchased from reputed Indian manufacturer.

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host country)	Star Wire (India) Vidyut Pvt. Ltd. (Private entity)	No

A.5. Public funding of project activity

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.6. Debundling for project activity

As per the "Guidelines on assessment of debundling for SSC project activities" EB 54, annexure 13 version 3, a proposed small scale project activity shall be deemed to be a de-bundled component of a large activity if there is a registered small scale CDM project activity or an application to register another small scale CDM project activity:

(a) With the same project participant;
(b) In the same project category and technology/measure; and
(c) Registered within the previous 2 years; and
(d) Whose project boundary is within 1 km of the project boundary of the proposed small scale activity at the closest point

The procedure to determine the same is also provided in the report and is to be followed in the given manner:

(a) Is there a registered SSC Project Activity with the same project participants as the proposed SSC PA?
No. There is no registered project activity by the same project proponent.

(b) Are the registered SSC Project Activity and proposed SSC Project Activity, type I activities providing energy to the same user? (as per EB30, paragraph 37)
Not applicable.

Are the registered SSC Project Activity and the proposed SSC Project Activity in transport sector involving boundaries/sources that are mobile? (as per EB 35, paragraph 58 & 59)

Not applicable.

(c) Is the boundary of the registered SSC Project Activity within 1 km of the boundary of the proposed SSC Project Activity at the closest point?
Not applicable

This implies that "*The proposed SSC Project Activity is not deemed to be a debundled component of a large project activity, therefore is eligible to use the simplified modalities and procedures for SSC PAs.*"

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

As per the Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, methodology AMS I.D. (Version 17) has been used.

Type: Renewable energy projects

Category: I.D.

Title: Grid connected renewable electricity generation

Reference:

The approved methodology uses the "Tool to calculate the emission factor for an electricity system" Version 02.2.1 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".

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.

B.2. Project activity eligibility

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

Conditions in the methodology	Applicability
This methodology comprises renewable energy	The project activity is the installation of a

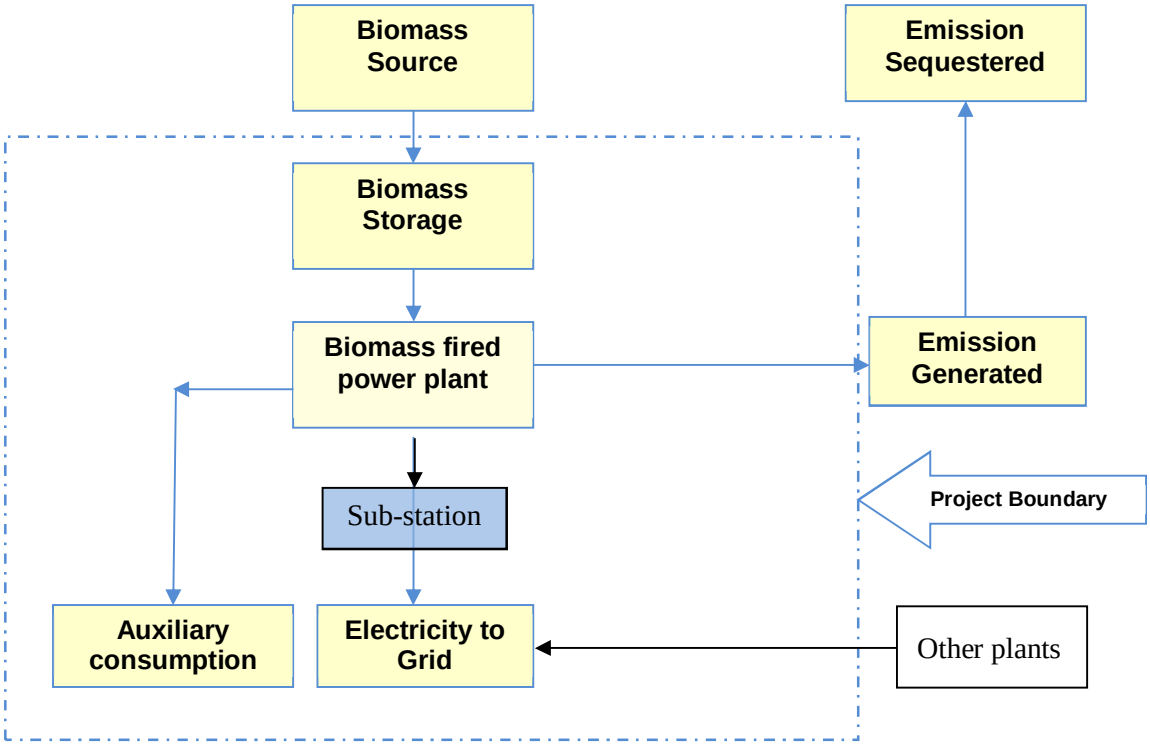
generation units, such as photovoltaic, hydro, tidal / wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid: or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling	Greenfield power plant for power generation from renewable biomass in Haryana. The project activity would supply electricity to the NEWNE grid that is primarily dominated with fossil fuel fired generating units. Hence, it satisfies the applicability criteria.
Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A) applies is included in Table 2	The project activity supply electricity to the NEWNE grid as explained above and meets one of the situations delineated under the Table 2, i.e., Supply electricity to a national of regional grid. Hence, this applicability condition is satisfied.
This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition1; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	The project activity is a Greenfield project and involves installation of a biomass based power plant of capacity 9.9 MW in Haryana. Hence, this applicability condition is satisfied.
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	The project activity is a biomass based power project. Hence, this is not an applicable criteria.
If the new unit 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 new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	The project has a gross generation capacity of 9.9 MW which is entirely sourced from renewable source. The unit has no non-renewable components or provision for future addition of a co-fired fossil fuel system. Thus, it meets the corresponding applicability condition as well.
Combined heat and power (co-generation) systems are not eligible under this category	The project activity involves only power generation through biomass and is not a cogeneration system. Hence it is eligible to use this methodology.
In the case of project activities that involve the	This condition is not applicable to the project

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.	activity as it is a Greenfield project activity proposed with the total installed capacity of 9.9 MW which is below 15MW.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	This condition is not applicable to the project activity as it is not a modification/ retrofit measure in an existing power plant.

Thus, the project activity satisfies all the applicability conditions of the applied methodology which are applicable to the project activity.

B.3. Project boundary

As per the guidelines mentioned in paragraph 9 of AMS I.D, Version 17 "The spatial extent of the project boundary includes the project power plant, the boiler, the turbine generator and other machinery required to run the project activity and all power plants (Sub-station) connected physically to the electricity system that the CDM project power plant is connected to. The project boundary is illustrated in the following diagram:



B.4. Establishment and description of baseline scenario

According to paragraph 10 and 11 of the methodology AMS.I.D, Version 17 the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources and hence the

baseline emissions is the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor:

$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$

Where:

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

As per paragraph 12 of AMS.I.D, Version 17, the Emission Factor can be calculated in a transparent and conservative manner. The calculation is delineated in Appendix 4 of the PDD

B.5. Demonstration of additionality

As per the "*Guidance on the demonstration and assessment of prior consideration of the CDM"* Version 04, EB 62, Annex 13, for project activities with start date after 02 August 2008, the project participant is required to inform the host party DNA and UNFCCC Secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. Such a notification is required to be made within six months of the project activity start date. In accordance with this guidance, the project proponent had informed the National CDM Authority (Host party DNA) as well as the UNFCCC Secretariat[2] on 27th October 2010 of its intention to seek CDM status so as to make the project activity financially viable. This notification was communicated to UNFCCC after the Board resolution was passed on 25/06/2010 as provided in section C.1.1.

CDM awareness of the Project Owner:

The chronology of events for CDM consideration for the project activity is as follows:-

Date	Activity
25/06/2010	Board Resolution was signed wherein CDM was seriously considered for the project activity
15/10/2010	Local Stakeholders Meeting
27/10/2010	Intimation to UNFCCC regarding prior CDM consideration for the project activity
27/10/2010	Intimation to NCDMA regarding prior CDM consideration for the project activity
16/03/2011	Project start date

The implementation of project activity is a voluntary initiative and it is not mandatory or a legal requirement. For power generation, the Indian legislation does not restrict or empower any authority to restrict the fuel choice, the applicable environmental regulations do not restrict the use of biomass energy and there is no legal requirement on the choice of a particular technology. Therefore, baseline scenario is in compliance with all applicable legal and regulatory requirements.

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

[2] http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html

PP has demonstrated the additionality of the project activity in the following manner:

Investment Barrier

The project proponent has chosen to establish the additionality of the project activity by performing benchmark analysis and has chosen Project Internal Rate of Return[3] as the indicator. The benchmark for the project activity is calculated as follows:

Benchmark Analysis:
In order to utilize a benchmark comparable to the project IRR, Weighted Average Cost of Capital (WACC) has been chosen as the benchmark. This is consistent with the "Guidance on the Assessment of Investment analysis", version 05 (EB 62) Paragraph 12 which states "*Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR*".

WACC for the project activity has been calculated as the weighted average of the rate of return on equity and debt. The expected rate of return on equity has been arrived at by using the Capital Asset Pricing Model (CAPM) which is well accepted methodology for estimating the expected rate of return on equity and is widely used for capital budgeting decisions. For a firm considering a new project, the CAPM can provide the required rate of return that the project needs to yield, based on its beta, to be acceptable to investors.

$$WACC = [D/(D+E)] \times [Costof\ Debt] \times [1 - T_c/100] + [E/(D+E)] \times [Costof\ Equity]$$

Where,
D = Debt component of total investment
E = Equity component of total investment
T_c = Corporate tax rate

Risk free rate:

The investment decision date of the proposed project activity is 25th June, 2010 when the average Government bond rate for the year 2008-09, which was 7.69% (Source: Weighted average yield for 2008-09 on Central Government Securities, RBI Annual Report 2008-09[4]).

Market rate of return
The market returns are calculated by considering the returns of BSE-sensex index which is the most relevant index for Indian context as it represents a market return over 2 decades that is comparable with project life time of 20 years. The market returns are considered since the inception of the index in 1991. The monthly closing values of the index along with the beta of selected companies shall be used to arrive at the Weighted Average Cost of Capital for project activity.

Beta Value:
The Beta value of the listed power companies engaged in similar business as the project activity i.e. power generation for a period of more than 10 years, at the time of investment decision are considered for the calculation of benchmark. The beta values have been calculated using the covariance of selected power generating companies with respect to the BSE Sensex index for a period of 5 years. This is in line with the guidance 15 of the "Guidelines on the assessment of investment analysis", Annex 5 EB62.

[3] The detailed IRR calculation sheets have been attached for reference
[4] http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/58APTB_09.pdf

The levered beta values of the selected companies are depicted in the table below:

Listed Company Beta Value

S.No.	Company	Levered Beta
1	TATA Power	1.07
2	Reliance Infrastructure	1.85
3	BF Utilities	2.40
4	Neyveli Lignite	1.48
5	CESC	1.17
6	GIPCL	1.25
7	JP power	1.72
	Average Beta	1.56

This average beta has been used for further analysis.

Market Rate of Return (Rm)
[{(BSE Sensex index at the time of start of project) / (BSE Sensex index at Inception)} ^ (Number of years since inception of index)] - 1
= [(16944.63/982.32) ^ (1/19.33)] - 1
= 15.87%

Market Risk Premium
= 15.87% - 7.69%
= 8.18%

Expected Rate of return on equity or cost of equity is
Ri = Rf + β (Rm-Rf)
= 7.69% + 1.56 x 8.18%
= 20.48%

The project financing for the Biomass based power project activity is proposed at 70% Debt and rest 30% Equity.

Hence, Benchmark Cost of Capital
= (Cost of equity)*(Equity%) + (Cost of debt)*(Debt%)*(Marginal tax rate))
= ((20.48%)*(30%) + (11.5%)*(70%)*(1-33.99%))
= 11.46%

Hence, the benchmark for project IRR of the project is the cost of capital for companies engaged in similar business as that of the project which is calculated as 11.46%.

The IRR analysis has been carried out in accordance with the "Guidance on the Assessment of Investment Analysis", (version 05, EB 62) Paragraph 3, which states that for carrying out IRR analysis, *"In general a minimum period of 10 years and a maximum of 20 years will be appropriate"*. The project IRR without CDM revenue has thus been computed for a period of 20 years, which is acceptable as per the guidance, with inclusion of salvage value of its assets at the end of the assessment period based on the following assumptions.

Assumption sheet			
Description	**Value**	**Unit**	**Source**
Installed Capacity	10	MW	Detailed Project Report, page no 63 (Though the installed capacity shall be 9.9 MW as per the approval accorded for the project activity, PP has used a generation capacity of 10 MW for IRR calculation as the 10 MW was envisaged at the decision making time)
No. of working days	365	days	Detailed Project Report, page no 63
Energy Generation			
Plant Load Factor	80%	%	Detailed Project Report, page no 63
Gross electricity Generation	70.080	GWh	Calculated
Auxiliary consumption	10%	%	Detailed Project Report, page no 63
Auxiliary consumption	7.01	GWh	Calculated
Net Exportable Electricity	63.07	GWh	Calculated
Project Cost			
Equity	30%	%	Detailed Project Report, page no 62
Debt	70%	%	Detailed Project Report, page no 62
Total Project Cost	526.94	INR million	Detailed Project Report, page no 62
Subsidy	8.8	INR million	Letter from REC to MNRE for subsidy (Letter_REC_MNRE for subsidy_22102012)
Tariff			
Tariff	4.46	INR/kWh	Haryana Electricity Regulatory Commission (HERC) Order (It states that 4 INR/kWh is the base price in FY 2007-08 and escalation shall take place at 2% per year)[5]. Further a notification stated that escalation on the base tariff shall be 3% from 2009-10 onwards[6]. But, the same is considered from 2010-2011 as the order came after the decision of implementing the project activity.
Escalation of Tariff	3%	%	
Raw Material			
Raw material mix :			
Biomass	100	%	Detailed Project Report, page 8

[5] http://www.herc.gov.in/old_website/orders/pdf/2009/20091106.pdf
[6] http://www.herc.gov.in/old_website/orders/pdf/2011/20110527a.pdf

	95309	MT	Detailed Project Report, page 8 (Adjusted for 9.9 MW of capacity instead of 10 MW)
Cost of Raw Material			
Biomass	1600	INR/MT	Detailed Project Report, page 63
Escalation of Biomass Cost	6%	%	Detailed Project Report, page 63
Specific Fuel Consumption of Biomass	1.36	ton/MWh	Detailed Project Report, page 63
O&M Expenses			
O&M Expenses (% of Project Cost)	7%	%	Haryana Electricity Regulatory Commission Order dated 06/11/2009 (http://herc.gov.in/old_website/orders/pdf/2009/20091106.pdf)
Escalation in O&M Expenses	7%	%	Haryana Electricity Regulatory Commission Order dated 06/11/2009 (http://herc.gov.in/old_website/orders/pdf/2009/20091106.pdf)
Wheeling charges	2%	%	Haryana Electricity Regulatory Commission Order dated 06/11/2009 (http://herc.gov.in/old_website/orders/pdf/2009/20091106.pdf)
Taxation Rates			
Income Tax	32.32%	%	FY 2010-11 (http://www.itaxindia.org/2011/10/income-tax-rates-companies-ay-2012-13.html)
MAT	16.995 %	%	
Interest Rates			
Working Capital Interest	12.50%	%	Detailed Project Report, page 63
Term Loan Interest	11.50%	%	
Depreciation Rates			
Depreciation Rate as per Companies Act – SLM			
i) Building	3.34%	%	Companies Act (http://asa-india.com/asa/Depreciation%20Rates%20Companies%20Act.pdf)
ii) Plant & Machinery	7.84%	%	
Depreciation Rate as per Income Tax Act – WDV			
i) Plant &	80%	%	Income Tax Act (http://asa-

Machniery			india.com/asa/Rates%20of%20Depreciation%20Income%20Tax%20Act.pdf
ii) Building	10%	%	

Using the assumptions in the table above, the post-tax project IRR for the project activity works out to be 6.78%. The same shall be compared with the benchmark calculated for the project activity to access the financial viability of the project activity.

Sensitivity analysis

A sensitivity analysis has been carried out, by varying the critical parameters of the project activity. The parameters which may have an impact on project IRR are related with various costs, generation and income, and are as below:

1. Electricity generation
2. Tariff
3. Biomass cost
4. Project cost
5. O&M cost
6. Total fuel cost

In accordance with the "Guidance on Assessment of Investment Analysis" Version 03, Paragraph 17, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues have been subjected to reasonable variation. In accordance with Paragraph 17 of the same guidance, a range of +10% to -10% has been considered as the range of variation.

Sensitivity - Project IRR			
Parameter	**-10%**	**0%**	**10%**
Electricity Generation	#DIV/0!	6.78%	12.72%
Tariff	#NUM!	6.78%	18.94%
Biomass cost	16.22%	6.78%	#DIV/0!
Project Cost	12.03%	6.78%	#DIV/0!
O&M cost	10.85%	6.78%	#DIV/0!
Total fuel cost	20.49%	6.78%	#DIV/0!

Please note that the values "#Div/0!" and #Num!" are not erroneous. The formulae for senstivity is same for all the values. In many cases where excel is not able to calculate the values, in case of "#Div/0" the calculation of IRR contains near zero as denominator and in case of "#Num" the excel is not able to iterate the value to an accurate result and these figures appear which is normal.

As can be seen from the table above, the project IRR exceeds the calculated benchmark in case of:

SI. No	Parameter	Variation resulting breach of benchmark	Remarks
1	Tariff	2.25%	The breach of benchmark is not envisaged as 3% annual escalation of the tariff is already taken into consideration for the calculation of the IRR, in

			accordance with the HERC tariff order and an additional increase is not envisaged. PPA clearly makes a mention of the same.. Therefore, it can be safely assumed that the project IRR is not crossing the calculated benchmark figure.
2.	Biomass cost	(-) 3.27%	The breach of benchmark is not envisaged as the trend has shown that the cost of biomass has been on a rise and therefore a decline in cost is not possible. Moreover, as explained above any decrease in input cost will subsequently result in lowering of the tariff also, thereby compensating for the increase in the IRR. Therefore, it can be assumed that the project IRR is not going to cross the calculated benchmark.
3.	Electricity generation	7.20%	The breach of benchmark is not envisaged keeping in mind the rated capacity of operation. Moreover, the PP has got an approval of implementing project with 9.9 MW capacity only and the PP shall comply to the HAREDA mandate. Also, PP has considered 365 days of operation in line with DPR. Since, PP shall have lower generation capacity with same project expenditure and there shall be some shutdown in operation that shall reduce expected generation, an increase in electricity generation from project activity is not possible. Hence, it can be safely assumed that the project IRR shall not breach the considered benchmark
4.	Project cost	(-) 8.80%	Expenditure towards the project cost is already made and the same may be verified from the purchase orders and work orders given against the project activity. Therefore, possibility of a situation where less expenditure is made towards project activity is not there.
5.	O&M cost	(-) 12.35%	A negative variation is O&M cost is not envisaged. In fact, PP is envisaging a higher O&M cost than considered while calculating IRR on ground of higher inflation in the country.
6.	Total fuel cost	(-) 1.65%	The breach of benchmark is not envisaged as the trend has shown that the cost of biomass has been on a rise and therefore a decline in cost is not possible. Moreover, as explained above any decrease in input cost will subsequently result in lowering of the tariff also, thereby compensating for the increase in the IRR. Therefore, it can be assumed that the project IRR is not going to cross the calculated benchmark.

Therefore, it may be safely assumed that the project is additional and shall not be financially viable without any additional source of returns (CDM revenue)

B.6. Emission reductions
B.6.1. Explanation of methodological choices

Emission Reductions

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

$$ER_y = BE_y - PE_y - LE_y$$

Where:

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

Baseline Emissions:

Since the project activity is the installation of a new grid-connected renewable power unit, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources. Therefore, it is the product of electricity produced at the project site multiplied by the grid emission factor:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

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

Determination of $EG_{BL,y}$

According to small scale methodology AMS I.D, Version 17, if the project activity uses fossil fuel to produce electricity, a specific energy consumption of each type of fuel (biomass or fossil) to be used shall be ex-ante. As per paragraph 11 of AMS I.D (Version 17), the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) calculated in a transparent and conservative manner as per paragraph 12 of AMS – I D, Version 17. The Emission factors are calculated according to the guidelines of CDM UNFCCC website.

Data source for the key parameters used to calculate emission reductions is furnished below:

Key Parameter	Value	Data Source	Website
EF_{co2}	Baseline emission	CEA published	http://www.cea.nic.in/reports/plannin

	factor (0.8401 tCO_2/MWh) of NEWNE Grid	baseline emission factor for NEWNE grid (CM), version 5, dated 25/11/2009	g/cdm_co2/cdm_co2.htm
EG_y	Net power export to the grid by the project activity per annum	From plant records. Ex post determination.	

The Baseline Emission Factor (Combined Margin) is calculated according to the methodological tool "Tool to Calculate the Emission Factor for an Electricity System" Version 2.2.1. The data considered for calculation of emission factor is from "CO_2 Baseline Database for the Indian Power Sector" User Guide, Version 5.0[7] published by CEA and the emission factor calculated for the NEWNE grid is 0.8401 tCO2 e/MWh.

This database is an official publication of the Government of India for the purpose of CDM baselines. It is based on the most recent data available to the Central Electricity Authority.

In case of Indian power sector Northern Regional Grid was synchronised with the integrated Eastern, North Eastern and Western Grid in August, 2006 and the four regional grids have since been operating in synchronous mode. The Combined Margin Emission factor for synchronous grid operation of Northern, Eastern, Western and North Eastern Grids (NEWNE) and therefore publishing Emission factors of NEWNE Grid. Now as the project activity lies in the Northern Region of India, NEWNE Grid has been selected for the calculation of the baseline grid emission factor.

Baseline Emission Calculation

The baseline emission factor in year y is calculated as the simple average of the OM and BM emission factors, i.e. OM and BM are each weighted with 50% for the first crediting period. As noted above, the resulting Combined Margin is fixed ex ante for the duration of the crediting period:

$$EF_y = EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

Where,

$EF_{grid,BM,y}$ – Build margin CO2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ – Operating margin CO2 emission factor in year y (tCO_2/MWh)
w_{OM} – Weighting of operating margin emissions factor(%)
w_{BM} – Weighting of build margin emissions factor(%)

As the proposed project activity is biomass based energy generation, the weighting of operating margin emission factor and weighting of build margin emission factor is considered as 0.5 and 0.5 respectively and calculated combined margin as under:

$$EF_y = EF_{grid,CM,y} = (0.5 * 1.00 + 0.5 * 0.68)\ tCO_2 / MWh$$
$$= 0.8401\ tCO_2 / MWh$$

Project emissions

The GHG emission due to the combustion of biomass is neutralized by the sequestration that took place during the growth of the biomass crop. Further, the biomass contains negligible quantities of nitrogen and sulphur so the emission of other green house gases from the combustion of biomass is not considered.

[7] http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm

Therefore, essentially there would not be any GHG emissions due to the project activity within the project boundary.

As per paragraph 20 of AMS.I.D, Version 17, since the project activity is neither a geothermal power plant nor does it have a water reservoir, the project emissions (PE_y) are estimated to be zero.

Also, the auxiliary consumption shall be met by the generation itself. Therefore, PP do not envisage usage of fossil fuel in the project activity. However, the same shall be monitored during the verification period and in case there is consumption of fossil fuel due to unforeseen events, the project emissions shall be calculated using the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", version 2, EB 41 in the following manner:

CO2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO2 emission coefficient of those fuels, as follows:

$$PE_{FF,j,.y} = \sum FC_{FF,y} * COEF_{i,y}$$

Where,

$PE_{FF,j,.y}$ = Are the CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr);

$FC_{FF,y}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);

$COEF_{i,y}$= Is the CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)

i = Fuel types combusted in year y

The CO_2 emission coefficient $COEF_{i,y}$ is calculated using option B of the tool, as follows:

$$COEF_{i,y} = NCV_{FF,i,y} * EF_{Fossil\ Fuel,i,y}$$

Where,

$COEF_{i,y}$= Is the CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)

$NCV_{FF,i,y}$ = Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)

$EF_{Fossil\ Fuel,i,y}$ = Is the weighted average CO_2 emission factor of the fuel type i in year y (tCO_2/GJ)

Leakage

As per AMS I.D, Version 17, 'if the energy generating equipment is transferred from another activity, leakage is to be considered'. In the project activity, there is no transfer of energy generating equipment and therefore the leakage from the project activity is considered as zero. Further, according to EB 44, paragraph 50, leakage from equipment transfer from outside the project boundary may be excluded from consideration in SSC methodologies.

To evaluate if there is a surplus of the biomass in the region of the project activity, which is not utilized, a biomass assessment study has been carried out in accordance with General guidance on leakage in biomass project activities, version 03, Annex 28, EB 47

The biomass requirement for the project activity is 94,356 MT/year. The biomass assessment study conducted for Star Wire (India) Vidyut Pvt. Ltd. By a third party concludes that the biomass generation (Mustard husk, Mustard stick, Paddy Waste, Saw Dust and trees (Branch cuttings) and bushes) in the district Mahendargarh is 520852 MT/year and the consumption of the same in the region including in project plant is 313743 MT/year. Thus, the surplus biomass as a percentage of consumption is found to be more than the figure of 25% required as per the guidance. Therefore, leakage emissions are not taken into account.

Further, in case collection/processing/transportation of biomass residues is outside the project boundary CO_2 emissions from collection/processing/transportation of biomass residues to the project site needs to be considered as the leakage emissions. (Though, if biomass residues are transported over a distance of more than 200 km due to the implementation of the project activity then this leakage source attributed to transportation shall be considered, otherwise it can be neglected).

As the biomass for the project activity will be transported less than 200 km, the leakage is taken as zero.

B.6.2. Data and parameters fixed ex ante

<table>
<tr><td>Data / Parameter</td><td>$EF_{CO2,y}$</td></tr>
<tr><td>Unit</td><td>tCO_2/MWh</td></tr>
<tr><td>Description</td><td>Ex- ante CO_2 emission factor for the NEWNE regional grid</td></tr>
<tr><td>Source of data</td><td>CO_2 Baseline Database for the Indian Power Sector Version 5.0 published by Central Electricity Authority (CEA)</td></tr>
<tr><td>Value(s) applied</td><td>0.8401</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>CEA is a statutory organisation under Ministry of Power which collects and records the data concerning the generation, transmission, trading, distribution and utilization of electricity. Combined margin has been calculated giving equal weightage (w_{OM} = 0.5 & w_{BM} = 0.5) to operating and build margin in accordance with the "Tool to Calculate the Emission Factor for an Electricity System", Version 2.2.1 by UNFCCC
<table>
<tr><th colspan="2">Combined Margin Estimation for NEWNE Grid</th></tr>
<tr><td>Average OM ($EF_{grid,OM,y}$)</td><td>1.0049 tCO_2 / MWh</td></tr>
<tr><td>BM, 2008-09 ($EF_{grid,BM,y}$)</td><td>0.6752 tCO_2 / MWh</td></tr>
<tr><td>Combined Margin ($EF_{grid,CM,y}$)</td><td>0.8401 tCO_2 / MWh</td></tr>
</table></td></tr>
<tr><td>Purpose of data</td><td>Calculation of the baseline emissions</td></tr>
<tr><td>Additional comment</td><td>This value is determined ex-ante and will be fixed for the crediting period</td></tr>
</table>

Data / Parameter	$SFC_{biomass,i}$
Unit	ton / MWh
Description	Biomass consumption per unit of electricity generated by the Power Plant
Source of data	DPR, page 63
Value(s) applied	1.36
Choice of data or Measurement methods and procedures	This is the specific fuel consumption of biomass considered by the Haryan Electricity Regulatory Commission (HERC) in its order for determination of tariff for biomass based power plants
Purpose of data	Calculation of the baggase consumption
Additional comment	This value is determined ex-ante and will be fixed for the crediting period

Data / Parameter	Demonstration of Surplus Biomass
Unit	MT
Description	Surplus biomass in District Mahendergarh Block Ateli Nangal, Kanina, Mahendragarh, Nangal, Nangal Chaudhary of Haryana State
Source of data	Biomass assessment study
Value(s) applied	207,109
Choice of data or Measurement methods and procedures	Biomass surplus has been determined based on the analysis carried out by "MCJ energy Engineers (P) Ltd". MCJ was hired for carrying out an assessment for biomass availability. The report demonstrates that the quantity of available biomass in the region is at least 25% larger than the quantity of biomass that is utilized including the project activity. Therefore, the source of leakage is neglected.
Purpose of data	To check for leakage emissions related to project activity, if any
Additional 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	$M_{biomass}$
Unit	%
Description	Moisture content of biomass
Source of data	Internal records of the monitoring
Value(s) applied	11.91
Choice of data or Measurement methods and procedures	The value has been provided by a third party (a NABL accredited laboratory) that carried out an independent assessment of the available biomass.
Purpose of data	To check for baseline emissions
Additional 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.6.3. Ex-ante calculation of emission reductions

Baseline emissions (BE_y)

Baseline emissions calculated as explained in section B.6.1 above are summarized as below.

$$BEy = EG_{facility,y} * EF_{grid,CM,y}$$

Therefore, EG_y is calculated as:

Parameter	Data Unit	Data Value	Data Source
Plant Capacity	MW	9.9	Letter from IJT (technology supplier) dated 06/09/2011
Plant Load Factor	%	80%	DPR, page 63
Number of days of operation in a year	Days	365	DPR, page 63
Number of hours of operation in a day	Hours	24	DPR, page 63
Gross energy Generation (GWh)	MWh/yr	69379	Calculated
Auxiliary consumption (10%)	MWh/yr	6938	Calculated
Net Energy Generated and exported to grid ($EG_{facility,y}$)	MWh/yr	62441	Calculated
Baseline emission factor	tCO_2/MWh	0.8401	CEA Database Ver 5.0

Therefore,

$BE_y = EG_{facility,y} * EF_{grid,CM,y}$

$BE_y = 62441$ MWh * 0.8401 tCO_2 e/MWh

$BE_y = 52453$ tCO_2/ year

Leakage (LE_y)

Since, there is no transfer of energy generating equipments in the project activity from another activitry of transfer of existing equipment to another activity and the biomass shall be sourced from region within 200 km from project activity, the leakage emissions are taken as zero.

Project activity emissions (PE_y)

As there would be no emissions due to the implementation of the project, the project emissions are estimated to be zero.

Emission reductions (ER_y)

Baseline Emissions (BE_y)	52,453	tCO_2/yr
Project Activity Emissions (PE_y)	0	tCO_2/yr
Leakage (LE_y)	0	tCO_2/yr
Emission Reductions (ER_y) = BE_y - PE_y - LE_y	**52,453**	**tCO_2/yr**

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

Year	Baseline emissions (tCO_2 e)	Project emissions (tCO_2 e)	Leakage (tCO_2 e)	Emission reductions (tCO_2 e)
02/07/2014 – 01/07/2015	52,453	0	0	52,453
02/07/2015 – 01/07/2016	52,453	0	0	52,453
02/07/2016 – 01/07/2017	52,453	0	0	52,453
02/07/2017 – 01/07/2018	52,453	0	0	52,453
02/07/2018 – 01/07/2019	52,453	0	0	52,453
02/07/2019 – 01/07/2020	52,453	0	0	52,453
02/07/2020 – 01/07/2021	52,453	0	0	52,453
02/07/2021 – 01/07/2022	52,453	0	0	52,453
02/07/2022 – 01/07/2023	52,453	0	0	52,453
02/07/2023 – 01/07/2024	52,453	0	0	52,453
Total	**524,530**	**0**	**0**	**524,530**
Total number of crediting years	10			
Annual average over the crediting period	52,453	0	0	52,453

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{gross,y}$
Unit	MWh/year
Description	Gross electricity generated by project activity in year y
Source of data	Meter readings
Value(s) applied	69,379
Measurement methods and procedures	Data Type: Monitored Data Archiving: Paper/ Electronic Monitoring Procedure: Energy Meters of accuracy class 0.5 installed at the generation point would be used to monitor the gross electricity generated by the project activity.
Monitoring frequency	***Recording Frequency:*** Continuous hourly monitoring summarised and recorded monthly and yearly in a logbook ***Monitoring frequency:*** Continuous hourly monitoring
QA/QC procedures	A check meter shall also be installed along with the main meter. The energy meter would be calibrated by a NABL accredited third party annually.
Purpose of data	To calculate baseline emissions
Additional 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	$EG_{gross\ export,y}$
Unit	MWh/year
Description	Gross electricity exported by project activity in year y
Source of data	Joint meter reading
Value(s) applied	62,441
Measurement methods and procedures	Data Type: Measured Data Archiving: Paper/ Electronic Monitoring Procedure: Energy Meters of accuracy class 0.2s would be used to measure the Gross electricity exported by the project activity.
Monitoring frequency	***Recording Frequency:*** Continuous hourly monitoring summarised and recorded monthly and yearly in a logbook ***Monitoring frequency:*** Continuous hourly monitoring
QA/QC procedures	A check meter shall also be installed along with the main meter. All the energy meters would be calibrated by a NABL accredited third party annually. The value of gross electricity exported by the project activity shall be cross checked with the values obtained by subtracting the auxiliary consumption from the gross electricity generated.
Purpose of data	To calculate baseline emissions
Additional 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	$EG_{gross\ import,y}$
Unit	MWh/year
Description	Gross electricity imported by project activity in year y
Source of data	Joint meter reading
Value(s) applied	0
Measurement methods and procedures	Data Type: Measured Data Archiving: Paper/ Electronic Monitoring Procedure: Energy Meters of accuracy class 0.2s would be used to measure the Gross electricity imported by the project activity.
Monitoring frequency	***Recording Frequency:*** Continuous hourly monitoring summarised and recorded monthly and yearly in a logbook ***Monitoring frequency:*** Continuous hourly monitoring
QA/QC procedures	A check meter shall also be installed along with the main meter. All the energy meters would be calibrated by a NABL accredited third party annually. The value of gross electricity imported by the project activity shall be cross checked with the values obtained by electricity invoice.
Purpose of data	To calculate baseline emissions
Additional 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	$EG_{facility,y}$
Unit	MWh/year
Description	Net electricity exported by project activity in year y
Source of data	Joint meter reading
Value(s) applied	62,441
Measurement methods and procedures	Data Type: Calculated from measured values Data Archiving: Paper/ Electronic Monitoring Procedure: Energy Meters (bi directional tri-vector)) of accuracy class 0.2s installed at the interconnection point, to measure gross electricity and imported electricity. The electricity imported from the grid would be subtracted from the gross electricity exported to the grid to obtain the net electricity exported.
Monitoring frequency	***Recording Frequency:*** Continuous hourly monitoring with hourly recording of gross export and import, summarised and recorded monthly and yearly in a logbook ***Monitoring frequency:*** Continuous hourly monitoring of gross export and import
QA/QC procedures	A check meter shall also be installed along with the main meter. All the energy meters would be calibrated by a NABL accredited third party annually. The value of net electricity exported by the project activity shall be cross checked with the invoices raised by SWIVPL on monthly basis.
Purpose of data	To calculate baseline emissions
Additional 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	$FC_{biomass,PJ,y}$
Unit	MT/year
Description	The quantity of biomass consumed in the project activity during the year y.
Source of data	Plant records
Value(s) applied	Total biomass: 94,356 Mustard husk: 80202.36 Julia flora: 12266.24 Paddy Waste: 1887.11
Measurement methods and procedures	The quantity of biomass fed into the boiler will be measured using a conveyor belt, equipped with load cells, and recorded in log book. The same shall be reported on dry basis. Data Type: Measured Monitoring: Quantity of biomass used in the project activity would be measured continuously and recorded in log books.
Monitoring frequency	Recording Frequency: Continuous (Load cell data shall be electronically saved) A separate log book shall be maintained Monitoring frequency: Continuous and estimate using annual energy balance
QA/QC procedures	The conveyor belt system would be calibrated annually by a NABL accredited third party to ensure the accuracy of the measurement. The amount of biomass consumed will be cross checked with an annual energy balance that is based on purchased quantities (e.g. with sales/receipts) and stock changes.
Purpose of data	To monitor the biomass quantity consumed in project activity
Additional 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	$NCV_{biomass,y}$
Unit	kcal/kg
Description	Net calorific value of biomass type k combusted during the year y
Source of data	Lab test reports
Value(s) applied	-
Measurement methods and procedures	Data Type: Measured Monitoring: NCV of the biomass would be tested by a NABL accredited laboratory on dry basis. NCV would be tested once in a quarter, by taking three samples, for the first year. The average value from the quarterly assessment of first year shall then be used for the entire crediting period.
Monitoring frequency	Recording Frequency: Determine once in the first year of the crediting period Monitoring frequency: Determine once in the first year of the crediting period
QA/QC procedures	The analysis of biomass will be carried out by an authorized testing agency. The average value of the first year shall be cross checked with relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. In case, the variation is significant in the fixed and latest available data, additional measurements shall be carried and conservative data shall be considered.
Purpose of data	To cross check the biomass quantity
Additional 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	$FC_{FF,y}$
Unit	MT/year
Description	The quantity of fossil fuel consumed in year y
Source of data	Plant records
Value(s) applied	0
Measurement methods and procedures	The quantity of fossil fuel fed to the boiler will be measured using a weighbridge and recorded in log book. Data Type: Measured Monitoring: Quantity of fossil fuel used in the project activity would be measured continuously and recorded in log books
Monitoring frequency	Recording Frequency: Continuous Monitoring frequency: Continuous
QA/QC procedures	The weighing system would be calibrated by a NABL accredited third party on annual basis to ensure the accuracy of the measurement. The amount of fossil fuel consumed will be cross checked by an annual energy balance that is based on the purchased fuel and stock inventory changes.
Purpose of data	To calculate project emissions
Additional 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	**$NCV_{FF,i,y}$**
Unit	kcal/kg
Description	Net calorific value of fossil fuel type i combusted during the year y
Source of data	Information provided by supplier. In case of non-availability of data from supplier the value shall be referred from IPCC
Value(s) applied	-
Measurement methods and procedures	Data Type: Monitored Monitoring: The value shall be sourced from the supplier on annual basis. In case the supplier is not able to provide the data, PP shall refer the same from IPCC.
Monitoring frequency	Recording Frequency: Annually Monitoring frequency: Annually
QA/QC procedures	The value applied shall be cross checked with publically available data
Purpose of data	To calculate project emissions
Additional 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	$EF_{Fossil\ Fuel,\ i,\ y}$
Unit	tCO2/GJ
Description	Weighted average CO_2 emission factor of fuel type i in year y
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	-
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	The latest available versions of the guidelines would be used
Purpose of data	To calculate project emissions
Additional comment	Archived data will be kept 2 years beyond the crediting period.

B.7.2. Sampling plan

PP is not required to have an in-house sampling plan, as it is monitoring 100% of the required data.

B.7.3. Other elements of monitoring plan

Star Wire (India) Vidyut Pvt. Ltd. has designed a comprehensive monitoring plan as per the guidance provided in the monitoring section of AMS.I.D Version 17

Description of monitoring plan

As per the requirement of monitoring methodology, the parameters mentioned in section B.7,1 shall be monitored on periodicity defined against each indicator.

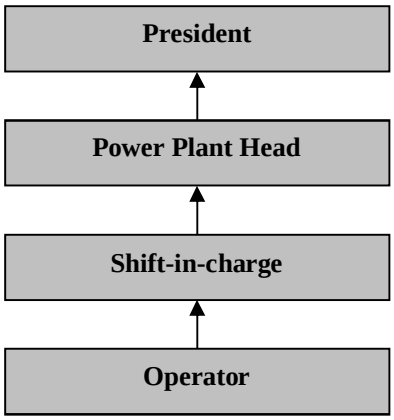
The electricity generated and the auxiliary consumption shall be recorded using energy meters. A spare meter shall be kept for both the readings. The net energy exported shall be cross checked with the difference of the gross electricity generated and the auxiliary consumption. Further, there will be two energy meters (main and check) installed at the interconnection point to record the energy exported to and imported from the grid by the project activity. In case the main meter goes out of operation or shows erroneous reading then the check meter reading would be used for billing and calculation of emission reduction purposes. Also, there is a provision for a spare meter which shall be kept at site. The net electricity would be calculated as the difference of the energy exported to and imported from the grid and would be used for the calculation of emission reductions of the project activity. As far as electricity is concerned, the monitoring and verification system would mainly comprise of these meters. The energy meters will be calibrated annually so that the accuracy of measurement can be ensured at all times.

The quantity of biomass being fed into the boiler will also be monitored using the belt conveyor system/load cell.

To ascertain the Quality Control and Quality Assurance of the monitored parameters, Star Wire (India) Vidyut Pvt. Ltd. has developed an internally accepted set of standards that would ensure accuracy of all monitoring and control functions. In accordance with this set of standards, the following operational and management structure has been adopted:

The electricity generation and auxiliary consumption of the plant would be recorded by shift-in-charges on a daily basis after taking reading from the meter. The quantity of biomass consumed would also be monitored on continuous basis. The power plant head would ensure that the data is properly collected and stored electronically/paper. The monthly report would be prepared by Shift Engineer by aggregating the daily readings and the same will be verified by the power plant head. Any discrepancy observed in the readings would be immediately rectified. The power plant personnel are qualified technical professionals. All the shift in-charges are trained and experienced diploma holders. Need based training of employees associated with the project activity will be carried out as and when felt necessary.

CDM Committee Organogram



SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

16/03/2011 (Purchase order of equipment)

C.1.2. Expected operational lifetime of project activity

20 years as per the lifetime certificate from technology supplier

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

Fixed crediting period

C.2.2. Start date of crediting period

02/07/2014

C.2.3. Length of crediting period

10 years

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

The Ministry of Environment and Forests (MoEF), Government of India, under the Environment Impact Assessment Notification[8] vide S.O.1533 dated 14/09/2006 has listed a set of industrial activities in the Schedule for which new projects or modernization/expansion projects will require environmental clearance and will have to conduct an Environmental Impact Assessment(EIA) study. Further a notification , vide number S.O. 195 (E) has been issued by the government on 19th January 2009 suggesting certain amendments in the EIA notification.

As per the latest notification, the biomass based projects with capacity up to 15 MW are exempt and are not required to carry out an EIA. Therefore, since Star Wire (India) Biomass Pvt. Ltd's project activity is only 9.9 MW it does not require EIA to be conducted according to this notification. Hence, the project proponent did not conduct any Environmental Impact Assessment study. However, the project proponent has obtained the necessary approvals from various authorities.

SECTION E. Local stakeholder consultation
E.1. Solicitation of comments from local stakeholders

The stakeholders are defined as the public, including individuals (villagers in the vicinity), groups or communities (other institutions, NGO's, etc), affected, or likely to be affected, by the proposed CDM project activity. Identified stakeholders were requested personally by the project proponent to participate in the stakeholder consultation meeting to discuss any potential concerns regarding the project activity. In this regard, an invitation letter comprising a brief summary of the project and the purpose of the said consultation was sent to the stakeholder 15 days before the stakeholder meeting and individual signature of the stakeholder was taken after reading the invitation to them in local language.

Subsequently, a meeting was organized by Star Wire (India) Vidyut Pvt. Ltd on 15/10/2010. Representatives from Star Wire (India) Vidyut Pvt. Ltd. facilitated the meeting. Stakeholders were explained the details of the project activity and were given an overview of the greenhouse gases emission, impact of GHG and CDM etc. They were apprised of how the project activity would lead to GHG

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

emission reduction and contribute to sustainable development in the region. Following this, certain concerns were raised by the stakeholders. These have been recorded and are available on request.

E.2. Summary of comments received

Local stakeholders had concerns about the environment pollution, if any, of the project activity and were curious on how the project activity will benefit them. The same was addressed by representatives of PP and the stakeholders were informed about the benefits of the project activity in terms of employment for unskilled and skilled labours, economic benefit in return of their crop waste, etc and were assured that there are proper measures in place to take care of safety and environmental issues.

Considering that the project activity aids in the conserving the natural resource and aids in providing employment opportunities to the local people, the stakeholders were very appreciative of the project activity.

E.3. Report on consideration of comments received

There were no adverse comments received from the stakeholders and the net beneficial effects of the project activity were acknowledged by the stakeholders present as delineated in the section E.2.

SECTION F. Approval and authorization

The Host Country Approval (HCA) for the project activity is already awarded for the project activity by the Ministry of Environment and Forestry (NCDMA of India).

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Appendix 1: Contact information of project participants

Organization	Star Wire (India) Vidyut Pvt. Ltd.
Street/P.O. Box	35, Link Road,
Building	Lajpat Nagar – III
City	Delhi
State/Region	New Delhi
Postcode	110024
Country	India
Telephone	011-29832650 – 52
Fax	011-29832542
E-mail	varuntodi@gmail.com
Website	-
Contact person	-
Title	-
Salutation	Mr.
Last name	Todi
Middle name	-
First name	Varun
Department	-
Mobile	-
Direct fax	011-29832542
Direct tel.	011-29832650 – 52
Personal e-mail	varuntodi@gmail.com

Appendix 2: Affirmation regarding public funding

No public funding as part of project financing from parties included in Annex I of the convention is involved in the project activity.

Appendix 3: Applicability of selected methodology

The justification for application of selected methodology is already provided in section B.2 of the PDD

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

The calculations for baseline emission are carried out in the following manner apart from what is presented in section B.6.3:

Selection of Grid boundary

In the approved consolidated methodology ACM0002, the following guideline is given for the selection of grid. *"Where DNA guidance is not available, in large countries with layered dispatch systems (e.g. state/provincial/regional /national) the regional grid definition should be used. A state/provincial grid definition may indeed in many cases be too narrow given significant electricity trade among states/provinces that might be affected, directly or indirectly, by a CDM project activity"*.

As stated earlier, the electrical transmission system in India is divided into two regions namely NEWNE Region and Southern Region. The NEWNE regional grid covers many states including Himachal Pradesh where the project activity is located. Therefore NEWNE grid region is selected as grid boundary to estimate the baseline emission factor.

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 baseline emission factor has been calculated in line with paragraph 12 of the AMS. I.D, Version 17 as follows:

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

OR

(b) The weighted average emissions (in kg CO_2 /MWh) of the current generation mix. The data of the year in which project generation occurs must be used."

The approach proposed in the "Option (a)" i.e. "Combined Margin" has been used for ascertaining baseline emissions and corresponding emission reductions using the 'Tool to calculate the emission factor for an electricity system", version 02.2.1, Annex 19, EB 63 as follows:

STEP 1: Identify the relevant electricity systems

The project activity displaces electricity generation that would otherwise be generated from the HERC grid, which is a part of the NEWNE grid of India. For the calculation of emission reductions, the NEWNE grid, as delineated by the Central Electricity Authority (CEA), may be considered as the reference grid since the HERC grid is interlinked with other state grids in the region and significant energy exchanges exist between them.

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

Since this is an optional step, PP has resorted to skip the same.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

(a) Simple OM; or

(b) Simple adjusted OM; or

(c) Dispatch data analysis OM; or

(d) Average OM.

Out of four methods mentioned, Simple OM approach has been chosen for calculations since in the NEWNE Grid, the low-cost/must run resources constitute less than 50% of total grid generation. The simple operating margin calculation is done based on ex-ante option. Therefore, 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 (referring CEA database version 5), has been delineated in the PDD. The most recent 3 years for which data is available and considered are 2006-07, 2007-08 and 2008-09.

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. The simple OM may be calculated by one of the following two options:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Out of the options, option A has been chosen for calculating the simple operating margin. Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

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

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO2 emission factor in year y (tCO2/MWh)

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

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

m = All power units serving the grid in year y except low-cost/must-run power units

y = The relevant year as per the data vintage chosen in Step 3

CEA (Central Electricity Authority) comes out with an annual database providing information on the electricity generation and emission factor of the connected power plants. Therefore, the values of both $EG_{m,y}$ and $EF_{EL,m,y}$ has been referred from latest available database at the time of initiating the validation exercise, i.e. version 5 and simple operating margin has been calculated as under:

$EF_{grid,OMsimple,y}$ = (384597.07*1.0085)+(409834.20*0.9999)+(421802.63*1.0066)

(384597.07+409834.20+421802.63)

= 1.0049 tCO_2/MWh

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

The build margin emission factor is calculated using option 1, where it is calculated 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.

The value of the BM is referred from CEA database which is calculated based on the tool to calculate the emission factor for an electricity system. The value thus obtained is 0.6752 tCO2/MWh.

Step 6: Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor (EFgrid,CM,y) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM

The weighted average CM method (option A) has been chosen by the PP to calculate the combined margin. Therefore, the combined margin emissions factor is calculated as follows:

$EF_{grid,CM,y}$ = $EF_{grid,OM,y}$ X W_{OM} + $EF_{grid,BM,y}$ X W_{BM}

Where,

W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period, and W_{OM} = 0.25 and W_{BM} = 0.75 for the second and third crediting period.

Therefore, emission factor for first crediting period is calculated as follows:

$EF_{grid,CM,y}$ = 1.0049 X 0.5 + 0.6752 X 0.5

= 0.5025 + 0.3376

= 0.8401tCO_2e

Combined Margin Estimation for NEWNE Grid (tCO_2 / MWh)	
OM, 2006-07	1.0085
OM, 2007-08	0.9999
OM, 2008-09	1.0066
Average OM ($EF_{grid, OM,y}$)	**1.0049**
BM, 2008-09 ($EF_{grid, BM, y}$)	**0.6752**
Combined Margin (EF_{CO2})	**0.8401**

Data used to determine Baseline Emissions

Parameter	Data Unit	Data Value	Data Source
Plant Capacity	MW	9.9	Letter from IJT

Plant Load Factor	%	80%	DPR, page number 63
Number of days of operation in a year	Days	365	DPR, page number 63
Number of hours of operation in a day	Hours	24	DPR, page number 63
Auxiliary consumption	%	10	DPR, page number 63
Baseline emission factor	tCO_2/MWh	0.8401	CEA – CO_2 Baseline Database for the Indian Power Sector, Version 5.0

In accordance with "Guidelines for the reporting and Validation of Plant Load Factors", Version 01 (EB48, Annex 11), the Plant Load Factor (PLF) has been sourced from the Detailed Project Report (DPR) prepared by third party:

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Appendix 5: Further background information on monitoring plan

The monitoring plan has been already delineated in detail in the section B.7.3

Appendix 6: Summary of post registration changes

This is not applicable as the PP is applying for registration of project activity with the UNFCCC.

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9).
03	EB 28, Annex 34 15 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.
02	EB 20, Annex 14 08 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>.
01	EB 07, Annex 05 21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		