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:

"Grid connected 13 MW biomass power project in Maharashtra"
Version: 1.0
Date: 01.08.2006

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

The proposed project activity is a 13MW renewable energy based power project from GAPS Power & Infrastructure Pvt. Ltd. Cotton stalk (other biomass such as Maize / Red gram stalks, and Juliflora etc would also be utilized) which is a renewable biomass available in the region would be utilized for power generation. The project activity will be located in Shendra Maharastra Industrial Development Corporation (MIDC) in Aurangabad District in the state of Maharashtra, India. The power generated in the plant would be exported to Maharashtra State Electricity Distribution Company Limited (MSEDCL) through Maharashtra State Electricity Transmission Company Limited (MSETCL), which is a part of Western Region (WR) Grid. The WR Grid is primarily based on fossil fuel. The displacement of equivalent power in the grid would result in emission reduction linked with fossil fuel combustion in power generation.

Though the biomass availability in the region is abundant however there is no proper collection & delivery network in place, hence project promoter would also have to develop a logistic network for biomass collection & delivery. It has also been observed (in many Indian states such as Punjab, Uttar Pradesh, and Andhra Pradesh etc) that biomass prices escalate substantially with increased usage. CERs from this project shall also be utilized in mitigating the fuel risks and to make investments in developing dedicated fuel sources.

The proposed project shall use the conventional Rankine cycle. The project activity would comprise of one boiler of 60 TPH @ 45 kg/cm2 and 440 deg C and one condensing turbine of capacity 13 MW. The pressure and temperature are less than other more efficient rankine cycle plants (operating at 87 Kg/Cm2 or 105 Kg/Cm2 and 550 degree C). This lower pressure and temperature technology has been chosen to facilitate the use of 100% cotton stalk as fuel which is a difficult fuel to use for power generation thus compromising on steam output efficiency. To minimize the possibilities of corrosion in the Boiler the size of the furnace has been enlarged which has resulted in increased project cost. Registering the project under Clean Development Mechanism of UNFCC and availing CERs will compensate lower efficiency and higher project cost as well as lower Plant Load Factor (PLF) of the plant compared to normal fossil fuel fired power plants.

The project activity has a number of sustainability aspects associated with it–

1. The project activity is renewable power project and would result in GHG emission reduction for the equivalent power in the WR grid, which is primarily based on fossil fuels.
2. The fuels proposed in the project are biomass residues from the area. This will provide a distinct source of revenue to the local farmers and other people from sale and transportation of these biomass residues.

3. The project activity would generate employment during construction and operation of the power project[1]
4. The power project would help in achieving regional energy security by bridging power demand supply gap in the state.
5. Use of biomass in power generation would lead to conservation of natural resources such as coal, oil etc.
6. The project activity would provide the desired impetus to other industries to come up with similar projects in the region and elsewhere.
7. More efforts and resources would be put into R&D in technologies to suit the similar project activities. Cotton stalk is a very difficult fuel to use for power generation, success of the project activity shall lead to implementation of more cotton stalk based power projects.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (yes/no)
Government of India	GAPS Power & Infrastructure Pvt. Ltd. (GAPS Power)	No

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

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

A.4.1.1. Host Party(ies):

Country: India

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

State: Maharashtra

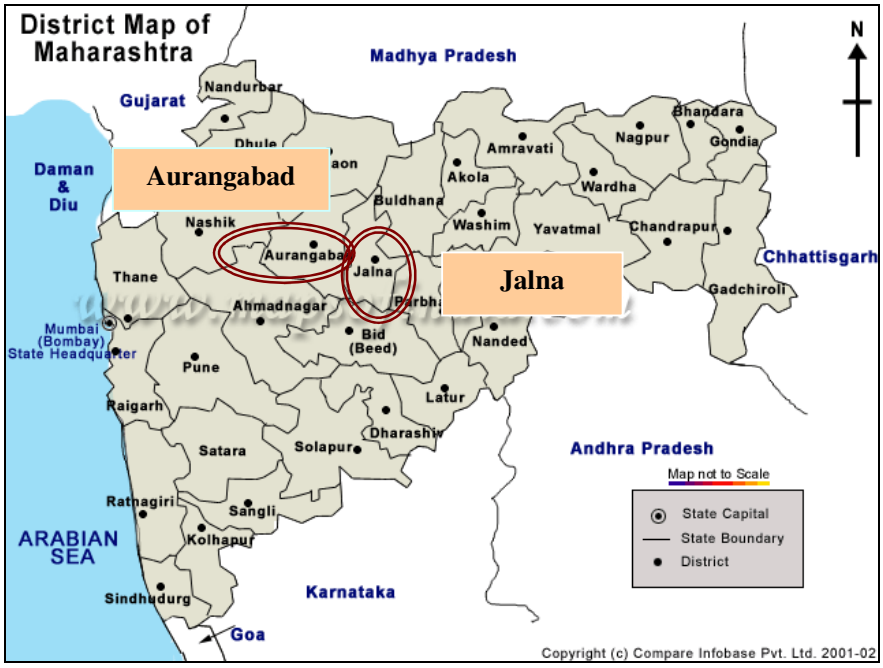
A.4.1.3. City/Town/Community etc:

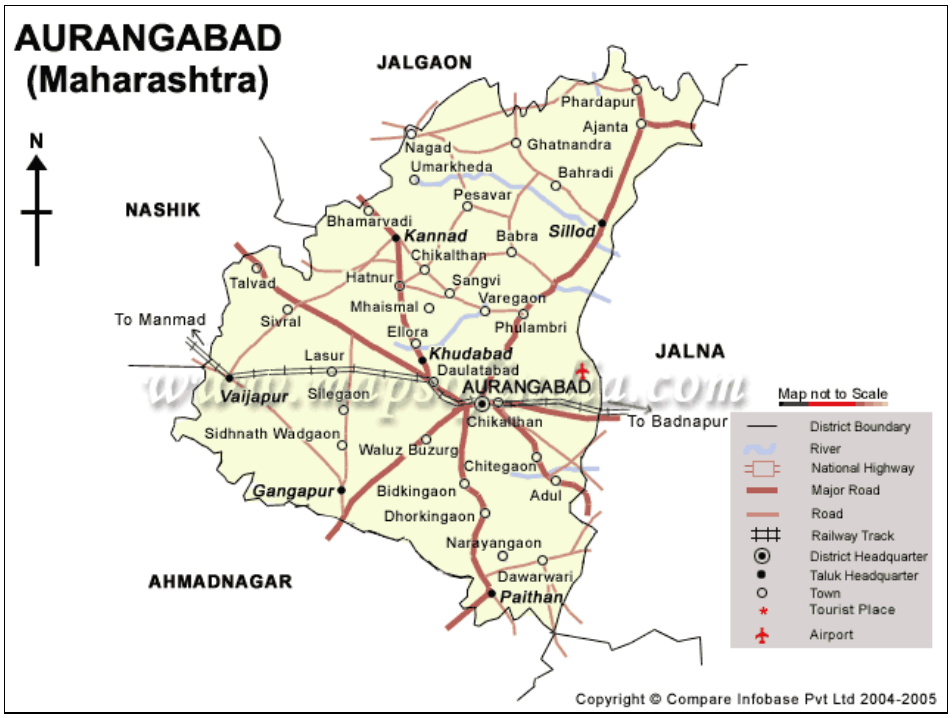
Area: Maharashtra Industrial Development Corporation (MIDC)
Village: Shendra
District: Aurangabad
State: Maharashtra

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

[1] Projected direct employment generation-80 people, and in-direct employment for 800 people. At the time of plant construction approx 350 people would be employed.

The proposed 13 MW biomass based power plant will be located in Shendra MIDC, Aurangabad district in the state of Maharashtra. Aurangabad district is located at Northern latitude between 19° & 20° and its East longitude between 74° & 76°. Shendra MIDC is located at a distance of about 20 km from Aurangabad city and about 40 km from Jalna. The geographic location in which the project activity is shown in the map below:





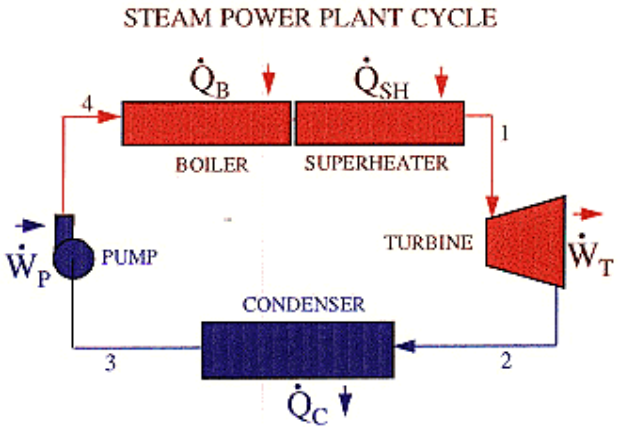
A.4.2. Type and category(ies) and technology of the small-scale project activity:

The project is a small scale CDM project activity and is based on Appendix B (Version 07, Date: 28 November 2005) of the simplified modalities and procedures for small-scale CDM project activities. The project activity conforms to the following category-

TYPE I: Renewable Energy Projects & Category ID: "Grid connected renewable electricity generation"
This category 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.

Reference: Version 9, Scope 1, dated 28/07/2006

The power plant in the project activity would be based on steam-power Rankine cycle. This would comprise of one multi-fuel travelling grate boiler of 60TPH capacity at 45 kg/cm2 and 440 Deg C and a condensing turbine of 13 MW with one uncontrolled bleed for feed water heating in de-aerator. Net power generated from the plant would be exported to MSEDCL grid via a 132 kV line to proposed sub-station



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:

The project activity results in emission reduction through substitution of power by energy generation using renewable biomass residues. The substituted power in this case is MSETCL grid electricity connected to WR grid, which is primarily based on fossil fuel combustion (more than 90% is coal/gas based power generation)[2]. Substitution of grid power would result in equivalent emission reduction associated with the fossil fuel burning. In addition the project activity will also prevent current ways of inefficient burning or rotting of biomass in open fields.

[2] Western Region Electricity Board (WREB) Annual Report 2004-05

In the absence of the project activity, equivalent power would have generated in the WR Grid primarily based on fossil fuels. The project activity faces a number of barriers such as Investment barrier, technical barrier, and risks associated with biomass logistics & price etc (details in section B.3 of the document). The project activity is also one & first of its kinds in the state. Due to these barriers the project activity would not happen without CDM benefits. GAPS Power envisages supporting the project and mitigating the risk with CDM backed revenues.

The estimated amount of emissions reduction over the 10 years of crediting period is : 667848 tonnes of CO_2 equivalent.

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

Years	Annual estimation of emission reductions in tones of CO2 e
2007- 2008	56919
2008- 2009	64508
2009- 2010	68303
2010- 2011	68303
2011- 2012	68303
2012- 2013	68303
2013- 2014	68303
2014- 2015	68303
2015- 2016	68303
2016- 2017	68303
Total estimated reductions (tonnes of CO2 e)	667848
Total number of crediting years	10 years
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	66785

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

No public funding for the project activity.

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

As per Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities – "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"

The project activity is not a de-bundled component of a large project activity as –

There is no small scale CDM project activity or an application registered by GAPS Power in the same project category in the last two years within 1 km of the project boundary of the proposed small-scale 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:

The project is a small scale CDM project activity. It is based on "**TYPE ID: Grid connected renewable electricity generation"** of Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

Reference: Version 9, Scope 1, dated 28/07/2006

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

Category	Applicability Criteria	Project Status
TYPE ID: **Grid connected renewable electricity generation**	This category 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.	The project activity is a renewable power project with biomass residues to be used as fuel. The power generated would be exported to MSEDCL through MSETCL grid which is a part of WR grid.
	If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.	The project capacity is 13 MW.

Important information for determination of baseline scenario:

SN	Key Information	Information Source
1	Biomass based power project technical features	Detailed Project Report (DPR) prepared by a

		well known consulting firm
2	Biomass availability	Assessment done by a third party
3	Grid Emission factor	Western Region Electricity Board (WREB) Annual Reports, Central electricity authority (CEA) and IPCC data

Grid emission factor estimation details provided in section B.5, Annex-4

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:

Proposed project activity is eligible to use simplified methodologies as

- It conforms to project category in "Appendix B of the simplified modalities & procedures for small scale CDM-project activities under AMS TYPE ID– "**Grid connected renewable electricity generation**"
- The power project capacity is 13 MW (<15 MW).
- It is not a debundled component[3] of a larger project activity, as it qualifies guidelines in "appendix C to the simplified M&P for the small-scale CDM project activities for guidance on how to determine whether the proposed project activity is not a debundled component of a larger project activity"

Project Additionality Analysis:

The additionality of the project activity is analysed using barrier analysis as per Attachment A of the simplified modalities & procedures for small scale CDM-project activities (version 06/30 September 2005).

A: Investment Barrier

Low Returns from the project
At this step it has been determined whether the project activity is economically or financially viable and attractive without the sale of Certified Emissions Reduction (CER).

The project activity entails high capital cost investments. An investment analysis of the project activity was done based on the Internal Rate of Return as the financial indicator. 'IRR' is one of the known financial indicators used by banks, financial institutions and project developers for making investment decisions. The equity IRR was then compared with RRR[4] for the project activity.

The project activity is highly investment intensive. The total investment made by GAPS Power on the power project implementation would be approx INR ~590 million[5]. So project activity could not have

[3] Refer section A.4.5

4 The RRR (14%) was calculated as Required Rate of Return for the project activity. Capital asset pricing model (CAPM) is used.

5 This is based on DPR projected cost and equipment quotations received by GAPS power at the time of PDD submission.

been possible if CDM benefits were not taken into account, which makes IRR of the project activity viable.

Summary of Financial analysis of project	
Capacity	13 MW
Debt Equity Ratio	70 % : 30 %
Interest Rate on term loan	12.25 %
Plant Load factor	75 % in First year, then moving up-to 90 % in the third year of operations
Auxiliary Power Consumption	10%
Operating period	330 days/24 hours
Project IRR without CERs	11.98[6] %
Cotton Stalk Calorific Value	3490 Kcal/Kg (as per sample testing done by well known Laboratory in India)
Fuel Cost	Rs 1000/ton
Station Heat Rate	3701
Project IRR with CERs	15.08 %
Required Rate of Return (RRR)	14.05 %
Tariff	As per MERC tariff policy for similar kinds of projects

Sensitivity Analysis

A detailed sensitivity analysis of the project activity was done to test the project feasibility with varying project parameters. The project activity feasibility is dependent on the following parameters.

- Annual export to MSEDCL
- Fuel Prices

Sensitivity Table showing impact of variations in key factors on IRR without CDM revenue:

(a) Variation in Annual Export of power-

SN	Parameters	Variation	IRR	% Change	Comments
1	Annual Export to MSEDCL	+5 %	15.11 %	+26.12 %	The probability of a 10% increase in annual export to MSEB is not very high as PLF considered for IRR estimation is anyways 90% in the third year of operations
		-5 %	8.64 %	-27.88 %	The IRR of the project activity is very low in comparison of RRR benchmark.

(b) Variation in Fuel Prices-

[6] Financial analysis is done by a well known financial consulting firm with experience in biomass based power projects

SN	Parameters	Variation	IRR	% Change	Comments
2	Fuel Prices variations	+5 %	5.54 %	-53.75 %	The IRR of the project activity is lower than the RRR benchmark i.e. 14%;
		-5 %	15.87 %	+32.47 %	Due to extremely low margin Price reduction possibilities are very low.

It has been concluded that proposed project activity is unlikely to be the most financially attractive.

Difficulties in Financial Closure
Getting financial closure for biomass based project is a difficult task in India. These type of projects are assessed to be risky by financial institutions due to risks of crop failure, crop pattern changes, risk of plant closure in case of biomass unavailability, lack of biomass delivery & collection network, risks of sudden fuel price rise, higher project costs as compared to coal based plant (and particularly for the project activity due to low efficiency and technical problems as well) etc[7]. Also given low IRR arranging equity participation for the project was difficult. Therefore the Promoters have approached a foreign investor (M/s Hampton Investment Group Limited) who is willing to provide part equity participation in the project against share of CERs generated from the project activity. Hence project promoters are proposing to remove the main barrier i.e. investment barrier (Financial closure and improvement in the project IRR) by registering the project activity as CDM project.

B: Technological Barrier

The primary fuel to be used in the project activity is Cotton Stalk, which is considered to be a difficult fuel to burn in the boiler due to following reason.

- Cotton stalk contains chlorine and potassium and presence of these substances makes it unsuitable for high pressure and high temperature combustion as potassium chloride has melting point of 500 Deg C and at this temperatures it starts fusing. This leads to build up on boiler tubes and consequent failure of boiler tubes. To avoid this GAPS Power have planned to install comparatively a low pressure and low temperature (45 kg/ cm2 and 440 Deg C) boiler, which has lower efficiency, compared to other similar high pressure and high temperature power systems.

- Cotton stalk has very high alkali content and hence firing of cotton stalk results in generation of high alkali gas which generally has the characteristic of frothing and foaming at a higher temperature. Due to this characteristic, an oil coating is formed on the super heater coil which reduces the heat transfer co-efficient in due course. This aspect needs special attention while designing a Boiler for firing cotton stalks. If 100% cotton stalk is used in the boiler, there will be a coating formation in the super heater coils leading to rapid reduction of super heat temperature and needing frequent shut down of boiler for cleaning of super heater coils. Although soot blowers are provided for steam cleaning the super heater, the efficacy of even frequent steam cleaning can be inadequate in getting rid of such coating. Hence, usage of 100% cotton stalk is

[7] This is evident by the queries raised by FIs/Banks regarding barriers associated with the project activity. Also FIs recommended 35% equity participation to cover up for the risks in the project (as against 30% norm considered by MERC) by the promoter which was a difficult proposition given high cost of the project.

generally avoided when super heater temperature exceeds 485 Deg. C to 500 Deg. C. However in order to sustain usage of 100% cotton stalk under such difficult conditions the Boiler furnace size has been increased, which has led to higher costs as compared to similar rating Boilers using other types of fuels

- The cotton stalk structure is also fibrous in nature. Fibrous fuels do not permit usage of screw feeder or drag chain feeder which is generally used for feeding other bio mass fuels. Hence, for firing a boiler with cotton stalks, over bed firing feeder with rotating drum feeding arrangement has to be provided & the conveyor should continuously run for feeding this drum feeder; there should be provision for continuous feed to the conveyor to avoid any variations in steam generation.

All the above listed problems with Cotton stalk as a fuel require significant design changes (low pressure/temperature & larger size furnace), which in turn increase the project costs and also lead to lower efficiency (as compared to high pressure & high temp systems). Higher cost and low efficiency makes the project activity less financially attractive and is therefore additional[8].

C: Operational barrier:

Biomass Logistics and Price Risk

Biomass, though abundant in supply, doesn't have proper logistics network for collection and delivery. In normal practice it is burned inefficiently or is left to rot in the field. This is a fuel availability risk, and to ensure continuous & economical fuel supply, Project Proponents will have to develop a viable fuel collection mechanism.

This is the first project of its kind in the district where the project is located. Hence there is no past history of prices for bio-mass for a situation where it is regularly used for commercial power generation. However it has also been observed in other parts of India that biomass prices increase significantly over the time as the bio-mass usage increases due to demand in bio-mass based power plants in the region. This happens due to lack of proper collection mechanism and delivery of biomass. This leads to short-term shortage and thus increased prices. Prices move up from low of ~Rs 800-900/T to Rs 2000-2200/ton as seen in areas such as Punjab, Uttar Pradesh and Andhra Pradesh etc. To overcome this type of problem and for long term strategy, GAPS Power is proposing to acquire waste land in the region to grow energy plantation. This would require further investment which has not been provided for in the already constrained resources.

Cotton crop (source of main fuel for the project activity) in Maharashtra is essentially rain-fed and major regions are characterized by scanty and uncertain rainfall. Only 3 percent of the cotton area is irrigated while 97 percent depends upon rainfall. It has also been observed in the region that farmers are prone to change crop pattern every few years, leading to uncertainty in availability of cotton stalk which is the main fuel for power plant. The same is evident in the following table showing area under cotton cultivation for Aurangabad & Jalna districts (two main areas from where biomass would be procured). Thus availability of biomass residue carries an inherent risk which is beyond the control of project proponent.

[8] These problems have also been described in technical consultant's report, communications with equipment suppliers & industry experts and technical papers

District		1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
Aurangabad	Area	1019	1100	1397	1526	1595	1324	1413	1355
	Production	683	961	820	1483	1132	552	915	755
	Yield	114	149	100	165	221	71	110	95
Jalna	Area	1550	1541	1520	1626	1703	1382	1572	1449
	Production	1169	1512	1027	1734	1216	936	1834	2000
	Yield	128	167	115	181	121	115	198	235

Source: Indira Gandhi Institute of Development Research, Mumbai January 2006

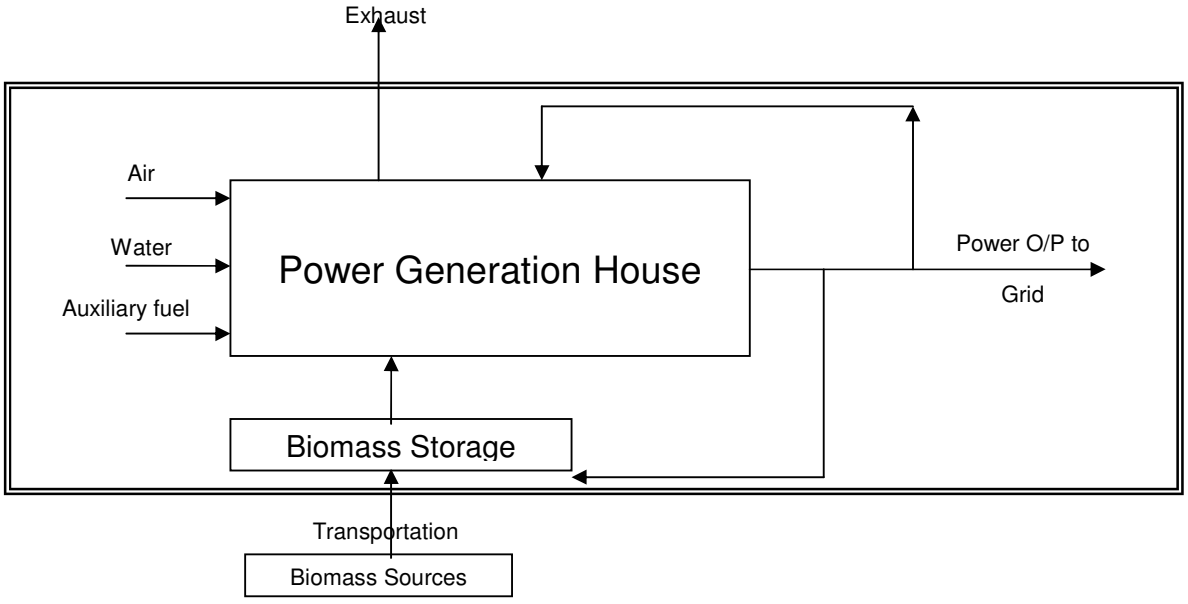
The uncertainty related to main fuel availability necessitates modifications in design of boiler compromising efficiency so that variety of fuels can be used in case cotton stalk is not available. These design changes have led to increased project cost and lower power generation efficiency.

Summary:
As per a report from MNES, Ministry of Non-conventional Energy Sources 2004-05, only one project of 3.5 MW capacity has been installed based on Biomass as fuel as against potential of 302 MW in the state as on 31st March 2005. This is expected to be the first operational plant in India based on 100% Cotton Stalks as a fuel. Therefore the Promoters have assumed a considerable risk.

The project activity is additional to the baseline scenario as it reduces emissions below baseline level and faces many barriers which prohibit its implementation. CERs will help bridge the profitability gap, as well as provide financial support for investing in development of dedicated biomass collection & delivery network, thus reducing the impact of some of the barriers.

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:

As per the Appendix B of simplified modalities & procedures for small-scale CDM-project activities, the project boundary is "The physical, geographical site of the renewable energy generating unit and the equipment that uses the electricity produced delineates the project boundary."



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

As per the methodology AMS-ID the "the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh) calculated in a transparent and conservative manner as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen.

OR

(b) The weighted average emissions (in kg CO2equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The GEF has been fixed (using ex-ante option for both OM and BM) and calculated using option (a) (ACM0002/version 06/19May2006). The procedure followed to calculate combined margin is as follows:

Step I: Calculate the Operating Margin (EF_{OM}) emission factor(s) based on one of the four following methods:

a. simple OM
b. simple adjusted OM
c. dispatch data OM or
d. Average OM

In India due to non availability of dispatch data, simple OM is used. Simple OM is fixed ex-ante and calculated as the generation-weighted average emissions per electricity unit (tCO2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants (low cost/must run plants contribute to less than 10% of overall capacity). In this case generation data for recent most three years is used to calculate OM.

Step II: Calculate Build Margin emission Factor (EF_{BM})

Build margin is the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants. There are two options to calculate Build margin as explained:

Option 1: Calculate the Build Margin emission factor *fixed ex-ante* based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

Option 2: For the first crediting period, the Build Margin emission factor must be updated annually *ex-post* for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, should be calculated *ex-ante*, as described in option 1 above. The sample

group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

The approach followed for OM is ax-ante; thereby we choose option 1 to calculate BM.

Step II: Calculate Baseline emission Factor (EF_{BL}). Emission factor is calculated as weighted average of Operating Margin and build Margin emission Factors.

As in Methodology ACM0002, the weightage for OM is 0.50 and for BM is 0.50 in case of Biomass based energy projects

$EF_{BL} = (0.50 \text{ X } EF_{OM}) + (0.50 \text{ X } EF_{BM})$

Vintage of data used: For the years 2002-03, 2003-04, 2004-05[9]

Parameter	Source	Remarks
Gross Power generation from power plants in Western Grid	WREB data for 2003-04, 2004-05 and CEA Data for 2002-03	For estimation of Current Generation Mix for respective years
Auxiliary Power Consumption in power generation in western Grid	WREB data for 2003-04, 2004-05 and CEA Data for 2002-03	For estimation of Current Generation Mix for respective years
Design Heat Rate for Coal based power plants	Performance Review of Thermal Power stations 2004-05; Central Electricity Authority data; http://www.cea.nic.in/god/opm/Thermal_Performance_Review/0405/CEA_Thermal%20Performance%20Review0405/SECTION-13.pdf	For estimation of fuel consumption in power generation
Design Heat Rate for Gas based power plants	Central Electricity Regulatory Commission (CERC) petition	For estimation of fuel consumption in power generation
NCV - Coal	IPCC default value	For estimation of fuel consumption in power generation
NCV – Gas	IPCC default value	For estimation of fuel consumption in power generation
Emission Factor – Coal	IPCC default value	For estimation of emissions in power generation
Emission Factor – Gas	IPCC default value	For estimation of emissions in power generation

[9] Data for year 2005-06 is not available at the time of PDD submission

Opearting Margin for Western Grid 2004-05	
OM, 2002-03	0.943
OM, 2003-04	0.932
OM, 2004-05	0.928
Average OM	**0.934**

Build Margin for Western Grid 2004-05	
Build Margin	**0.704**

Combined Margin for Western Grid 2004-05	
OM, 2002-03	0.943
OM, 2003-04	0.932
OM, 2004-05	0.928
Average OM	**0.934**
BM	0.704
Combined Margin, CM	**0.819**

tCO2e/ MWh

Date: 01/08/2006

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

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

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

20/05/2006

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

25 years

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

C.2.1. Renewable crediting period:

NA

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

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/09/2007

C.2.2.2. Length:

10 years

SECTION D. Application of a monitoring methodology and plan:

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

The project is a small scale CDM project activity. It is based on "**TYPE ID: Grid connected renewable electricity generation"** of Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

Reference: Version 9, Scope 1, dated 28/07/2006

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

The monitoring of the project activity is in line with the monitoring requirement stipulated in the small scale methodology AMS ID: "Grid connected renewable electricity generation".

D.3 Data to be monitored:

ID number	Data variable	Data unit	Measured (m), calculated © or estimated (e)	Recording frequency	How will the data be archived? (electronic/ paper)	Comment
1.1	NETy : Net power export to the grid	kWh	M	Daily	Electronic/ paper	Based on the meter at substation of MSEDCL. This meter would be used by MSEDCL for monthly billing purposes.
1.2	Gross Power generation in project	kWh	M	Daily	Electronic/ paper	

	plant					
1.3	Auxiliary Power Consumption	kWh	M	Daily	Electronic/ paper	
1.4	Quantity of biomass i combusted	Tonnes	M	Daily	Electronic/ paper	As per order passed by MERC Order 8th August 2005, all biomass based power projects are required to furnish monthly details of all kinds of fuel purchased and used in the plant. These reports will also be useful for CDM monitoring as well.
1.5	Calorific Value of biomass fuel i used	Kcal/Kg	M	Every Quarter	Electronic/ paper	This will be done at a Government approved independent laboratory. In case it is not available IPCC default values would be used.
1.6	QFF_y Quantity of fossil fuel i combusted in the project plant	Tonnes	M	Daily	Electronic/ paper	
1.7	Calorific Value of fossil fuel i used	Kcal/Kg	M	Every Quarter	Electronic/ paper	This will be done at a Government approved independent laboratory. In case it is not available IPCC default values would be used.
1.8	FEF_{CO2}: Emission factor for fossil fuel i in the project plant	tCO2e/ tonne	C	Yearly	Electronic/ paper	Calculated using IPCC default emission factor for type of fossil fuel used
1.9	GEF: Grid Emission Factor	T CO2/MWh	E	Once at the time of PDD submission	Electronic/Paper	Grid Emission factor is fixed ex-ante at the time of PDD submission.

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

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.

1.1-1.3	Low	Net power exported to grid would be based on the meter at substation of MSEDCL This meter would be used by MSEDCL for monthly billing purposes. Bills would be used for CERs estimation. Also data related to net power export could be cross-checked with meters installed in plant (for gross and auxiliary) Meters used in the measuring the data would be calibrated as descried in the monitoring plan.
1.4, 1.6	Low	Meters used in the measuring the data would be regularly calibrated.
1.5-1.7	Low	Fuel calorific values are either lab tested or IPCC default values
1.8, 1.9	Low	IPCC default emission factor for fuel used Publicly available information used for GEF estimation.

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:

GAPS Power proposes following monitoring plan for monitoring, recording and quality assurance of the data required for the project activity.

Company structure
GAPS Power, proposed to have operation, maintenance, purchase, stores, finance, accounts and laboratory sections. Each section will be headed by one Section Head supported by shift-in-charge and support staff i.e. operators. The overall responsibility of the department functioning will be with the respective section heads. Maintenance sections will include mechanical, electrical and instrumentation departments. These will be responsible for the overall upkeep of plant machinery and instruments.

GAPS Power also proposes following procedures to ensure the completeness and correctness of the data needed to be monitored for CDM project activity.

Formation of CDM Team:
A CDM project team would be constituted with participation from relevant departments. People would be trained on CDM concept and monitoring plan. This team will be responsible for data collection and archiving.

This team will meet periodically (as per internal audit plant) to review CDM project activity, check collected data, emissions reduction etc. In case of any irregularity observed by any of the CDM team members, it will be informed to the concerned person for necessary actions. These reports would be kept for verification purposes.

Responsibility:
Plant Head: Overall responsibility of compliance with the CDM monitoring plan

Section In-charge: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation

Shift In-charge: Responsibility of daily report generation

Training of CDM team personnel:

The training of the CDM team and plant personnel will be carried out on CDM principles, CDM activities, monitoring of data and record keeping through a planned schedule made in advance and a record of various training programmes undertaken would be kept for verification.

For normal plant operations & maintenance, people will be trained by equipment suppliers.

Day to day data collection and record keeping:
Plant data shall be collected on operation under the supervision of the respective Shift-in-charge and record would be kept in daily logs.

Archiving of data:
The data shall be kept for a period of two years after the crediting period.

Reliability of data collected:
The reliability of the meters will be checked by testing the meters on yearly basis. Documents pertaining to testing of meters shall be maintained. The metering equipment will consist of Main and Check Meters and these shall be identical in make, technical standards of 0.5 % accuracy class and calibration and comply with the requirements of Electricity Rules.

Frequency:
The frequency for data monitoring shall be as per the monitoring details in Section D of this document.

Calibration of instruments:
GAPS Power would have procedures well defined for the calibration of instruments. A log of calibration records would be maintained. Instrumentation department in the company would be responsible for the upkeep of instruments in the plant.

As per PPA, MSEDCL shall be doing testing of meters used for net power export once in a year and if any inconsistency or errors are found, these would be corrected immediately.

Maintenance of instruments and equipments used in data monitoring:
The operation department shall be responsible for the proper functioning of the equipments/ instruments and shall inform the concerned department for corrective action if found not operating as required. Corrective action shall be taken by the concerned department and a report on corrective action taken shall be maintained as done time to time along with the details of problems rectified.

Checking data for its correctness and completeness:
The CDM team would have the overall responsibility of checking data for its completeness and correctness. The data collected from daily logs is forwarded to the team after verification from respective departments.

Internal audits of CDM project compliance:
CDM audits shall be carried out to check the correctness of procedures and data monitored by the internal auditing team entrusted for the work. Report on internal audits done, faults found and corrective action taken shall be maintained and kept for external auditing.

Emergency preparedness:
The project activity does not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

Report generation on monitoring:
After verification of the data and due diligence on corrective ness if required an annual report on monitoring and estimations shall be maintained by the CDM team and record to this effect shall be maintained for verification.

Environment Management Plan
GAPS Power management proposes to have a separate and adequate budgetary allocation of environment management and laboratory. The management proposes to routinely air and water quality both at source and in the ambient at the plant site to be done regularly as per Central Pollution Control Board (CPCB) guidelines after, the plant is commissioned. If the results indicate any deviation from normal values necessary corrective measures will be promptly initiated. As part of its environmental management, the factory proposes to develop a scientifically designed green belt in and around the factory site (33% of the total area of the plot) to mitigate air and noise pollution impacts on the surroundings.

Sustainable Development Aspects
The project provides an opportunity for the local people to get employment directly or indirectly and helps in the upliftment of the socioeconomic status of the area. The project proponents propose to involve in social activities of the surrounding community by planning the betterment of neighbouring social conditions through awareness and welfare programs will ensure an improved relation. The commitment of management can include upliftment of social, health, basic needs of drinking water supply and provision of educational facilities. Many of the beneficiaries of such programs shall include own employees as well. The good will of the local populace can never be ignored. The channels employed may vary either through direct contact or by means of local organizations. Another important fact of social environment identified by the project proponents is a green appearance; hence the management will develop a green belt towards aesthetic beautification, as the same is necessary to be considered as a responsible, social neighbour.

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

Mr. Sumeet Nindrajog
GAPS Power & Infrastructure Pvt. Ltd.
Metro Estate, 178 CST Road
Kalina, Santa Cruz(E)
Mumbai 400098
Telephone: + 91 22 26527625

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

NA

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

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:

Carbon dioxide emissions from on-site consumption of fossil fuels
The proper and efficient operation of the biomass power plant may require using some fossil fuels, e.g. for start-ups or during rainy season (when biomass humidity is high).

$$\mathbf{PE_y = \sum QFF_{,y} X FEF_{CO2}}$$

Where

PE_y : Project emissions from on-site fuel combustion in year y, tCO2e
QFF_y : Quantity of fossil fuel combusted in the project plant in year y, tonne
FEF_{CO2} : Carbon emission factor for fossil fuel

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

No leakage due to competing use of biomass in the region is expected as biomass is available in abundance and has not much commercial/household use[10].

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

$$\mathbf{PE_y = \sum QFF_{,y} X FEF_{CO2}}$$

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:

$$\mathbf{BE_y = NET_y X GEF}$$

Where
BE_y : Baseline emissions in the year y, tCO2e
NET_y : Net electricity export to the grid in year y, MWh
GEF : Grid emission factor, tCO2e/ MWh

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:

ERy = BEy – PEy

Where

[10] Annex-3 Summary of Biomass assessment

ERy : Emissions reduction in year y, tCO2e
BEy : Baseline emissions in year y, tCO2e
PEy : Emissions due to project activity in year y, tCO2e

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

SN	Particulars	Units	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
	Baseline Emissions											
1	Grid Emission factor	TCO2/Mwh	0.819	0.819	0.819	0.819	0.819	0.819	0.819	0.819	0.819	0.819
2	Plant Capacity	MW	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
6	Net Power Output	MW-hrs	69,498	78,764	83,398	83,398	83,398	83,398	83,398	83,398	83,398	83,398
7	Total Baseline Emissions	T of CO2	56919	64508	68303	68303	68303	68303	68303	68303	68303	68303
	Project Emissions											
8	Coal Conusmption	Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Total Project Emissions	T CO2/annum	-	-	-	-	-	-	-	-	-	-
10	Leakage (Transportation)	T CO2/annum	-	-	-	-	-	-	-	-	-	-
	Total CER Generation	Units	56919	64,508	68,303	68,303	68,303	68,303	68,303	68,303	68,303	68,303
	Cummulative CER value	Units	56,919	121,427	189,730	258,032	326,335	394,637	462,940	531,243	599,545	667,848
										average over credit period		66,785

SECTION F.: Environmental impacts:

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

Following are the effects expected from the project activity and also measures towards management of these effects.

CONSTRUCTION PHASE

The project activity shall ensure to keep the pollution potential level in the construction phase to a minimum. Wherever applicable, detailed procedures will be developed for control of pollution during project execution phase. The following are few important parameters to be appropriately managed to minimize the pollution load.

- ***Site Preparation***

During the site preparation considerable amount of soil movement is involved due to site levelling operations which will carry out. During the dry season it is necessary to control uplift of dust during the excavation, levelling and transportation by spraying water in the paths, and along the temporary roads.

- ***Sanitation***

The facilities like toilets, drinking water and proper shelter for the persons staying in the construction site will be provided with utmost importance. The toilets will be attached to septic tank so as to minimize the percolation and to control the subsequent impact on the environment. These facilities will be properly designed and maintained to ensure minimum environmental impact.

- ***Waste from Construction equipments***

The construction activity may involve movement of heavy vehicles for earth moving and to move the equipment like dozers and cranes etc. The vehicles will be maintained properly so as to minimize the emissions from exhaust

POST CONSTRUCTION PHASE

The major pollution from the proposed biomass based power plant will be in the form of air, water and soil waste. The source of pollution and treatment plan are described in the following sections.

- ***Waste water management***

Strict in-plant measures would be initiated to reduce the concentrations of pollutants and flow rates of waste water streams. Waste water discharges would be kept to the minimum and the same would be treated properly before disposing for horticultural purposes. Domestic effluent would be sent to ETP and after treatment same will be utilized for gardening.

- ***Air Environment***

As the boiler is fired with biomass, which is considered as environmental friendly, as the ash content in the biomass is less than 10% compared to coal which will have ash content of about 45%. Also the SOx emission will be very low in biomass fired boiler when compared with coal fired boiler. The site preparation would not lead to cutting of trees as the site is covered with bushes and shrubs. However, a green belt would be developed which will enhance environmental quality through; mitigation of fugitive emissions, attenuation of noise levels, balancing Eco-environment, consumption of treated effluent, prevention of soil erosion, and creation of aesthetic environment.

- ***Noise Environment***

Noise absorbing materials will be used in the construction of Roofs, walls, floors, and in the generators. Safety equipment for noise like ear muffs and other protective devises will be provided to the staff working near noise generation source. The green belt proposed will also help in the reduction of noise levels outside the plant.

SECTION G. Stakeholders' comments:

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

Stakeholders identified for the project activity are –

a) Local community
b) Maharashtra State Electricity Distribution Company Ltd (MSEDCL)
c) Maharashtra Pollution control Board (MPCB)
d) Ministry of Environment and Forest (MoEF)
e) Maharashtra Energy Development Agency (MEDA)
f) Sources of biomass residues

The project activity has obtained all necessary approvals for setting up the power plants, and meets all regulatory requirements as mandated by Government agencies.

To collect feedback from local community following process was adopted

- **One to one discussion regarding project activity:** Pre designed questionnaires are canvassed in 100 villages selected equally from 11 talukas (6 talukas in Aurangabad district and 5 talukas from Jalna district). This assessment was done as part of biomass availability study in the region during May-June 2005. To ensure fairness and transparency, these discussions were conducted by an independent consulting firm.

- **Meetings with local people:** Meetings were held with people in nearby areas (Panchayat members and local community people) during June-July 2006 to discuss about project, impact on the local community & environment. Local community has expressed their consent for such type of project. Additional employment generation and Cleaner environment were considered to be the most important outcome of this project.

G.2. Summary of the comments received:

Following were the positive points as expressed by the local community

- Employment Generation (in the plant, and biomass procurement)
- Additional income source for farmers for sale of biomass to the project
- Better electricity supply in the region, as pressure on grid would be eased
- Less GHG emissions
- Infrastructure development in the region

Meeting with suppliers for biomass were also held. Their views have been taken while estimating biomass availability in the region. As per these interactions, biomass is abundantly available in the region and has no significant commercial/household use for the same.

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

No adverse comment received, hence no corrective action required.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Gaps Power & Infrastructure Pvt. Ltd.
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URL:	
Represented by:	
Title:	Mr.
Salutation:	
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Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding for the project activity is envisaged.

Annex 3: Summary of Biomass assessment conducted for the project activity

Biomass assessment was done by an independent consultant. The scope of this study included estimation of biomass availability in the region, current usage of biomass, surplus biomass availability for the project activity, collection & delivery network and price etc.

Primary and secondary data were collected for the assessment. Following are the sources for secondary data collection. Government departments such as Agriculture department, Forest department, Census department Electricity board, Taluka offices, Civil Supply department, Veterinary and Animal Husbandry department etc.

In Aurangabad district in total and within a radial distance of 75 Kms from proposed plant location at MIDC, Shendra, pre designed questionnaires are canvassed in 100 villages selected equally from 11 talukas (6 talukas in Aurangabad district and 5 talukas from Jalna district) for collection of primary data on generation, consumption and surplus aspects.

Following are the key points of the assessment

- The major surplus residues found in the study area are cotton stalks, maize stalks & cobs, sugarcane tops & trash and red gram stalks, which are presently being disposed by way of burning or mulching in the fields.

- Biomass is available in abundance for the project activity. Total surplus available in the study area is more than 2.5 times the total annual biomass requirement in the power plant. Hence no leakage due to competing use of biomass is predicted due to implementation of the project activity.

- In respect of crop residues also, price and collection mechanism is not established, since, there were no commercial transactions. In addition, residues are generated in a particular season and consumption is throughout the year. Hence an organized mechanism has to be developed for collection and transportation and storage.

Residue Source	***Gross Surplus***		***% of Generation***	
	Aurangabad District	***Within 75 Kms***	***Aurangabad District***	***Within 75 Kms***
Agriculture Activity	***228640***	***279760***	***21***	***24***
Agro-Industries	***0***	***0***	***0***	***0***
Non-Forest lands	***0***	***11852***	***0***	***3***
Agro-Forestry/ energy Plantation	***0***	***0***	***0***	***0***
Total	*228640*	*291612*	*16*	*18*

Biomass Collection & Delivery Mechanism

In respect of crop residues, price and collection mechanism is not established, since, there is no commercial application of the same in the region. Following is a plan for biomass collection & delivery for the project activity.

For efficient and sustainable operations of power plant, to carry out collection from dispersed sources of residue generation and fuel preparation, a consortium will be formed with different agencies such as producers, government agencies, NGOs, Banks and unemployed youth. As in the case of Sugarcane or Milk collection and transportation, a society or collection network shall be established at various geographical locations based on availability of residues and accessibility to the source. As the use of crop residue will create employment to local people and provide additional income generation source, local government agencies and financial institutions can be involved in forming societies or networking agencies and fixation of remuneration.

Biomass thus collected would be stored in a few common collection centers/storage sites. These sites will be managed by biomass collection heads in respective regions. From these common storage sites, biomass would be delivered to plant site as per requirements.

.

Annex 4: Grid Emission Factor

unit: GWh

Western Grid Power Generation [2002-03]

Gorss Generation

Source	Thermal	Gas	Hydro	Nuclear	Wind	Diesel	Others	Total
Gujarat	30522.03	5824.31	588.45	0.00	179.36	0.00	0.00	37114.15
Madhya Pradesh	13680.86	0.00	1771.34	0.00	32.52	0.00	0.00	15484.72
Chattisgarh	7593.22	0.00	276.95	0.00	0.00	0.00	0.00	7870.17
Maharashtra	52204.04	5043.07	5535.41	0.00	666.63	0.00	0.00	63449.15
Goa	0.00	273.05	0.00	0.00	0.00	0.00	0.00	273.05
Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dadra Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Sector	33391.85	7572.87	0.00	6200.00	0.00	0.00	0.00	47164.72
Total Western	**137392.00**	**18713.30**	**8172.15**	**6200.00**	**878.51**	**0.00**	**0.00**	**171355.96**

Auxiliary Consumption

Source	Thermal	Gas	Hydro	Nuclear	Wind	Diesel	Others	Total
Gujarat	3029.67	117.97	7.14	0.00	0.00	0.00	0.00	3154.78
Madhya Pradesh	1314.99	0.00	4.68	0.00	0.00	0.00	0.00	1319.67
Chattisgarh	735.02	0.00	0.49	0.00	0.00	0.00	0.00	735.51
Maharashtra	4165.65	119.78	38.08	0.00	0.00	0.00	0.00	4323.51
Goa	0.00	2.73	0.00	0.00	0.00	0.00	0.00	2.73
Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dadra Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Sector	2769.58	117.35	0.00	600.00	0.00	0.00	0.00	3486.93
Total Western	**12014.91**	**357.83**	**50.39**	**600.00**	**0.00**	**0.00**	**0.00**	**13023.13**

Net generation

Source	Thermal	Gas	Hydro	Nuclear	Wind	Diesel	Others	Total
Gujarat	27492.36	5706.34	581.31	0.00	179.36	0.00	0.00	33959.37
Madhya Pradesh	12365.87	0.00	1766.66	0.00	32.52	0.00	0.00	14165.05
Chattisgarh	6858.20	0.00	276.46	0.00	0.00	0.00	0.00	7134.66
Maharashtra	48038.39	4923.29	5497.33	0.00	666.63	0.00	0.00	59125.64
Goa	0.00	270.32	0.00	0.00	0.00	0.00	0.00	270.32
Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dadra Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Sector	30622.27	7455.52	0.00	5600.00	0.00	0.00	0.00	43677.79
Total Western generation	**125377.09**	**18355.47**	**8121.76**	**5600.00**	**878.51**	**0.00**	**0.00**	**158332.83**

unit: GWh

Western Grid Power Generation [2003-04]

Gorss Generation

Source	Thermal	Gas	Hydro	Nuclear	Wind	Diesel	Others	Total
Gujarat	28400.09	9968.01	859.34	0.00	150.66	0.00	0.00	39378.10
Madhya Pradesh	13168.61	0.00	2745.81	0.00	20.74	0.00	0.00	15935.16
Chattisgarh	8247.50	0.00	295.56	0.00	0.00	0.00	0.00	8543.06
Maharashtra	54197.54	5432.08	5490.89	0.00	683.66	0.00	0.00	65804.17
Goa	0.00	202.27	0.00	0.00	0.00	0.00	0.00	202.27
Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dadra Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Sector	32685.69	7108.91	0.00	5671.06	0.00	0.00	0.00	45465.66
Total Western	**136699.43**	**22711.27**	**9391.60**	**5671.06**	**855.06**	**0.00**	**0.00**	**175328.42**

Auxiliary Consumption

Source	Thermal	Gas	Hydro	Nuclear	Wind	Diesel	Others	Total
Gujarat	2566.79	137.09	3.96	0.00	0.00	0.00	0.00	2707.84
Madhya Pradesh	1381.97	0.00	5.23	0.00	0.00	0.00	0.00	1387.20
Chattisgarh	749.40	0.00	0.43	0.00	0.00	0.00	0.00	749.83
Maharashtra	4188.24	125.26	42.68	0.00	0.00	0.00	0.00	4356.18
Goa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dadra Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Sector	2278.98	162.64	0.00	602.62	0.00	0.00	0.00	3044.24
Total Western	**11165.38**	**424.99**	**52.30**	**602.62**	**0.00**	**0.00**	**0.00**	**12245.29**

Net generation

Source	Thermal	Gas	Hydro	Nuclear	Wind	Diesel	Others	Total
Gujarat	25833.30	9830.92	855.38	0.00	150.66	0.00	0.00	36670.26
Madhya Pradesh	11786.64	0.00	2740.58	0.00	20.74	0.00	0.00	14547.96
Chattisgarh	7498.10	0.00	295.13	0.00	0.00	0.00	0.00	7793.23
Maharashtra	50009.30	5306.82	5448.21	0.00	683.66	0.00	0.00	61447.99
Goa	0.00	202.27	0.00	0.00	0.00	0.00	0.00	202.27
Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dadra Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Sector	30406.71	6946.27	0.00	5068.44	0.00	0.00	0.00	42421.42
Total Western generation	**125534.05**	**22286.28**	**9339.30**	**5068.44**	**855.06**	**0.00**	**0.00**	**163083.13**
Net Drawl from other Grid								10543.44
grand total								**173626.57**

unit: GWh

Western Grid Power Generation (2004-05)

Gorss Generation

Source	Thermal	Gas	Hydro	Nuclear	Wind	Diesel	Total
Gujarat	30120.94	13366.83	873.19	0.00	86.50	0.00	44447.46
Madhya Pradesh	13502.55	0.00	3737.85	0.00	11.03	0.00	17251.43
Chattisgarh	7924.98	0.00	382.64	0.00	0.00	0.00	8307.62
Maharashtra	55543.13	5450.19	5583.54	0.00	502.02	0.00	67078.88
Goa	0.00	138.36	0.00	0.00	0.00	0.00	138.36
Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dadra Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Sector	34870.00	6851.87	0.00	5099.68	0.00	0.00	46821.55
Total Western	**141961.60**	**25807.25**	**10577.22**	**5099.68**	**599.55**	**0.00**	**184045.30**

Auxiliary Consumption

Source	Thermal	Gas	Hydro	Nuclear	Wind	Diesel	Total
Gujarat	2933.63	261.59	7.07	0.00	0.00	0.00	3202.29
Madhya Pradesh	1414.69	0.00	7.31	0.00	0.00	0.00	1422.00
Chattisgarh	782.82	0.00	0.00	0.00	0.00	0.00	782.82
Maharashtra	4452.14	124.89	39.08	0.00	0.00	0.00	4616.11
Goa	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dadra Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Sector	2364.72	148.30	0.00	603.17	0.00		3116.19
Total Western	**11948.00**	**534.78**	**53.46**	**603.17**	**0.00**	**0.00**	**13139.41**

Net generation

Source	Thermal	Gas	Hydro	Nuclear	Wind	Diesel	Total
Gujarat	27187.31	13105.24	866.12	0.00	86.50	0.00	41245.17
Madhya Pradesh	12087.86	0.00	3730.54	0.00	11.03	0.00	15829.43
Chattisgarh	7142.16	0.00	382.64	0.00	0.00	0.00	7524.80
Maharashtra	51090.99	5325.30	5544.46	0.00	502.02	0.00	62462.77
Goa	0.00	138.36	0.00	0.00	0.00	0.00	138.36
Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dadra Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Sector	32505.28	6703.57	0.00	4496.51	0.00		43705.36
Total Western generation	**130013.60**	**25272.47**	**10523.76**	**4496.51**	**599.55**	**0.00**	**170905.89**