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

CONTENTS

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

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6 MW Natural gas based electricity generation and Waste Heat Recovery based steam production at Pratibha Syntex Limited, Pithampur, Madhya Pradesh.
Version: 01
Dated: 05/01/2008

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

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An integrated fibre-to-garment company, Pratibha Syntex Ltd. launched its operations in the year 1997. The company has established itself successfully in the manufacturing of raw cotton, cotton yarn, bamboo yarn, knitted fabric and garments and boasts of many awards for its performance; the Udyog Ratna award, Export Performance award and the Best Performance award, to name a few. In the year 1992, Pratibha made its foray into organic farming. Today, Pratibha enjoys the unique distinction of being the largest organic cotton producer in India.

Keeping in view the company's responsibility towards the environment, the Board of Directors have envisaged a natural gas based captive power plant, that would effectively replace the current energy-intensive sources of power and steam being used within the factory premises. In addition to the 6 MW power plants, the project installs a waste heat recovery boiler that would utilize the flue gases being generated at the gas based plant, to produce steam, which would be channelled into successive industrial processes. The project will significantly reduce the fuel consumption from the fuel-oil based captive power plant, the coal-fired boilers and DG sets, as well as cut down on electricity withdrawal from the state grid. The company also proposes to expand its existing production capacity by installing a Spinning unit and a KDG unit.

By way of the proposed gas-based and waste heat recovery project, the company shall be producing approximately 418 lakh units of electricity and 37010 tonnes of steam yearly. A total of 18138 tonnes of carbon di-oxide is estimated to be reduced on an average per year. The proposed project demands a huge investment, of the order of 180 million INR, and is being undertaken for the purpose of resource conservation and overall environmental integrity. The project is a unique combination of fuel switch from energy-intensive fuels and power sources to a cleaner fuel, along with the capture of thermal-energy of exhaust gases being produced thereof.

View of the project participants on the contribution of the project activity to sustainable development
In addition to Electricity and steam production the project has been conceived for the following benefits:

Social well being

- The project brings about social development by creating direct and indirect job openings and opportunities.
- The activity leads to energy savings and reduces atmospheric pollution in the nearby regions as it substitutes the use of polluting fossil fuels such as oil and coal within the industrial premises.

Environmental well being

- The combined natural gas and waste heat recovery project is a conscious step towards adopting cleaner and more efficient technology.
- Natural gas is one of the cleanest available fossil fuels and hence emits very few by-products as atmospheric pollutants. Further, it leaves no soot, ash or odor.
- The use of the waste heat substitutes the use of the conventional fossil fuel based boiler thereby reducing pollution as well as resulting in efficient use of energy.

Economic well being

- The proposed project increases the efficiency of the systems within the industrial premises leading to better resource utilization and financial savings.

Technological well being

- The project activity introduces natural gas based power generation and advanced Waste Heat Recovery (WHR) systems in the industrial area of Pithampur.
- Successful performance of the plants would encourage nearby industries to adopt similar activities thereby leading to decreased atmospheric GHG concentration and global climate change mitigation.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host party)	Private and/or public entity (ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
Government of India (Host Country)	Pratibha Syntex Limited	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the party (ies) involved is required.		
Note: When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM), at least the host Party (ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

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

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

A.4.1.1. Host Party(ies):

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India

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

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State: Madhya Pradesh
District: Dhar

A.4.1.3. City/Town/Community etc:

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Village: Kheda (Pithampur Industrial Area)

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

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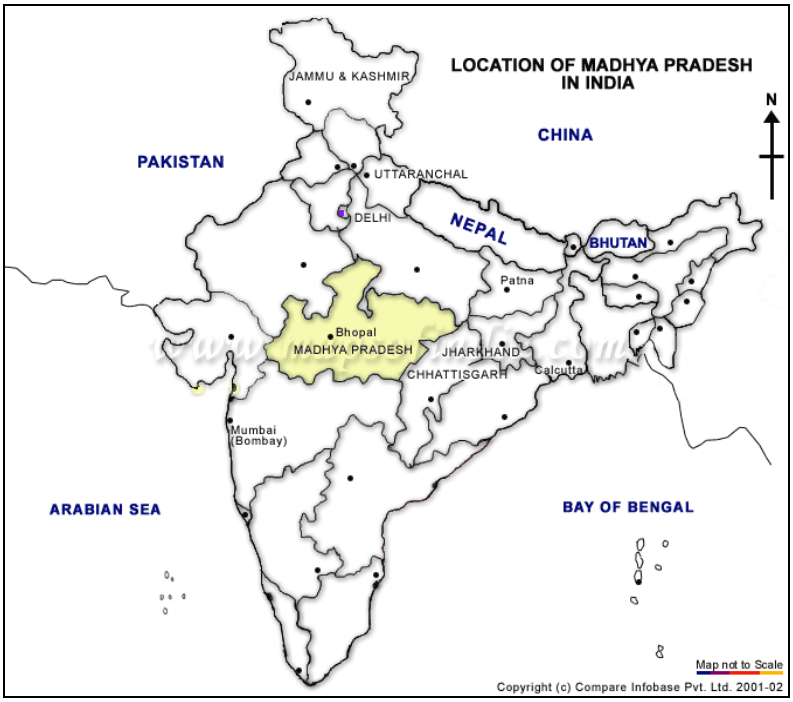
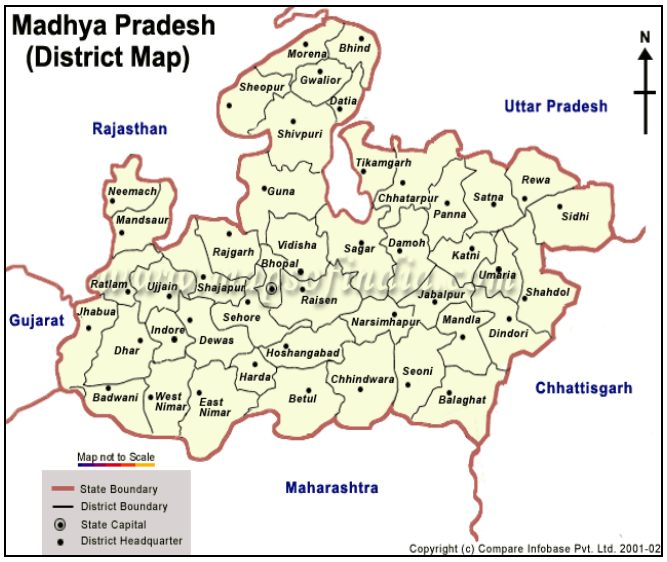
The project activity lies within the factory premises of Pratibha Syntex, located at the Pithampur Industrial Area in Dhar district. The nearest railway station is in Indore at a distance of approximately 100 kilometres. The specific location of the project facility is:

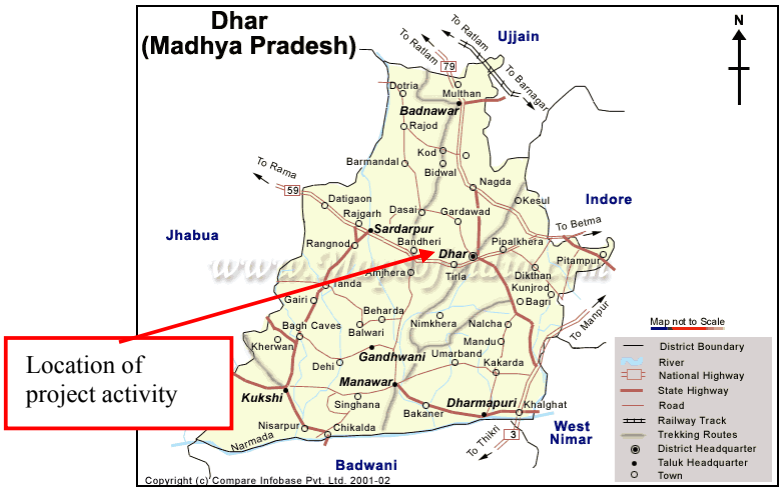
Latitude 22° 35´ N
Longitude 75 °20´ E



Location of Madhya Pradesh in India



State Map of Madhya Pradesh



District Map of Dhar

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

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Natural gas based electricity generation

The natural gas based power plant is designed for base load operation and is intended for power generation. The system is designed for operation in grid parallel / island mode.

The Wärtsilä 34SG is a four-stroke spark-ignited gas engine, which is designed according to the Otto process and the lean burn principle. The engine has ported gas admission and a pre-chamber with a spark plug for ignition.

The Lean Burn Concept
In a lean burn gas engine the mixture of air and fuel in the cylinder is lean. This means that there is more air present in the cylinder than is necessary for complete combustion. As the air/fuel ratio is increased, the emission of NOx is reduced and the thermal efficiency is increased.
In order to stabilize the ignition and combustion of the lean mixture, a pre-chamber is used. A rich air/fuel mixture inside the pre-chamber is ignited by means of a spark plug. The burning mixture coming from the pre-chamber then ignites the lean air/fuel mixture in the main combustion chamber. The pre-chamber properly directs the explosion into the main chamber to completely ignite the lean mixture.

Technical Details
Configuration
The stationary power plant is equipped with 1 engine of the Wartsila 18V34SG type, as the prime mover.

Power Plant Gross Performance at design ambient conditions
Electrical active power – 1 X 5993 kWe

Generating Set
The Wartsila 18V34SG engine and the generator are mounted on a common base frame. The common base frame is flexibly mounted on a concrete foundation by means of steel springs.

Wartsila 18V34SG engine
General engine description
The engine is of a four strokes, lean burn, pre-chamber, spark ignited, port injected, trunk piston, turbocharged and inter-cooled design. The engine has a fully micro processor based control system (WECS), controlling the combustion process individually in each cylinder.

Engine Main Data

Configuration	V form
Number of Cylinders	18
Cylinder Bore	340 mm
Stroke	350 mm
Speed	750 rpm

Generator
Generator Type
The generator is of the synchronous, three-phase, salient pole type.

Generator Main Data

Generator apparent power	7491.25 kVA
Rated Power Factor	0.8
Nominal Voltage	11000 V
Rate current (ln)	393 A
Voltage adjustment range	+/- 5 %
Frequency	50 Hz
Speed	750 rpm

Further details on the technical specifications of the plant are available on http://ws.wartsila.com/updatetool/images/1629.pdf

Waste Heat Recovery for Steam production

The waste heat recovery unit at Pratibha Syntex utilises the heat content of waste flue gases of flared natural gas to generate electricity for its captive requirement. The rated capacity of the engine is 6MW and at 100% load, the exhaust gas quantity is approximately 37 tonnes/ hour.

The hot gas at a temperature of about 415°C enters the boiler. The gases carry an average specific heat of 0.269 kcal/kg°C while entering the boiler. The exhaust gas boilers are of water tube type with single drum force circulation design with economiser. From 400°C to 210°C, the flue gases are used to generate superheated steam at 10 kg/cm^2 (g) and 100°C. No auxillary fuel is fired in order to increase the heat content of the exhaust gases. The gas temperature drops down to about 200°C at the outlet of the convection section, from 200 °C to about 170 °C, the flue gas is cooled in the economiser section, which is further channelled into the water pre-heater and is finally enters the outlet at a temperature of 145°C. The feed water is routed back into the boiler at a temperature of 90°C. The water circulation through the evaporator unit is maintained by circulating pumps. The steam is separated from the water in the steam drum. A non-return valve on the steam outlet from the drum prevents back flow when the boiler is not in use. Both the convection section and the economiser section are enclosed in a carbon steel casing. The technical specifications are given in Annex 6.

Technology transfer
There is no transfer of technology and technical know-how to the host party since technology is readily available in host country (India) from reputed manufacturers.

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

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The chosen crediting period is 10 years which is fixed crediting period.

S. No.	Year	Annual Emission Reduction tCO_2e
1	Year 2008	18138
2	Year 2009	18138
3	Year 2010	18138
4	Year 2011	18138
5	Year 2012	18138
6	Year 2013	18138
7	Year 2014	18138
8	Year 2015	18138
9	Year 2016	18138
10	Year 2017	18138
Total estimated reductions (tonnes of CO_2e)		181380
Total number of crediting years		**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)		18138

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

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The project activity does not seek financial any support from public funds, overseas development funds or other similar financing options. Also there is no subsidy element in implementation of the project activity.

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

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

- With the same project participants
- In the same project category and technology
- Registered within the previous two years; and
- Whose project boundary is within 1km of the project boundary of the proposed small scale activity

The project promoters hereby confirm that there is no registered small scale project activity registered within the previous two years with them in the same project category and technology whose project boundary is within 1km of the project boundary of the proposed small scale activity. Thus the project is not a de-bundled component of any other large scale project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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Natural gas based electricity generation

Project Type: III	Other Project Activities
Project Category: III B	Switching fossil fuels (Latest version 12, 2nd November 2007)
Reference:	Appendix B of the Simplified Modalities & Procedures for small scale CDM project activities.

Waste Heat Recovery for Steam production

Project Type: III	Other Project Activities
Project Category: III Q	Waste gas based energy system (Latest version 01, 19th Oct. 2007)
Reference:	Appendix B of the Simplified Modalities & Procedures for small Scale CDM project activities.

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

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Natural gas based electricity generation

III B Switching fossil fuels

This category comprises fossil fuel switching in existing, industrial, residential, commercial, institutional or electricity generation applications. Fuel switching may change efficiency as well. If the project activity primarily aims at reducing emissions through fuel switching, it falls into this category. If fuel switching is part of a project activity focused primarily on energy efficiency, the project activity falls in category II.D or II.E. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.

The proposed CDM project is a fossil fuel switching measure in an existing industrial facility and leads to emission reductions of less than 60 kt CO2e annually. Hence the project is applicable under the given methodology.

Waste Heat Recovery for Steam production

III Q Waste Gas based Energy systems

The project results in emission reduction of 18138 tons of CO_2 /yr which is less than the threshold value - 60 kt CO_2 hence Simplified M&P for Small-Scale CDM Project Activity, Category III. Q. is applicable for this project.

This category is applicable for project activities that utilize waste gas and/or waste heat at existing facilities as an energy source for:

- Cogeneration; or
- Generation of electricity; or
- Direct use as process heat; or
- For generation of heat in elemental process (e.g. steam, hot water, hot oil, hot air).

As the project activity utilizes waste heat of the flue gases from natural gas based captive power plant to produce steam which will be further channelled into successive industrial processes, it fits the applicability criteria of the given methodology III.Q (Version 01). Thus, the applied methodology AMS IIIQ can be applied for the proposed CDM project activity.

B.3. Description of the project boundary:

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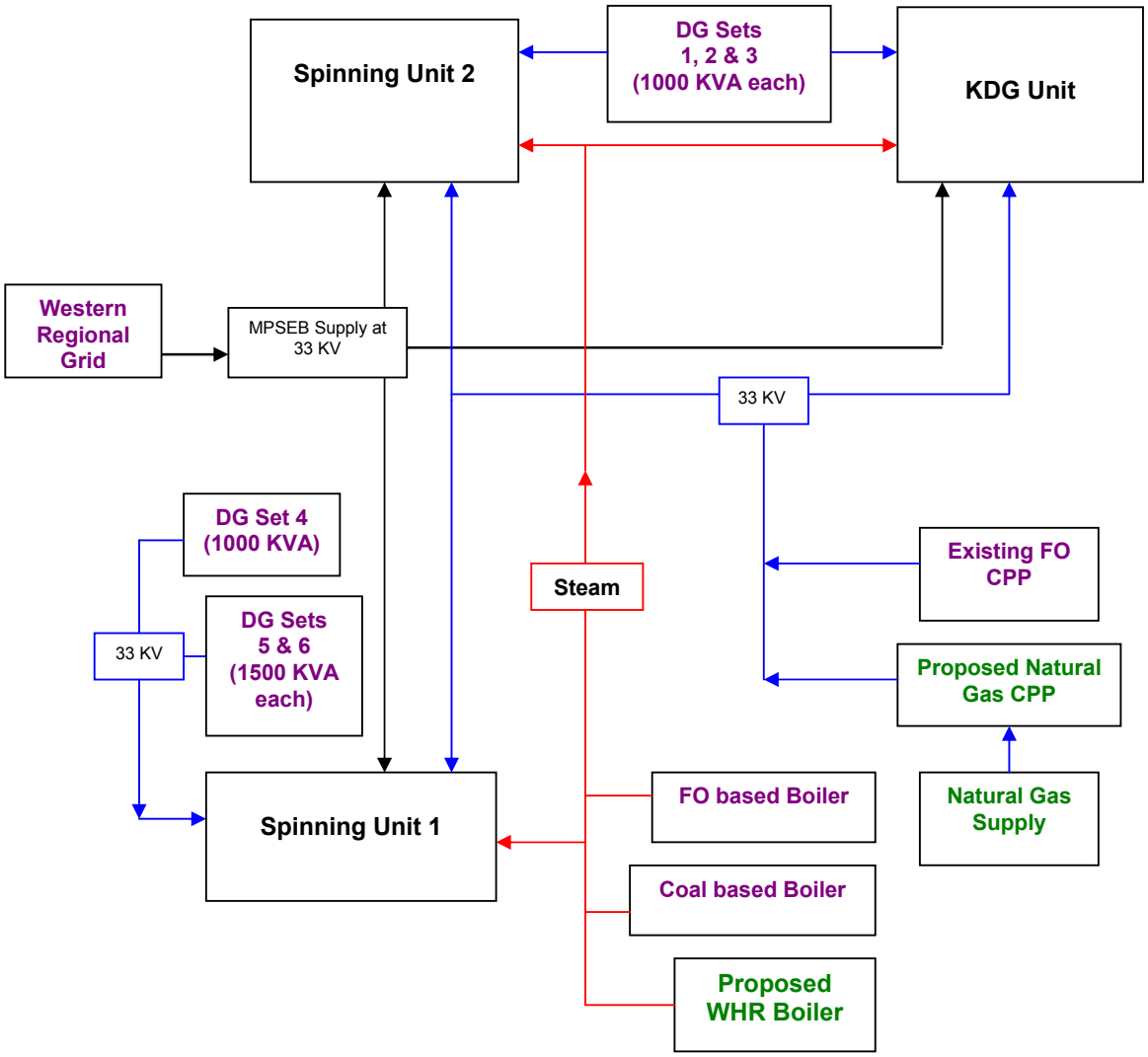
According to the approved small scale methodology III B, the project boundary is the physical, geographical site where the fuel combustion affected by the fuel-switching measure occurs, and as per III Q, the project boundary is the physical, geographical site, of the facility where the waste gas/heat/ pressure is produced and transformed into useful energy delineates the project boundary.

The project boundary of the bundled project therefore starts from the point of natural gas supply to the project site, the natural gas based power plant, the waste heat recovery boiler, the fuel oil based CPP, the diesel generator sets, the coal based boiler, up to the point of electricity and steam generation. Since the project also involves displacement of grid electricity, the boundary will also include the western regional grid supply.



B.4 Description of baseline and its development:

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Natural gas based electricity generation

The project activity is switching fuel from Furnace Oil to natural gas and would follow small scale methodology. According to the methodology available in paragraph 4 of Type – III Other Projects (B: Fuel Switching Projects) of the "Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories", the emission baseline is the current emissions of the facility expressed as emissions per unit of output (e.g., kg CO2e/kWh). Emission coefficients for the fuel used by the generating unit before and after the fuel switch are also needed. IPCC default values for emission coefficients may be used. The project shows reduction in the GHG emission per unit of electricity generation since the CO2 emission from natural gas is lower than from coal and Furnace Oil.

In the project activity under consideration the emission reductions occurs due to the switch in fuel from Furnace Oil to Natural gas. In the absence of the project activity the baseline would be consumption of Furnace Oil as fuel for power generation. Therefore the emissions at the baseline are the emissions that would have occurred due to the burning of the fossil fuel i.e. Furnace Oil in the CPP. Since the current electricity requirements of the facility are being met through the fuel oil based CPP. Hence, in the absence of the proposed project activity, the CPP on Furnace Oil would have been used for meeting the electricity requirements of the facility.

The parameters that have been used to calculate the emission coefficient for the baseline have been given below:

CALCULATION OF EMISSION FACTOR FOR CPP BASELINE				
Sr	**Parameter**	**Notation**	**Unit**	**Value**
1	Emission factor for CPP	EF captive,y	tCO2/MWh	0.80
2	CO2 emission factor of fuel used in captive power generation-FO-IPCC Value	EF CO2,i	tC/TJ	21.1
3	Carbon to Carbon Dioxide conversion factor		(%)	3.67
4	MWh to TJ conversion factor		TJ/MWh	0.0036
5	Efficiency of captive power generation	Eff captive	(%)	35%

Waste Heat Recovery for Steam production

III Q Waste Gas based Energy systems

Baseline as per Paragraph 6 of "Type AMS. I. C. Thermal energy for the user with or without electricity (Version 12: Valid from 10th August, 2007 onwards)" of Appendix B of the simplified M&P for small-scale CDM project activities:

"6. For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used."

Before the project activity the boiler was running on Coal which causes emissions due to burning of fossil fuel in boiler but due to the utilization of Waste Hot gases from NG based CPP the emissions due to burning of coal are reduced. Therefore the proposed baseline is the GHG emissions that would have occurred due to use of Coal in the boiler in absence of this project activity.

Key information and data used to determine the baseline scenario (variables, parameters, data sources etc.) are:

Sr.	Key information /Data / Parameters	Average Value	Data Source
1	Steam Generation	37010 T/year	Boiler log-sheets maintained at Prathiba Syntax
2	CO_2 Emission Coefficient for Coal	96.1 tCO2/TJ	Table 2.2 of Chapter 2 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories
3	Latent heat of steam in Kcal/Kg	540	From standard literature

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

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The proposed project is not mandated by law and is a voluntary decision made by the company in view of climate change mitigation and energy conservation. Further there no restrictions on the type of fuel being used for power and steam requirements in the plant.

The project is a combination of fuel switch and energy efficiency and leads to emission reductions of the order of 18138 tCO2e annually, which is additional to the business as usual scenario. The project can be deemed additional by analysing the following barriers that it faces during and after the project implementation:

Barrier Analysis

1. Barrier due to Natural Gas availability and infrastructure

The demand for natural gas comes from consumers in power, fertilizer, industrial, commercial, domestic and various other sectors. The majority of demand is for the power and the fertilizer sectors.

The demand potential for natural gas projected by the Hydrocarbon Vision 2025 cross various sectors is as given below. The report also highlights that the supply would remain stagnant at below 100 MMSCMD thereby increasing the demand-supply gap manifold.

YEAR	DEMAND (MMSCMD)
2001-02	151
2006-07	231
2011-12	313

According to the Marketing & Development Research Associates (MDRA) Report prepared for GAIL, the demand-supply gap for natural gas up to year 2009 would be as follows:

Demand-Supply Gap

	2004-05	2005-06	2006-07	2007-08	2008-09
Demand Scenario (A)	162.03	180.38	247.07	269.86	283.3

Supply Conservative Scenario (B)	81.17	103.12	158.65	164.49	169.16
Supply Optimistic Scenario (C)	81.17	103.17	164.25	205.49	267.16
Gap (A-B)	**80.86**	**77.26**	**88.42**	**105.37**	**114.14**
Gap (A-C)	**80.86**	**77.21**	**82.82**	**64.37**	**16.14**

Given the restricted supply options for NG in the country, the demand-supply gap for the gas would be around 115 MMSCMD in 2008-09 presuming a conservative supply scenario and 17 MMSCMD under an optimistic supply scenario. In both cases, the supply of the gas would not be sufficient to meet the demand, the consequences of which could greatly hamper the economics of the proposed project. The gap between demand and supply is set to widen unless major gas discoveries are made.

The power sector is already starting to experience shortage of gas supply[1]. According to a statement by the Ministry of Power in May 2005, 38 gas-based power stations with a total capacity of 9,536 MW had to operate at a plant load factor (PLF) of only 58% during the financial years 04/05 due to shortage of gas supply. Low PLF linked to NG based power plants can cause a serious impediment to the proposed project, as the CPP running on Fuel oil has a PLF of over 95% in the baseline scenario, and closing down of a high-performing plant to switch over to an unreliable source of power would greatly hamper the industrial processes and productivity.

It must be mentioned hereby that the proposed project activity has already experienced hindrances in the successful commissioning of the CPP. As per the initial contract with GAIL, the project was to be commissioned by August 2005. However, there have been delays on the supplier's end for over the past 18 months and the setting up of the pipelines and associated infrastructure has only been completed recently. The deadline now given to the proponent by GAIL authorities is the 28th of February 2007. The continual postponement has caused a significant impact on the projected returns and financials of the project. Furthermore, the delay in the NG plant commissioning has impacted the commissioning of the waste heat recovery boiler as well, and has led to an overall loss for the company.

The initial delay in the gas supply also clearly indicates that the risks associated with the availability of gas are very much real and are being faced by the project proponent even at this initial stage of project implementation. The delay acts as a clear indicator of the issues that the project proponent could face in the future. The proponent was aware of the uncertainty involved with natural gas supply in the country and hence had factored in CDM revenue as a way of mitigating these risks.

2. Barrier due to NG price fluctuations

According to the contract with GAIL, the price of NG for the proponent has been fixed up to December 2008, beyond which the rate of gas supply would be subject to future government regulations and market fluctuations. Gas prices are subject to variations in the international oil market, the policy environment, infrastructure status of various elements in the LNG chain and pipelines, security and sustainability of supplies, role played by NOCs (National Oil Companies), private players and others[2]. The pricing of natural gas has undergone drastic changes in the past few months. The new discoveries, intensification of exploration activities and extensive work on development of LNG terminals have effectively transformed

[1] International Energy Agency: Gas-Fired Power generation in India – Challenges and Opportunities, October 2005.

[2] *Infraline's Paper on Natural Gas Pricing Scenario in India (July 2005)*

the natural gas pricing scenario in India from subsidized controlled regime to market determined pricing regime. Such a scenario has led to competition among the various supply sources of natural gas apart from the competition faced by natural gas from other fuels. The government is also contemplating regulatory changes that may bring in more competition and market-determined pricing for all sources of gas.
Given the above possibilities of continuous reform in NG rates, which are also influenced by the international fuel oil prices, the proposed project is a challenge undertaken by the investor that may see unsteady and unpredictable income returns over its lifetime.

3. Barrier due to prevailing practice

a) First of its kind activity

The proposed project is the first project in the industrial region of Pithampur, wherein natural gas is being utilized for power generation. This is evident from the following GAIL data that represents the list of industries that are using natural gas in various processes:

- Anant steel, Pithampur for Furnace
- Porwal Auto, Pithampur for Furnace
- Bridge stone Pithampur for Boilers
- Bajaj Tempo Pithampur for Thermopack fluid heater.
- National Steel Ltd Pithampur for Furnaces.
- Ruchi steels & alloys Ghatabilod for Furnaces.
- Eicher motors, Pithampur for Thermopacks.
- Raj Ratan Global wires Pithampur for Furnaces.

It is clear from the above that Pratibha Syntex is the first textile company in Pithampur to venture into electricity production from a gas based engine. Having no prior experience in this field, the company has undertaken considerable risk by switching from reliable fuel sources, in terms of their availability, and using known technology, to an unsteady and unreliable energy source like natural gas, based on technology that is unfamiliar to the investor.

b) Power Scenario in Madhya Pradesh

As per the CEA[3] database of grid connected power plants in the country, there is no natural gas based power plant supplying to the grid. According to the [4]Ministry of Power report 2006, till the year 2003, there were no gas based plants within the state of Madhya Pradesh. The western regional grid itself represents a very small proportion of gas based plants of the total installed capacity. This amounts to only 0.15% of the total capacity. Furthermore, over the 10th plan period, approximately 218 MW of capacity addition in power generation through natural gas has occurred in the state of Gujarat. This represents barely 0.02% of the total additions that have come about in the past five years in the western grid.

Taking into account the above, it can be said that the natural gas based CPP would be a positive addition to the existing power mix in Madhya Pradesh that is greatly dominated by energy intensive fuels. The policy scenario surrounding gas availability, associated infrastructure and pricing is not conducive enough to enable penetration of this form of energy into the power sector. Thus the 6 MW CPP at Pratibha syntax would be generating electricity that is cleaner as compared to the current state of energy sources in the given state and the regional grid.

4. Barriers faced by the Waste Heat Recovery Boiler

[3] *Central Electricity Authority: Co2 baseline database, version 1.1, 21st December 2006.*

[4] *Power Sector Profile, Ministry of Power, November 2006*

The functioning of the WHR boiler is directly dependent on that of the NG based CPP. Fluctuations in the supply of NG would hamper the operations of the WHR as the fuel used in it comes from the former.
The WHRB is of the horizontal type which is not the commonly used installation type.
The coal and FO based boilers shall be shut down after commencement of the WHRB. This is a sizeable financial risk undertaken as the boilers have operational lives of 15 years each, and are being voluntarily closed down by the company, much before they reach the end of their operational lifetime. The performance of the proposed WHR is uncertain as there may be obstacles such as irregular NG supply at the CPP and hence low generation of waste gases coupled with low Plant Load Factor and occasional tripping.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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1. Natural Gas Based Captive Power Generation using Gas Engines

Baseline Emissions (BEy_1)

The project involves the electricity generation using Natural Gas which otherwise would be generated by using FO to fulfil the power requirement of the plant. The activity displaces the quantity of FO used in CPP to generate electricity from the grid. Therefore the proposed baseline is the GHG emissions that would have occurred due to electricity generated from combustion of fossil fuel in the power boiler in absence of this project activity. In the proposed baseline, Western Region grid is used as the reference region for estimating the Weighted Average Emission. Using the methodology available for small-scale project activities, the Weighted Average Emission factor (in tCO_2e/MWh) of Western Region grid of India is used for the calculation of baseline. The Weighted Average Emission factor data calculated and provided by Central Electricity Authority (CEA) is used for the project activity.

$BEy_1 = (EG – AC) \times EF \times 0.001$…….. (Eq. 1)

Where

BEy_1 is baseline emissions occurring in the absence of project activity (TCO_2-e per year)
EG is the total electricity generated from the gas engines (KWh/year)
AC is the auxiliary consumption in the power plant (KWh/year)
EF is the baseline emission factor (TCO_2/MWh)
0.001 is the conversion from KWh to MWh

Baseline emission factor = Total baseline emissions (TCO_2)/ Total net generation (MWh)
= 0.80 TCO_2/MWh
= ((CO2 emission factor of fuel used in captive power generation-FO-IPCC Value x Carbon to Carbon Dioxide conversion factor x MWh to TJ conversion factor)/ (Efficiency of captive power generation))

Project Emissions (PEy_1)

The anthropogenic GHG emissions due to the project activity involve emissions of CO_2, CH_4 & N_2O (due to burning of natural gas in the gas engines), which are calculated using formulae:

(PEy_1) = (Energy Generated from Natural Gas in TJ/year x Carbon Oxidation Factor for natural gas x IPCC default value for CO_2 emission for Natural gas)

(PEy_1) = (NGH in TJ/year x 56.1 x 1) ……. (Eq. 2)

NGH = Net energy generated by combustion of Natural Gas in the gas engines in TJ/year
= Q_{NG} (Sm^3/yr) x NCV_{NG} (Kcal/Sm^3) x 4.18 x 10^-9

Where

Q_{NG} (Sm^3/yr) = Total quantity of Natural Gas consumed in Sm^3/year
NCV_{NG} = Net Calorific Value of Natural Gas in Kcal/Sm^3
4.18 = Conversion from Kcal to KJ
10^-9 = Conversion from KJ to TJ

Emission Reduction: ER_1 (yr)

The emission reduction ER (in TCO2-e per year) of the project activity during any given year is the difference between the baseline emissions (BE) and project emissions (PE)

ER_1 (yr) = BEy_1 – PEy_1……..(Eq. 3)

Where

BEy_1 = Total Baseline Emissions of the Project Activity

PEy_1= Total Project Emissions of the Project Activity

2. Waste Heat Recovery through Exhaust of the Gas Engines

Baseline Emissions (BEy_2)

The activity involves recovery of waste heat from the exhaust gases through the Natural Gas based CPP. The recovered heat is used for steam generation through boiler, which would otherwise be carried out by Coal burning. Therefore the emission baseline is the energy recovered in the project activity times an emission coefficient for fossil fuel, which would have been burnt in the absence of the project activity.

(BEy_2) = (Total waste heat recovery through exhaust of gas engines (TJ/year) x IPCC default value for CO_2 emission for coal (TCO_2/TJ)

(BEy_2) = HGy * EF CO_2 /ηth …… (Eq. 4)

Where:

BEy the baseline emissions from steam/heat displaced by the project activity during the year y in tCO2e.

HGy the net quantity of steam/heat supplied by the project activity during the year y in TJ.

EF_{CO2} the CO_2 emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO_2 / TJ), obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used.

ηth the efficiency of the boiler on NCV

BEy_2= HGy *96.1/0.80

Project Emissions (PEy_2)

There is no project emission from the project activity because waste heat is recovered in the waste heat recovery boiler

PEy_2 = 0…….. (Eq.5)

Emission Reduction: ER_2 (yr)

The emission reduction ER (in TCO2-e per year) of the project activity during any given year is the difference between the baseline emissions (BE) and project emissions (PE)

ER_2 (yr) = BEy_2– PEy_2……..(Eq. 6)

Total Emission Reduction: ER (yr) = ER_1 + ER_2……(Eq.7)

Leakage: LK

As per paragraph 7 of "AMS III. B. Switching fossil fuels (Version12: Valid from 02 November 2007 onwards)" of Appendix B of the simplified M&P for small-scale CDM project activities:

"7. No leakage calculation is required."
In this project activity, implementation of energy efficient technologies does not involve any transfer of equipment from another activity. Also existing equipment is not transferred to another activity. Therefore leakage calculation is not required.

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

(Copy this table for each data and parameter)

Data / Parameter:	**$EF_{CO2,NG}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor for Natural Gas.
Source of data used:	Volume 2 of 2006 IPCC guidelines for National Greenhouse Gas Inventories

Value applied:	56.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	The CO_2 emission factor for Natural Gas has been chosen from the Default emission factors for Stationary combustion in Manufacturing Industries.
Any comment:	Referring table 2.2 of chapter 2 of volume 2 of 2006 IPCC guidelines, value for CO_2 emission factor for RFO is 56100 $KgCO_2/TJ$, which is equal to 56.1 TCO_2/TJ

Data / Parameter:	**$EF_{CO2,RFO}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor for RFO
Source of data used:	Volume 2 of 2006 IPCC guidelines for National Greenhouse Gas Inventories
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	The CO_2 emission factor for RFO has been chosen from the Default emission factors for Stationary combustion in Manufacturing Industries.
Any comment:	Referring table 2.2 of chapter 2 of volume 2 of 2006 IPCC guidelines, value for CO_2 emission factor for RFO is 77400 $KgCO_2/TJ$, which is equal to 77.4 TCO_2/TJ

B.6.3 Ex-ante calculation of emission reductions:

>>

1. Natural Gas Based Captive Power Generation using Gas Engines.

Baseline Emissions (BEy_1) (TCO_2-e/year)

Referring to Eq.1, Baseline emissions are calculated as:

BEy_1 = (EG – AC) x EF x 0.001…….. (Eq.1)

Where,

EG = Total electricity generated from at the power plant (KWh/year)
= Total electricity generated from at the power plant (KWh/day) x Operating days in a year
= 115200 x 363
= 41817600 KWh/year

AC = Total auxiliary consumption in the power plant (KWh/year)
= 1672704.00 KWh/year

EF = Baseline emission factor (TCO_2/MWh)
= 0.80

BEy_1 = (41817600– 1672704.00) x 0.80 x 0.001
= 40144896.00 x 0.80 x 0.001
= 31946

BEy_1= 31946 TCO_2-e/year

Project Emissions (PEy_1) (TCO_2-e/year)

Referring to Eq. 2, Project emissions are calculated as:

(PEy_1) = (NGH in TJ/year x 56.1 x 1) …….. (Eq.2)

NGH = Net energy generated by combustion of Natural Gas in the CPP in TJ/year
= Q_{NG} (Sm^3/yr) x NCV_{NG} (Kcal/Sm^3) x 4.18 x 10^-9

Q_{NG} (Sm^3/yr) = Total quantity of Natural Gas consumed in Sm^3/year
= 11302054 Sm^3/year

NGH =11302054 x 9000.00 x 4.18 x 10^-9
= 425 TJ/year

(PEy_1) = (425 x 56.1 x 1)
= **23853** TCO_2-e/year

PEy_1 = 23853 TCO_2-e/year

ER_1 = BEy_1 – PEy_1 ……..(Eq.3)

Referring to Eq. 3, Emissions Reductions are calculated as:
= 31946 – 23853
= 8093 TCO_2-e/year

2. Waste Heat Recovery through Exhaust of the CPP

Baseline Emissions (BEy_2)

Referring to Eq. 4, Baseline emissions are calculated as:
(BEy_2) = HGy * EF CO_2 /ηth ……(Eq. 4)

(HGy) = HGy the net quantity of steam/heat supplied by the project activity during the year y in TJ.

Total Steam output Kg/Cm2-g = 37009930 Kg/year

CDM – Executive Board

Steam generated per year Kg/Cm2-g = **37010** Tons/Year

Latent heat of steam in Kcal/Kg (h_1) = 540 Kcal/Kg

Energy generated, Kcal = Total Steam output ,Kg/year X Latent heat of steam in Kcal/Kg
= 37009930 X 540
= 19985361930 Kcal

Energy generated, TJ = 19985361930 * 4.184*10^-9
=84 TJ

CO2 emission factor for coal, TCO2/TJ = 96.1 TCO2/TJ

Efficiency of coal fired boiler on NCV, % = 80 %

HGy = 84 TJ

BEy_2 = (84 x 96.1)/0.80
= 10045 TCO2-e/year

Project Emissions ($PEy_{2)}$ = 0

There is no project emission from the project activity because waste heat is recovered in the waste heat recovery boiler

PEy_2 = 0 …… (Eq.5)

ERy_2 = BEy_2 – PEy_2 …….. (Eq.6)
= 10045- 0
= 10045 TCO2-e/year

Total baseline emission = 31946 +10045
= 41991

Annual emission reduction due to the project activity is = Emission Reduction (ERy_1) + Emission Reduction (ERy_2)

Referring to Eq. 7, Emissions Reductions are calculated as

ERy = (ERy_1 + ERy_2)
= 8093 + 10045
= **18138**

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

>>

It is to be noted that as the operating conditions are going to be same for the whole crediting year, the electricity generation will be same for the next years as that of the current year. Therefore it is considered that the emissions will also be the same as per the current year for the next years.

On applying the formulae, the values are as follows:

Year	Estimation of project activity emissions (tCO2 e)	Estimation of baseline emissions (tCO2 e)	Estimation of leakage (tCO2 e)	Estimation of overall emission reductions (tCO2 e)
Year 2008	23853	41991	0	18138
Year 2009	23853	41991	0	18138
Year 2010	23853	41991	0	18138
Year 2011	23853	41991	0	18138
Year 2012	23853	41991	0	18138
Year 2013	23853	41991	0	18138
Year 2014	23853	41991	0	18138
Year 2015	23853	41991	0	18138
Year 2016	23853	41991	0	18138
Year 2017	23853	41991	0	18138
Total (tonnes of CO2 e)	238530	419910	**0**	181380

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

Monitoring methodology and plan as per Paragraph 10 of "Type AMS. III. B. Switching fossil fuel" of Appendix B of the Simplified M&P for Small-Scale CDM Project Activities (Version 11: Valid from 02 November 2007) states that:

"10. In the case of a new facility, monitoring shall consist of
(a) Metering the energy use of the equipment installed;
(b) Calculating the energy savings due to the equipment installed."

The project activity comprises new facilities, therefore choice of monitoring methodology as given in paragraph 10 of "Type AMS. III. B. Switching fossil fuel" of Appendix B of the Simplified M&P for Small-Scale CDM Project Activities (Version 11: Valid from 02 November 2007) is justified.

Monitoring methodology and plan as per Paragraph 13 of "Type AMS. III. Q. Waste gas based energy systems" of Appendix B of the Simplified M&P for Small-Scale CDM Project Activities (Version 01: Valid from 19 October 2007) states that:

13. For baseline emissions determination, monitoring shall consist of:
(a) Metering the thermal and/or electrical energy produced. In case of thermal energy the enthalpy of the thermal energy output stream like hot water/steam should be monitored.
(b) Metering the amount of waste gas or the amount of energy contained in the waste heat or waste pressure.

The project activity comprises waste heat recovery through exhaust gas and jacket water of engines, therefore choice of monitoring methodology as given in paragraph 13 of "Type AMS. III. Q. Waste gas based energy systems" of Appendix B of the Simplified M&P for Small-Scale CDM Project Activities (Version 01: Valid from 19 October 2007) is justified.

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	**EG_{PJ}**
Data unit:	KWh/day
Description:	Total Electricity generated from the natural gas based Power plant
Source of data to be used:	Logsheets maintained at the plant
Value of data	41817600.00
Description of measurement methods and procedures to be applied:	KWh generation from the plant is monitored by meter installed & maintained in the logsheets at the plant.
QA/QC procedures to be applied:	The meter used to measure the electricity generated is calibrated from accredited laboratory. It is periodically tested and it can be repaired or replaced as per the requirement.
Any comment:	The data is metered continuously. Data will be maintained in the logsheet (paper) for 3 years and in the spreadsheet (electronic) for 12 years.

Data / Parameter:	**AC**
Data unit:	KWh/day
Description:	Out of the electricity generated, auxiliary electricity consumption in the power plant .
Source of data to be used:	Logsheets maintained at the plant
Value of data	1672704.00
Description of measurement methods and procedures to be applied:	Auxiliary electricity consumption in the plant is monitored by meter installed & maintained in the logsheets at the plant.
QA/QC procedures to be applied:	The meter used to measure the auxiliary consumption is calibrated from accredited laboratory. It is periodically tested and it can be repaired or replaced as per the requirement.
Any comment:	The data is metered continuously. Data will be maintained in the logsheet (paper) for 3 years and in the spreadsheet (electronic) for 12 years.

Data / Parameter:	**FC_{NG}**
Data unit:	Sm^3/year
Description:	Total quantity of Natural Gas burnt in the CPP in order to generate the power from it.
Source of data to be used:	Logsheets maintained at the plant

Value of data	11302054
Description of measurement methods and procedures to be applied:	Quantity of natural gas consumed by the gas engines for power generation is monitored by meter installed & maintained in the logsheets at the plant.
QA/QC procedures to be applied:	The meter used to measure the gas consumption is calibrated from accredited laboratory. It is periodically tested and it can be repaired or replaced as per the requirement.
Any comment:	The data is metered continuously. Data will be maintained in the log sheet (paper) for 3 years and in the spreadsheet (electronic) for 12 years.

Data / Parameter:	**NCV_{NG}**
Data unit:	$Kcal/Sm^3$
Description:	Calorific value of Natural Gas used in project plant for power generation
Source of data to be used:	Reports received from the laboratory
Value of data	9000
Description of measurement methods and procedures to be applied:	Values obtained from test records from accredited laboratory & verified from natural gas supplier.
QA/QC procedures to be applied:	Sample of the Natural Gas is sent to accredited laboratory for measurement of NCV monthly once. Reports received from the laboratory are archived at the Power plant.
Any comment:	The data monitored will be archived in Logbook (Paper) for 3 years and Spread sheet (Electronic) for 12 years.

Data / Parameter:	**(HGy)**
Data unit:	TJ
Description:	Total waste heat recovery through exhaust of gas engines
Source of data to be used:	Logsheets maintained at plant
Value of data	84
Description of measurement methods and procedures to be applied:	Total waste heat recovered through the exhaust of gas engines is continuously monitored & recorded in the logsheets.
QA/QC procedures to be applied:	-
Any comment:	The data monitored will be archived in Logbook (Paper) for 3 years and Spread sheet (Electronic) for 12 years.

B.7.2 Description of the monitoring plan:

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Operational & Management Structure:

The operational and management structure basically consists of two levels:

A. Project Owner
B. Project Manager
C. Project Operator

A. Project Owner:

The owner of the project represents the project activity, which is Pratibha Syntax Management.

Their specific responsibilities:

1. Handling of the project performances.
2. Ensure that recording & monitoring procedure followed at the project site is in line with the verification requirement of the project
3. To keep the records of the data monitored by outside agencies.
4. To provide the records of the data monitored by outside agencies to Project Operator.

B. Project Manager: Manager, Pratibha Syntax Limited

His specific responsibilities:

1. Appointment of project operators.
2. Ensure that project operators have undergone initial training to create awareness about the process.
3. Assure that the project operators have received proper training regarding the process
4. To direct the project operators on key maintenance aspects
5. Ensure proper & timely calibration of the monitoring equipement & also the data acquisition
6. Ensure that annual monitoring report is as per requirement of the verification of the project.
7. Submission of the annual monitoring report for verification to the Designated Operational Entity (DOE).

C. Project Operators: Operators (Power Plant Incharge), Pratibha Syntax Limited.

Their specific responsibilities will include:

1. Collect the necessary data as required by the monitoring methodology.
2. Store relevant data in a systematic & reliable way in logbook (paper) and spread sheet (electronic)
3. Keep the record of collected data in a logbook for at least three years and in a spreadsheet for at least twelve years
4. Reporting & recording of any distinguishing event as a special log
5. Ensure that the data is entered properly and to take proper care to avoid any loss of information.
6. Evaluate the monitored data regularly & ensure the availability of pertinent information for verification
7. Prepare the annual monitoring report.
8. Check that CER calculation is carried out as per the monitoring methodology
9. Submit the annual monitoring report to the Project Manager.

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

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Date of first completion – 9th February 2008
Monitoring will be carried out as per Monitoring Plan.

Name of persons/entities determining the baseline:

Senergy Global Pvt. Ltd.
9th floor, EROS Corporate Tower
Nehru Place
New Delhi – 110019
Tel: +91-11-4180 55001/2/3
Fax: +91-11-4180 5504 / 4650 6006
Mobile: +91 – 9818569933
Email: mail@senergyglobal.com

Senergy Global Pvt. Ltd. is not project proponent.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
Project is yet to be implemented.

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

>>

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

C.2.1. Renewable crediting period

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

>>
N/A

C.2.1.2. Length of the first crediting period:

>>
N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/06/2008 or after the date of registration of project to UNFCCC

C.2.2.2. Length:

>>

10 years and 0 months

SECTION D. Environmental impacts

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

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The Ministry of Environment and Forests (MoEF), Government of India, under the Environment Impact Assessment Notification vide S.O. 60(E) dated 27/01/94 has listed a set of industrial activities in Schedule I of the notification which for setting up new projects or modernization/ expansion will require environmental clearance and will have to conduct an Environment Impact Assessment (EIA) study.
According to paragraph 3b of the notification new thermal power projects with less than 100 crore investment do not require an EIA. The project proponent hence does not require an EIA as the total investment is less than 100 crore Indian Rupees.

However, the following factors were analyzed for potential impacts and the conclusions are here follows:

1. Impact on Land Use – There would be no new land acquired for the purpose of the project. No loss of habitation or livelihood is perceived.
2. Impact on Water – There would no process waste water disposed of into the environment thereby causing no water pollution or thermal pollution. Further there would be no impact on the water quality and properties of nearby rivers and streams.
3. Impact on Air – GHG emissions into the atmosphere, as a result of the project, would be minimized by the use of less energy intensive fuels and energy efficiency systems.
4. Impact on Ecology – The project activity is being carried out within the factory premises and thus, no harmful impacts on the ecology can be perceived. There are no nearby forests, or zones high on biodiversity, or other sensitive locations around the factory that may be affected negatively due to the project. Further, no harmful impact shall be caused on the aquatic ecology as well as the local vegetation.

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

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The factory and hence the project is located in a sparsely populated area with no vulnerable flora or fauna. The proposed CDM activity does not lead to any negative impacts on the environment; rather, it results in positive environmental impacts (lower emissions) and resource conservation.

SECTION E. Stakeholders' comments

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

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The project has stakeholders at many levels and organizations. They are as follows:

1) GAIL: The deal for the supply of natural gas has been finalized with GAIL. The institution has cleared the necessary procedures and agreed to supply NG at a stipulated rate to the proponent.

2) MPPCB: The Madhya Pradesh Pollution Control Board has given the necessary clearances for the project commissioning and the following have been obtained. This reflects on the environmentally safe and beneficial nature of the proposed project that adheres to the prescribed standards of compliance.
- Consent to Establish
- Consent to Operate

3) Management and Employees at Pratibha Syntex Ltd: The project proponent organized a stakeholder meeting on 7th February 2007, within the factory premises, in order to take into account the concerns of the many stakeholders regarding the project implementation. Invitations were sent out to the management, plant managers, plant labourers and workers. Discussions were held, with the project in charge and other project management personnel addressing the meetings. The meeting began with a welcome speech by Mr. Pramod Sharma (Deputy Manager - IR) followed up with an introductory session by Mr. T.K Sahu (G.M Engineering) on the Gas engine and the WHRB, focusing on their nature, functioning and fuel use. The gathering was briefed about the overall concept of the project and the purpose behind it.
Feedback questionnaires were prepared and distributed amongst the stakeholders for their comments. It was prepared both in English and Hindi for easy understanding. The questionnaires addressed various aspects of the project monitoring, training imparted, occupational hazards and perceived negative impacts by the stakeholders.

E.2. Summary of the comments received:

>>

From the management team of the project, a total of 26 members were present during the meeting and provided their inputs and observations. These stakeholders are responsible for various processes of the project at different stages and together concluded that there were no perceived negative impacts due to the project. They also felt that each one was adequately familiar and trained regarding the functioning of the NG plant and boilers and that their commissioning would improve the efficiency standards of the plant. Some concerns were raised regarding effective monitoring and safety measures to be observed.

A total of 25 factory workers submitted their inputs after having acquired full project information. They encouraged the concept of pollution abatement and energy conservation. Through the stakeholder feedback form they confirmed that the project would cause no adverse impacts to them, lead to no displacement of locals and no health hazards. Furthermore, there has been no loss of private property during construction and no inconveniences caused due to the NG pipelines. There has been no additional pollution caused by the project as well.

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

>>

Since all comments and responses received from the various stakeholders indicate that the project is approved at all levels and is contributing to the overall enhancement of the plant efficiency and global environment, no remedial or grievance redressal actions were deemed necessary. The committee noted the concerns raised by the stakeholders and assured that a sound management protocol would be in place to monitor the activity thoroughly.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Pratibha Syntex Limited
Street/P.O.Box:	Plot No. 4, Industrial Growth Centre
Building:	
City:	Kheda, Pithampur
State/Region:	Madhya Pradesh
Postfix/ZIP:	454774
Country:	India
Telephone:	+91-7292-404362-64, 404357
FAX:	+91-7292-404326, 256340
E-Mail:	info@pratibhasyntex.com
URL:	www.pratibhasyntex.com
Represented by:	Mr. Aditya Goyal
Title:	Director
Salutation:	Mr.
Last Name:	Goyal
Middle Name:	
First Name:	Aditya
Department:	
Mobile:	09826028887
Direct FAX:	07292-256340/41
Direct tel:	07292-404303
Personal E-Mail:	aditya@pratibhasyntex.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in this project

Annex 3

BASELINE INFORMATION

Detailed explanation is given in B.4 & B.6.3

Annex 4

MONITORING INFORMATION

Detailed explanation is given in B.7.2

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