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

CONTENTS

Annexes

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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Title : **Fossil Fuel switch project at Asahi India Glass Ltd, Taloja, Maharashtra, India**

Version: 02

Date : 05/11/2007

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

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AIS Float Glass is one of the premier manufacturers of international quality float glass in India, with a advanced glass manufacturing facility at Taloja near Mumbai, having a manufacturing capacity of 550 TPD of Float Glass.

The plant has a Glass making furnace where the raw material (Cullet, Silica and other materials) required for producing glass is melted in the glass furnace, which generates hot flue gases at about 475°C - 550°C. Typically these waste gases generated from the furnace are exhausted into atmosphere through the chimney.

Transparent Energy Systems Pvt. Ltd (TESPL) and Asahi India Glass Ltd. (here after referred as 'Project Proponent') have developed a novel low pressure heat recovery system for steam and power generation using heat from exhaust gases of glass furnace in glass industry.

The project proponent has taken up the project activity as Clean Development Mechanism (CDM) project, as the project activity involves substantial risk in stabilization and operation of Glass furnace combined with the fact that the rate of return for the investment made was not attractive.

The purpose of the project activity is to avoid usage of fossil fuel based energy resources by recovering waste heat by installing a Waste Heat Recovery Boiler (WHRB) from the flue gases of the Glass furnace and to produce steam and power from the waste heat recovered. This would help to reduce the dependence on fossil fuel based Grid power and Steam boilers (furnace oil based) which were previously utilized before project activity.

The project will be implemented in two phases namely Phase I and Phase II. In Phase I system utilizes exhaust waste gases from the chimney to produce medium pressure saturated steam which will be utilized for process heating purpose. The system consists of a vertical, water-tube type boiler to recover the heat from the waste gases for producing steam. This Waste Heat Recovery Steam Generator will reduce the fossil fuel consumption in the furnace oil fired boilers by utilizing the waste heat of furnace exhaust gases.

In Phase II of the project, waste heat of furnace exhaust gases will be used to generate superheated steam which in turn will be utilized in a steam turbine coupled with an alternator to generate power (electricity). The system consists Bare Tube Type Waste Heat Recovery Boiler with Super-heater and Economizer. The power is generated from the fully condensing Steam Turbine with Alternator. The gross electric power generation will be 1.5 MW and the Net power generation will be 1.35 MW after deducting the 150 kW of Auxiliary power consumption. The net energy generation will be 10,854,000 kWh/year. This Waste Heat Recovery Steam Generator will avoid fossil fuel based grid power and reduce the fossil fuel consumption in the Western Region Grid by utilizing the waste heat of furnace exhaust gases.

Thus the project activity avoids usage of furnace oil for steam generation and reduced grid dependency of project proponent from the Western grid, India thereby helping in significant reduction of GHG emissions.

The project also contributes to sustainable development in the following manner in terms of environmental, socio-economic, technological development:

- Reduction in GHG emission mainly (CO_2) and other pollution occurring due to fossil fuel usage in steam boiler and in the power plants of the western regional grid
- Encouraging other industrial facilities irrespective of sector to adopt small but effective waste heat recovery measures to switch from fossil fuel based energy sources to waste heat which would enable protection of the environment.
- Minimize temperature of flue gas vented in to atmosphere resulting in reduction in heat content added to surrounding ambient air.

Project's Contribution to sustainable development: The four pillars of sustainable development have been addressed as follows:

Social well being

The project activity produces steam and power from waste heat i.e., heat available from the flue gases of Glass furnace. The project activity leads to employment of local people which provides boost to local economy. Project Proponent gave preference to employment of local people during construction and operation at project site. The activity has resulted in job creation (mostly skilled labour) and had attracted investment in areas which have difficulty attracting new investment.

Environmental well being

The project utilizes waste heat available from the flue gases for generating process steam and electricity which otherwise would have been generated through furnace oil for steam generation and most likely - fossil fuel based power plants, contributing to reduction in emissions including GHG emissions. Being a waste heat resource, using waste heat to generate steam and electricity contributes to resource conservation. Thus the project contributes results in lesser emissions to the surrounding environment contributing to environmental well-being on a regional as well as global level.

Economic well being

The project activity creates job opportunities for local people during construction and operation period. The project activity provides business opportunity for local stakeholders such as suppliers, manufacturers, contractors etc. Western Grid has a huge demand-supply gap; the project helps in reducing the gap by reducing the electricity from the local grid.

Technological well being

The project has high replication potential of usage of Waste Heat Recovery system in the Glass Industry, and will encourage other Glass industries to adopt the similar measures thereby leading to the global causes of reduction in fossil fuel consumption and consequent GHG emission reduction.

A.3. Project participants:

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Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants(as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India	1. Asahi Glass India Ltd 2. Transparent Energy Systems Pvt. Ltd	No

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

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

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A.4.1.1. Host Party(ies):

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India

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

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Maharashtra

A.4.1.3. City/Town/Community etc:

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MIDC Industrial Area, Taloja, Mumbai

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

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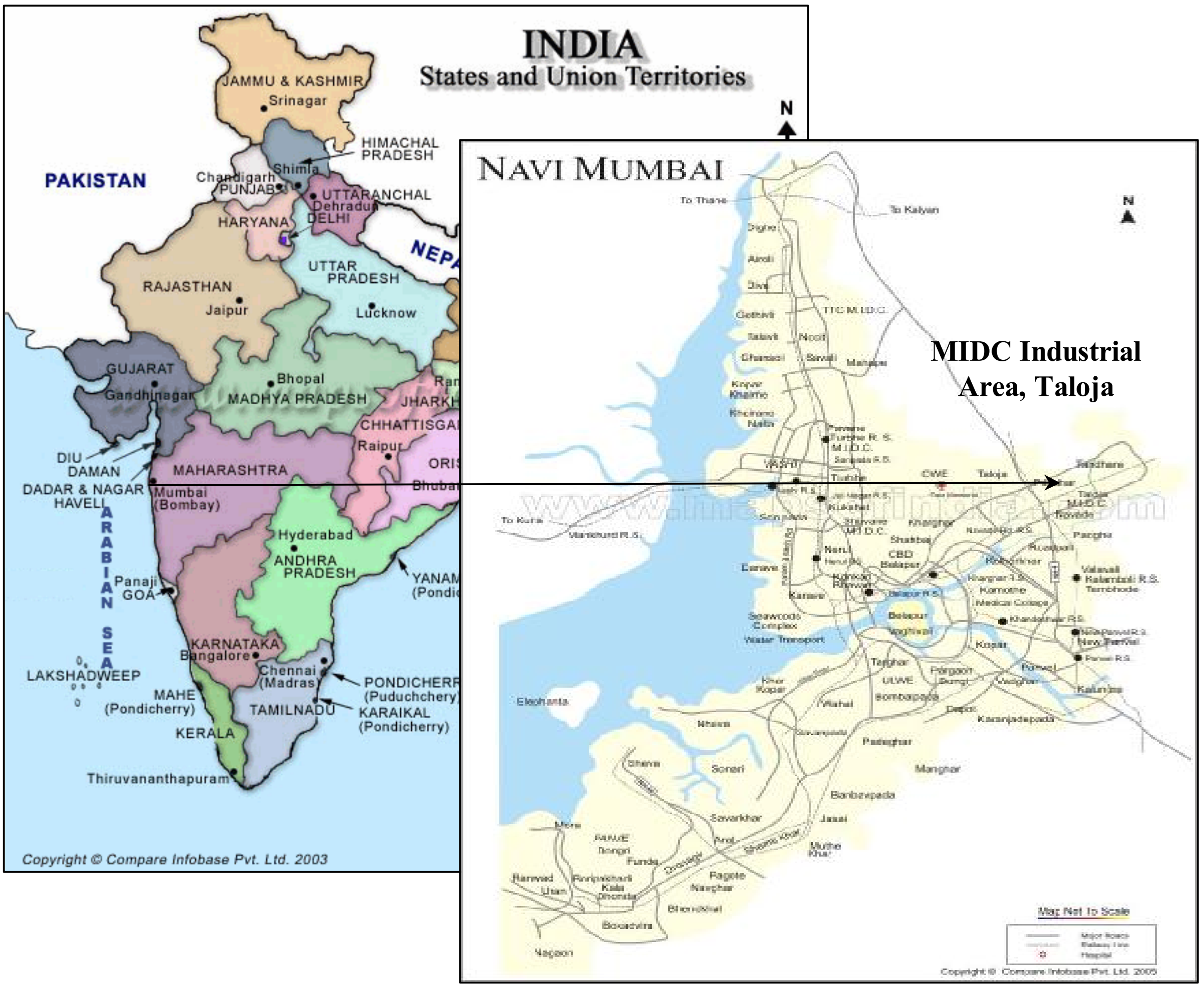
Project activity is a Waste Heat Recovery project at Asahi India Glass Ltd, Taloja, Maharashtra, India. The geographic location (Plot No T-7, MIDC Industrial Area, Taloja, Dist Raigad, Maharashtra. Pin : 410 208) has been indicated in the map given below.



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

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Title: AMS. III.Q (Version 1 Sectoral Scope: 4 EB 35)

TYPE III – Other Project Activities

III.Q. Waste Gas based energy systems

Reference: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html.

As per para 9 of AMS III.Q "For computing the emissions in the baseline the procedure provided in paragraphs 6 to 13 of AMS I.C shall be used". As per para 7 of AMS I.C "Cogeneration projects shall use one of the four following options for baseline emission calculations depending on the technology that would have been used to produce the thermal energy and electricity in the absence of the project activity:

(a) Electricity is supplied from the grid and steam/heat is produced using fossil fuel;

And as per para 9 "Baseline emissions for electricity supplied from the grid shall be calculated as the amount of electricity produced with the renewable technology (GWh) multiplied by the CO2 emission factor of that grid. The emission factor for grid electricity shall be calculated as per the procedures and herewith the ACM0002. Further as per para 10 "For steam/heat produced using fossil fuels the baseline emissions are calculated using, the IPCC default values for emission coefficients".

The description of how environmentally safe and sound technology and know how is being applied by the project activity is as described below:

Technology employed by the project activity

The Project Proponent has an fuel oil fired Glass Furnace with designed capacity of 550 TPD. The fuel oil firing rate is 3979 litre/hr. The Combustion air in furnace is supplied by the secondary air fans with rating of 55 kW, 72,000 m^3/hr. The maximum temperature maintained in the glass melting furnace is about 1700^{o}C. The flue gas temperature after the regenerator and before the stack damper is about 475°C - 550°C and at the base of the chimney is about 450^{o}C to 525^{o}C. The total flue gas flow from the glass furnace is about 90,000 kg/hr with 10% of Oxygen content.

The project activity aims to recover the heat available from the flue gas at 450^{o}C - 550^{o}C and generate steam and power thereby avoiding usage of furnace oil based steam boiler and fossil fuel based grid power.

The WHRB project is divided in two phases. In phase–I the steam is produced from the waste heat would be utilized for heating up the fuel oil which is used as a fuel for furnace firing. In phase-II the superheated steam produced would be utilized for power generation and the power generated would be internally consumed by project proponent thereby reducing the western region grid power consumption.

Phase-I: In phase-I flue gas is tapped at the base of the chimney and passed through the Bare Tube Vertical Cope-Co type Waste Heat Recovery Boilers (1100 kg/hr, 182^{o}C, 10.54 kg/cm^2) and released back to the chimney at the height of 17 meters. Approximately the 10% of the total flue gas is diverted through the Boilers by ID Fan (3-phase, 415 V, 25 HP, 2800 rpm, 31457 m^3/hr, 133 mmWC). The amount of the flue gas diverted through the boiler depends on

- The temperature to be maintained at the Heat Exchanger (119^{o}C) for heating up the fuel oil
- The refiner (Glass melting furnace) draft has to be maintained at 0.11 kg/cm^2 because of process limitations.

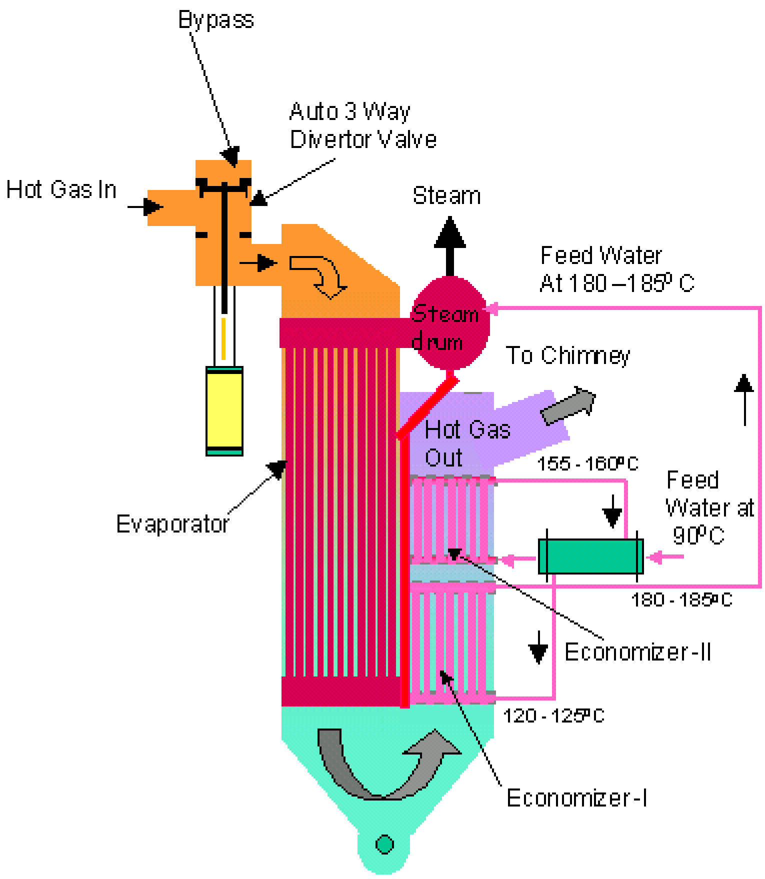
❖ The steam pressure in the steam drum has to be maintained at 8.0 kg/cm2.

Before the project activity fuel oil heating is done by the steam generated from the FO (Furnace Oil) Fired boilers (4 Nos, 600 kg/hr, 180^{o}C) which are consuming about 40 kilo litres of FO per month.

Phase-II: In phase-II also the flue gas is tapped at the base of the chimney and passed through the Bare Tube Type Waste Heat Recovery Boiler with Super-heater and Economizer. The power is generated from the fully condensing Steam Turbine with Alternator. The gross electric power generation will be 1.5 MW. And the Net power generation will be 1.35 MW after the 150 kW of Auxiliary power consumption. The net energy generation will be 10,854,000 kWh/year after considering 24 hr/day and 335 days/year of operations.

The waste heat recovery boilers specially designed bare tube vertical boilers offering very low pressure drop for the flue gas path and lower SOx and dust accumulation over the heat recovery tubes there by ensuring maximum heat recovery and higher heat transfer effectiveness.

The process of heat recovery system is given below:



The special features of the Waste Heat Recovery boiler is given below:

Type	Water tube, Co-flow (Co-current gas flow) IBR
Installation	Vertical - Outdoor.
Tube Orientation	Vertical
Waste gas flow direction	Vertical
Quality of waste gases	Specially designed for dust laden gases. Provided with special mechanized soot removal and collection system.
Acceptable dust in waste gases	High dust level readily accepted.
Type of heat recovery output	Steam - Dry & Saturated / Superheated
Media of waste heat	Hot flue gases
Water side circulation	Natural circulation / forced (Assisted circulation)
Steam separation	In steam drum moisture separator.
Number of heat recovery stages possible	3 to 4 stages of heat recovery like super-heater evaporator, economizer, water preheater.
Protection against sulphur corrosion on cold end side	Provided by various means to ensure that metal temperature is maintained above the actual incipient limit.

The above technologies utilized in the project activity are available locally and there is no transfer of technology between the host parties.

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

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Year	**Annual estimation of emission reductions in tonnes of CO_2 e**
2008	10408
2009	10408
2010	10408
2011	10408
2012	10408
2013	10408
2014	10408
2015	10408

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2016	10408
2017	10408
Total estimated reductions (tones of CO_2 e)	**104080**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2 e)	**10408**

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

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No public funding is available to the project activity from parties included in Annex I.

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

As per 'Appendix C of simplified modalities and procedures for Small Scale CDM project activities' occurrence of debundling is determined as follows:

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 proposed CDM project activity is the first by the company and satisfies all the above conditions. Thus the project activity is not debundled component of a large 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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Title: AMS. III.Q (Version 1 Sectoral Scope: 4 EB 35)

TYPE III – Other Project Activities

III.Q. Waste Gas based energy systems

Reference: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html.

As per para 9 of AMS III.Q "For computing the emissions in the baseline the procedure provided in paragraphs 6 to 13 of AMS I.C shall be used". As per para 7 of AMS I.C "Cogeneration projects shall use one of the four following options for baseline emission calculations depending on the technology that would have been used to produce the thermal energy and electricity in the absence of the project activity:

(b) Electricity is supplied from the grid and steam/heat is produced using fossil fuel;

And as per para 9 "Baseline emissions for electricity supplied from the grid shall be calculated as the amount of electricity produced with the renewable technology (GWh) multiplied by the CO2 emission factor of that grid. The emission factor for grid electricity shall be calculated as per the procedures and herewith the ACM0002. Further as per para 10 "For steam/heat produced using fossil fuels the baseline emissions are calculated using, the IPCC default values for emission coefficients".

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

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The project activity fits under AMS III.Q – Waste gas based energy systems. The project activity recovers heat from the waste gas and generates steam and electricity.

The indicative simplified baseline and monitoring methodology applicable to category III.Q has been used for the project including baseline calculations. The emission reduction calculation is based on amount of heat recovered from the waste gas by the project activity. The annual emission reductions from the project activity is 10408 tCO2e, which is well below the limit of 60 ktCO2e, as specified in the methodology.

The applicability criteria(s) of the applied methodology, AMS III.Q, with relevant project justification(s), are as follows:

Para	Methodology Requirement	Applicability of Project Activity
1.	*The category is for project activities that utilize waste gas and/or waste heat at*	The project activity entails recovery of the heat content of the waste gas generated from Glass Furance, utilization of the same in Waste Heat

	existing facilities as an energy source for: • *Cogeneration; or* • *Generation of electricity; or* • *Direct use as process heat source; or* • *For generation of heat in element process (e.g. steam, hot water, hot oil, hot air);*	Recovery Boilers for generation of steam and subsequently electricity. Therefore the project activity meets the above applicability condition of the methodology.
2.	*The category is also applicable to project activities that use waste pressure to generate electricity at existing facilities.*	The project activity does not involve usage of the waste gas pressure for generation of electricity. Therefore this applicability condition is not applicable for the project activity under consideration.
3.	*The recovery of waste gas/heat may be a new initiative or an incremental gain in an existing practice.*	The project activity is a new initiative taken by the project proponent and before the project activity there has been no waste heat recovery.
5.	*Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.*	The annual emission reduction from the project activity is about 10.408 ktCO2e which is below the limit of 60 ktCO2e as specified in the methodology.
6.	*The category is applicable under the following conditions:* • *The energy produced with the recovered waste gas/heat or waste pressure should be measurable* • *Energy generated in the project activity shall be used within the facility where the waste gas/heat or waste pressure is produced. An exception is made for the electricity generated by the project activity which may be exported to the grid.* • *The waste gas/heat or waste pressure utilized in the project activity would have been flared or released into the atmosphere in the absence of the*	The steam (energy) and electricity produced by the project activity is measured and monitored by the project proponent. The steam (energy) and electricity produced by the project activity is utilized within the facility where the waste gas is produced. Also before the project activity the waste gas produced by the glass furnace has been released in to the atmosphere. Therefore the project activity meets the applicability condition of the methodology.

	project activity.	
7.	*For the purpose of this category waste gas/heat/pressure is defined as: by-product gas/heat or pressure of machines and technical processes for which no useful application is found in the absence of the project activity and for which it can be demonstrated that it has not been used prior to, and would not be used in absence of the CDM project activity (e.g. because of low pressure, heating value or quantity available). In the project scenario, this waste gas/heat/pressure is recovered and conditioned for use.*	The waste gas utilized in the project activity is the exhaust gas obtained from the glass furnace which was exhausted in to the atmosphere before the project activity. The heat available in the exhaust gas was not utilized before the project activity because of technical & financial barriers explained in Section B. Therefore the project activity meets the applicability condition of the methodology.

B.3. Description of the project boundary:

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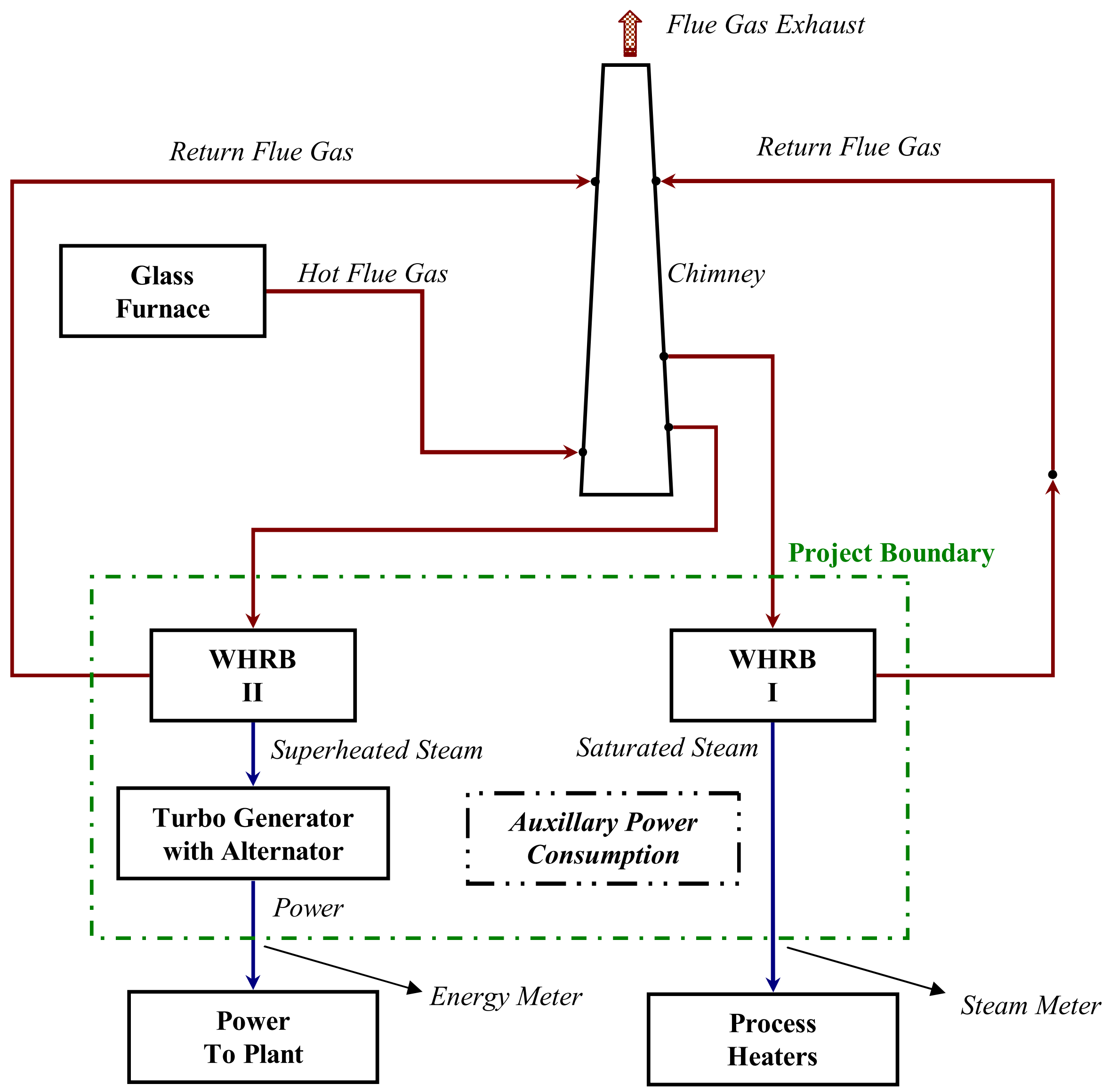
Based on baseline methodology, 'the project boundary is the physical, geographical site where the fuel combustion affected by the fuel-switching measure occurs'. The project boundary of the project activity is shown below:

<u>*Schematic representation of Project Boundary*</u>



B.4. Description of baseline and its development:

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Detail of the energy and emission baseline has been developed using the baseline methodology prescribed by the UNFCCC in Appendix B to Simplified M&P for small scale CDM projects activities belonging to AMS III.Q.

As per para 9 of AMS III.Q "For computing the emissions in the baseline the procedure provided in paragraphs 6 to 13 of AMS I.C shall be used". As per para 7 of AMS I.C "Cogeneration projects shall use one of the four following options for baseline emission calculations depending on the technology that would have been used to produce the thermal energy and electricity in the absence of the project activity:

(c) Electricity is supplied from the grid and steam/heat is produced using fossil fuel;

And as per para 9 "Baseline emissions for electricity supplied from the grid shall be calculated as the amount of electricity produced with the renewable technology (GWh) multiplied by the CO2 emission factor of that grid. The emission factor for grid electricity shall be calculated as per the procedures and herewith the ACM0002. Further as per para 10 "For steam/heat produced using fossil fuels the baseline emissions are calculated using, the IPCC default values for emission coefficients".

The baseline study is a two-step study conducted to determine the Baseline emissions over the crediting period in absence of project activity.

Step I: Determination of Energy Baseline

In the absence of the project activity, the existing furnace oil fired boilers and electricity consumption from the grid would have continued over the entire crediting period. Therefore the energy baseline would be the furnace oil consumption of boilers and electricity consumption from the grid equivalent to the Waste Heat Recovery power generation. Thus the energy sources primarily include electrical energy and furnace oil consumption. The base line data (two years data of the years prior to project implementation) has been used to determine the energy baseline.

Step II: Determination of carbon intensity of the chosen baseline

As stated above there are three energy sources

- ✓ Electrical energy drawn from Western Region Grid (major contributor)
- ✓ Thermal energy generated from Furnace oil combustion for steam boilers (major contributor)

The emission coefficient for each of these sources has been determined herein:

[A] Emission Coefficient of the Western Regional Grid[1]

Present generation mix for western regional grid with sector wise installed capacities, emission co-efficient and generation efficiencies are used to arrive at the net emission coefficient of the chosen grid. As per the provisions of the methodology the emission coefficient for the electricity consumption reduced would be calculated / considered in accordance with Baseline Carbon Dioxide Emission Database Version 2.0 from Central Electricity Authority (CEA), Ministry of Power, Government of India. The provisions require the emission coefficient (measured in kg CO_2 eq / kWh) to be calculated in a transparent and conservative manner as:

(a) The average of the "approximate operating margin" and the "build margin" (or combined margin)

OR

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix.

The baseline emission factor is calculated based on both approaches above and the combined margin emissions factor of generation mix has been selected to calculate the baseline emission factor.

Combined Margin

The baseline methodology suggests that the project activity will have an effect on both the operating margin (i.e. the present power generation sources of the grid, weighted according to the actual participation in the regional grid mix) and the build margin (i.e. weighted average emissions of recent capacity additions) of the selected western regional grid and the baseline emission coefficient would therefore incorporate an average of both these elements.

Operating Margin

As mentioned above the project activity will have some effect on the Operating Margin (OM) of the western regional grid. The emission coefficient as per the operating Margin takes into consideration the present power generation mix of 2000 - 2006 excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation of the selected grid, efficiency of thermal power plants and the default value of emission factors of the fuel used for power generation.

The real mix of power in a particular year is based on actual units generated from various sources of power. The data collected and used is presented in the calculations.

The most important parameter in estimating the emissions is the thermal efficiency of the power plant. On basis of references from CEA report the average efficiency of coal based power plant is taken 36.5% and Diesel based power plant is taken as 41.71% and gas based power plant for base line calculations is considered as 45%. Standard emission factors given in IPCC for coal and gas (thermal generation) are

[1] Emission Factor of WR Grid from www.cea.nic.in based on ACM0002 version 06

applied along with the Oxidation Factor (IPCC) over the expected generation mix and net emission factors are determined.

Build Margin

The project activity will have some effect on the Build Margin (BM) of the western regional electricity grid. The baseline emission coefficient as per the Build Margin takes into consideration the delay effect on the future projects and assumes that the past trend will continue in the future. As per the baseline methodology, the baseline factor for Build Margin is calculated as the weighted average emissions of recent capacity additions to the system, defined as the greater (in MWh) of most recent 20% of plants built or the 5 most recent plants. In case of western regional electricity grid capacity additions (in MWh) of most recent 20% of the existing plants are greater than that of 5 most recent plants. The data is presented in calculation excel sheets. The thermal efficiencies of coal and gas based plants for calculating build margin has been assumed same as that for calculating operating margin.

Combined Margin Emission Coefficient of Western Regional State Grid is = **0.811688 kg of CO_2 / kWh**[2] generation.

[B] Emission Coefficient for Furnace Oil (FO)

The emission coefficient is based on NCV and Emission Factor

As per the provisions of paragraph 59 of Appendix B of Simplified Modalities and Procedures for Small Scale CDM Project Activities [FCCC/CP/2002/7/Add.3, English, Page 21], the emission coefficient (measured in kg of CO2/ kg of Furnace Oil) for the Furnace oil reduced had been calculated in accordance with the IPCC default values as well as the laboratory analysis and stoichiometric analysis.

Emission factors

The emission factors are based on IPCC Guidelines for National Greenhouse Gas Inventories and are given below.

Fuel	Emission Factor (kg CO_2/TJ)[3]	Emission factor (kg CO_2/kg)[4]	Calorific Value (TJ/Gg)[5]
Residual Fuel Oil (Furnace Oil)	77400	3.13	40.40

Baseline Emissions

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[2] Emission Factor of WR Grid from www.cea.nic.in based on ACM0002 version 06

[3] IPCC 2006 Default Emission Factor for Residual Fuel Oil

[4] Calculated based on IPCC 2006 values

[5] IPCC Default value (Revised 2006) or NCV value from Furnace oil supplier

The Baseline emissions associated to electrical energy are computed as a product of the Energy Baseline (*i.e.* electrical energy generated from the waste heat recovery boiler that is measured as net electricity generated from the WHR system after deducting its auxiliary consumption) and emission coefficient of grid.

The Baseline emissions associated to thermal energy from Furnace oil are computed as a product of the Energy Baseline (*i.e.* Furnace oil use of the steam boilers which is replaced by WHR system, calculated as the product of quantity of steam produced per annum with the specific furnace oil consumption) and emission coefficient of Furnace oil.

Auxiliary power is also consumed by the boilers in baseline scenario. The emission related to the auxiliary power consumption is computed as a product of quantity of steam produced per annum with the specific auxiliary power consumption and grid emission factor. The sum of above three would give the total baseline emissions.

Capping of baseline emissions

As per para 10 of AMS III.Q "As an introduction of element of conservativeness, this category requires that baseline emissions should be capped irrespective of planned/ unplanned or actual increase in output of plant, change in operational parameters and practices, change in fuel types and quantity resulting in increase in waste gas generation. In case of planned expansion a separate CDM project should be registered for additional capacity. The cap can be estimated using the two methods described below. In order to apply the cap the energy produced should be multiplied by a capping factor f_{cap}".

Thus as per Method 2 specified in the methodology the Quantity of waste gas generated prior to the start of the project activity is estimated based on the expert analysis and the following results were obtained.

$Q_{WG,BL}$ (Quantity of waste gas generated prior to the start of the project activity) is estimated as 90000 Nm^3/hr.

The above value is arrived based on the Glass production capacity ($Q_{BL,Product}$) of 23 TPH and Amount of waste gas the glass furnace generates per unit of glass produced ($q_{wg,Product}$) which is 3913 Nm^3/T of glass.

Considering $Q_{WG,y}$ as 90000 Nm_3/hr the capping factor f_{cap} is set to 1.0.

Leakage

The project activity involves installation of equipments / technologies to recover waste heat from the exhaust gases generated from the glass furnace.

As per the AMS III.Q guidance para 11 "Project Emissions include emissions due to combustion of auxiliary fuel to supplement waste gas and emissions due to consumption of electricity by the project activity". The project activity consumes electrical energy for the operation of the waste heat recovery boiler, hence project proponent has considered leakage in applying this methodology.

Baseline data requirement and data source

S. No.	Parameter	Unit	Data source
1	Calorific Value of Furnace Oil	kJ/kg	IPCC/ Plant
2	Steam Generation	TJ/annum	Plant
3	Emission Factor of Furnace Oil	tCO2e/TJ	IPCC
4	Electricity Produced	kWh/annum	Plant
5	Grid Emission Factor	kgCO2e/kWh	CEA Emission Factor
6	Boiler efficiency	%	Supplier/Plant report
7	Boiler Auxiliary consumption	kWh/annum	Plant

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:

In accordance with paragraph 3 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in Appendix B may be used for a small-scale CDM project activity if project participants are able to demonstrate to a designated operational entity that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in Attachment A of Appendix. B.

These barriers are:

- Investment barrier
- Technological barrier
- Barrier due to prevailing practice
- Other barriers

The project activity aims to avoid usage of fossil fuel based steam generation and reduce usage of fossil fuel based grid electricity resulting in net CO_2 emission reductions through switching from fossil fuel based energy generation to waste heat based energy generation.

In India, it is not legally required / mandatory to install Waste Heat Recovery system by any Glass manufacturing company. However despite this, Project Proponent has taken measures to recover heat from the flue gases of Glass furnace.

Project Proponent has identified plausible project options, which include all possible courses of actions that could be adopted. These plausible options were further analyzed as per the guidance in Attachment A to Appendix B of the small scale modalities and procedures to establish project additionality and determine an appropriate baseline scenario.

There were only two plausible alternatives available with project proponent with regard to the project activity. They were

Alternative I: Continuation of current situation;

In the above alternative the project proponent would continue the existing furnace oil based boiler operations and withdrawn fossil fuel based grid power without introducing the project actiivty which aims at recovery of waste heat and avoids usage of fossil fuel in the glass making process. This alternative is in compliance with all applicable legal and regulatory requirements. This alternative has been operative at project proponent plant since inception. Therefore this alternative does not entail any investment, neither does it have any technological or other operational risks associated to its implementation and may be the baseline.

Alternative 2 (Project activity)- Implementation of the project activity (Waste Heat Recovery project) at Project proponent's Plant;

This alternative is in compliance with all applicable legal and regulatory requirements but there is no legal binding on Project proponent to take up the project activity. Further this alternative was exposed to limitations related to the project activity implementation. These barriers were primarily related to investment issues, technological issues like design of a proper heat transfer mechanism and the process related risks involved with the adaptation of the new technology and its outcome and other operational barriers. The barriers and the risks associated with the implementation of the project activity are detailed below.

Investment Barriers:

The Project Proponent has calculated the proposed project activity's internal rate of return (IRR) and compared it with the company internal benchmark for project approvals. The financial internal rate of return of the project activity without CDM revenues was calculated based on the following aspects:

- ✓ IRR was computed from the year 10 years (Crediting period) + 1 year.
- ✓ The cost of Electrical Energy and Furnace Oil (FO) were considered based on prevailing price during 2005 – 2006 and escalated every year 5% and 15% respectively.
- ✓ Cost of utilities & maintenance was assumed based on Project proponents operating experiences

The financial internal rate of return of the proposed project activity without CDM revenues was found to be lower than 20%, the company's internal benchmark. This posed to be one of the major limitations to project implementation.

However with CDM revenues, the internal rate of return of the project activity would overcome the hurdle of the company internal benchmark marginally if the internal rate of return was calculated based on the following assumptions:

- ✓ Annual CER generated per annum: 10408
- ✓ Exchange rate : 1EURO equivalent to INR 57/-
- ✓ CER price per ton of CO_2 equivalent 7 EURO[6]
- ✓ Other assumptions same as above

The internal rate of return of the project activity with and without CDM revenues was one of the considerations in the project activity feasibility assessments.[7] Other important considerations included technological/operational aspects and prevailing practices.

Barriers due to prevailing practice:

The project activity, which is waste heat recovery in glass industry of India, is not a common prevailing practice in Indian Glass Industry. This is the first initiative of its kind in the Indian Float Glass sector. Most of the Domestic Indian Glass sector[8] (which includes M/s. Saint Gobain Glass India Ltd., Kanchipuram, Tamil Nadu and M/s Gujarat Guardian Ltd., Dist. Bharuch, Gujarat) in India use either furnace oil or mix fuel (i.e. using a mixture of coal and furnace oil) for steam generation and grid power or DG power options for individual steam generation systems and power generation systems, to meet their plant's steam and power demand.

Several barriers have resulted in the small penetration of this WHR technology (adopted in the project activity under consideration) in this industrial sector. The Project Proponent has taken steps in order to overcome technological barriers and bring about the greenhouse gas emission reductions. The barriers and the risks associated with the implementation of the project activity are detailed under technological barriers section.

Thus, though the project is not a common practice, the project proponent has take up this new initiative of utilizing waste heat as primary fuel by overcoming the various barriers to prevailing practises and set example for others. However, the project proponent is well aware of the various barriers to project

[6] Conservative CER price

[7] All financial data used to determine the internal rate of return of the proposed project activity with and without CDM revenues would be provided to the DOE in the process of Validation.

implementation. However the barriers would be overcome with the availability of carbon financing against a sale consideration of carbon credits that would be generated once the project gets implemented. The project proponent took this CDM revenue stream into consideration at the planning stage itself.

Operational barrier(s) related to non-availability/inconsistency of waste gas

As stated earlier, in the project scenario, only waste gas will be used as the heat source in the WHR system to generate both steam and power. Waste gas availability and consistency of waste gas parameters (includes temperature, draft and flow rate) are the most important aspects that can affect the performance of the project activity. Any non-availability of waste gas or inconsistency of key waste gas parameters will result in inadequate steam and power generation. Since the fossil fuel based steam generation is completely stopped any disruption in steam will have a detrimental effect on project proponent's entire plant operations.

Non-availability or fluctuations of flue gas flow may occur due to functional disturbances in the Glass Furnace or due to any kind of network failure.

Glass Furnace operation is very complex and fluctuations in its operating conditions are very frequent. Some of the operational disturbances in flue gas flow and temperature, which would result in insufficient generation / fluctuations of flue gas, include the following:

- ❖ Cycling between Left firing and Right firing which reverses ever 20 minutes with reversal time of 55 seconds and 55 seconds 'NO' firing mode. 'NO' firing mode will result in minimum generation of flue gas during that time period which may affect the flue gas flow rate thereby resulting in lower steam and power generation.
- ❖ The difference in flue gas temperature of about 50^{o}C generated between Left firing and Right firing mode due to longer route and shorter route from the furnace to the chimney will also have an effect on the quality of steam (pressure and temperature) and power generation.

The steam generated from the WHR system is utilized in FUEL OIL preheating before fired in to main glass melting furnace. The FUEL OIL is preheated to maintain proper flow characteristics of FUEL OIL fried in main glass furnace. Under such situations mentioned above, the lower steam (pressure & temperature) generated will affect the temperature of the FUEL OIL being heated thereby affecting the FUEL OIL flow in to the main furnace affecting the main furnace temperature. Any fluctuations in main furnace temperature would directly affect the furnace productivity resulting in production losses.

The flue gas generation also directly depends on the float glass production and subsequently depends on the market demand. Any reduction in flue gas generation may affect the Plant Load Factor (PLF) of the power

[8] http://commerce.nic.in/adint_floatglass.htm

generation and would increase the dependency on the fossil fuel based grid power. So any fluctuations in PLF may affect the feasibility of the project activity.

Technological Barriers:

The technology used for the project activity is one of the first of its kind in India Glass making Industry. Therefore, Project Proponents management had inhibitions of implementing the technology, which had no precedence. Further, the project proponent was also aware of the other operational risks associated to the project activity implementation, which could increase proposed commissioning timelines and annual production losses due glass furnace downtime, leading to a negative impact on the financial considerations and on the Project proponent's productivity. Some of the operation risks which were taken into consideration have been elaborated below:

1. **Criticality of Main Furnace Draft:** The project activity is installation of a Waste Heat Recovery system or installation of a heat exchanger to recover heat from the flue gas generated from the main glass furnace. In pre-project scenario the main glass furnace draft (pressure) was maintained by delicate natural draft based chimney. The project activity adds an additional heat exchanger in the flue gas path there by increasing the resistance for the flue gas flow which was maintained by delicate natural draft. The increase in flue gas flow resistance will have drastic effect on the main furnace draft which was maintained at 0.11 mm WC in 'Refiner' and 3.2 mm WC in 'Melter'. This is very critical for the furnace operation point of view directly affecting the production. Any slight increase in the furnace pressure will affect the productivity of the plant and may resulting in numerous quality related problems.

   Increase in main furnace draft (+ve pressure) may result in following:

   i. Seat bubbles will be formed on the output glass directly affecting quality

   ii. Flame conditions will be disturbed and molten glass level in the furnace will fluctuate and based on project proponents operational experience, resuming normal operational conditions will take minimum 2 working days affecting stable production

   iii. Output of molten glass from the spout will be disturbed and there will be variations in thickness of the glass formed resulting in quality problems

   iv. Tridimite stones will be formed on glass (formed due to deposition fall from the furnace crown)

   Decrease in main furnace draft (-ve pressure) may result in following:

   i. Ambient air leak inside the furnace resulting in thermal shock to the furnace resulting in cracking of furnace insulation

ii. Furnace temperature inside the 'Melter' may be affected there by affecting quality of the glass output

The project proponent has effectively mitigated the above risk by installing an induced draft fan for the waste heat recovery system with latest auto control system like speed control based on draft which needs to be maintained in the main furnace.

2. **Corrosive nature of flue gas and WHR unique design:** The flue gas generated from the main furnace has significant amount of corrosive components like SOx and NOx. Furnace emissions also contain dust (arising from the volatilization and subsequent condensation of volatile batch materials) and traces of chlorides, fluorides and metals present as impurities in the raw materials. Based on the flue gas analysis before the project activity the quantity of SOx in flue gas is about 820 kg/day which is substantial resulting in corrosion of waste heat recovery boiler heat exchanger. Therefore the service life of this boiler heat exchanger tubes is expected to fall. If this is prevalent, heat exchanger tubes has to be replaced, which would lead to higher operating and maintenance costs of WHR system. The WHR system is specially designed to mitigate this risk having co-current flue gas flow and co-current water flow. This unique design will minimize the accumulation of the SOx in the boiler tubes there by increasing the feasibility of the project activity.

3. **Modification in Existing Chimney:** The project activity installations required substantial modifications in the existing natural draft chimney. If the part of the flue gas diverted through the WHR system, the main furnace draft would be affected. This was one of most important limitations to project implementation. The project proponent developed a new innovative solution to give back the flue gas utilized for waste heat recovery back to the draft chimney. This solution has been achieved by drilling holes in concrete chimney at 14.5 m level to connect the flue gas duct back the chimney. If the main furnace draft would not be maintained by this modification as expected, it would directly affect the Project proponent's productivity. The Project proponents has taken the risk of utilizing the new design for flue gas exhaust with prime aim to install the WHR system and operate it successfully which would reduce the electricity energy consumption and avoid fossil fuel consumption for steam generation.

Other operational limitations:

(a) Since there is no know-how available at Project proponent to implement the project activity, the project proponent's management could fore-see many operational limitations. The in-house team had no technical experience of implementing the project activity and project proponent had to depend primarily on the technology suppliers for any operational problems.

(b) The technology design is driven by software and control systems installed with speed control for ID fans. Any operational failure of the speed controls will lead to furnace downtime and its associated production losses. These speed control devices rectifications cannot be done by the in-house team.

Any problem in the speed control devices requires addressal by technology supplier and therefore leading to large losses in plant operation.

(c) The glass furnaces are designed to operate continuously for 12 – 15 years for one production cycle after which time they are rebuilt with either partial or total replacement of the structure depending on its condition. Any disturbances in the furnace operation may result in complete shutdown of the furnace resulting in major financial loss for the project proponent. A major rebuild would cost 30 - 50 million euros vs a new float line (typically 500 tonnes per day) would cost in the region of 100 million euros.

Therefore adaptation of an entirely new technology was challenging in all respects. At the decision stage itself the project proponent had anticipated the operational limitations and its impacts on the financial considerations and Project proponent's productivity. Each of them, especially the technological barriers could have resulted in project failure and huge financial losses. Without the CDM revenue, this alternative was not a feasible option for project proponent to adopt.

The above discussion clearly establishes that Alternative 1 was the only alternative option available to project proponent in absence of the project activity. Therefore, Alternative 1 has been considered as the baseline scenario for the project activity under consideration.

The project proponent's management chose to undertake the project activity and to invest in the CDM process only after adjusting for the potential carbon financing.

In summary, the corporate decision to invest:

- in overcoming the barriers facing project implementation and operation;
- in the CDM project activity and,
- in additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining M&V protocol to fulfill CDM requirements

was guided by the anthropogenic greenhouse gas emission reductions the project activity would result in and its associated carbon financing the project activity would receive through sale of CERs under the Clean Development Mechanism .

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

The procedure followed for estimating the emissions reductions from this project activity during the crediting period are as per the following steps:

Steps	Description	Equation Used	Methodological Choices
1.	Procedure followed for calculating baseline emissions (BE,y)	The baseline emissions are calculated as per equation $BE_y = BE_{Steam,y} + BE_{Elec,Grid,y}$	Baseline emissions both for steam generation & power generation are being accounted.
		The emissions related with steam generation has been calculated as $BE_{Steam,y} = HG_y \times EF_{FO} / \eta_{th} + HG_y \times SC \times EF_{Grid} / 1000$	As per AMS I.C, the emissions related with furnace oil combustion & auxiliary power consumption is calculated from IPCC and grid emission factor.
		The emissions related with power generation have been calculated as $BE_{Elec,Grid,y} = Q_{Elec,y} \times EF_{Grid} \times \frac{1}{1000}$	Calculated based on the grid emission factor.
2.	Procedure followed for calculating project emissions	The project emissions have been calculated as $PE_y = HG_y \times SC_P \times EF_{Grid} / 1000$	Only the emissions related with auxiliary power consumption have been considered. There are no other project emissions.
3.	Procedure followed for calculating Emission Reductions (ER,y)	The equation used to calculate emission reductions is $ER_y = BE_y - PE_y$	It has been calculated as per the methodology.

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

(Copy this table for each data and parameter)

Data / Parameter:	SC_B
Data unit:	kWh/TJ of Steam
Description:	Specific baseline electricity consumption for steam generation
Source of data used:	Plant
Value applied:	5866.116
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value applied is taken from the plant for the year April 2005 – September 2006. The plant being ISO 9000 & 14000 certified, all relevant QMS procedures are followed in measurement and recording of the data.
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	EF_{FO}
Data unit:	tCO_2e/TJ
Description:	Emission Factor of furnace oil
Source of data used:	IPCC 2006
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default values obtained from IPCC database
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	EF_{Grid}
Data unit:	$kgCO_2e/kWh$
Description:	Grid Emission Factor
Source of data used:	CEA Emission Factor
Value applied:	0.811688
Justification of the choice of data or description of measurement methods and procedures actually applied :	Obtained from published data Central Electricity Authority (CEA), Government of India (Version 2.0)
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$H_{Steam,T,P}$
Data unit:	kJ/kg
Description:	Enthalpy of Steam at temperature T & pressure P
Source of data used:	Reference Book

Value applied:	2778.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per equipment design of Temperature – 182^0C Pressure – 10.54 kg/cm^2
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	OF_{FO}
Data unit:	No units
Description:	Oxidation Factor for furnace oil
Source of data used:	IPCC 2006
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value from IPCC database
Any comment:	Data will be kept for crediting period + 2 years.

B.6.3 Ex-ante calculation of emission reductions:

>>

Baseline Emissions

a) Baseline Emissions for steam & power generation

Calculated based on Furnace oil consumption & auxiliary power consumption in boiler for steam generation & grid emissions factor for power generation

$$BE_y = BE_{Steam,y} + BE_{Elec,Grid,y} \quad \textbf{(1)}$$

$$BE_{Steam,y} = HG_y \times EF_{FO} / \eta_{th} + HG_y \times SC \times EF_{Grid} / 1000 \quad \textbf{(2)}$$

$$BE_{Elec,Grid,y} = Q_{Elec,y} \times EF_{Grid} \times \frac{1}{1000} \quad \textbf{(3)}$$

S.No	Parameter	Description	Unit
1	BE_y	Baseline Emissions in year y	tCO_2e
2	$BE_{Steam,y}$	Baseline emissions due to Furnace oil consumption for steam production	tCO_2e
3	$BE_{Elec,Grid,y}$	Baseline emissions due to electricity generation	tCO_2e
4	HG_y	Steam generation per annum	TJ/annum
5	EF_{FO}	Emission Factor of furnace oil	tCO_2e/TJ
6	SC_B	Specific baseline auxiliary electricity consumption for steam	kWh/TJ of Steam

		generation	
7	EF_{Grid}	Grid Emission factor	tCO_2e/kWh
8	$Q_{Elec,y}$	Electricity produced in year y	kWh
9	OF_{FO}	Oxidation factor for furnace oil	

Applying the values from section 6.2 & Section 7.1, the baseline emissions value is **10442** tCO_2e per annum.

Project Emissions

$$PE_y = HG_y \times SC_P \times EF_{Grid} / 1000 \quad \textbf{(4)}$$

S.No	**Parameter**	**Description**	**Unit**
1	SC_P	Specific project auxiliary electricity consumption for steam generation	kWh/TJ of Steam
2	PE_y	Project Emissions in year y	tCO_2e

Applying the values from section 6.2 & Section 7.1, the project emissions value is **34** tCO_2e per annum.

Emission Reductions

$$ER_y = BE_y - PE_y \quad \textbf{(5)}$$

S.No	**Parameter**	**Description**	**Unit**
1	ER_y	Emission Reductions in year y	tCO_2e

Applying the values from above, the emission reduction value is **10408** tCO_2e per annum

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

>>

Year	Baseline Emission	Project Emission	Emission Reductions
	tCO2/year	tCO2/year	tCO2/year
2008	**10442**	**34**	**10408**
2009	**10442**	**34**	**10408**
2010	**10442**	**34**	**10408**
2011	**10442**	**34**	**10408**
2012	**10442**	**34**	**10408**
2013	**10442**	**34**	**10408**
2014	**10442**	**34**	**10408**
2015	**10442**	**34**	**10408**
2016	**10442**	**34**	**10408**
2017	**10442**	**34**	**10408**
Total Emission	**104420**	**340**	**104080**
Crediting years	**10**	**10**	**10**
Average Emission Reductions over the Crediting Years (10 Years)	**104420**	**34**	**10408**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	HG_y
Data unit:	TJ
Description:	Process Steam produced in year y
Source of data to be used:	Plant Records
Value of data	5440200
Description of	Data type: Measured

measurement methods and procedures to be applied:	Recording Frequency: Calculated and reported daily Data Archiving Policy: Paper & Electronic Monitoring procedure: Flow meter totalizer will be used Calibration Procedures: as per ISO reference. Calibration Frequency: 6 months
QA/QC procedures to be applied:	As per ISO 9001 or other data management system
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$Q_{Elec,y}$
Data unit:	kWh
Description:	Electricity produced in year y
Source of data to be used:	Plant Records
Value of data	4824000
Description of measurement methods and procedures to be applied:	Data type: Measured Recording Frequency: Calculated and reported daily Data Archiving Policy: Paper & Electronic Monitoring procedure: Energy meter totalizer will be used Calibration Procedures: as per ISO reference. Calibration Frequency: 6 months
QA/QC procedures to be applied:	As per ISO 9001 or other data management system
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	SC_P
Data unit:	kWh/TJ
Description:	Specific project auxiliary electricity consumption for steam generation
Source of data to be used:	Plant Records
Value of data	2745
Description of measurement methods and procedures to be applied:	Data type: Measured/ Calculated Recording Frequency: Measured/ Calculated and reported daily Data Archiving Policy: Paper & Electronic Calibration Procedures: as per ISO reference. Calibration Frequency: 6 months
QA/QC procedures to be applied:	As per ISO 9001 or other data management system
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	T
Data unit:	^0C
Description:	Steam Temperature
Source of data to be used:	Plant Records
Value of data	182^0C

Description of measurement methods and procedures to be applied:	Data type: Measured Recording Frequency: Measured and reported continuously Data Archiving Policy: Paper & Electronic Monitoring Procedure: Temperature indicator will be used Calibration Procedures: as per ISO reference. Calibration Frequency: 6 months
QA/QC procedures to be applied:	As per ISO 9001 or other data management system
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	P
Data unit:	kg/cm^2
Description:	Steam Pressure
Source of data to be used:	Plant Records
Value of data	10.54 kg/cm^2
Description of measurement methods and procedures to be applied:	Data type: Measured Recording Frequency: Measured and reported continuously Data Archiving Policy: Paper & Electronic Monitoring Procedure: Pressure indicator will be used Calibration Procedures: as per ISO reference. Calibration Frequency: 6 months
QA/QC procedures to be applied:	As per ISO 9001 or other data management system
Any comment:	Data archived: Crediting period + 2 yrs

B.7.2 Description of the monitoring plan:

>> As per the provisions of paragraph 14 of Draft simplified modalities and procedures for small scale CDM project activities [FCCC/CP/2002/7/Add.3, English, Page 21] the "Project participants may use the simplified baseline and monitoring methodologies specified in appendix B for their project category" if they meet the applicability criteria of small scale CDM project activity.

Since the project activity is a small-scale CDM project of AMS III.Q. category, the monitoring methodology and plan has been developed in line with the guidance provided in paragraph 13 of category III.Q. for baseline emissions determination.

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.

As per para 14 "For project emissions determination, the Tool to calculate project or leakage CO2 emissions from fuel combustion and the Tool to calculate project emissions from electricity consumption shall be used".

Thus as per the methodology, monitoring shall consist of:

1. Metering of steam generation after the project activity.
2. Metering of electrical energy generated by switching over from grid power.
3. Monitoring and metering of Auxillary power consumption of project activity.
4. Computation of Emission Factor from published CEA database.

Monitoring plan:

A Monitoring & Verification (M&V) Plan has been developed by the project proponent for monitoring and verification of actual emission reduction. The Monitoring and Verification (M&V) procedures define a project-specific standard against which the project's performance (i.e. GHG reductions) and conformance with all relevant criteria will be monitored and verified.

The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicator to determine project outcomes, greenhouse gas (GHG) emission reductions.

The project revenue is based on the quantum of heat recovered from the waste gas as compared to the baseline fossil fuel consumption before project activity implementation. The monitoring and verification system would mainly comprise of the electronic power (energy) meters, furnace oil flow meters, steam flow meters, installed at the each project activity site in order to measure the quanity of 'waste heat recovered' after project implementation.

The above meters used for monitoring of the project activity will comprise microprocessor-based instruments of reputed make with desired level of accuracy. All instruments will be calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time.

Monitoring Approach

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and reporting

❖ Frequency of monitoring

The project proponent has installed power meters, steam flow meters and furnace oil flow meters to monitor and record the ‘energy use’ data for the all the poject activity sites on a continuous basis.

Reliability

All measurement devices will be of microprocessor based with best accuracy and procured from reputed manufacturers. Since the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the results all power measuring instruments would be calibrated once a year for ensuring reliability of the system. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration. Therefore the system ensures the final energy use data is highly reliable.

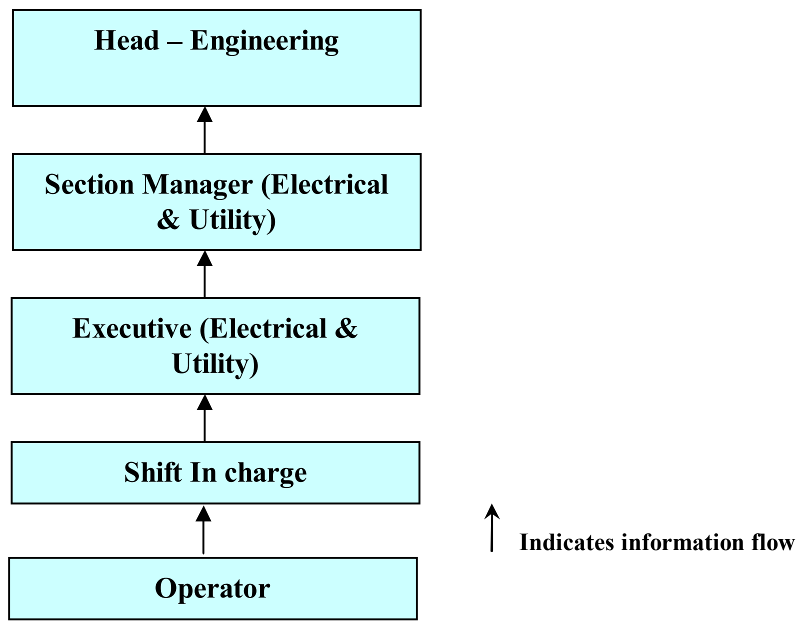
Registration and reporting

Registration of data is captured manually through logging the energy meter reading in log books in hard copy as well as there will be logging in soft copy also. Daily, weekly and monthly reports are prepared stating the cumulative energy use. Based on the monitored data and the IPCC emission factors the baseline emissions and project activity emissions are calculated.

There is no technology transfer in the project activity therefore the project activity doesn’t lead to any leakage emissions. The difference between the baseline and project emissions is reported as emission reduction from the project activity.

Emission monitoring and calculation procedure will follow the following organisational structure.

Organizational structure for monitoring plan



Monitoring and calculation activities and responsibility

Monitoring and calculation activities	Procedure and responsibility
Data source and collection	Data is taken from the plant. Most of the data is available in ISO 9001 quality management system.
Frequency	Monitoring frequency should be as per section B.7.1 of PDD.
Review	All received data is reviewed by the Shift In charge in the production.
Data compilation	All the data is compiled and stored in electricity & utility department.
Emission calculation	Emission reduction calculations will be done annual based on the data collected. Executive (Electrical & utilities) will do the calculations
Review	Section Manager (Electrical & Utilities) will review the calculation.
Emission data review	Final calculations is reviewed and approved by Head – Engineering
Record keeping	All calculation and data record will be kept with the Electrical & Utilities

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

>>

Date of completing the final draft of this baseline and monitoring methodology: 05/11/2007

Name of person/entity determining the baseline: Project Proponent and its associated consultants.

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:

>>

01/03/2006

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

>>

15 Years

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

C.2.1. Renewable crediting period

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

>>

Not Applicable

C.2.1.2. Length of the first crediting period:

>>

Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

01/01/2008 or From the date of registration of the project activity which ever is later.

C.2.2.2. Length:

>>

10 Years 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:

>> As per the latest EIA notification by Ministry of Environment & Forests, no EIA is required for the project activity. Project proponent has obtained the required permissions like Boiler Test Certificates from the concerned authorities.

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:

>>

It is not mandatory to carry out environmental impact assessment (EIA) for the project as per the national legislations. However the assessment of environmental impact due to the project activity has been carried out to understand if there are any significant environmental impacts.

The project is an environmentally friendly project as it improves the environmental condition in the surroundings by reducing the temperature of flue gas exhausted in to the atmosphere.. However the environmental impacts during construction phase and operation phase of installation of Waste Heat Recovery Systems such as boilers, Turbines and pipelines are listed below:

Report on Environmental Impact

The impact of the project on the environment occurs during two stages:

- Construction phase
- Operational phase

Impacts during construction phase

The impacts due to the construction of the project activity are very negligible as it would only involve installation of equipments such as boilers, turbines, pumps and pipings with insulation systems. Laying of with insulation pipeline would cause air pollution which would be usually short-term and would cease to exist beyond the construction phase.

Impacts during operational phase

The operational phase of the project activity involves heat recovery from waste flue gas to generate steam which was otherwise exhausted to atmosphere. The environmental impacts would occur such as usage of boiler water chemicals and sulphue deposition in boiler tubes may result in sulphur and chemicals release to the surroundings.

Project proponent has installed safety devices and implemented the environmental management system (EMS) as per ISO 14001 for this Waste Heat Recovery project. The environmental management plan (EMP) consists of measures to mitigate such emissions arising from normal, abnormal and emergency conditions.

SECTION E. Stakeholders' comments

>>

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

>>

The project proponent considered the following while conducting the stakeholder consultation:

- transparency
- accountability
- flexibility
- increased stakeholder awareness of policy issues
- broad stakeholder input and involvement
- efficiency and effectiveness
- promotion of stakeholder confidence
- an understanding of stakeholder perspectives.

Since the project activity implementation involves avoidance of fossil fuels for steam generation and reduces the usage of fossil fuel based grid power in the glass manufacturing process (not requiring major transportation or other energy inputs), and is relatively small scale it has no significant negative environmental impacts on noise, air or water pollution outside the facilities, therefore comments from the local population was not found necessary.

However the project proponent has identified the following stakeholders for the project activity were as under:

- Employees
- State pollution control board
- Consultants
- Customers
- Equipment suppliers
- Local population

The project proponent communicated their plan to implement the project activity along with salient information of the project activity with all the stakeholders enlisted above to receive their comments/suggestions if any. The opinions expressed by them were recorded. Since the project activity is small it does not require any approvals and clearances from governmental organization.

E.2. Summary of the comments received:

>>

Stakeholders Involvement

The project is an environmentally friendly project which enables improvement of the project local area where the high temperature flue gas was earlier being exhausted. It did not require any displacement of any local population. The project has therefore not caused any adverse social impacts on local population but has rather helped in improving their quality of life.

The local people and employees of AIS & TESPL are direct beneficiaries of the project. The construction and continuous operation of the Waste Heat Recovery system constituted local manpower. The project does not require any displacement of any local population. Also, the installation of WHR stack and turbines would not create any inconvenience to the employees. In summary, the project activity has received complete support from the employees and local population.

Thus, the project will not cause any adverse social impacts on local population. Comments have been gathered by AIS and TESPL from identified stakeholders. (Local population/ equipment supplier/ project consultants/ employees for the project). The comments received have been positive.

Project consultants were involved in the project to take care of various pre contract and post contract project activities like preparation of reports, preparation of engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project implementation, successful commissioning and trial runs.

Equipment suppliers have supplied the equipments as per the specifications finalized for the project and were responsible for successful erection and commissioning of the same at the site.

Stakeholders' Comments

The comments received from contractors and employees affected by this project activity are all positive, stressing how the project has been beneficial to them both economically and environmentally. Copies of the comments received are enclosed in a separate enclosure.

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

>>

As per UNFCCC requirement the PDD will be published at the validator's/UNFCCC web site for public comments for a period of 30 days.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Asahi India Glass Ltd
Street/P.O.Qox:	MIDC Industrial Area
Building:	Plot No. T-7
City:	Taloja, Raigarh
State/Region:	Maharashtra
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from parties included in Annex I is available to the project activity.

Annex 3

BASELINE INFORMATION

S.No	Parameter	Description	Unit	Value
1	T	Steam Temperature	^0C	182
2	P	Steam Pressure	kg/cm^2	10.54
3	$H_{Steam,T,P}$	Enthalpy of Steam	kJ/kg	2778.3
4	EF_{Grid}	Grid Emission Factor	$kgCO_2e/kWh$	0.811688
5	EF_{FO}	Emission Factor for Furnace oil	$kgCO_2e/TJ$	77.40
6	$SC_{FO,B}$	Specific baseline Furnace oil consumption for steam generation	kg/TJ	31489.255
7	$SC_{Elec,B}$	Specific baseline Furnace oil consumption for steam generation	kWh/TJ	5866.116
8	OF_{FO}	Oxidation Factor for furnace oil		1.0

Annex 4

MONITORING INFORMATION

Monitoring information as per given in section B.7.

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