**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.<br>• 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:

>>
Energy efficiency and fuel switch project at Welspun India Limited.

**Version: 03**
**Date: 04/08/2008**

Gelöscht: 2
Gelöscht: 1
Gelöscht: 3

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

>>
Back ground of the project
Welspun India Ltd. is engaged in the manufacturing of Textiles. The company is located at Vapi, Gujarat – India.

Purpose of the project

This project activity involves installation of an energy efficient 5.9 MW (at $35^0$ C ambient temperature) gas turbine with heat recovery steam generator (HRSG), a 6.79 MW gas engine generator with 1260 TR vapour absorption chillers (VAC). These measures replace use of lower efficient power systems which comprises of FO based Generating sets (2*2MW, 1*4MW and 1 * 6MW) with Exhaust Gas Boiler (EGB) (1*1.5TPH, 1*2.1TPH, 1*1.6TPH) for steam and power generation, FO based boilers (3*6TPH) for steam generation and centrifugal chillers (2*500TR, 1*390 TR) for chilled water generation. The 1260 TR Vapour Absorption Chiller will use the exhaust heat from the gas engine for chilled water generation and in turn replaces use of Centrifugal Chillers thereby reducing the electricity consumption for the equivalent amount of chilled water generation.

The project activity also involves switching of fuel from Furnace Oil to natural gas in electricity and steam generation at above applications and processes. The fuel switch measure is happening due to installation of new Natural Gas based Gas turbine and Gas engine which replaces use of FO based DG set. In addition the other fuel switch measure is happening for steam generation at the existing boilers where switching of fuel from furnace oil to natural gas is done at 2 of the 3 number of boilers. The HRSG in project activity also uses natural gas for additional steam generation in addition to the steam generation from the exhaust heat from the GT.

All these energy efficiency and fuel switch measures primarily aims at reducing GHG emission into the atmosphere per unit of output through increase in efficiency and switching of fuel from Furnace Oil (FO) to natural gas in electricity and, steam generation. Energy efficiency is also happening in chilled water generation.
The process flow diagram of the Baseline Scenario is elaborated in Annex 3 and Project Activity Scenario diagram is elaborated in section B.3.

**Contribution of the project activity to sustainable development**

Ministry of Environment and Forests, Govt. of India has stipulated the social well being, economic well being, environmental well being and technological well being as the four indicators for sustainable development in the host country approval eligibility criteria for Clean Development Mechanism (CDM) projects[1].

**Social well being**

- The project demonstrates harnessing electricity and steam from cleaner source of fuel (natural gas).
- The project activity has generated 2 more employment opportunities.

**Environmental well being**

- The project results in reduced GHG intensity per unit of electricity and steam generation at the Welspun India site.
- The project reduces the local air pollutants and environmental impacts due to use of natural gas for power generation.
- This is the first project activity which is initiated by the project proponent in Vapi region. It has already encouraged other facilities irrespective of sector to adopt such kind of project.

**Economic well being**

This kind of fuel switch initiative will allow the Project developer to adopt cleaner fuel switch measures and get the carbon revenue benefit through implementation of this measure.

**Technological well being**

- This is a clean technology demonstration which uses natural gas for electricity, steam and chilled water generation.

### A.3. Project participants:

>>

| Name of Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (Host) | Welspun India Ltd. | No |
| United Kingdom | Cantor Fitzgerald Europe | No |

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

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

>>

##### A.4.1.1. Host Party(ies):

>>

India

[1] http://cdmindia.nic.in/host_approval_criteria.htm

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

>>
Western Region, Gujarat

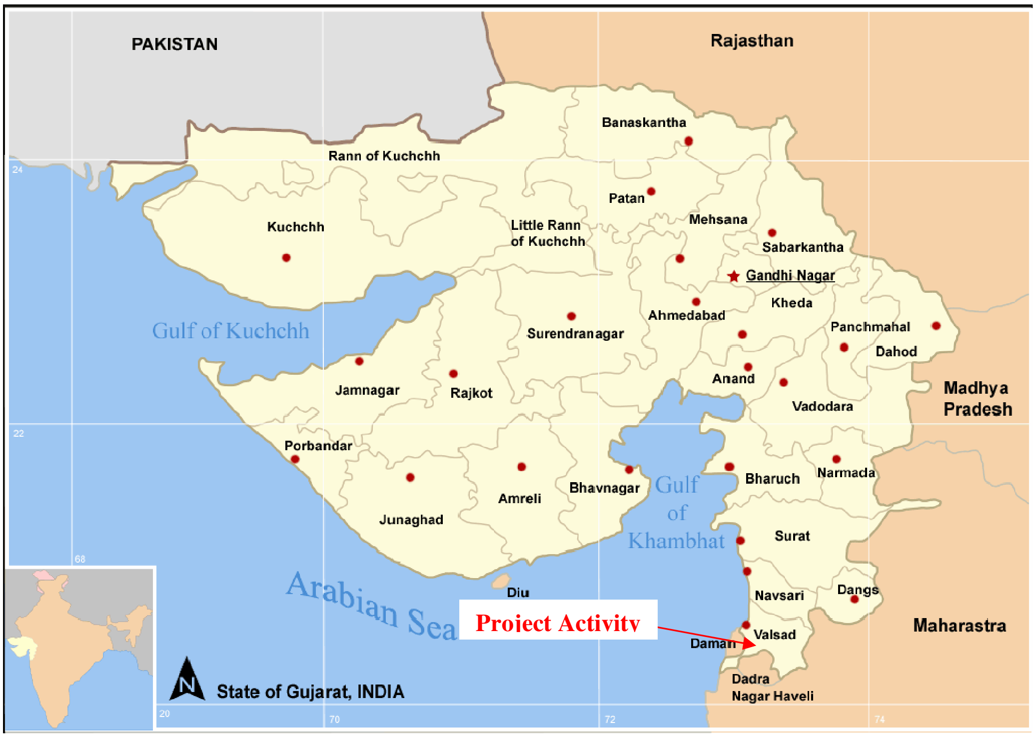
**A.4.1.3. City/Town/Community etc:**

>>
Vapi

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

>>
The Welspun India Limited's manufacturing facility is located in Morai Village, Valsad District, Gujarat State. The Gas engines are located along the east-south periphery of the existing factory within the same premises.

The project site at Morai village is located at $20^0 25'$ North latitude and $72^0 54'$ East Longitude. It is located near the National Highway Number 8. Vapi is the nearest railway station and Daman airport is the nearest airport.



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

>>

| **Project Category** |
|---|
| **Type II:Energy Efficiency Improvement Projects**<br>**Category IID: Energy efficiency and fuel switching measures for industrial facilities**<br>**II.D./Version 9**<br>**Sectoral Scope: 4**<br>**EB 31** |

**Technology that was employed by the project activity**

The capacity of the gas gas engine generator is 6.79 MW. M/s Rolls Royce Marine of Norway is the supplier of this gas engines. The rated Active Power capacity of the Generator is 6790 kW and rated Power (MCR) of the engine is 6945 kW. The capacity of the gas turbine is 5.9 MW. M/s Turbomach of Switzerland is the supplier of this gas turbine. The capacity of the gas turbine at continuous rating at Power shaft at ISO conditions is 7886 kW (gas fuel)

The Gas turbine being used by Welspun is of the model Taurus 70 which is a single shaft, axial flow design consisting of air inlet assembly, fourteen stage compressor with fixed and variable vane assemblies, compressor diffuser assembly, combustor assembly with annual combustion chamber, three stage turbine assembly, turbine exhaust diffuser and exhaust system connector. The Gas Engine being used is a 4-stroke, turbocharged, inter-cooled Bergen Gas Engine. The use of natural gas in the gas turbine and gas engine replace use of furnace oil at the DG set for electricity generation and at the boiler for steam production.

The project activity primarily aims at reducing GHG gas emission through increase in efficiency and switching Furnace Oil as a fuel to Natural Gas as a fuel in plant's power and steam generation. The installed power generating capacity of the project is 12.69 MW. Welspun India Limited has installed Vapour Absorption Chillers on waste exhaust gases of Gas Engine and steam generated from waste exhaust gases from Gas Turbine Generator Set.

Vapour Absorption Chiller capacity of 1260 TR is operating on waste exhaust heat of Gas Engine . The 1260 TR VAC replaces use of Centrifugal Chillers for equivalent amount of chilled water generation thereby reducing the electricity consumption.

The Vapour Absorption chillers has been imported from Broad Company of China, market leader in Vapour Absorption technology. The VAC uses exhaust heat instead of electrical energy to provide cooling. A thermal compressor consists of an absorber, a generator, a pump, and a throttling device, and replaces the mechanical vapour compressor.

In the Vapour Absorption chiller, refrigerant vapour from the evaporator is absorbed by a solution mixture in the absorber. This solution is then pumped to the generator. There the refrigerant is re-vaporized using a waste steam heat source. The refrigerant-depleted solution then returns to the absorber via a throttling device. The refrigerant/absorbent mixtures used in absorption chillers are water/lithium bromide.

All the aforementioned technologies applied in the project activity are environmentally safe and sound.

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

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| Total Chosen Crediting period (June 2008 to May 2018) | |
|---|---|
| **Years** | **Annual estimation reductions in tonnes of $CO_2$ e** |
| June 2008 – May 2009 | 35131 |
| June 2009 – May 2010 | 35131 |
| June 2010 – May 2011 | 35131 |
| June 2011 – May 2012 | 35131 |
| June 2012 – May 2013 | 35131 |
| June 2013 – May 2014 | 35131 |
| June 2014 – May 2015 | 35131 |
| June 2015 – May 2016 | 35131 |
| June 2016 – May 2017 | 35131 |
| June 2017 – May 2018 | 35131 |
| **Total estimated reductions (tonnes of $CO_2$ e)** | 351310 |
| Total number of crediting years | 10 |
| **Annual average of the estimated reduction over the crediting period** | 35131 |

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

>>

Public funding from Annex I and diversion of ODA is not involved in this project.

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

As mentioned under *Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project Activities,* the following results into debundling of large CDM project:

"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 identified CDM project is being promoted by Welspun India Ltd.

With reference to aforementioned points of de-bundling, the project activity does not comply with any of the above conditions, therefore, the project activity is considered as small scale CDM 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:

>>
Project has applied approved methodology available for small-scale CDM project at UNFCCC website under Appendix B of the simplified modalities and procedures for small-scale CDM project activities

**Type II:Energy Efficiency Improvement Projects**
**Category D: Energy efficiency and fuel switching measures for industrial facilities**
**Reference:**
**II.D./Version 9**
**Scope: 4**
**EB31**

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

According to the selected methodology for the small scale CDM project the baseline has defined as:
**Type II:Energy Efficiency Improvement Projects**
**Category D: Energy efficiency and fuel switching measures for industrial facilities**
*This category comprises any energy efficiency and fuel switching measure implemented at a single industrial or mining and mineral production facility. This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B. Examples include energy efficiency measures (such as efficient motors), fuel switching measures (such as switching from steam or compressed air to electricity) and efficiency measures for specific industrial or mining and mineral production processes (such as steel furnaces, paper drying, tobacco curing, etc.). The measures may replace, modify or retrofit existing facilities or be installed in a new facility. The aggregate energy savings of a single project may not exceed the equivalent of 60 GWhe per year. A total saving of 60 GWhe per year is equivalent to a maximal saving of 180 GWhth per year in fuel input.*

The applicability of the above mentioned methodology can be explained in the following given arguments:

- The Energy Efficiency and fuel switching measure is implemented at the single industrial facility at Welspun India Limited, Vapi.
- This project activity involves installation of an energy efficient 5.9 MW (at $35^0$ C ambient temperature) gas turbine with heat recovery steam generator, a 6.79 MW gas engine with 1260 TR vapour absorption chiller. These measures replace use of lower efficient systems which comprise of FO based Generating sets (2*2MW, 1*4MW and 1 * 6MW) with Exhaust Gas Boilers (EGB) (1*1.5TPH, 1*2.1TPH, 1*1.6TPH) for steam and power generation, modification of FO based boilers (2 out of the 3*6TPH) for steam generation and replacement of centrifugal chiller (2*500TR, 1*390 TR) for chilled water generation.by Vapour Absorption Chillers. The

1260 TR Vapour Absorption Chillers will use the exhaust heat from the gas engine for chilled water generation and in turn replaces use of Conventional Centrifugal Chillers for the equivalent amount of chilled water generation thereby reducing the electricity consumption for chilled water generation. Thus project activity aims at GHG reductions into the atmosphere primarily by implementing energy efficiency measure for generation of electricity, steam and chilled water leading to decrease in consumption of fossil fuel quantities per unit of output.

- The project activity replaces furnace oil with the natural gas for power and steam generation.
- The aggregate fuel input saving of the project activity is 66.19 GWhth per annum.

From the above discussion, it can be concluded that project meets all the applicability criteria set under the selected approved small scale CDM methodology and hence the project category is applicable to the CDM project.

**B.3. Description of the project boundary:**

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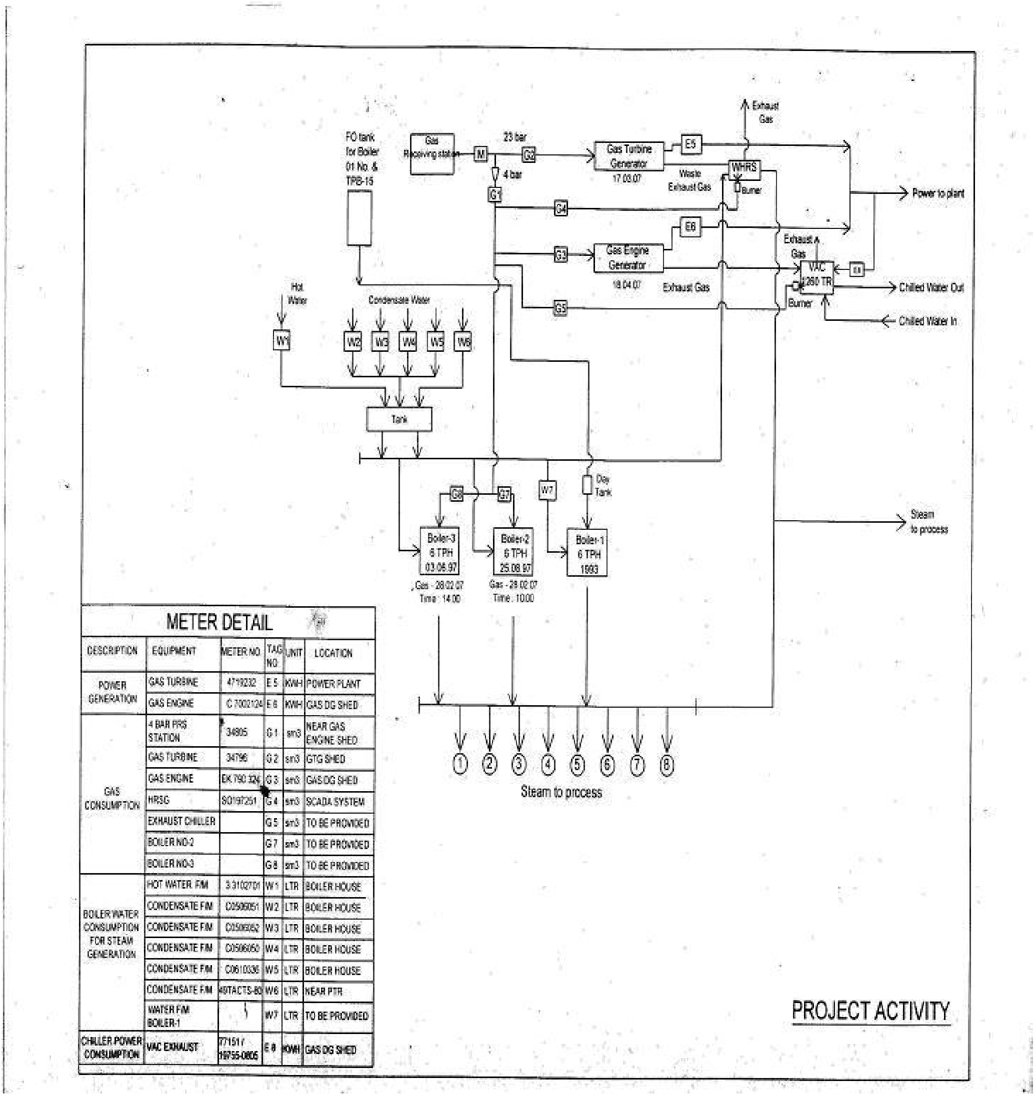
**Boundary** –According to the selected approved project category the project boundary is the physical, geographical site of the industrial or mining and mineral production facility, processes or equipment that are affected by the project activity.

The Physical boundary in this case consists of the Power Plant and the boiler house at Welspun India Ltd. . The equipments that are affected by the project activity are :

1. 5.9 MW Gas Turbine Generator Set with Heat Recovery Steam Generator (HRSG).
2. 6.79 MW Gas Engine Generator Set.
3. 1260 TR VAC
4. Two numbers of 6 Tons Per Hour Natural Gas fired Boilers.




METER DETAIL

| DESCRIPTION | EQUIPMENT | METER NO | TAG NO | UNIT | LOCATION |
|---|---|---|---|---|---|
| POWER GENERATION | GAS TURBINE | 4719232 | E 5 | KWH | POWER PLANT |
| | GAS ENGINE | C 7002124 | E 6 | KWH | GAS DG SHED |
| GAS CONSUMPTION | 4 BAR PRS STATION | 34805 | G 1 | sm3 | NEAR GAS ENGINE SHED |
| | GAS TURBINE | 34796 | G 2 | sm3 | GTG SHED |
| | GAS ENGINE | EK 790 324 | G 3 | sm3 | GAS DG SHED |
| | HRSG | SO197251 | G 4 | sm3 | SCADA SYSTEM |
| | EXHAUST CHILLER | | G 5 | sm3 | TO BE PROVIDED |
| | BOILER NO-2 | | G 7 | sm3 | TO BE PROVIDED |
| | BOILER NO-3 | | G 8 | sm3 | TO BE PROVIDED |
| BOILER WATER CONSUMPTION FOR STEAM GENERATION | HOT WATER F/M | 3.3102701 | W 1 | LTR | BOILER HOUSE |
| | CONDENSATE F/M | C0506051 | W 2 | LTR | BOILER HOUSE |
| | CONDENSATE F/M | C0506052 | W 3 | LTR | BOILER HOUSE |
| | CONDENSATE F/M | C0506050 | W 4 | LTR | BOILER HOUSE |
| | CONDENSATE F/M | C0610036 | W 5 | LTR | BOILER HOUSE |
| | CONDENSATE F/M | 49TACTS-80 | W 6 | LTR | NEAR PTR |
| | WATER F/M BOILER-1 | | W 7 | LTR | TO BE PROVIDED |
| CHILLER POWER CONSUMPTION | VAC EXHAUST | 771517 / 19755-0805 | E 8 | KWH | GAS DG SHED |

It is to be noted that the Boiler number 1 as shown in the diagram above is F.O fired boiler and will be used only in case of emergency. Though it is not the part of project boundary, the same has been shown in the diagram as the reading of the water flow meter W7 will be used in determining the total steam produced by the Natural Gas based Boilers (Boiler number 2nd and 3rd ) in the project activity to ensure that the steam produced during the emergency by Boiler number 1 is not accounted for in the emission reduction calculation. ( i.e. $ST_p$ = W1+W2+W3+W4+W5+W6-W7).

| | **Source** | **Gas** | **Included?** | **Justification / Explanation** |
|---|---|---|---|---|
| **Baseline Activity** | Fuel Consumption for electricity generation (DG sets) | $CO_2$ | Yes | Main emission source. |
| | | $CH_4$ | No | Excluded for simplification. |
| | | $N_2O$ | No | Excluded for simplification. |
| | Fuel Consumption for steam generation (boilers) | $CO_2$ | Yes | Main emission source. |
| | | $CH_4$ | No | Excluded for simplification. |
| | | $N_2O$ | No | Excluded for simplification. |
| | Electricity Consumption ( Centrifugal Chiller) | $CO_2$ | Yes | Main emission source. |
| | | $CH_4$ | No | Excluded for simplification. |
| | | $N_2O$ | No | Excluded for simplification. |
| Project Activity | Fuel Consumption for electricity generation (Gas Turbine and Gas Engine) | $CO_2$ | Yes | Main emission source. |
| | | $CH_4$ | No | Excluded for simplification. |
| | | $N_2O$ | No | Excluded for simplification. |
| | Fuel Consumption for steam generation ( Boiler) | $CO_2$ | Yes | Main emission source. |
| | | $CH_4$ | No | Excluded for simplification |
| | | $N_2O$ | No | Excluded for simplification |
| | Electricity Consumption ( Vapour Absoprtion Chiller) | $CO_2$ | Yes | Main emission source. |
| | | $CH_4$ | No | Excluded for simplification |
| | | $N_2O$ | No | Excluded for simplification |

**B.4. Description of baseline and its development:**

>>
As per the methodology:
Type II D

- In the case of replacement, modification or retrofit measures, the baseline consists of the energy baseline of the existing facility or sub-system that is replaced, modified or retrofitted. In the case of a new facility the energy baseline consists of the facility that would otherwise be built.
- In the absence of the CDM project activity, the existing facility would continue to consume energy (ECbaseline, in GWh/year) at historical average levels (EChistorical, in GWh/year), until the time at which the industrial or mining and mineral production facility would be likely to be replaced, modified or retrofitted in the absence of the CDM project activity (DATEBaselineRetrofit). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline energy consumption (ECbaseline) is assumed to equal project energy consumption (ECy, in GWh/year), and no emission reductions are assumed to occur.

  ECbaseline = EChistorical until DATEBaselineRetrofit
  ECbaseline = ECy on/after DATEBaselineRetrofit

  In order to estimate the point in time when the existing equipment would need to be replaced in the absence of the project activity (DATEBaselineRetrofit), project participants may take the following approaches into account:
  (a) The typical average technical lifetime of the equipment type may be determined and documented, taking into account common practices in the sector and country, e.g. based on industry surveys, statistics, technical literature, etc.
  (b) The common practices of the responsible industry regarding replacement schedules may be evaluated and documented, e.g. based on historical replacement records for similar equipment. The point in time when the existing equipment would need to be replaced in the absence of the project activity should be chosen in a conservative manner, i.e. if a range is identified, the earliest date should be chosen.
- Each energy form in the emission baseline is multiplied by an emission coefficient (in kg $CO_2$e/kWh). For the electricity displaced, the emission coefficient is calculated in accordance with provisions under category I.D. For fossil fuels, the IPCC default values for emission coefficients may be used.

As per the methodology AMS II D the baseline scenario consists of the energy baseline of the existing facility or sub-system that is replaced, modified or retrofitted. Therefore the project proponent can continue the current business as usual practice of producing electricity from the DG set, steam from the boiler and exhaust gas boiler and operation of centrifugal chiller. In this case FO is used as the input fuel in the DG sets and boilers and electricity generated in the DG sets is used in the centrifugal chiller.

The project activity replaces the use of FO based DG set and centrifugal chillers which will be used as stand by for operation under emergency situations at the existing facility. The documents related to the residual lifetime of all the equipments has been submitted to the DOE to prove that the residual lifetime of all the equipments are more than the crediting period of the current project activity. The equipments have been assessed by Chartered Engineer on the basis of following factors:

- Local environment in which machine has been installed and is being operated: Local environment is free from pollutants and aggressive chemicals which can harm DG Set, Boilers and chillers.
- Operating parameters: Operating parameters were checked and compared with parameters recorded during commissioning and were found to be within range specified by manufacturer.
- Maintenance records: Maintenance records were verified and found to be done as per manufacturer guidelines.
- General condition of machines: Cylinder head covers, cam shaft covers and crankcase covers were opened to check the conditions of parts and these were found to be in perfect condition for DG Sets. Boiler internal and external inspection was carried out parts were in good condition.

**Formatiert:** Nummerierung und Aufzählungszeichen

The residual lifetime of the major equipments being retired due to this project activity were assessed as :

**Gelöscht:** <#>Local environment in which machine has been installed and is being operated¶
<#>Operating parameters¶
<#>Maintenance records¶
<#>General condition of machines¶

| Equipment | Year of installation | Remaining Life (year) as on September 2007 |
|---|---|---|
| DG Set No. 1 (2140 kW) | 1995 | 12 |
| DG Set No. 3 (6220 kW) | 1998 | 15 |
| DG Set No. 4 (4206 kW) | 2002 | 19 |
| EGB-1 with DG-1 (1.5 TPH at 10.5 kg/cm$^2$) | 1998 | 30 |
| EGB-2 with DG-3 (2.24 TPH at 10.5 kg/cm$^2$) | 1998 | 30 |
| EGB-3 with DG-4 (1.87 TPH at 10.5 kg/cm$^2$) | 2003 | 35 |
| Boiler -1 (6 TPH at 10.5 kg/cm$^2$) | 1994 | 26 |
| Boiler -2(6 TPH at 10.5 kg/cm$^2$) | 1999 | 31 |
| Boiler – 3 (6 TPH at 10.5 kg/cm$^2$) | 1999 | 31 |
| Chiller – PEH 087 | 2001 | 18 |
| Chiller – HS 400 S | 1997 | 14 |

Since all the major equipments had remaining life time more than 10years, the DATEBaselineRetrofit is the year 2019 which beyond the crediting period opted by the project participant.

Hence ECbaseline = EChistorical for the entire crediting period

The project activity aims at GHG reductions into the atmosphere primarily due to increased energy efficiency resulting in decrease in fossil fuel quantities per unit of output and switch over of fuel to low carbon intensive fuel. In the absence of the project activity the baseline would be consumption of furnace oil as fuel for power, steam generation and continuation of the use of centrifugal chillers. Therefore the emissions at the baseline are the emissions that would have occurred due to the use of lower efficient DG sets and burning of the fossil fuel i.e. Furnace Oil in the DG sets engines, boilers, and the consumption of electricity by centrifugal chillers.

Type II D

**Baseline Emissions**
Baseline emissions have been calculated using the actual data of consumption and generation for the year 2005 and 2006.

$BE = SE_1 \times EG_{PA} + SE2 \times ST_P + E_{CB}$

BE = Total Baseline emissions ($tCO_2e$) per annum.
$SE_1$ = Specific Emission Factor for Electricity Generation in baseline ($tCO_2e/kWh$)
$EG_{PA}$ = Electricity generated in Project activity(kWh) per annum.
$SE_2$ = Specific Emission Factor for Steam Generation in baseline($tCO_2e/Kg$)
$ST_P$ = Steam Generated during the Project Activity (steam from HRSG and boilers) (Kg) per annum.
$E_{CB}$ = Baseline Emissions from Centrifugal Chiller in Baseline activity for chilled water generation ($tCO_2e$) per annum.

$SE_1 = E_{GB} / EG_{BA}$
$E_{GB}$ = Emissions from Electricity Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006.
$EG_{BA}$ = Electricity generated by DG sets in the baseline scenario (kWh) in the year 2005 and 2006.

$SE_2 = E_{SB} / ST_{total}$
$SE_2$= Specific emission for steam generation in baseline activity ($tCO_2e/Kg$)
$E_{SB}$=Emissions from Steam Generation in Baseline ($tCO_2e$) in the year 2005 and 2006.
$ST_{total}$ = Total steam generated in baseline (Kg) in the year 2005 and 2006.
$ST_{total} = ST_{B1} + ST_{B2}$
$ST_{B1}$=Quantity of Steam Generated from 3 Boilers in baseline (Kg) in the year 2005 and 2006.
$ST_{B2}$= Quantity of steam generated from 3 Exhaust Gas Boilers in (Kg) baseline in the year 2005 and 2006.

**Emission for Electricity Generation**
$E_{GB} = Q_{FOB1} \times D_{FOB} \times NCV_{FOB} \times (4.186/10\text{^}9) \times EF_{FO}/1000$

$E_{GB}$ = Emissions from Electricity Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006.
$Q_{FOB1}$ =Quantity of Furnace Oil consumed in DG Sets (liters) in the year 2005 and 2006.
$D_{FOB}$ =Density of FO (kg/liters)
$NCV_{FOB}$ =Net calorific value of Furnace Oil (kcal/kg)
4.186/10^9 =Conversion from kcal to TJ
$EF_{FO}$ = Effective $CO_2$ Emission Factor of Furnace Oil (kgCO2e/TJ)

$SE_1 = E_{GB} / EG_{BA}$
$E_{GB}$=Emissions from Electricity Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006.
$EG_{BA}$ = Electricity generated by DG sets in the baseline scenario (kWh) in the year 2005 & 2006.

**Emission for Steam Generation**

$E_{SB} = Q_{FOB2} \times D_{FOB} \times NCV_{FOB} \times (4.186/10^9) \times EF_{FO}/1000$

$E_{SB}$ =Emissions from Steam Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006.
$Q_{FOB2}$ =Quantity of Furnace Oil consumed in 3 Boilers (liters) in the year 2005 and 2006.
$D_{FOB}$ =Density of FO (kg/liters)
$NCV_{FOB}$ =Net calorific value of Furnace Oil (kcal/kg)
4.186/10^9 =Conversion from kcal to TJ
$EF_{FO}$ = Effective $CO_2$ Emission Factor of Furnace Oil (kgCO2e/TJ)

$SE_2 = E_{SB} / ST_{total}$
$SE_2$= Specific emission for steam generation in baseline activity ($tCO_2e$/Kg)
$E_{SB}$=Emissions from Steam Generation in Baseline ($tCO_2e$) in the year 2005 and 2006.
$ST_{total}$ = Total steam generated in baseline (Kg) in the year 2005 and 2006.
$ST_{total} = ST_{B1} + ST_{B2}$
$ST_{B1}$=Quantity of Steam Generated from 3 Boilers in baseline (Kg) in the year 2005 and 2006.
$ST_{B2}$= Quantity of steam generated from 3 Exhaust Gas Boilers in (Kg) baseline in the year 2005 and 2006.

**Emission for Chilled water generation**

The baseline scenario involves 2 centrifugal chillers having cooling capacity of 500 TR each and 1 centrifugal chiller having cooling capacity of 390 TR. The electricity consumption figure for the year 2005 and 2006 has been considered for determining baseline emissions.

Actual refrigeration generated was monitored. However as a conservative approach we have considered total cooling capacity of the centrifugal chiller as the cooling capacity factor in the specific power consumption calculation of power driven centrifugal chillers.

$E_{CB} = SE_3 \text{ x } R_P \text{ x } OH_P \times SE_P$

$E_{CB}$ =Emissions from Centrifugal Chiller in Baseline activity for chilled water generation ($tCO_{2e}$) per annum.
$SE_3$ = Specific Power Consumption of centrifugal chiller (kW/TR).
$R_P$ =VAC Cooling Capacity (TR)
$OH_P$ = Operating hours of VAC in a year ( Hours)
$SE_P$ = Specific Emission Factor for electricity generation in Project Scenario ($tCO_2e$/kWh)

$SE_3 = EC_{chillers} / R_B$

$EC_{chillers}$ = Power consumption by 3 centrifugal chillers in baseline activity in 2005 and 2006(kWh).
$R_B$ =Total Cooling Generated in the year 2005 & 2006(TR)

$R_B = R_1 \times OH_1 + R_2 \times OH_2 + R_3 \times OH_3$

$R_B$ =Total Cooling Generated in the year 2005 & 2006 (TR).

$R_1$ =Rated Capacity of McQuay – PH1 Centrifugal Chillers (TR.
$OH_1$ = Operating Hours of McQuay - PH1 Centrifugal Chillers for the year 2005 & 2006.

$R_2$ = Rated Capacity of McQuay – PH2 Centrifugal Chillers (TR).
$OH_2$ = Operating Hours of McQuay - PH2 Centrifugal Chillers for the yer 2005 & 2006.

$R_3$ = Rated Capacity of Voltas Centrifugal Chillers (TR).
$OH_3$ = Operating Hours of Voltas Centrifugal Chillers (TR) for the year 2005 & 2006.

| **Variable** | **Data Source** |
|---|---|
| $Q_{FOB1}$ – Quantity of Furnace Oil Consumed in 4 DG Sets | Plant record for 2005 and 2006 |
| $Q_{FOB2}$ – Quantity of Furnace Oil Consumed in 3 Boilers | Plant Record for 2005 and 2006 |
| $EC_{Chillers}$ - Electricity Consumed by the 3 centrifugal chillers | Plant Record for 2005 and 2006 |
| $EG_{BA}$ – Electricity generated by the 4 DG sets | Plant Record for 2005 and 2006 |
| $ST_{B1}$ – Quantity of Steam generated from 3 Boilers | Plant Record for 2005 and 2006 |
| $ST_{B2}$ – Quantity of Steam generated from 3 Exhaust Gas boilers | Plant Record for 2005 and 2006 |
| Operating Hours for chillers | Plant Record for 2005 and 2006 |
| **Parameter** | **Data Source** |
| $NCV_{FO}$ – Calorific value of Furnace Oil | As per IS:1448 [P : 7] – 1960 |
| $EF_{FO}$- Emission Factor of Furnace Oil | IPCC Default Value, Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Rated Capacity of Chillers | Technical Specification |

Refer to Annexure 3 for further information

**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:**

As explained above, the project initiative qualifies under Type IID- Energy efficiency and fuel switching measures for industrial facilities. The following paragraph has been detailed on project additionality.

In response to decision 1/CMP.2 (paragraph 15(a)), which encouraged the Board to provide non-binding best practice examples on the demonstration of additionality to assist the development of project design documents, in particular for small-scale project activities, after considering public input and an expert assessment, the Board at its thirty-fifth meeting agreed to provide the following examples:

Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

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

The barriers that has been overcome by the project developer is listed below:
a) Investment barrier

**Investment Barrier:**

The project activity envisages switching of fuel from Furnace Oil to Natural gas for electricity and steam generation and installation of VAC (with an installed capacity 1260 TR) replacing the Centrifugal Chillers. The investment would reduce the emission of GHGs into the atmosphere (a) on account of the use of lesser GHG emissive fuels for steam and power generation and (b) due to the reduced consumption of electricity for the chilled water generation and (c) fuel saving due to steam generation from the exhaust heat from the GT at the HRSG. Therefore, the baseline scenario is FO based electricity and steam generation and utilization of Centrifugal chillers.

The project is a small scale project activity. Nevertheless, the PP has chosen to establish the additionality of the project activity using the NPV financial tool. Several financial indicators like IRR, NPV, Cost Benefit Analysis and Levelized unit cost of electricity are available to demonstrate the additionality. Invariably, the choice is between NPV and IRR. NPV, as opposed to IRR is a direct measure of the rupee economic value (or loss) expected on a project and thus facilitates quick decision making. Both NPV and IRR methods involve discounted cash flow analysis, the mathematics of which affects the rate that a project's cash flows can be reinvested during the life of the project. The reinvestment rate embedded in NPV is the project's cost of capital. The reinvestment rate assumed under IRR is the IRR rate itself. Reinvestment at the cost of capital is a better and correct assumption. These features render NPV as a superior financial indicator as compared to IRR for this project activity.

The baseline is compared with the proposed project activity using following parameters to demostrate additionality

- Cost of generation of electricity
- Benefit from steam generation from HRSG ( refer to Appendix 1)
- Reduction in electricity consumption for chilled water generation

.
Investment decision of the project activity is based on NPV . NPV is computed as the difference in the cash flow derived from the cost of generation of electricity and steam in the project activity and the baseline activity. The differential cash flow takes into account

- Cost of generation of electricity
- Benefit from steam generation from HRSG ( refer to Appendix 1)
- Reduction in electricity consumption for chilled water generation

Due to cost difference between natural gas and FO, as well as the initial investment required to be made, the differential cash flow is negative in the initial years and positive in the later years. The Project participant has computed the cash flow differential for a period of 15 years – being the life of the project. The negative cash flow differential in the initial years has been taken as the cash outflow. Further more as a conservative approach, the initial investment in VAC and conversion of 2 numbers of Furnace Oil fired Boilers to Natural Gas fired boilers has not been considered in the financial analysis. The inclusion of these investments would only further strengthen and reinforce the additionality conclusion.

In the instant case, the entire project activity is financed by loan from bank. This loan carry interest at 9%. Discount rate for NPV calculation is taken as 9% which is equal to the interest on loan It is imperative that the net cash flows discounted at the benchmark – being the interest rate on loan – should be atleast zero if not positive. A negative NPV is indicative of the financial unattractiveness of the project..

In order to compute the differential cash flows, the PP has made certain assumptions, which together with the basis for making such assumptions are as follows:

| Furnace Oil Generator | Units | Value | Basis |
|---|---|---|---|
| | | | |
| Furnace Oil (FO) Generator Output | KWe | 14000 | Technical Specification |
| Auxiliary consumption | % | 4.00 | Plant data |
| Net Calorific Value of FO | Kcal/Kg | 9842 | Supplier Invoice |
| Heat rate at Generator terminal | Kcal/kwhe | 2059 | Supplier Data |
| Genset loading | % | 81.30 | Plant Data |
| No. of days working | days | 350 | Plant Data |
| No. of hours working | hours | 24 | Plant Data |
| Lube oil consumption | Grams/kwhe | 0.70 | Plant Data |
| Lube Oil cost | Rs./Kg. | 90.00 | Supplier Invoice |
| FO landed cost | Rs./Kg. | 9.93 | Supplier Invoice |
| Escalation in FO and Lube oil cost | % p.a. | 4.00 | Past supplier invoice |
| Spares and O&M cost | Re/kWh | 0.25 | Plant Data |
| Stocking period of FO | days | 15 | Plant Data |
| O & M expenses | month | 1.00 | Plant Data |
| Lube oil | month | 2.00 | Plant Data |
| Bank interest | % | 9.00 | Loan sanction letter |
| | | | |
| Natural Gas | | | |
| | | | |
| N.G. Generator output – GTG | kWe | 5900 | Technical Specification |
| - GDG | kWe | 6790 | Technical Specification |
| Auxiliary consumption – GTG | % | 1.08 | Technical Specification |

| | | | |
|---|---|---|---|
| - GDG | % | 2.25 | Technical Specification |
| Net Calorific Value of NG | Kcal/SCM | 8350 | Supplier's invoice |
| Heat rate at Generator terminal - GTG | Kcal/kwhe | 2808 | Tech.input from supplier |
| - GDG | Kcal/kwhe | 1960 | Tech. input from supplier |
| Genset loading GTG | % | 95.00 | Plant Data /Tech. Specs. |
| - GDG | | 70.00 | Plant Data / Tech. Spec. |
| No. of days working | days | 350 | Plant Data |
| No. of hours working | hours | 24 | Plant Data |
| Lube oil consumption - GTG | Grams/kwhe | 0.10 | Tech. Specs. |
| - GDG | Grams/kwhe | 0.42 | Tech. Specs |
| Total equipment cost - GTG | Rs. Lakhs | 1857 | CAPEX document |
| - GDG | Rs. lakhs | 1463 | CAPEX Document |
| Amortisation period of loan | Year | 6.00 | Loan sanction letter |
| Initial Moratorium | Year | 1.00 | Loan sanction letter |
| Interest on term loan | % | 9.00 | Loan sanction letter |
| NG landed cost | Rs./SCM | 9.70 | Supplier data |
| Lube oil cost | Rs./Kg. | 90.00 | Historical data |
| Escalation in NG and Lube oil cost | % p.a. | 4.00 | Historical data |
| Spares and O&M cost | Re/kWh | 0.25 | Tech. Specs. |
| Rate of depreciation | % | 10.34 | Company's Act, |
| Steam generation | TPH | 14.00 | Plant data |
| Steam credit | Re./Kg. | 0.73 | Computed (Refer to Apepndix -1)) |

The financial analysis made, based on the above assumptions, reveals that the fuel switch and chiller switch are not financially attractive as the NPV (of net cash flows discounted at 9%) without CDM revenues is (-) Rs. 100.52 million. The economically attractive scenario will be the use of furnace oil for power and steam generation and use of centrifugal chillers for chilled water generation. However, when the benefits from CDM revenues are taken into account (considering CERs at Euro 14/tCO2 and an exchange rate of Rs.57 per Euro), the NPV becomes positive at Rs.79.39 million. Therefore, it is only with credits from GHG emission reductions that the PP can hope to reduce the deficit.

Thus from the above discussion it can be concluded that the project activity faces the investment barrier and is not a business as usual scenario.

As the starting date of project activity is before the commencement of validation, the evidence of serious consideration of CDM benefit in the form of Board of directors resolution dated 30$^{th}$ July 2004 is incorporated in Appendix 2 of this PDD.

**B.6. Emission reductions:**

**B.6.1. Explanation of methodological choices:**

In the absence of the project activity the baseline would be consumption of furnace oil as fuel for power generation and steam generation.

**Baseline Emissions**

$BE = SE_1 \times EG_{PA} + SE2 \times ST_P + E_{CB}$

$BE$ = Total Baseline emissions ($tCO_2e$) per annum.
$SE_1$ = Specific Emission Factor for Electricity Generation in baseline ($tCO_2e/kWh$)
$EG_{PA}$ = Electricity generated in Project activity(kWh) per annum.
$SE_2$ = Specific Emission Factor for Steam Generation in baseline($tCO_2e/Kg$)
$ST_P$ = Steam Generated during the Project Activity (steam from HRSG and boilers) (Kg) per annum.
$E_{CB}$ = Baseline Emissions from Centrifugal Chiller in Baseline activity for chilled water generation ($tCO_2e$) per annum.

$SE_1 = E_{GB} / EG_{BA}$
$E_{GB}$ = Emissions from Electricity Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006
$EG_{BA}$ = Electricity generated by DG sets in the baseline scenario (kWh) in the year 2005 and 2006

$SE_2 = E_{SB} / ST_{total}$
$SE_2$= Specific emission for steam generation in baseline activity ($tCO_2e/Kg$)
$E_{SB}$=Emissions from Steam Generation in Baseline ($tCO_2e$) in the year 2005 and 2006.
$ST_{total}$ = Total steam generated in baseline (Kg) in the year 2005 and 2006.
$ST_{total} = ST_{B1} + ST_{B2}$
$ST_{B1}$=Quantity of Steam Generated from 3 Boilers in baseline (Kg) in the year 2005 and 2006.
$ST_{B2}$= Quantity of steam generated from 3 Exhaust Gas Boilers in (Kg) baseline in the year 2005 and 2006.

**Emission for Electricity Generation**
$E_{GB} = Q_{FOB1} \times D_{FOB} \times NCV_{FOB} \times (4.186/10^9) \times EF_{FO}/1000$

$E_{GB}$ =Emissions from Electricity Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006.
$Q_{FOB1}$ =Quantity of Furnace Oil consumed in DG Sets (liters) in the year 2005 and 2006.
$D_{FOB}$ =Density of FO (kg/liters).
$NCV_{FOB}$ =Net calorific value of Furnace Oil (kcal/kg)
4.186/10^9 =Conversion from kcal to TJ
$EF_{FO}$ = Effective $CO_2$ Emission Factor of Furnace Oil (kgCO2e/TJ)

$SE_1 = E_{GB} / EG_{BA}$
$E_{GB}$=Emissions from Electricity Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006.
$EG_{BA}$ = Electricity generated by DG sets in the baseline scenario (kWh) in the year 2005 and 2006.

**Emission for Steam Generation**
$E_{SB} = Q_{FOB2} \times D_{FOB} \times NCV_{FOB} \times (4.186/10^9) \times EF_{FO}/1000$

$E_{SB}$ =Emissions from Steam Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006
$Q_{FOB2}$ =Quantity of Furnace Oil consumed in Boilers (liters) in the year 2005 and 2006

$D_{FOB}$ =Density of FO (kg/liters)
$NCV_{FOB}$ =Net calorific value of Furnace Oil (kcal/kg)
4.186/10^9 =Conversion from kcal to TJ
$EF_{FO}$ = Effective $CO_2$ Emission Factor of Furnace Oil (kgCO2e/TJ)

$SE_2 = E_{SB} / ST_{total}$
$SE_2$= Specific emission for steam generation in baseline activity ($tCO_2e$/Kg)
$E_{SB}$=Emissions from Steam Generation in Baseline ($tCO_2e$) in the year 2005 and 2006.
$ST_{total}$ = Total steam generated in baseline (Kg) in the year 2005 and 2006.
$ST_{total} = ST_{B1} + ST_{B2}$
$ST_{B1}$=Quantity of Steam Generated from 3 Boilers in baseline (Kg) in the year 2005 and 2006.
$ST_{B2}$= Quantity of steam generated from 3 Exhaust Gas Boilers in (Kg) baseline in the year 2005 and 2006.

**Emission for Chilled water generation**
The baseline scenario involves 2 centrifugal chillers having cooling capacity of 500 TR each and 1 centrifugal chiller having cooling capacity of 390 TR. The electricity consumption figure for the year 2005 and 2006 has been considered for the baseline reference figure.

Actual refrigeration generated was monitored. However as a conservative approach we have considered total cooling capacity of the centrifugal chiller as the cooling capacity factor in the specific power consumption calculation of power driven centrifugal chillers.

$E_{CB} = SE_3 \text{ x } R_P \text{ x } OH_P \times SE_P$

$E_{CB}$ =Emissions from Centrifugal Chiller in Baseline activity for chilled water generation ($tCO_{2e}$) per annum.
$SE_3$ = Specific Power Consumption of centrifugal chiller (kW/TR)
$R_P$ =VAC Cooling Capacity (TR)
$OH_P$ = Operating hours of VAC (hours)
$SE_P$ = Specific Emission Factor for electricity generation in Project Scenario ($tCO_2e$/kWh)

$SE_3 = EC_{chillers} / R_B$

$EC_{chillers =}$ Power consumption by 3 centrifugal chillers in baseline activity in 2005 and 2006
$R_B$ =Total Cooling Generated in the year 2005 & 2006(TR)

$R_B = R_1 \times OH_1 + R_2 \times OH_2 + R_3 \times OH_3$

$R_B$ =Total Cooling Generated in the year 2005 & 2006 (TR).
$R_1$ =Rated Capacity of McQuay – PH1 Centrifugal Chillers (TR).
$OH_1$ = Operating Hours of McQuay - PH1 Centrifugal Chillers for the year 2005 & 2006.
$R_2$ = Rated Capacity of McQuay – PH2 Centrifugal Chillers (TR).
$OH_2$ = Operating Hours of McQuay - PH2 Centrifugal Chillers for the yer 2005 & 2006.
$R_3$ = Rated Capacity of Voltas Centrifugal Chillers (TR).
$OH_3$ = Operating Hours of Voltas Centrifugal Chillers (TR) for the year 2005 & 2006.

**Project Emissions**

**Emission for Electricity Generation**

$E_{GP}= (Q_{NGP1}+Q_{NGP2}) \times NCV_{NG} \times (4.186/10^9) \times EF_{NG} /1000$

$E_{GP}$ =Emissions from Electricity Generation in Project Activity (tCO2e) per annum.
$Q_{NGP1}$ =Quantity of Natural Gas consumed in Gas Turbine ($sm^3$) per annum.
$Q_{NGP2}$ =Quantity of Natural Gas consumed in Gas Engine ($sm^3$) per annum.
$NCV_{NGP}$ =Net calorific value of Natural Gas (kcal/$sm^3$)
4.186/10^9 =Conversion from kcal to TJ
$EF_{NG}$ =Effective $CO_2$ Emission Factor of Natural Gas (kg$CO_2$/TJ)

$SE_P= E_{GP} / EG_{PA}$

$SE_P$ =Specific Emission Factor for electricity generation in Project Scenario (t$CO_2$e/kWh)
$E_{GP}$ =Emissions from Electricity Generation in Project Activity (t$CO_2$e) per annum.
$EG_{PA}$ = Electricity generated in the project activity (kWh) per annum

**Emission for Steam Generation**

$E_{SP} = (Q_{NGP3}+Q_{NGP4}+Q_{NG5})$ x $NCV_{NG} \times (4.186/10^9) \times EF_{NG}/1000$

$E_{SP}$ =Emissions from Steam Generation in Project Activity (t$CO_2$e) per annum.
$Q_{NGP3}$ =Quantity of natural gas consumed in HRSG Boiler ($sm^3$) per annum.
$Q_{NGP4}$ =Quantity of natural gas consumed in 2nd Boiler ($sm^3$) per annum.
$Q_{NGP5}$ =Quantity of natural gas consumed in 3rd Boiler ($sm^3$) per annum.
$NCV_{NG}$ =Net calorific value of Natural gas (kcal/$sm^3$)
4.186/10^9 =Conversion from kcal to TJ
$EF_{NG}$ =Effective $CO_2$ Emission Factor of Natural Gas (kgCO2/TJ)

**Emission for Chilled water generation**

The project activity involves installation of a 1260 TR VAC operating on exhaust gas of the Gas Engines. This replaces use of centrifugal chillers of similar capacity.

$E_{CP}= EG_C \times SE_P + E_{VACNG}$

$E_{CP}$ =Emissions from Vapour Absorption Chiller in Project activity for chilled water generation(t$CO_2$e) per annum.
$EG_C$ = Electricity consumed by the VAC (kWh) per annum.
$SE_P$ =Specific Emission Factor for electricity generation in Project Scenario (t$CO_2$e/kWh)
$E_{VACNG}$ =Emissions from NG firing in VAC in Project Activity (t$CO_2$e) per annum.
$EG_C= VAC_{AUX} \times OH_P$

$EG_C$ =Total electricity consumed by the VAC per annum.
$VAC_{AUX}$ =Rated capacity of auxiliaries (kW)
$OH_P$ = Number of operating hours of VAC (hours) in a year.

NG will be fired into the VAC only when exhaust gas from Gas engine generator will not be available.

$E_{VACNG}= (Q_{NGP6}) \times (4.186/10^9) \times EF_{NG}/1000$

$E_{VACNG}$ =Emissions from VAC in Project Activity due to natural gas use ($tCO_2e$) per annum.
$Q_{NGP6}$ =Quantity of natural gas consumed in VAC ($sm^3$) per annum.
$EF_{NG}$ =Effective $CO_2$ Emission Factor of Natural Gas (kgCO2/TJ)

Project Emissions (PE) = $E_{GP} + E_{SP} + E_{CP}$

**Leakage**
As per the methodology AMS II D If the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.
In the project activity case equipments has not be transferred to another activity. Hence the leakage is not to be considered in this scenario.

Emissions Reductions = Baseline Emissions (BE) – Project Emissions (PE) – Leakage (L)

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

*(Copy this table for each data and parameter)*

| **Data / Parameter:** | **$EG_{BA}$** |
|---|---|
| Data unit: | kWh |
| Description: | Electricity generated during the baseline activity from the 4 DG sets in the year 2005 and 2006. |
| Source of data used: | Management Information system (MIS) |
| Value applied: | 163240636 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | It is calculated as the summation of the electricity generated by the DG sets which is calculated from measurement done on continuous basis and recorded on daily basis. It is entered into the computer on daily basis. |
| Any comment: | The data in the value applied row is the total of the historic plant data during the years of 2005 and 2006. |

| **Data / Parameter:** | $Q_{FOB1}$ |
|---|---|
| Data unit: | liters |
| Description: | Quantity of Furnace oil consumed in 4 DG Sets in the baseline for electricity in the year 2005 and 2006. |
| Source of data used: | Power plant daily MIS log sheet |
| Value applied: | 38154876 ( 19187083 for the year 2005 + 18967793 for the year 2006). |
| Justification of the choice of data or description of measurement methods | Tank Dip difference method is used for monitoring on daily basis. Difference of oil level in tank is considered as basis for that. This is measured at 6am and the data is entered into power plant MIS soft copy. The operator takes the level of FO in the tank and deducts the previous reading. If any fresh receipt of |

| | |
|---|---|
| and procedures actually applied : | furnace oil, it is added into the FO stock. This level difference is converted to respective litres quantity in the tank as per the calibration chart. Total four number of tanks are there. |
| Any comment: | Calculated on daily basis. The data in the value applied row is the total figure of the accumulated daily data of the years 2005 and 2006 |

| **Data / Parameter:** | $Q_{FOB2}$ |
|---|---|
| Data unit: | liters |
| Description: | Quantity of Furnace oil consumed in 3 Boilers in the baseline in the year 2005 and 2006. |
| Source of data used: | Boiler house steam log sheet, |
| Value applied: | 8409862 ( 4017873 for the year 2005 + 4391989 for the year 2006). |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Tank Dip difference method is used for monitoring on daily basis. Difference of oil level in tank is considered as basis for that. This is measured at 6am and the data is entered into power plant MIS soft copy. The operator takes the level of FO in the tank and deducts the previous reading. If any fresh receipt of furnace oil, it is added into the FO stock. This level difference is converted to respective litres quantity in the tank as per the calibration chart. This is done on the main tank. |
| Any comment: | Calculated on daily basis. The data in the value applied row is the total figure of the accumulated daily data of the years 2005 and 2006. |

| **Data / Parameter:** | $ST_{B1}$ |
|---|---|
| Data unit: | kg |
| Description: | Steam generated from 3 Boilers during the baseline activity in 2005 and 2006. |
| Source of data used: | Boiler house steam log sheet, |
| Value applied: | 119177667 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Is the quantity of steam produced in the boilers in kg (corresponds to the quantity of boiler feed water plus condensate minus boiler blowdown minus steam from EGB). As a conservative emission reduction calculation measure boiler blowdown is excluded from the calculation. |
| Any comment: | The data in the value applied row is the total of the accumulated daily data for the years 2005 and 2006 |

| **Data / Parameter:** | $ST_{B2}$ |
|---|---|
| Data unit: | kg |
| Description: | Steam generated from the exhaust gas boilers during the baseline activity in 2005 and 2006 |
| Source of data used: | Boiler house steam log sheet, |
| Value applied: | 78725411 |
| Justification of the choice of data or description of measurement methods and procedures | This is measured by the Steam flow meter of the exhaust gas boilers. This is measured on hourly basis in a daily EGB log sheet and same data feed into the computer by the shift engineer. |

| | |
|---|---|
| actually applied : | |
| Any comment: | Is measured using the flow meter. the data in the value applied row is the total of the accumulated daily data for the years 2005 and 2006 |

| **Data / Parameter:** | $D_{FOB}$ |
|---|---|
| Data unit: | Kg/liters |
| Description: | Density of Furnace Oil |
| Source of data used: | FO invoice |
| Value applied: | 0.97 or the year 2005 and 0.9696 for 2006 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This is given by the suppliers in their invoices. |
| Any comment: | |

| **Data / Parameter:** | $NCV_{FOB}$ |
|---|---|
| Data unit: | kcal/kg |
| Description: | Net Calorific Value of Furnace Oil |
| Source of data used: | FO invoice/ IS:1448-1960 |
| Value applied: | 9842.5 for the year 2005 and 9847.14 for the year 2006 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This is calculated by using IS:1448-1960. Density of FO given in the FO supplier invoice is matched with the calorific value chart of the IS 1448-1960 chart. |
| Any comment: | |

| **Data / Parameter:** | $EC_{Chillers}$ |
|---|---|
| Data unit: | kWh |
| Description: | Electricity consumed by 3 centrifugal chillers in baseline activity in 2005 & 2006. |
| Source of data used: | SPG 1 and SPG 2 column from MIS . |
| Value applied: | 8180570 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Operators Calculated from readings of energy meters and all the reading is entered into computer by the engineers. This is summation of two meters readings. The data is stored in WTT tab of the MIS (Power Plant). |
| Any comment: | The data in the value applied row is the accumulated daily data for the years 2005 and 2006. |

| **Data / Parameter:** | $OH_1$ |
|---|---|
| Data unit: | Hours |

| | |
|---|---|
| Description: | Number of operational hours of McQuay-PH1 Chiller in the year 2005 and 2006 |
| Source of data used: | Chiller log book |
| Value applied: | 6772 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | These data is recorded from the hours meter. The operating hours are calculated from recorded initial reading at the start and the final reading at the end of each year. |
| Any comment: | The data in the value applied row is the figure of the accumulated daily data of the years 2005 and 2006 |

| **Data / Parameter:** | $OH_2$ |
|---|---|
| Data unit: | Hours |
| Description: | Number of operational hours of McQuay-PH2 Chiller in the year 2005 and 2006 |
| Source of data used: | Chiller log book |
| Value applied: | 9220 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | These data is recorded from the hours meter. The operating hours are calculated from recorded initial reading at the start and the final reading at the end of each year. |
| Any comment: | The data in the value applied row is the figure of the accumulated daily data of the years 2005 and 2006 |

| **Data / Parameter:** | $OH_3$ |
|---|---|
| Data unit: | Hours |
| Description: | Number of operational hours of Voltas Chiller in the year 2005 and 2006 |
| Source of data used: | Chiller log book |
| Value applied: | 6859 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | These data is recorded from the hours meter. The operating hours are calculated from recorded initial reading at the start and the final reading at the end of each year. |
| Any comment: | The data in the value applied row is the figure of the accumulated daily data of the years 2005 and 2006 |

| **Data / Parameter:** | $R_1$ |
|---|---|
| Data unit: | TR |
| Description: | Chiller Cooling capacity of McQUAY – PH1 Chiller |
| Source of data used: | Name plate/Technical specification |
| Value applied: | 500 |

| | |
|---|---|
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Actual refrigeration generated was monitored. However as a conservative approach we have considered total cooling capacity of the McQUAY – PH1 centrifugal chiller in calculating the total coolig generated ( $R_B$) in the specific power consumption calculation of power driven centrifugal chillers. |
| Any comment: | |

| **Data / Parameter:** | $R_2$ |
|---|---|
| Data unit: | TR |
| Description: | Chiller Cooling capacity of McQUAY – PH2 Chiller |
| Source of data used: | Name plate/Technical specification |
| Value applied: | 500 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Actual refrigeration generated was monitored. However as a conservative approach we have considered total cooling capacity of the McQUAY – PH2 centrifugal chiller in calculating the total coolig generated ( $R_B$) in the specific power consumption calculation of power driven centrifugal chillers. |
| Any comment: | |

| **Data / Parameter:** | $R_3$ |
|---|---|
| Data unit: | TR |
| Description: | Chiller Cooling capacity of Voltas Chillers |
| Source of data used: | Name plate/Technical specification |
| Value applied: | 390 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Actual refrigeration generated was monitored. However as a conservative approach we have considered total cooling capacity of the Voltas centrifugal centrifugal chiller in calculating the total coolig generated ( $R_B$) in the specific power consumption calculation of power driven centrifugal chillers. |
| Any comment: | |

| **Data / Parameter:** | $EF_{FO}$ |
|---|---|
| Data unit: | Kg $CO_2$e/TJ |
| Description: | Emission Factor of Furnace Oil |
| Source of data used: | IPCC Default Value, Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Value applied: | 77400 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Any comment: | IPCC Default Value |

| **Data / Parameter:** | $EF_{NG}$ |
|---|---|
| Data unit: | Kg $CO_2$e/TJ |
| Description: | Emission Factor of Natural Gas |
| Source of data used: | IPCC Default Value, Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, |
| Value applied: | 56100 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Any comment: | IPCC Default Value |

| **Data / Parameter:** | $SE_1$ |
|---|---|
| Data unit: | t$CO_2$e/kWh |
| Description: | Specific Emission Factor for Electricity Generation |
| Source of data used: | calculated |
| Value applied: | 0.0007232 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | $SE_1 = E_{GB} / EG_{BA}$ |
| Any comment: | The value is based on the electricity generation and furnace oil consumption data for the year 2005 & 2006. This value would be used through the crediting period for calculating equivalent amount of baseline emissions for electricity generated in project activity. |

| **Data / Parameter:** | $SE_2$ |
|---|---|
| Data unit: | t$CO_2$e/Kg |
| Description: | Specific Emission Factor for Steam Generation |
| Source of data used: | calculated |
| Value applied: | 0.0001314 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | $SE_2 = E_{SB} / ST_{total}$ |
| Any comment: | The value is based on the steam generation and Furnace oil consumption data for the year 2005 & 2006. This value would be used through the crediting period for calculating equivalent amount of baseline emissions for steam generated in project activity. |

| | |
|---|---|
| Data / Parameter: | $SE_3$ |
| Data unit: | kW/TR |
| Description: | Specific Power Consumption of centrifugal chiller |
| Source of data used: | calculated |
| Value applied: | 0.77 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | $SE_3$=$EC_{chillers}$ / RB<br><br>ECchillers = Power consumption by 3 centrifugal chillers in baseline activity in 2005 and 2006(kWh)<br>RB =Total Cooling Generated in the year 2005 & 2006(TR)<br>RB = R1 × OH1 + R2 × OH2 + R3 × OH3<br><br>RB =Total Cooling Generated in the year 2005 & 2006 (TR)<br><br>R1 =Rated Capacity of McQuay – PH1 Centrifugal Chillers (TR)<br>OH1 = Operating Hours of McQuay - PH1 Centrifugal Chillers for the year 2005 & 2006<br><br>R2 = Rated Capacity of McQuay – PH2 Centrifugal Chillers (TR)<br>OH2 = Operating Hours of McQuay - PH2 Centrifugal Chillers for the year 2005 & 2006<br><br>R3 = Rated Capacity of Voltas Centrifugal Chillers (TR)<br>OH3 = Operating Hours of Voltas Centrifugal Chillers (TR) for the year 2005 & 2006 |
| Any comment: | The value is based on data for the year 2005 & 2006. This value would be used through the crediting period for calculating equivalent amount of baseline emissions for chilled water generated in project activity. |

| | |
|---|---|
| **Data / Parameter:** | $VAC_{AUX}$ |
| Data unit: | kW |
| Description: | Rated capacity of auxiliaries (kW) |
| Source of data used: | Supplier data |
| Value applied: | 191.2 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | It is calculated as the summation of the electricity auxiliaries of the VAC. |
| Any comment: | |

**B.6.3 Ex-ante calculation of emission reductions:**

**Baseline Emissions**

$BE = SE_1 \times EG_{PA} + SE2 \times ST_P + E_{CB}$

BE = Total Baseline emissions ($tCO_2e$) per annum.
$SE_1$ = Specific Emission Factor for Electricity Generation in baseline ($tCO_2e/kWh$)
$EG_{PA}$ = Electricity generated in Project activity(kWh) per annum.
$SE_2$ = Specific Emission Factor for Steam Generation in baseline($tCO_2e/Kg$)
$ST_P$ = Steam Generated during the Project Activity (steam from HRSG and boilers) (Kg) per annum.
$E_{CB}$ = Baseline Emissions from Centrifugal Chiller in Baseline activity for chilled water generation ($tCO_2e$) per annum.

$SE_1 = E_{GB} / EG_{BA}$
$E_{GB}$ = Emissions from Electricity Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006
$EG_{BA}$ = Electricity generated by DG sets in the baseline scenario (kWh) in the year 2005 and 2006

$SE_2 = E_{SB} / ST_{total}$
$SE_2$= Specific emission for steam generation in baseline activity ($tCO_2e/Kg$)
$E_{SB}$=Emissions from Steam Generation in Baseline ($tCO_2e$) in the year 2005 and 2006.
$ST_{total}$ = Total steam generated in baseline (Kg) in the year 2005 and 2006.
$ST_{total} = ST_{B1} + ST_{B2}$
$ST_{B1}$=Quantity of Steam Generated from 3 Boilers in baseline (Kg) in the year 2005 and 2006.
$ST_{B2}$= Quantity of steam generated from 3 Exhaust Gas Boilers in (Kg) baseline in the year 2005 and 2006.

**Emission for Electricity Generation**
$E_{GB} = Q_{FOB1} \times D_{FOB} \times NCV_{FOB} \times (4.186/10^9) \times EF_{FO}/1000$

$E_{GB}$ =Emissions from Electricity Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006.
$Q_{FOB1}$ =Quantity of Furnace Oil consumed in DG Sets (liters) in the year 2005 and 2006.
$D_{FOB}$ =Density of FO (kg/liters).
$NCV_{FOB}$ =Net calorific value of Furnace Oil (kcal/kg).
4.186/10^9 =Conversion from kcal to TJ.
$EF_{FO}$ = Effective $CO_2$ Emission Factor of Furnace Oil ($kgCO_2e/TJ$).

$E_{GB}$ = 19187083 × 0.97 × 9842.50 × (4.186/10^9) × 77400/1000 + 18967793× 0.9696 × 9847.14 × (4.186/10^9) × 77400/1000 = 118055.069($tCO_2e$)

19177083 = Fuel consumption for the year 2005 (liters)
0.97 = The data for density for the year 2005 (kg/liters)
9842.50 = The data for Net Calorific value for the year 2005 (kcal/kg)

18967793= Fuel consumption for the year 2006 (liters)
0.9696 = The data for density for the year 2006 (kg/liters)
9847.14 = The data for Net Calorific value for the year 2006 (kcal/kg)
77400 = Effective $CO_2$ Emission Factor of Furnace Oil (kgCO2e/TJ)

$SE_1 = E_{GB} / EG_{BA}$
$E_{GB}$=Emissions from Electricity Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006.

$EG_{BA}$ = Electricity generated by DG sets in the baseline scenario (kWh) in the year 2005 and 2006

$SE_1$ = 118055.069 / 163240636 = 0.0007232 ($tCO_2e$/kWh)

118055.069 = $E_{GB}$ ($tCO_2e$)
163240636 = $EG_{BA}$ ( kWh)

**Emission for Steam Generation**
$E_{SB}$ = $Q_{FOB2} \times D_{FOB} \times NCV_{FOB} \times (4.186/10^9) \times EF_{FO}/1000$

$E_{SB}$ =Emissions from Steam Generation in Baseline Activity ($tCO_2e$) in the year 2005 and 2006.
$Q_{FOB2}$ =Quantity of Furnace Oil consumed in Boilers (liters) in the year 2005 and 2006
$D_{FOB}$ =Density of FO (kg/liters)
$NCV_{FOB}$ =Net calorific value of Furnace Oil (kcal/kg)
4.186/10^9 =Conversion from kcal to TJ
$EF_{FO}$ = Effective $CO_2$ Emission Factor of Furnace Oil (kgCO2e/TJ)

$SE_2 = E_{SB} / ST_{total}$
$SE_2$= Specific emission for steam generation in baseline activity ($tCO_2e$/Kg)
$E_{SB}$=Emissions from Steam Generation in Baseline ($tCO_2e$) in the year 2005 and 2006
$ST_{total}$ = Total steam generated in baseline (Kg) in the year 2005 and 2006
$ST_{total} = ST_{B1} + ST_{B2}$
$ST_{B1}$ =Quantity of Steam Generated from 3 Boilers in baseline(Kg) in the year 2005 and 2006
$ST_{B2}$ = Quantity of steam generated from 3 Exhaust Gas Boilers in baseline(Kg) in the year 2005 and 2006

($E_{SB}$) = $4017873 \times 0.97 \times 9842.50 \times (4.186/10^9) \times 77400/1000 + 4391989 \times 0.9696 \times 9847.14 \times (4.186/10^9) \times 77400/1000 = 26020.714$($tCO_2e$)

4017873 = Fuel consumption for the year 2005(liters)
0.97 =The data for density for the year 2005 (kg/liters)
9842.50 = The data for Net Calorific value for the year 2005 (Kcal/kg)
4391989 = Fuel consumption for the year 2006 (liters)
0.9696 = The data for density for the year 2006 (kg/liters)
9847.14 = The data for Net Calorific value for the year 2006 (Kcal/kg)

$SE_2 = E_{SB} / ST_{total}$
$E_{SB}$=Emissions from Steam Generation in Baseline ($tCO_2e$) in the year 2005 and 2006.
$ST_{total}$ = Total steam generated in baseline (Kg) in the year 2005 and 2006.
$ST_{total} = ST_{B1} + ST_{B2}$
$ST_{B1}$=Quantity of Steam Generated from 3 Boilers in baseline in 2005 and 2006
$ST_{B2}$= Quantity of steam generated from 3 Exhaust Gas Boilers in baseline in 2005 and 2006
$ST_{total}$ = 119177667 + 78725411=197903078

$SE_2$= 26020.714 / 197903078 = 0.000131483
26020.714 = $E_{SB}$
197903078 = $ST_{total}$ ( kg)

**Emission for Chilled water generation**
The baseline scenario involves 2 centrifugal chillers having cooling capacity of 500 TR each and 1 centrifugal chiller having cooling capacity of 390 TR. The electricity consumption figure for the year 2005 and 2006 has been considered for the baseline reference figure.

Actual refrigeration generated was monitored. However as a conservative approach we have considered total cooling capacity of the centrifugal chiller as the cooling capacity factor in the specific power consumption calculation of power driven centrifugal chillers.

$E_{CB}$ = $SE_3$ x $R_P$ x $OH_P \times SE_P$
$E_{CB}$ =Emissions from Centrifugal Chiller in Baseline activity for chilled water generation for the year 2005 and 2006.
$SE_3$ = Specific Power Consumption of centrifugal chiller (kW/TR)
$R_P$ =VAC Cooling Capacity (TR)
$OH_P$ = Operating hours of VAC (hours) per year.
$SE_P$ = Specific Emission Factor for electricity generation in Project Scenario ($tCO_2e/kWh$)

$E_{CB} = 0.77 \times 1260 \times 8400 \times 0.00055779 = 4526$

$SE_3 = EC_{chillers} / R_B$

$EC_{chillers}$ = Power consumption by 3 centrifugal chillers in baseline activity in 2005 and 2006(kWh)
$R_B$ =Total Cooling Generated in the year 2005 & 2006(TR)
$R_B = R_1 \times OH_1 + R_2 \times OH_2 + R_3 \times OH_3$

$R_B$ =Total Cooling Generated in the year 2005 & 2006 (TR)

$R_1$ =Rated Capacity of McQuay – PH1 Centrifugal Chillers (TR)
$OH_1$ = Operating Hours of McQuay - PH1 Centrifugal Chillers for the year 2005 & 2006

$R_2$ = Rated Capacity of McQuay – PH2 Centrifugal Chillers (TR)
$OH_2$ = Operating Hours of McQuay - PH2 Centrifugal Chillers for the yer 2005 & 2006

$R_3$ = Rated Capacity of Voltas Centrifugal Chillers (TR)
$OH_3$ = Operating Hours of Voltas Centrifugal Chillers (TR) for the year 2005 & 2006

$SE_3 = 8180570 / 10670620 = 0.77$

$R_B = 500 \times 6772 + 500 \times 9220 + 390 \times 6859 = 10670620$

$BE= SE_1 \times EG_{PA} + SE2 \times ST_P + E_{CB}$

BE = Total Baseline emissions ($tCO_2e$) per annum.
$SE_1$ = Specific Emission Factor for Electricity Generation in baseline ($tCO_2e/kWh$) =0.00072
$EG_{PA}$ = Electricity generated in Project activity(kWh) per annum.= 84791364
$SE_2$ = Specific Emission Factor for Steam Generation in baseline($tCO_2e/Kg$) =0.0001314
$ST_P$ = Steam Generated during the Project Activity (steam from HRSG and boilers) (Kg) per annum.= 143746086
$E_{CB}$ = Baseline Emissions from Centrifugal Chiller in Baseline activity for chilled water generation ($tCO_2e$) per annum = 4526

$BE = 0.00072 \times 84791364 + 0.0001314 \times 143746086 + 4526 = 84747\ tCO_2e$

| Year | BEy ($tCO_2e$) |
|---|---|
| June 2008 – May 2009 | 84747 |
| June 2009 – May 2010 | 84747 |
| June 2010 – May 2011 | 84747 |
| June 2011 – May 2012 | 84747 |
| June 2012 – May 2013 | 84747 |
| June 2013 – May 2014 | 84747 |
| June 2014 – May 2015 | 84747 |
| June 2015 – May 2016 | 84747 |
| June 2016 – May 2017 | 84747 |
| June 2017 – May 2018 | 84747 |

**Project Emission**

**Emission for Electricity Generation**

$E_{GP}= (Q_{NGP1}+Q_{NGP2}) \times NCV_{NG} \times (4.186/10^9) \times EF_{NG}/1000$

$E_{GP}$ =Emissions from Electricity Generation in Project Activity ($tCO_2e$) per annum.
$Q_{NGP1}$ =Quantity of Natural Gas consumed in Gas Turbine ($sm^3$) per annum.
$Q_{NGP2}$ =Quantity of Natural Gas consumed in Gas Engine ($sm^3$) per annum.
$NCV_{NGP}$ =Net calorific value of Natural Gas ($kcal/sm^3$)
4.186/10^9 =Conversion from kcal to TJ
$EF_{NG}$ =Effective $CO_2$ Emission Factor of Natural Gas (kgCO2/TJ)

$E_{GP} = 24119939 \times 8350 \times (4.186/10^9) \times 56100/1000 = 47296\ tCO_2e$

24119939=(15279921+8840018)= Quantity of NG consumed in Gas Turbine and Gas Engine.
8350 = Net calorific value of Natural Gas ($kcal/sm^3$)
56100 = Effective $CO_2$ Emission Factor of Natural Gas (kgCO2/TJ)

$SE_P= E_{GP} / EG_{PA}$

$SE_P$ =Specific Emission Factor for electricity generation in Project Scenario ($tCO_2e/kWh$)
$E_{GP}$ =Emissions from Electricity Generation in Project Activity ($tCO_2e$) per annum.
$EG_{PA}$ = Electricity generated in the project activity (kWh) per annum.

$SE_P$ ($tCO_2e/kWh$) = 47296 / 84791364 = 0.00055779
47296 = $E_{GP}$
84791364 = $EG_{PA}$

**Emission for Steam Generation**
$E_{SP} = (Q_{NGP3}+Q_{NGP4}+Q_{NG5}) \text{ x } NCV_{NG} \times (4.186/10\text{^}9) \times EF_{NG}/1000$

$E_{SP}$ =Emissions from Steam Generation in Project Activity ($tCO_2e$) per annum.
$Q_{NGP3}$ =Quantity of natural gas consumed in HRSG Boiler ($sm^3$) per annum.
$Q_{NGP4}$ =Quantity of natural gas consumed in 2nd Boiler ($sm^3$) per annum.
$Q_{NGP5}$ =Quantity of natural gas consumed in 3rd Boiler ($sm^3$) per annum.
$NCV_{NG}$ =Net calorific value of Natural gas ($kcal/sm^3$)
4.186/10^9 =Conversion from kcal to TJ
$EF_{NG}$ =Effective $CO_2$ Emission Factor of Natural Gas (kgCO2/TJ)

$E_{SP}$ ($tCO_2e$) = 726168 × 8350 × (4.186/10^9) × 56100 /1000 = 1424 $tCO_2e$

726168 = $(Q_{NGP3}+Q_{NGP4}+Q_{NG5})$
8350 = $NCV_{NG}$
56100 = $EF_{NG}$

**Emission for Chilled water generation**
The project activity involves installation of a 1260 TR VAC operating on exhaust gas of the Gas Engines. This replaces use of centrifugal chillers of similar capacity.

$E_{CP}= EG_C \times SE_P + E_{VACNG}$

$E_{CP}$ =Emissions from Vapour Absorption Chiller in Project activity for chilled water generation($tCO_2e$) per annum.
$EG_C$ = Electricity consumed by the VAC (kWh) per annum.
$SE_P$ =Specific Emission Factor for electricity generation in Project Scenario ($tCO_2e/kWh$)
$E_{VACNG}$ =Emissions from VAC in Project Activity ($tCO_2e$) ($tCO_2e$) per annum.

$EG_C= VAC_{AUX} \times OH_P$

$VAC_{AUX}$ =Rated capacity of auxiliaries (kW)
$OH_P$ = Number of operating hours of VAC (hours) in a year.

$EG_C$=191.2 X 8400 = 1606080 kWh
191.2=$VAC_{AUX}$
8400= $OH_P$

NG will be fired into the VAC only when exhaust gas from Gas engine generator will not be available.

$E_{VACNG}$= ($Q_{NGP6}$) × (4.186/10^9) × $EF_{NG}$/1000

$E_{VACNG}$ =Emissions from VAC in Project Activity due to natural gas use ($tCO_2e$)
$Q_{NGP6}$ =Quantity of natural gas consumed in VAC ($sm^3$)
$EF_{NG}$ =Effective $CO_2$ Emission Factor of Natural Gas (kgCO2/TJ)

($E_{CP}$) = (1606080 × 0.00055779)+(0) = 896 $tCO_2e$

1606080= $EG_C$=Total electricity consumed by the VAC (kWh) in a year.
0.00055779= $SE_P$=Specific Emission Factor for electricity generation in Project Scenario (Refer to Emission for Electricity Generation section)

0= $Q_{NGP6}$ =Quantity of natural gas consumed in VAC ($sm^3$)

Project Emissions (PE) = $E_{GP}$ + $E_{SP}$ + $E_{CP}$

PE = 47296+ 1424 + 896 = 49616 tCO2e

| Year | PEy ($tCO_2e$) |
|---|---|
| June 2008 – May 2009 | 49616 |
| June 2009 – May 2010 | 49616 |
| June 2010 – May 2011 | 49616 |
| June 2011 – May 2012 | 49616 |
| June 2012 – May 2013 | 49616 |
| June 2013 – May 2014 | 49616 |
| June 2014 – May 2015 | 49616 |
| June 2015 – May 2016 | 49616 |
| June 2016 – May 2017 | 49616 |
| June 2017 – May 2018 | 49616 |

**Leakage**
As per the methodology AMS II D If the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.
In the project activity case DG sets will not be transferred to another activity. Hence the leakage is not to be considered in this scenario.
.

**B.6.4 Summary of the ex-ante estimation of emission reductions:**
>>
Emissions Reductions = Baseline Emissions (BE) – Project Emissions (PE) – Leakage (L)

| Year | Estimation of Project activity emissions ($tCO_2e$) | Estimation of baseline emissions ($tCO_2e$) | Estimation of leakage ($tCO_2e$) | Estimation of overall emission reductions ($tCO_2e$) |
|---|---|---|---|---|
| | t CO2 | t CO2 | | t CO2 |
| June 2008 – May 2009 | 49616 | 84747 | 0 | 35131 |

| | | | | |
|---|---|---|---|---|
| June 2009 – May 2010 | 49616 | 84747 | 0 | 35131 |
| June 2010 – May 2011 | 49616 | 84747 | 0 | 35131 |
| June 2011 – May 2012 | 49616 | 84747 | 0 | 35131 |
| June 2012 – May 2013 | 49616 | 84747 | 0 | 35131 |
| June 2013 – May 2014 | 49616 | 84747 | 0 | 35131 |
| June 2014 – May 2015 | 49616 | 84747 | 0 | 35131 |
| June 2015 – May 2016 | 49616 | 84747 | 0 | 35131 |
| June 2016 – May 2017 | 49616 | 84747 | 0 | 35131 |
| June 2017 – May 2018 | 49616 | 84747 | 0 | 35131 |
| Total (tonnes of CO2e) | 496160 | 847470 | 0 | 351310 |

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

As per the AMS II D for the project activity monitoring shall consist of:
(a) Documenting the specifications of the equipment replaced;
(b) Metering the energy use of the industrial or mining and mineral production facility, processes or the equipment affected by the project activity;
(c) Calculating the energy savings using the metered energy obtained from subparagraph (b).

**B.7.1 Data and parameters monitored:**

| **Data / Parameter:** | **$EG_{PA}$** |
|---|---|
| Data unit: | kWh |
| Description: | Electricity Generated during the project activity from the Gas turbine and gas engine per annum |
| Source of data to be used: | Daily MIS ( Management Information System) log sheet in the power plant |
| Value of data | 84791364 |
| Description of measurement methods and procedures to be applied: | The electricity generated is calculated as the sum of the electricity generated from the Gas Engine and Gas Turbine which is measured using the energy meter on continuous basis. This is recorded on daily basis. The GT energy meter E5 is located at GT HT panel. The Gas engine energy meter E6 is located at HT panel in the Gas DG set. E5+E6 (Final reading – initial reading).<br>The above value is based on the actual data of May 07 and June 07 and extrapolated for 12 months. |
| QA/QC procedures to be applied: | As per the ISO 9000/ISO14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$Q_{NGP1}$** |
|---|---|
| Data unit: | SCM |
| Description: | Quantity of NG consumed in Gas Turbine per annum. |
| Source of data to be | Power plant daily MIS sheet |

| | |
|---|---|
| used: | |
| Value of data | 15279921 |
| Description of measurement methods and procedures to be applied: | The quantity of NG used is calculated from initial and final readings using the Gas turbine flow meter G2 on daily basis (Final reading – initial reading) . The measurement by G2 is on continuous basis.<br>The above value is based on the actual data of May 07 and June 07 and extrapolated for 12 months. |
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$Q_{NGP2}$** |
|---|---|
| Data unit: | SCM |
| Description: | Quantity of NG consumed in Gas Engine per annum. |
| Source of data to be used: | Power plant daily MIS sheet |
| Value of data | 8840018 |
| Description of measurement methods and procedures to be applied: | The quantity of NG used is calculated from initial and final readings measured using the Gas flow meter G3 on daily basis (Final reading – initial reading). The measurement by G3 is on continuous basis.<br>The above value is based on the actual data of May 07 and June 07 and extrapolated for 12 months. |
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$Q_{NGP3}$** |
|---|---|
| Data unit: | SCM |
| Description: | Quantity of NG consumed in HRSG per annum. |
| Source of data to be used: | Distributed Control System (DSC) system on HRSG |
| Value of data | 726168 |
| Description of measurement methods and procedures to be applied: | The quantity of NG used is calculated from initial and final readings measured using the gas flow meter G4 on daily basis (Final reading – initial reading). The measurement by G4 is on continuous basis.<br>The above value is based on the actual data of May 07 and June 07 and extrapolated for 12 months. |
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$Q_{NGP4}$** |
|---|---|
| Data unit: | SCM |
| Description: | Quantity of NG consumed in the $2^{nd}$ boiler per annum. |
| Source of data to be used: | Power plant daily MIS sheet |
| Value of data | 0 |

| | |
|---|---|
| Description of measurement methods and procedures to be applied: | The quantity of NG used is calculated from initial and final readings will be measured using the Gas flow meter G7 on daily basis (Final reading – initial reading). The measurement by G7 will on continuous basis. |
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$Q_{NGP5}$** |
|---|---|
| Data unit: | SCM |
| Description: | Quantity of NG consumed in the 3rd boiler per annum. |
| Source of data to be used: | Power plant daily MIS sheet |
| Value of data | 0 |
| Description of measurement methods and procedures to be applied: | The quantity of NG used is calculated from initial and final readings will be measured using the Gas flow meter G8 on daily basis (Final reading – initial reading). The measurement by G8 will on continuous basis. |
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$Q_{NGP6}$** |
|---|---|
| Data unit: | SCM |
| Description: | Quantity of NG consumed in VAC per annum. |
| Source of data to be used: | Power plant daily MIS sheet |
| Value of data | 0 |
| Description of measurement methods and procedures to be applied: | The quantity of NG used will be calculated from initial and final readings using the VAC flow meter G5 on daily basis (Final reading – initial reading). The measurement by G5 will be on continuous basis. |
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$ST_P$** |
|---|---|
| Data unit: | kg |
| Description: | Amount of steam generated from HRSG, Boiler no 2 and 3 per annum. |
| Source of data to be used: | Power plant MIS |
| Value of data | 143746086 |
| Description of measurement methods and procedures to be applied: | The steam generated is calculated from readings measured using the meters W1, W2, W3, W4, W5 and W6 on daily basis W1+W2+W3+W4+W5+W6 . The steam for the boiler number 1 (W7) will be deducted from the above figure. Net steam produced by HRSG, Boiler 2 and 3 will be W1+W2+W3+W4+W5+W6- |

| | |
|---|---|
| | W7.. Measurements by water meters will be on continuous basis.<br>The above value is based on the actual data of May 07 and June 07 and extrapolated for 12 months. |
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$R_P$** |
|---|---|
| Data unit: | TR |
| Description: | Vapour Absorption Chiller Cooling Capacity |
| Source of data to be used: | Chiller Log Book |
| Value of data | 1260 |
| Description of measurement methods and procedures to be applied: | The cooling generated is measured in the display and operating panel of the VAC and the reading is recorded every 2 hours. The operating hours of the VAC is recorded by the shift engineer. The daily cumulative readings of the cooling generation noted down is divided 12, being number of readings in the day and is multiplied with the operating hours of the chiller to calculate the actual cooling generation. |
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$OH_P$** |
|---|---|
| Data unit: | Hours |
| Description: | Number of operational hours of VAC in a year |
| Source of data to be used: | VAC log sheet |
| Value of data | 8400 |
| Description of measurement methods and procedures to be applied: | The operating hours of the chiller is recorded every hour by the shift operator and is stored in the VAC log sheet. |
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | **$NCV_{NGP}$** |
|---|---|
| Data unit: | Kcal/SCM |
| Description: | Net Calorific Value of Natural Gas |
| Source of data to be used: | Invoice from suppliers |
| Value of data | 8350 |
| Description of measurement methods and procedures to be applied: | GSPL provides GCV of NG on daily basis. It is normally observed that NCV is approx. 90% of GCV. |

| | |
|---|---|
| QA/QC procedures to be applied: | As per the ISO 9000/ ISO 14001 procedures |
| Any comment: | |

| **Data / Parameter:** | $SE_P$ |
|---|---|
| Data unit: | $tCO_2e/kWh$ |
| Description: | Specific Emission Factor for electricity generation in Project Scenario |
| Source of data to be used: | Calculated |
| Value of data | 0.00055779 |
| Description of measurement methods and procedures to be applied: | Specific Emission Factor for electricity generation in Project Scenario ($SE_P$) ($tCO_2e/kWh$) = $E_{GP}$ / $EG_{PA}$ |
| QA/QC procedures to be applied: | |
| Any comment: | The value of $SE_P$ will be used in calculation of baseline emissions for equivalent amount of chill water generated in project activity. This value would be calculated ex-post each year during crediting period. |

| **Data / Parameter:** | **Energy_Saving** |
|---|---|
| Data unit: | GWhth |
| Description: | Aggregate Fuel Input Saving per annum in the project activity. |
| Source of data to be used: | Calculated |
| Value of data | 66.19 |
| Description of measurement methods and procedures to be applied: | Calculated as Energy Saving = (energy consumption per annum in project scenario for steam generation ($E_{Steam}$) + energy consumption per annum in project scenario for electricity generation ($E_{Electricity}$) ) – ( (Specific energy consumption for steam generation in baseline ($SE_4$) * amount of steam generated per annum in project scenario ($EG_{PA}$) ) + (specific energy consumption for electricity generation in baseline ($SE_5$) * amount of electricity generated per annum in project scenario ($ST_P$) ) ) + electricity consumption reduction due to VAC per annum ($ECR_{VAC}$) (GWhth)<br><br>$E_{Steam} = ((Q_{NGP3} + Q_{NGP4} + Q_{NGP5}) * NCV_{NGP})/(860*10\text{^}6)$<br>$E_{Electricity} = ((Q_{NGP1} + Q_{NGP2}) * NCV_{NGP})/(860*10\text{^}6)$<br>$ECR_{VAC} = 3 * ( (SE_3 * OH_P * R_P) – (VAC_{AUX} – OH_P) )$ |
| QA/QC procedures to be applied: | The amount of energy savings will be calculated ex-post each year during the crediting period. |
| Any comment: | |

**B.7.2 Description of the monitoring plan:**

The site has ISO 9001:2000, ISO14001: 2004 and SA 8000:2001 Management systems in place. Accordingly, the monitoring plan proposed herein has become an integral part of the project Management Programmes and would be constituent of operational and management structure of the Management systems.

.

The project activity is operated and managed by the project proponent. The individual plant record data related to their respective project activity. In order to monitor and control the project performance, Welspun India Ltd. has placed a project management team. They are coordinated by Project Executor and Head (Power Plant and Utilities) who is responsible for checking the information consistency. Welspun India Ltd. has well diversified procedure for collection of data and analysis of data at different levels and for subsequent corrective actions as when required in line with these policies.

The project team has been entrusted with the responsibility of storing, recording the data related to the project activity. The project team is also responsible for calculation of actual emission reduction in the most transparent and relevant manner.

Inspection and record of daily check list of critical parameters of project activity is maintained. The maintenance staff access the condition of all the power plant equipment and measuring equipment and any action required is taken.

Installed meters are calibrated according to the calibration schedule programmed at the start of the operation and recalibrated annually.

.

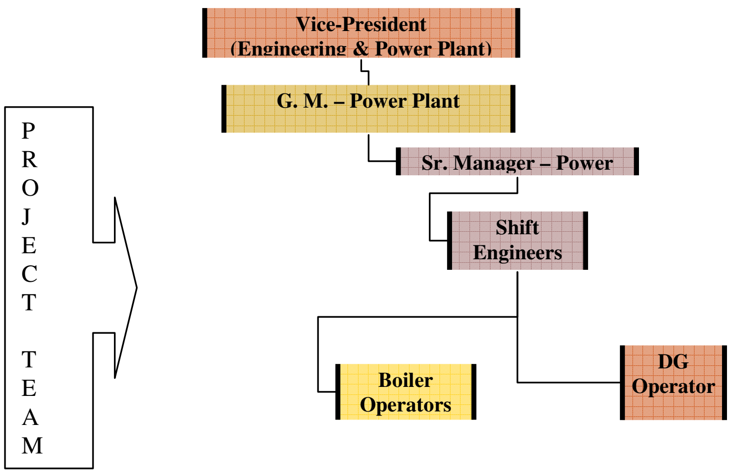
All the monitoring data is stored /will be recorded and kept under safe custody of the Project Executor and Head (Power Plant and Utilities) for a period of crediting period (10 years fixed crediting period) + 2 years or the last issuance of CERs + 2 years whichever occurs later.

The Instrumentation and the control system for the project activity are designed with adequate instruments to control and monitoring the various operating parameters for safe and efficient operations. All the instruments are of reputed make and are calibrated at regular intervals.

The natural gas based power project abides and will abide by all regulatory and statutory requirements as prescribed under the state and central laws and regulations.
Also any change within the project boundary, such as change in equipments will be recorded and any change in the emission reduction due to such alteration will also be studied and recorded.

Details of the meters and daily CDM monitorijg sheet have been given in Annexure 4..

**Operational and Management Structure**
All relevant functions and tasks are sufficiently described in the manual and the standard operating procedures of the quality management system.




| **Designation** | **Responsibilities** |
|---|---|
| **Vice-President (Engineering & Power Plant)** | Registration<br>Project Execution |
| **G. M. – Power Plant** | Operation<br>Verification of data<br>Inspection of data whenever necessary to independently check the authenticity of data and take corrective actions wherever required.<br>Storage of data |
| **Sr. Manager – Power Plant** | Operation, Monitoring and Verification of Data<br>Data Recording<br>Storage of data |
| **Shift Engineers And Operators** (Operation and Maintenance) | Operation and Maintenance<br>Storage of data<br>Data Recording<br>Data Collection<br>Archiving of data<br>Observation ,Monitoring |

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

Mr. Tarnjit Singh, Welspun India Ltd.

**Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:** 16/02/2008

## SECTION C. Duration of the project activity / crediting period

### C.1 Duration of the project activity:

Formatiert

#### C.1.1. Starting date of the project activity:

>>
27/11/2004

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

>>
15 years 0 Months

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

#### C.2.1. Renewable crediting period

NA

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

>>
NA

##### C.2.1.2. Length of the first crediting period:

>>
NA

#### C.2.2. Fixed crediting period:

10 years

##### C.2.2.1. Starting date:

01/06/2008 or a date not earlier than the date of registration

##### 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 stated in the environmental impact assessment (EIA) notification vide S.O. 60(E)[2] dated 27/01/1994, India's Environmental Protection Act of 1986 project such as this with the investment of less than Rs.

[2] http://www.envfor.nic.in/legis/eia/so-60(e).html

500 million does not have to produce an EIA .The investment in this project is less than 500 million i.e. it involves investment of 332 millions only. Thus EIA is not required to be conducted. However a rapid environmental impact assessment was conducted by third party for Welspun India Limited, as a voluntary initiative to understand the impacts and mitigate any additional impacts that may arise due to the proposed project activity.

The environmental Impact Assessment study showed that overall environmental impacts are not significant. A summary of impacts is presented below:
Land use
The project activity is located at the power plant. Therefore it will not change any land use.

Water quality
It will not have any impact on water quality.

Air quality
The air quality will be cleaner in comparison to the furnace oil situations.

Liquid Effluent generation

The waste water characteristics will improve due to project activity as the oil and grease concentration will be reduced.

Solid Waste Generation

Tank bottom sludge is not expected to be there in the case of Natural gas, in comparison to FO. Accordingly, the solid waste generation is expected to reduce in the case of Natural Gas.

Surface and Ground Water.

It will not have any impact on surface and groundwater sources;

Flora and Fauna

No impacts of ecology – flora and fauna, is expected.

Employment

There will be marginal decrease in employment, as the handling of FO required labour and this is not required in the case of natural Gas. However the gas supplier has engaged number of people for the gas pipeline connection.

**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:**
>>

Only positive impacts are expected, such as better local air quality and GHG emission reductions into the atmosphere.The environmental impacts are considered not significant by the project participants.

## SECTION E. Stakeholders' comments

>>

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

>>
A stakeholders consultation meeting was organized on 24th August 2006 at Welspun India Limited, Vapi. Welspun identified its employees, suppliers, distributors, local community and govt officials as the most important stakeholders for the project activity. Accordingly the stakeholders were duly informed 15 days before the meeting by means of invitation letters to suppliers, local community, government officials and by notice on company notice board to its employees of the consultation meeting. In addition public notices were also displayed and distributed at key public places for the local stakeholder consultation meeting.

Comments of stakeholders were recorded during the stakeholder meeting.

The stake holder meeting process is followed in the following sequence

- Election of the Chair of the meeting and approval of the proposed Agenda
- Presentation of the CDM-Kyoto Protocol and role of local stake holder
- Presentation of the Projects completed or undertaken at Welspun India Limited
- Discussion and Articulation of concerns
- Chair summarizing the local stake holder concerns
- Vote of Thanks followed by Tea

Mr. Idris A. Vohra (IAS) was elected as the chairman for the stakeholder meeting.

The language used for the presentation, sharing and responding to the questions was in Gujarati. The summary of the meeting was recorded - copy of which will be made available to Designated Operating Entity during validation process. The list of participants with their signature is kept for record and photographs of the event were also taken.

The participants i.e. representatives of regulating agencies, Pradhan and his colleagues ( panchs) villagers, regular and contractor employees of Welspun India Limited, Vapi were welcomed by Mr. Darra Pardiwala (Secretary to Chairman). Then the agenda and purpose of meeting i.e. to receive, understand, record and address the concerns of stakeholders for CDM projects was presented and got approved.

Mr. Niroj Mohanty had presented the concept of Kyoto Protocol and Clean Development Mechanism (CDM). He had also stressed the role of stakeholders in the fuel switch project activity.

After his presentation Mr Darra Pardiwala had presented detailed about all the project activity (completed and undertaken) in the regional Gujarati language (Gujarati).

The participants were then requested to share their views or concerns.

At the end the chairman in his speech appreciated the CDM initiatives and applauded the effort towards cleaner energy. He commended Welspun for being the first company in south Gujarat who has taken up such kind of initiative. Overall there was unanimous agreement that the project activity was really a proactive initiative by the project party, which contributes, to the sustainable development.

**E.2. Summary of the comments received:**

>>

The specific concerns expressed by the participants are summarized below along with clarifications provided on such concerns:

| Stakeholder concerns / question / comment | Answer / clarifications |
|---|---|
| | |
| What will be the amount of reduction in the pollution by this Natural Gas based power Plant initiative? | It was informed that emission reduction will be to the extent of 40% in comparison to the baseline scenario. |
| What are the advantages to Welspun with this project initiative | Welspun will get financial benefit through the sale of Carbon Credits |
| Why did Welspun not opt for wind power in place of natural gas based power plant | It was informed that considering the plant location wind power is not a feasible option |
| What are the socio-economic benefits of this project | Socio-economic benefits of this project will be cleaner environment and reduced traffic hazards because of road transportation of fossil fuels will be eliminated. |
| What are the other project initiative through which you will be able to reduce emission | It was informed that the other initiatives reduction in power consumption by installations of the VFDs and hot water recovery. Welspun is thinking of other initiatives through which it will be able to reduce electricity and fuel consumption. |

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

>>

The stakeholders were provided clarifications on the issues raised as above to their satisfaction. None of the concerns expressed by the stakeholders required an action to be taken by the Welspun India Ltd during the project operation and at any other stage.

## Annex 1

### CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
| Organization: | Welspun India Ltd. |
| Street/P.O.Box: | Survey No.76 |
| Building: | Morai Village, Vapi |
| City: | Valsad Dist |
| State/Region: | Gujarat |
| Postfix/ZIP: | 396191 |
| Country: | INDIA |
| Telephone: | +91-260-2437437 |
| FAX: | +91-260-2437088 |
| E-Mail: | Tarnjit_singh@welspun.com |
| URL: | www.welspun.com |
| Represented by: | |
| Title: | V.P ( Engineering &Power plant) |
| Salutation: | Mr |
| Last Name: | Singh |
| Middle Name: | |
| First Name: | Tarnjit |
| Department: | Engineering |
| Mobile: | +91-9825127347 |
| Direct FAX: | +91-260-2437088 |
| Direct tel: | +91-260-2437588 |
| Personal E-Mail: | |

| | |
|---|---|
| Organization: | Cantor Fitzgerald Europe |
| Street/P.O.Box: | 17 Crosswall |
| Building: | |
| City: | London |
| State/Region: | |
| Postfix/ZIP: | EC3N 2LB |
| Country: | United Kingdom |
| Telephone: | +44 207 894 7000 |
| FAX: | +44207 894 7553 |
| E-Mail: | msnelling@cantor.co.uk |
| URL: | www.cantor.co.uk |
| Represented by: | |
| Title: | Director Legal (Europe and Asia) and Company Secretary |
| Salutation: | Mr |
| Last Name: | Snelling |
| Middle Name: | |
| First Name: | Mark |
| Department: | Legal |
| Mobile: | |
| Direct FAX: | +44207 894 7553 |
| Direct tel: | +44 207 94 7892 |
| Personal E-Mail: | |

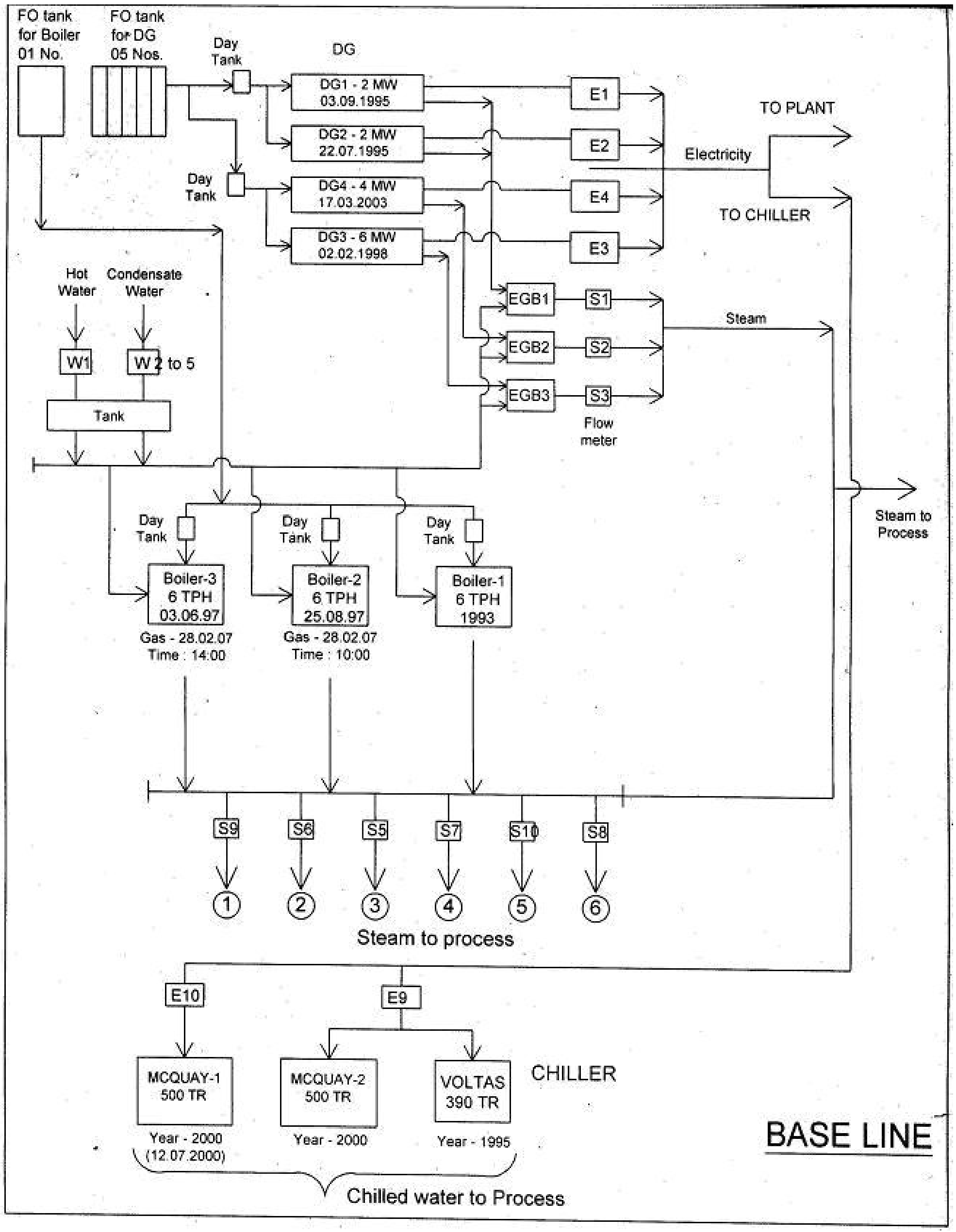
## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

Public funding from Annex I and diversion of ODA is not involved in this project.

**Annex 3**

**BASELINE INFORMATION**



Total Baseline Emissions from Steam Generation

| Year | Steam gen of Boiler (in Kg) | Steam gen of EGB (in Kg) | Total Steam | FO cons of Boiler (in Ltr) | Density | NCV (Kcal/Kg) | EF (kgCO2/TJ) | Emissions (tCO2) |
|---|---|---|---|---|---|---|---|---|
| 2005 | 54817675 | 35881154 | 90698829 | 4017873 | 0.97 | 9842.50 | 77400.00 | 12434.1178 |
| | | | | | | | | |
| 2006 | 64359992 | 42844257 | 107204249 | 4391989 | 0.969614286 | 9847.14 | 77400.00 | 13586.59633 |

| | | | |
|---|---|---|---|
| Total Steam Generation (Kg) | 197903078 | Total Emissions | 26020.71414 |

Specific Emissions Factor 0.00013148 (tCO2/Kg of steam)

Baseline Emissions From Power Generation

| Year | POWER GEN.(KWh) | FUEL CONS. (L) | Density (Kg/l) | NCV (Kcal/kg) | EF | Emissions (tCO2) |
|---|---|---|---|---|---|---|
| 2005 | 81862152 | 19187083 | 0.97 | 9842.50 | 77400.00 | 59378.29486 |
| | | | | | | |
| 2006 | 81378484 | 18967793 | 0.97 | 9847.14 | 77400 | 58676.77419 |

| | | | |
|---|---|---|---|
| Total Power Genration | 163240636 | Total Emissions | 118055.0691 |

(tCO2/KWh)

Baseline emission for Chilled Water Generation

| Year | Specific Power consum-ption in baseline scenario (kW/TR) | Quantity generated from VAC | Total Installed capacity of auxillaries in VAC (KW) | Electri-city consu-mption in VAC (KWh) | Electricity consumption in baseline scenario (kWh) | Electricity consumption reduction due to VAC (kWh) | Specific Emission Factor for Electricity Generation in project scenario(tCO2/GWH) | Baseline Emissions (tCO2) |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.77 | 10584000.00 | 191.20 | 1606080.00 | 8114163.11 | 6508083.11 | 0.000557793 | 4526.024326 |

## Annex 4
## MONITORING INFORMATION

-

| METER | METER TAG NO. IN DRG | ACCURACY CLASS / % ACCURACY | CALIBRATION FREQUENCY | REMARK |
|---|---|---|---|---|
| GAS TURBINE ENERGY METER | E 5 | 1 | YEARLY | |
| GAS ENGINE ENERGY METER | E 6 | 0.5 | YEARLY | |
| VAC CHILLER ENERGY METER | E 8 | 1 | YEARLY | |
| 4 BAR GAS FLOW METER | G 1 | 1% | YEARLY | |
| TURBINE GAS FLOW METER | G 2 | 1% | YEARLY | |
| GAS ENGINE GAS FLOW METER | G 3 | 1% | YEARLY | |
| HRSG GAS FLOW METER | G 4 | 1% | YEARLY | |
| EXHAUST CHILLER GAS FLOW METER | G 5 | 1% | YEARLY | ORDER PLACED, TO BE PROVIDED |
| BOILER NO-2 GAS FLOW METER | G 7 | 1% | YEARLY | ORDER PLACED, TO BE PROVIDED |
| BOILER NO-3 GAS FLOW METER | G 8 | 1% | YEARLY | ORDER PLACED, TO BE PROVIDED |
| HOT WATER FLOW METER BOILER HOUSE | W 1 | 1% | YEARLY | |
| CONDENSATE FLOW METER BOILER HOUSE | W 2 | 2% | YEARLY | |
| CONDENSATE FLOW METER BOILER HOUSE | W 3 | 2% | YEARLY | |
| CONDENSATE FLOW METER BOILER HOUSE | W 4 | 2% | YEARLY | |
| CONDENSATE FLOW METER BOILER HOUSE | W 5 | 2% | YEARLY | |
| CONDENSATE FLOW METER BOILER HOUSE - PTR MACHINE | W 6 | 2% | YEARLY | |
| WATER FLOW METER FOR BOILER NUMBER 1 BASED ON FURNACE OIL | W7 | 1% | YEARLY | |

**Gelöscht:** -

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DATE

| CDM DAILY MONITORING SHEET | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MONITORING POINT | | | | DATE | | METER READING | | | | |
| | EQUIPMENT | TAG NO. | UNIT | LOCATION OF METER | CALIBRATION DONE | CALIBRATION DUE | INITIAL | FINAL | DIFFERENCE | MULTIPLYING FACTOR | TOTAL |
| POWER GENERATION | GAS TURBINE | E 5 | KWH | POWER PLANT | | | | | 0 | 14000 | 0 |
| | GAS ENGINE | E 6 | KWH | GAS DG SHED | | | | | 0 | 10000 | 0 |
| GAS CONSUMPTION | GAS INLET 4 BAR | G 1 | $SM^3$ | 4 BAR PRS STATION | | | | | 0 | 1 | 0 |
| | GAS TURBINE | G 2 | $SM^3$ | GTG SHED | | | | | 0 | 1 | 0 |
| | GAS ENGINE | G 3 | $SM^3$ | GAS DG SHED | | | | | 0 | 1 | 0 |
| | HRSG | G 4 | $SM^3$ | SCADA SYSTEM | | | | | 0 | 1 | 0 |
| | EXHAUST CHILLER | G 5 | $SM^3$ | POWER PLANT | | | | | 0 | 1 | 0 |
| | BOILER NO-2 | G 7 | $SM^3$ | TO BE PROVIDED | | | | | 0 | 1 | 0 |
| | BOILER NO-3 | G 8 | $SM^3$ | TO BE PROVIDED | | | | | 0 | 1 | 0 |
| BOILER WATER CONSUMPTION - FOR STEAM GENERATION | HOT WATER F/M- B/H | W 1 | LTR | BOILER HOUSE | | | | | 0 | 1 | 0 |
| | CONDENSATE F/M - B/H | W 2 | LTR | BOILER HOUSE | | | | | 0 | 1 | 0 |
| | CONDENSATE F/M - B/H | W 3 | LTR | BOILER HOUSE | | | | | 0 | 1 | 0 |
| | CONDENSATE F/M - B/H | W 4 | LTR | BOILER HOUSE | | | | | 0 | 1 | 0 |
| | CONDENSATE F/M - B/H | W 5 | LTR | BOILER HOUSE | | | | | 0 | 1 | 0 |
| | CONDENSATE F/M - PTR | W 6 | LTR | NEAR PTR | | | | | 0 | 1 | 0 |
| | WATER FLOW METER BOILER NO. 1 - BOILER HOUSE | W 7 | LTR | BOILER HOUSE | | | | | | | |
| STEAM GENERATION | TOTAL OF WATER AND CONDENSATE FLOW METER | | KG | | | | | | | | 0 |
| CHILLED WATER GENERATION FROM EXHAUST CHILLER | EXHAUST CHILLER | | TR | POWER PLANT | | | | | | | |
| CHILLER POWER CONSUMPTION | EXHAUST CHILLER | E 8 | KWH | GAS DG SHED | | | | | 0 | 1 | 0 |
| | | | | | | | | | | | |

- - - - -

**Appendix 1**

The steam credit for Gas Turbine when the comparison is made with Furnace Oil is taken INR 0.73/Kg
The assumption for the steam credit calculation is given below:

**Steam Cost**

| DESCRIPTION | UNIT | FO BOILER | BASIS |
|---|---|---|---|
| **Net steam required from fired boiler** | **Tons / hr** | **7.0** | |
| **Type of fuel** | | **FO** | |
| Net Calorific value of fuel | Kcal/kg | 9842 | Supplier Invoice |
| Thermal efficiency | % | 83 | CII Report |
| Enthalpy of steam at 7.5 bar | Kcal/kg | 660.2 | From steam table |
| Feed water temperature | deg C | 65.0 | Plant Data |
| Fuel consumption/kg steam | kg/kg steam | 0.07 | Calculated |
| **Steam generation / kg fuel** | **Kg/liters/kg** | **13.72** | Calculated |
| Cost of fuel | Rs / kg | 9930 | Supplier Invoice |
| **Fuel cost** | **Rs/kg steam** | **0.72** | **Calculated** |
| **Fuel consumption/day** | **kg/day** | **12241** | **Calculated** |
| Connected electrical load | kw | 53 | |
| Power consumption | Kwh | 42 | Plant Data |
| Manpower: | | | |
| Operator @Rs 4500/- PM | No. | 3 | Plant Data |
| Fireman @ 2500/- PM | No. | 0 | Plant Data |
| Helper @ 2500/- PM | No. | 3 | Plant Data |
| Power cost @ 2,40/kwh | Rs Lacs/Month | 0.030 | Calculated |
| Manpower cost | Rs Lacs/Month | 0.210 | Calculated |
| Steam consumption | Tons / month | 5040 | Plant Data |
| Steam cost / month | Rs Lacs/Month | 36.47 | Calculated |
| Operating cost | Rs. Lacs/Month | 36.71 | Calculated |
| Steam cost | Rs/kg | 0.73 | Calculated |

Appendix –2

WELSPUN

MD

WELSPUN INDIA LIMITED

EXTRACTS FROM THE MINUTES OF THE MEETING OF THE BOARD OF DIRECTORS OF WELSPUN INDIA LIMITED HELD ON 30TH JULY, 2004.

"**RESOLVED THAT** the Board do approve establishment of natural gas based power plant for which the Company will take the initiative accordingly and explore CDM revenue from the project for the purpose of obtaining necessary approval from appropriate authorities and also benefits that may be accrued to the Company, Mr. B. K. Goenka, Mr. R. R. Mandawewala, Mr. M. L. Mittal, Mr. Swapan Nath, Mr. D. K. Patil and Mr. Tarnjit Singh are severally authorized to do all such acts, deeds and things as may be necessary to give effect to the foregoing."

CERTIFIED TRUE COPY
FOR WELSPUN INDIA LIMITED

12/06/2007
D. K. PATIL
COMPANY SECRETARY

Corporate Office:
Trade World, 'B' Wing, 9th Floor
Kamala Mills Compound
Senapati Bapat Marg Lower Parel,
Mumbai - 400 013.INDIA

Tel: +91-22-66136000 / 24908000
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**Works:** Welspun City, Tal. Anjar, Dist. Kutch, Gujarat - 370 110, INDIA. Tel: +91-02836-279000 / 09 Fax: +91-02836-279010

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