CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

Revision history of this document

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

SECTION A. General description of the small-scale project activity

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

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Reduction in Specific Steam Consumption of Vapour Absorption Chillers at Indo Rama Synthetics (India) Limited, Butibori, Distt- Nagpur, Maharashtra, India.

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

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Indo Rama Synthetics (India) Limited (IRSL) is a multinational group having synthetic fibre complex at Butibori, Nagpur District, Maharashtra, India. Polyester Chips, Partially Oriented Yarn, Piolyster Staple Fibre & Draw Twisted Yarn are manufactured at the IRSL fibre complex. Chilled water is required for producing conditioned air for process, yarn quenching, comfort air conditioning etc., There are 8 no.s of Vapour absorption chillers (VACs) having capacity of 1125 to1240 TR each and 4 no.s of electric chillers (3 x 450 TR and 1 x 1000 TR) to meet the chilled water demand. The specific steam consumption of existing VACs is in the range of 5.0 to 5.4 kg/TR/hr. IRSL is in the process of replacing three VACs with energy efficient ones in phased manner to reduce the steam demand and thereby to reduce fossil fuel consumption. The specific steam consumption of proposed VACs is about 3.9 kg/TR/hr. Two VACs have already been commissioned between July 2004 and August 2004. Third one is under erection and expected to be commissioned by Aug 2006.

The purpose of the project activity is to reduce the GHG emissions by improving energy efficiency of steam utilization system.

The contributions of project activity towards sustainable development are explained with indicators like socio-economic, environment and technology as follows:

1. Socio-economic well being:

Business opportunities for local stakeholders such as consultants, suppliers, manufacturers, contractors etc has been enhanced during implementation phase of the project activity.

Fossil fuel saved due to project activity, can be utilized for other needy sections of the economy.

2. *Environmental well being:*

The project activity would results in savings of fossil fuel and thereby reduction of Greenhouse Gas (GHG) emissions.

The chromate is used as corrosion inhibitor in the existing chillers. Instead of resisting the corrosion, it act as a corrosion accelerator and lead to leakage of Lithium bromide (Libr). The corrosion inhibitor

(Molybdate) used in the project activity will minimize the loss of LIBr as compared to existing (Chromate as corrosion inhibitor) Chillers by avoiding corrosion. Hence it minimizes the harmful effects which would have occurred due to leakage of LiBr.

3. *Technological well being:*

The Proposed Vapour absorption chiller is designed with improved heat transfer area, better material and less specific steam consumption of 3.9 kg/TR/hr. Molybdate is used as a corrosion inhibitor which does not results in loss of LiBr as in the case of chromate.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host party)	Private and/or public entity(ies) Project participants(*) (as applicable)	Party involved wishes to be considered as project participant (Yes/No)
India (host)	Indo Rama Synthetics (India) Limited	No

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

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

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A.4.1.1. Host Party(ies):

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India

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

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Maharashtra

A.4.1.3. City/Town/Community etc:

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Butibori, Distt- Nagpur.

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

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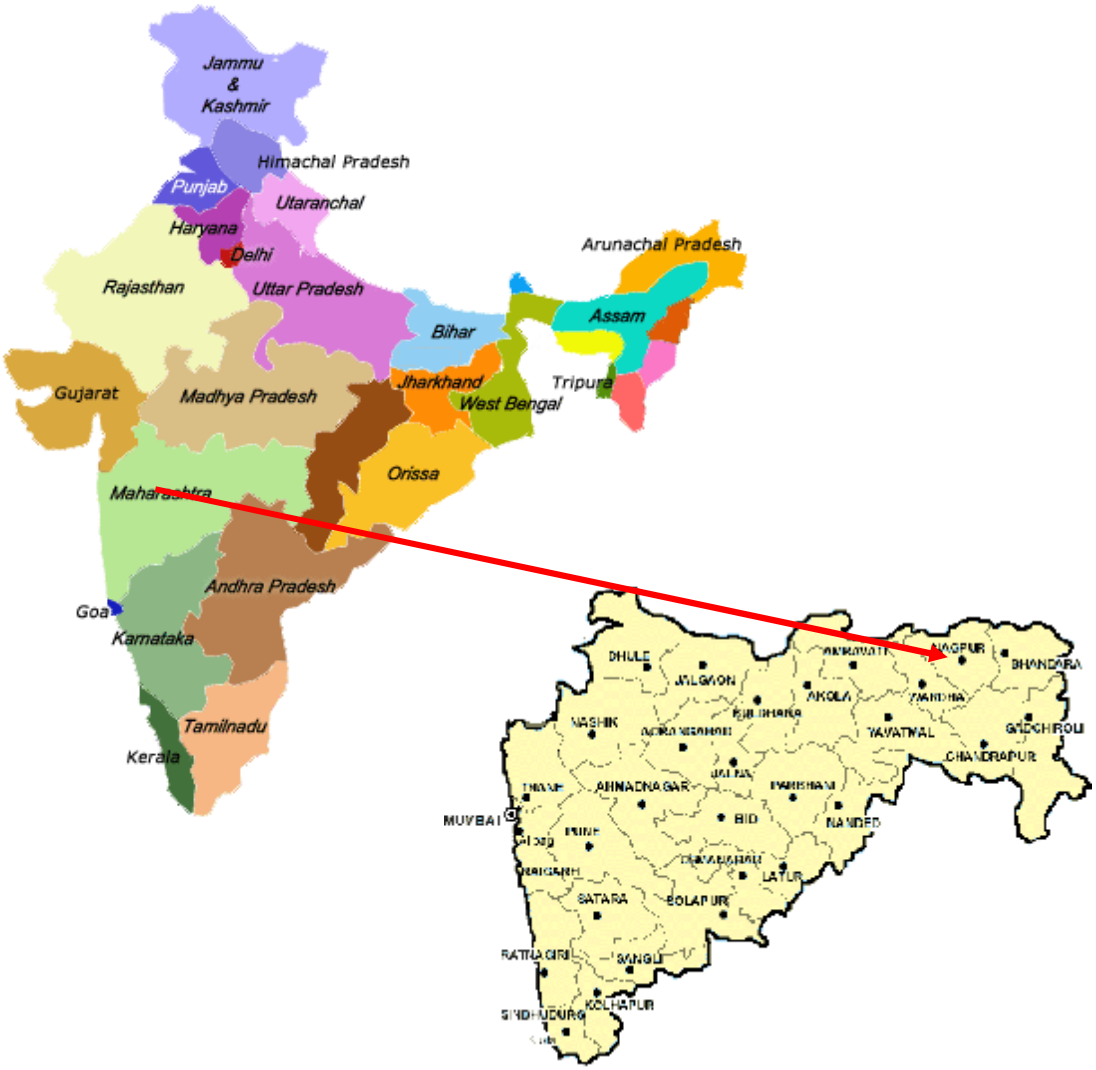
The project activity would be located at Butibori, Distt- Nagpur, Maharashtra, India. (Latitude: 21.09 North, Longitude: 79.09 East), in the synthetic fibre complex of IRSL. IRSL requires chilled water for producing conditioned air for process, yarn quenching, comfort air conditioning etc, which is produced by the project activity. The geographical location of the project activity is shown in the following map:


Jammu & Kashmir
Himachal Pradesh
Punjab
Uttaranchal
Haryana
Delhi
Rajasthan
Uttar Pradesh
Bihar
Arunachal Pradesh
Assam
Tripura
Jharkhand
West Bengal
Gujarat
Madhya Pradesh
Orissa
Maharashtra
Andhra Pradesh
Goa
Karnataka
Tamilnadu
Kerala
DHULE
JALGAON
AKOLA
NASHIK
YAVATMAL
GADCHIROLI
CHANDRAPUR
AHMADNAGAR
BID
NANDED
MUMBAI
PUNE
LATUR
SATARA
SOLAPUR
RATNAGIRI
SANGLI
KOLHAPUR
SINDHUDURG

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

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As the project activity is energy efficiency improvement in steam utilisation system, it falls under the **Type II -** Energy Efficiency Improvement Projects of indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories. **Category D** - Energy efficiency and fuel switching measures for industrial facilities.

The basic criterion for a small scale CDM project activity of Type II Category D is "*the aggregate energy savings of a single project may not exceed the equivalent of 15 GWh$_e$ per year". A total saving of 15 GWh$_e$ per year is equivalent to a maximal saving of 45 GWh$_{th}$ per year in fuel input.*

The maximum saving in fuel input from the project activity is estimated below:

No. of VACs replaced	=	3
Capacity of VACs	=	1125 TR
Specific Steam Consumption of old VACs	=	5.4 kg/TR/hr
Specific Steam Consumption of new VACs =	3.9 kg/TR/hr	
Enthalpy of input steam to VACs (8.5 kg/cm^2_g)	=	2772.9 kJ/kg/^{o}C
Enthalpy of condensate (90 ^{o}C)	=	376.76 kJ/kg/^{o}C
Efficiency of boiler	=	80%
Maximum Savings in fuel input	=	

$$\frac{3\times 1125\times(5.4-3.9)\times(2773-377)\times 24\times 365}{(0.8\times 3600\times 10^6)}$$

= 36.89 GWh$_{th}$ per year

Hence it is clear that the project activity meets the criteria since the maximum saving in fuel input is less than 45 GWh$_{th}$ per year.

Technology of project activity

The technology to be employed in the project activity is given below:

Equipment	: Chiller
Type	: Vapour Absorption
Refrigerant	: Water
Absorbent	: LiBr
Energy Supply	: Steam
Capacity	: 1240 TR
Specific Steam Consumption	: 3.9 kg/TR/hr

Corrosion Inhibitor : Molybdate

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

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The project activity reduces the specific steam consumption of VACs and thereby reduces the steam demand. The steam is generated by LP FBC (coal fired) boilers (2 x 10 TPH) and DG set based Waste heat recovery boilers (3 x 1.7 TPH and 3 x 6 TPH). As the LP FBC (coal fired) boiler is costlier source compared to WHRBs, the reduction in steam demand would results in reduction in coal consumption. The CO_2 emission due to the combustion of equivalent coal quantity would be reduced. In the absence of the project activity, the existing VACs would continue to operate and there would not be any reduction in coal consumption and hence there would be no anthropogenic greenhouse gas emission reduction. Therefore, the project activity results in reduction of anthropogenic greenhouse gas by sources which would not occur in the absence of the project activity.

There will be GHG emission reduction of around **24,570** tonnes of CO_2e over a 10 year crediting period due to the project activity.

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

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Years	Annual Estimation of emission reduction in tonnes of CO_2e
2007-2008	2,457
2008-2009	2,457
2009-2010	2,457
2010-2011	2,457
2011-2012	2,457
2012-2013	2,457
2013-2014	2,457
2014-2015	2,457
2015-2016	2,457
2016-2017	2,457
Total estimated reductions (tonnes of CO_2e)	**24,570**
Total number of crediting years	**10 years**

Annual Average over the crediting period of estimated reduction (tonnes of CO_2e)	2,457

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

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

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

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The guideline for de-bundling mentioned in paragraph 2 of appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities is given as follows:

A proposed small scale project activity shall be deemed to be a de-bundled 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*
- *Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.*

The project proponent is proposing another energy efficiency project in same project category at same location, but the technology of the other project is; "Steam Cascading System for Thermosetting Process", which is altogether different technology/measure from the project activity. Hence, the proposed project is not a de-bundled component of a large project activity.

SECTION B. Application of a baseline methodology:

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

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The project activity satisfies the eligibility criteria to adopt simplified modalities and procedure for small-scale CDM project activities as explained in paragraph 6 (c) of decision 17/CP.7.

Details of methodology for baseline calculations for small scale CDM projects are referred from the "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories". Reference has been taken from Main Category: **Type II –Energy Efficiency Improvement Project; Sub Category: D – Energy efficiency and fuel switching measures for industrial facilities version 07 - 28 November 2005**.

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

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The project activity falls under **Type II –Energy Efficiency Improvement Project; Sub Category: D – Energy efficiency and fuel switching measures for industrial facilities**. This category comprises any energy efficiency and fuel switching measure implemented at single industrial facility. This category covers project activities aimed primarily at energy efficiency; 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 processes (such as steel furnaces, paper drying, tobacco curing, etc.). The measures may replace existing equipment or be installed in a new facility.

As the project activity replaces the existing VACs by energy efficient one, the project activity is applicable to project category.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

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The project activity is associated with the following barriers to its implementation:

Barriers due to prevailing practice

The project activity replaces existing VACs of 1125 TR capacity each by energy efficient VACs. The specific steam consumption of existing VACs is in the range of 5.0 to 5.4 kg/TR/hr. IRSL explored opportunities to replace the existing energy intensive chillers by energy efficient one. As the VACs of this capacity having lesser specific steam consumption is not readily available in the market, IRSL consulted with Equipment supplier on continuous basis regarding this subject. Based on in-house R&D work and customized design, Equipment Supplier delivered VACs with improved heat transfer area, better material

of construction and less specific steam consumption (3.9 kg/TR/hr). This is the first project (LiBr-H_2O VAC) in textile sector in India, having specific steam consumption of 3.9 kg/TR/hr of this size (1240 TR). In absence of any precedence of successful implementation of similar project, IRSL took voluntary initiative to install the energy efficiency, high capacity VACs at Butibori unit.

Technological Barrier(s)

IRSL has 8 no.s of LiBr-H_2O based Vapor absorption chillers with specific steam consumption of 5 - 5.4 kg/TR/hr. The performance of the chillers are not satisfactory as there are frequent maintenance problems and design capacity is not delivered due to corrosion, fouling etc. IRSL perceived the risk in operating the LiBr-H_2O VACs as its frequent shutdown causes significant production loss. IRSL has been motivated by carbon credit opportunities and inspite of above-mentioned barrier, IRSL considered the energy efficient VACs project on voluntary basis in order to conserve the fossil fuel.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:

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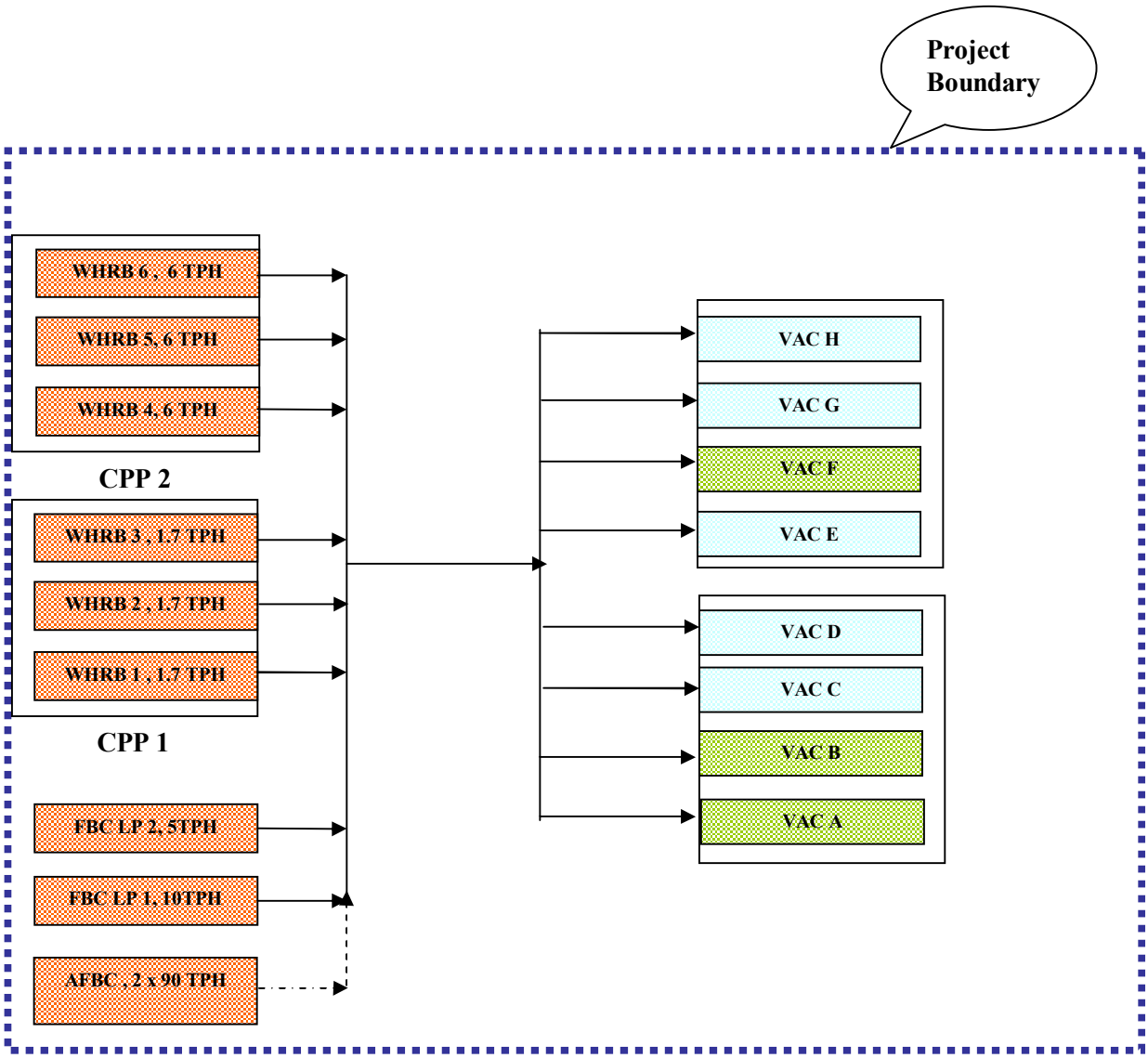
As per the guidelines provided in the approved methodology, project boundary encompasses the physical and geographical site of the industrial facility, processes or equipment that are affected by the project activity. Thus, project boundary includes fuel storage, LP FBC (coal fired) boilers, AFBC Boilers DG set based Waste heat recovery boilers, steam generation and distribution, VACs and electrical chillers.

The schematic layout of project boundary is given below:



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

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The baseline for the proposed project activity has been estimated by using the methodology specified in the applicable project category for small-scale CDM project activities. The details are given in section E 1.2.4 and E 1.2.5.

Date of completion of the baseline: 12/07/2006

Name of person/entity determining the baseline: M/s Indo Rama Synthetics (India) Limited

The detail of the project participant is enclosed in Annex 1 of this document.

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

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

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

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June 04

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

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15 years - 0 month

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

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The project activity would use fixed ten years crediting period.

C.2.1. Renewable crediting period:

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Not applicable

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

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Not applicable

C.2.1.2. Length of the first crediting period:

>>

Not applicable

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>
15/11/06

C.2.2.2. Length:

>>
10 years

SECTION D. Application of a monitoring methodology and plan:

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

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The approved monitoring methodology of the project activity is as follows:

Type II – **Energy Efficiency Improvement Project;**

Sub Category: D – Energy efficiency and fuel switching measures for industrial facilities

Reference: The monitoring methodology of the project activity is referred from 'Paragraph 6, 7 and 8' of Type II –Energy Efficiency Improvement Project; Sub Category: D – Energy efficiency and fuel switching measures for industrial facilities version 07 - 28 November 2005.

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

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As per the paragraph 12 of Simplified Modalities and Procedures for Small Scale CDM Project activities, a proposed project activity shall,

(a) Meet the eligibility criteria for small-scale CDM project activities set out in paragraph 6 (c) of decision 17/CP.7;

(b) Conform to one of the project categories in appendix B to this annex;

(c) Not be a de-bundled component of a larger project activity, as determined through appendix C to this annex.

As explained earlier in A.4.2 and A.4.5, the project activity meets the eligibility criteria for small-scale CDM project activities set out in paragraph 6 (c) of decision 17/CP.7, falls under small-scale CDM project of Type II. Category D and is not a de-bundled component of a larger project activity.

The monitoring plan has been drawn as per the guidance provided in paragraph 6, 7 and 8 of 'Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories Type II - Category D - version 07 - 28 November 2005'.

Description of monitoring plan

The monitoring plan is formulated to monitor the energy use of the equipment affected by the project activity. The metered parameters would be used to calculate energy savings and thereby emission reductions.

GHG Sources

Direct On-Site Emissions

The project activity replaces three VACs by energy efficient one and thereby results in reduction of fuel (coal). The emission due to the combustion of coal is direct On-site emissions which would be reduced after implementation of the project. Hence it is essential to monitor the parameters related with steam savings like Specific steam consumption of each VACs and also the parameters required for calculation of fuel savings like coal consumption, steam generation, steam pressure & Temperature, operating hours of boilers, etc. The list of data to be monitored is given in D.3.

Direct Off-Site Emissions

The emissions due to transportation of fuel for the project activity are regarded as direct off-site project emissions. Similar quantum of emissions would have also occurred in the baseline due to the transportation of coal. Hence, the net direct off-site emissions would be due to transportation of coal. As the quantum of coal savings would be nominal value which could be regarded as negligible on conservative basis.

Indirect On-Site Emissions

The energy consumption for the construction of the project would lead to indirect on site emissions. Considering the small construction period of the VAC chillers, emissions under this category would be negligible.

D.3 Data to be monitored:

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ID No.	Data Variable	Data Source	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1	Fuel consumption	Utility Log Book	Ton / month	e	Once in a month	Total	Paper	CP+2 years	Used for baseline emission calculations. Measured by Number of bunkers charged and bunk volume
2	Steam generation from boilers	Utility Log Book	Tpd	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
3	Steam Pressure from boiler	Utility Log Book	kg/cm^2	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
4	Steam Temperature from boiler	Utility Log Book	^oC	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
5	Quantity of Steam to VAC A	VAC Log Book	TPD	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
6	Quantity of Steam to VAC B	VAC Log Book	TPD	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
7	Quantity of Steam to VAC F	VAC Log Book	TPD	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
8	Chilled water Flow to VAC A	VAC Log Book	m^3/d	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
9	Chilled water Flow to VAC B	VAC Log Book	m^3/d	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.

10	Chilled water Flow to VAC F	VAC Log Book	m^3/d	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
11	Temperature of inlet chilled water to VAC A	VAC Log Book	^0C	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
12	Temperature of inlet chilled water to VAC B	VAC Log Book	^0C	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
13	Temperature of inlet chilled water to VAC F	VAC Log Book	^0C	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
14	Temperature of Outlet chilled water to VAC A	VAC Log Book	^0C	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
15	Temperature of Outlet chilled water to VAC B	VAC Log Book	^0C	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
16	Temperature of Outlet chilled water to VAC F	VAC Log Book	^0C	m	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
17	Operating hours of VAC A	VAC Log Book	Hrs	e	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
18	Operating hours of VAC B	VAC Log Book	Hrs	e	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.
19	Operating hours of VAC F	VAC Log Book	Hrs	e	daily	Total	Paper	CP+2 years	Used for baseline emission calculations.

20	Calorific Value of fuel	Lab report	kJ/kg	m	Shiftment basis	Actual Sample Testing	Paper	CP+2 years	Used for project emission calculations

Note: The specifications of the equipment to be replaced are documented below:

S.NO	Description	VAC A	VAC B	VAC F
Pre - Project details				
1	Capacity, TR	1125	1125	1125
2	Type of chiller	Vapour absorption	Vapour absorption	Vapour absorption
3	Refrigerant	Water	Water	Water
4	Absorbent	LiBr	LiBr	LiBr
5	Energy supply	Steam	Steam	Steam
6	Specific steam consumption , kg/TR/hr(Design)	5.4	5.4	5.4
7	Corrosion inhibitor	Chromate	Chromate	Chromate
Post - Project details				
1	Capacity, TR	1240	1240	1150
2	Type of chiller	Vapour absorption	Vapour absorption	Vapour absorption
3	Refrigerant	Water	Water	Water
4	Absorbent	LiBr	LiBr	LiBr
5	Energy supply	Steam	Steam	Steam
6	Specific steam consumption , kg/TR/hr(Design)	3.9	3.9	3.9
7	Corrosion inhibitor	Molybdate	Molybdate	Molybdate

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

>>

Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored. The details are as follows:

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?
D.3.1	Low	Yes, it is planned as per ISO 9000 procedure
D.3.2	Low	Yes, it is planned as per ISO 9000 procedure
D.3.3	Low	Yes, it is planned as per ISO 9000 procedure
D.3.5	Low	Yes, it is planned as per ISO 9000 procedure
D.3.6	Low	Yes, it is planned as per ISO 9000 procedure
D.3.7	Low	Yes, it is planned as per ISO 9000 procedure
D.3.8	Low	Yes, it is planned as per ISO 9000 procedure
D.3.9	Low	Yes, it is planned as per ISO 9000 procedure
D.3.10	Low	Yes, it is planned as per ISO 9000 procedure

Project Parameters affecting Emission Reduction

Parameters related with Steam Generation:

Fuel consumption in Boilers

The fuel consumption of boiler is estimated on daily basis based on bunker charged and the volume of bunker. The estimation would be cross checked with monthly stock inventories on monthly basis.

Calorific Value of Fuel

The calorific value of fuel would be tested on every batch/shiftment received to premises by sending the sample to authorized external lab.

Steam Generation from LP FBC Boilers

Steam Generation rate

The steam generation from boiler is measured individually by orifice type transmitter. The orifice type transmitter would be calibrated once in a year by physical measurement of condensate.

Steam Pressure and Temperature

The pressure and temperature of steam generation from boilers are measured by pressure gauge and temperature indicator. The pressure gauge and temperature indicator would be checked every month by internal instrument department.

Parameters related with Vapour Absorption Chillers:

Quantity of steam to VAC

The LP steam supplied to each VACs (VAC A, B and F) are measured by orifice type transmitter. The orifice type transmitter would be calibrated on every year by physical measurement of condensate by instrument department in association with Utility department.

Chilled water Flow

The chilled water circulation of each VACs (VAC A, B and F) are measured by the individual (Anubar) flow meter. The meter would be calibrated every year by instrument department.

Chilled water Temperature (inlet and Outlet)

The chilled water inlet and outlet temperature across each VACs (VAC A, B and F) are measured by the temperature indicator available at common header and it would be checked every month by instrument department.

Operating hours

The chilled water parameters like flow and temperature are logged on hourly basis. Base on frequency of other parameters, Operating hours of VACs (VAC A, B and F) are calculated and logged on daily basis.

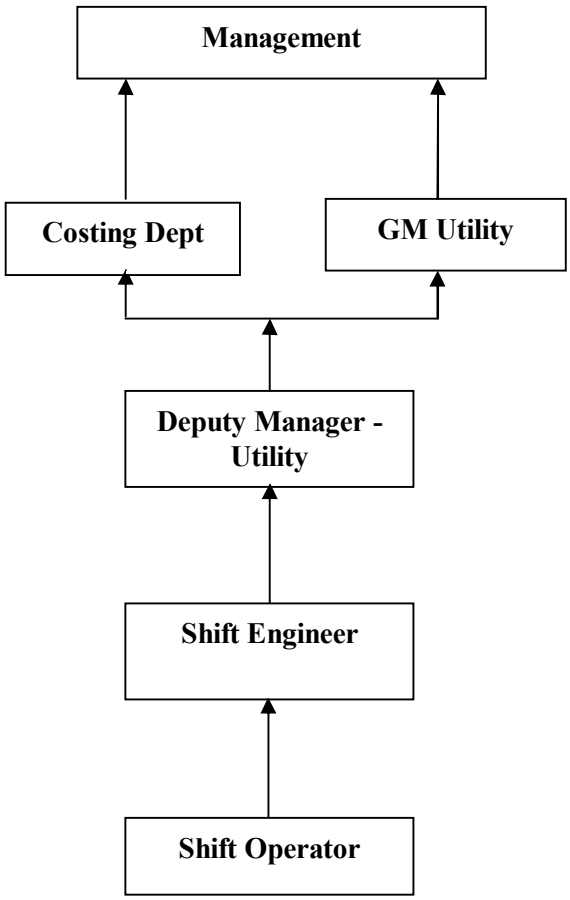
D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

>>

IRSL would ensure accuracy of the measurement system by adopting the following operational and management structure.

- The Shift Operators would be responsible for data recording of the parameters mentioned in the monitoring plan. They are qualified technicians with 5-10 years experience.
- The Shift Engineer would compile the daily report and submit to Deputy Manager - Utility.
- Deputy Manager will verify the data and will take immediate action if required. He will compile the monthly report and submit to GM -Utility and Costing department.
- GM - Utility will be responsible to report the status and the progress of the project to management.
- Costing Department would forward the report to management.

The schematic layout of operational and management structure is given below:



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

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M/s Indo Rama Synthetics (India) Limited

The project participant details are given in Annex 1 of this document.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

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E.1.1 Selected formulae as provided in appendix B:

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The formula for estimation of GHG emission reduction is not mentioned in 'Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories Type II - Category D - version 07 - 28 November 2005'.

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

>>

The project activity replaces three no.s of VACs with energy efficient one. Due to project activity, there will be decrease in specific steam consumption of VACs and hence the steam demand. Eventually there will be reduction in coal consumption. It is essential to estimate the savings in steam and thereby coal to calculate the GHG emissions reduction due to the project activity. Therefore, the specific steam consumption ratio of each VACs and the equivalent coal consumption to generate the steam are to be estimated. The formula for estimation is explained in the following sections.

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

>>

The formula for estimation of anthropogenic emissions by sources of GHGs due to project activity is given below:

Step 1: Estimation of Specific Steam Consumption of VACs

$$SSC_{\Pr oject} = \frac{(Steam\ Consumption)}{\left(M_{ChW} \times Op.hrs \times Cp \times (T_{in} - T_{out}) \Big/ (3600 \times 3.5)\right)} \quad kg\ of\ Steam/TR$$

Where

$SSC_{\Pr oject}$ = Specific Steam Consumption

M_{ChW} = Chilled Water Flow to VAC, m^3/hr

$Op.hrs$ = Operating hours of VAC, hrs/d

Cp = Specific heat capacity of Chilled Water, kJ/kg/^{0}C

T_{in} = Chilled Water inlet Temperature, ^{o}C

T_{out} = Chilled Water Outlet Temperature, ^{o}C

Step 2: Estimation of Specific Fuel consumption of VACs

$$SFC = \frac{SSC_{\Pr oject} \times h_{steam}}{\left(\eta_{(boiler)} \times CV\right)} \; kg\ of\ Coal / TR$$

Where

SFC = Specific Fuel Consumption
h_{steam} = Enthalpy of steam at generated conditions, kJ/kg
η_{LP1} = Efficiency of coal fired boiler, %
CV = Calorific Value of fuel, kJ/kg

The efficiency of boilers is estimated as below:

$$\eta_{(boiler)} = \frac{StGen \times Enthalpy_{steam}}{Fuel\ Consn \times CV_{Fuel}}$$

Where

$StGen$ = Steam Generation rate, TPD
$Enthalpy_{Steam}$ = Enthalpy of steam generation, kJ/kg
$Fuel\ Consn$ = Fuel consumption, TPD
CV_{Fuel} = Calorific Value of fuel, kJ/kg

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

>>

As per paragraph 5 of Indicative simplified baseline and monitoring methodology for selected small-scale CDM project activity -Type II - Category D - version 07 - 28 November 2005. It has been specified that "*If the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered*".

In the proposed project activity, the equipments are newly procured and are not transferred from another activity and the three existing VACs would be scrapped. Hence the leakage due to project activity need not to be considered.

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

>>

The project activity emissions would be only due to the combustion of fuel.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

>>

The specific steam consumption of individual VAC`s (VAC A, B, and F) would be estimated for every month for the baseline period.

Step 1: Estimation of Specific Steam Consumption of VACs

$$SSC_{Baseline} = \frac{\left(SC_{baseline}\right)}{\left(M_{ChW} \times Cp \times \left(T_{in} - T_{out}\right) \Big/ \left(3600 \times 3.5\right)\right)} \quad kg\ of\ Steam / TR$$

Where

$SSC_{Baseline}$ = Specific Steam Consumption

$SC_{baseline}$ = Steam consumption based on the monthly average of baseline, Ton/month

M_{ChW} = Chilled Water Flow to VAC, m^3/d for every month, based on the average of corresponding month baseline period.

Cp = Specific heat capacity of Chilled Water, kJ/kg/^{0}C

T_{in} = Chilled Water inlet Temperature, ^{o}C

T_{out} = Chilled Water Outlet Temperature, ^{o}C

Step 2: Estimation of Specific Fuel consumption of VACs

The specific fuel consumption of individual VAC`s (VAC A, B, and F) would be estimated for every month for the baseline period.

$$SFC_{Baseline} = \frac{SSC_{Baseline} \times h_{steam}}{\left(\eta \times CV\right)} \quad kg\ of\ Fuel / TR$$

Where

$SFC_{Baseline}$ = Specific Fuel Consumption

h_{steam} = Enthalpy of steam at generated conditions, kJ/kg

η = Efficiency of boiler, %

CV_{fuel} = Calorific Value of fuel, kJ/kg

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

>>

The emission reduction due to the project activity would be estimated by the following formula

$$\textbf{Emission Reduction} = \frac{\left(\left(SFC_{Baseline} - SFC_{\Pr oject}\right) \times TR_{actual} \times Op.hrs \times CV_{coal} \times EF_{coal} \times 44\right)}{\left(10^9 \times 12\right)}$$

Where

TR_{actual} = Actual Tons of Refrigeration, TR

$Op.hrs$ = Operating hours of VAC, hrs/d

CV_{Coal} = Calorific Value of coal, kJ/kg

EF_{coal} = Emission coefficient of coal, Ton of C/TJ, Referred from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

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

>>

Emission Reductions:

S.No.	Operating Years	Emission Reductions, (Tonnes of CO_2)
1.	2007-2008	2,457
2.	2008-2009	2,457
3.	2009-2010	2,457
4.	2010-2011	2,457
5.	2011-2012	2,457
6.	2012-2013	2,457
7.	2013-2014	2,457
8.	2014-2015	2,457
9.	2015-2016	2,457
10	2016-2017	2,457
	Total	**24,570**

SECTION F.: Environmental impacts:

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

>>

The project does not fall under the purview of the Environmental Impact Assessment (EIA) notification[1] S.O. 60 (E) of the Ministry of Environment and Forest, Government of India.

There would not be any significant negative impact over the environment due to the project activity. The following are the major benefits of the project activity towards environment

- The project activity would results in reduction of GHG emissions.
- The loss of LiBr would be minimized due to corrosion inhibitor (Molybdate) used in the project activity as compared to existing (Chromate as corrosion inhibitor) Chillers. Therefore it minimizes the harmful effects due to loss of LiBr.

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

SECTION G. Stakeholders' comments:

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

>>

The local stakeholders for in-house energy efficiency projects are mainly management representatives and employees of the industry. The project proponent consulted employees of the industry by briefing them about the project activity during internal environment meeting. They responded positively about the project activity and there were no major comment/concern raised during the consultation meeting.

G.2. Summary of the comments received:

>>

The employees have expressed their support on understanding the various benefits of project activity. They appreciated that the project activity would not only results reduction of steam demand and thereby coal but also minimize the harmful effects due to loss of LiBr. There were no major comments/concerns raised by the employees.

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

>>

There are no comments or concerns raised during the consultation with stakeholders. Further, as required by the CDM cycle, the PDD would be published at the DOE`s web site for public comments

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Indo Rama Synthetics (India) Limited
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Represented by:	
Title:	President and CFO
Salutation:	Mr.
Last Name:	Chatterjee
Middle Name:	
First Name:	Abhinandan
Department:	--
Mobile:	--
Direct FAX:	--
Direct tel:	--
Personal E-Mail:	--

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

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Enclosure 1 - Estimation of emission Reduction calculations

		August-03	September-03	October-03	November-03	December-03	January-04	February-04	March-04	April-04	May-04	June-04	July-04	
	Baseline Emissions													
VAC A	SSC,kg of steam/TR	4.90	5.50	4.90	5.00	0.00	0.00	5.20	5.40	5.40	5.40	4.90	5.20	
	SFC, kg of coal/TR	0.69	0.77	0.69	0.71	0.00	0.00	0.73	0.76	0.76	0.76	0.69	0.76	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Baseline Emissions,T CO2	506.68	474.15	362.25	173.09	0.00	0.00	337.75	7.82	271.19	525.31	496.95	441.42	
VAC B	SSC,kg of steam/TR	5.20	5.50	5.10	5.20	0.00	0.00	0.00	0.00	0.00	0.00	5.20	5.20	
	SFC, kg of coal/TR	0.73	0.77	0.72	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.76	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Baseline Emissions,T CO2	200.36	494.94	467.01	267.51	0.00	0.00	0.00	0.00	0.00	0.00	190.24	406.68	
VAC C	SSC,kg of steam/TR	4.50	4.70	4.50	4.50	4.60	4.60	4.50	4.70	4.70	4.70	4.50	4.50	
	SFC, kg of coal/TR	0.63	0.66	0.63	0.64	0.65	0.65	0.63	0.66	0.66	0.66	0.63	0.66	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Baseline Emissions,T CO2	328.34	323.44	128.55	354.75	509.75	449.47	46.49	33.78	269.41	488.37	402.52	480.92	
VAC D	SSC,kg of steam/TR	4.70	4.90	4.70	4.70	4.70	0.00	4.70	4.90	4.90	4.90	4.70	4.70	
	SFC, kg of coal/TR	0.66	0.69	0.66	0.66	0.66	0.00	0.66	0.69	0.69	0.69	0.66	0.69	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Baseline Emissions,T CO2	534.14	494.13	552.90	195.56	41.26	0.00	4.04	610.91	544.80	644.88	603.52	637.94	
VAC E	SSC,kg of steam/TR	4.90	5.20	4.70	4.80	5.20	0.00	0.00	5.20	5.20	5.20	4.90	4.90	
	SFC, kg of coal/TR	0.69	0.73	0.66	0.68	0.73	0.00	0.00	0.73	0.73	0.73	0.69	0.72	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Baseline Emissions,T CO2	414.98	506.02	182.47	35.81	506.72	0.00	0.00	26.18	67.98	281.57	458.19	380.46	
VAC F	SSC,kg of steam/TR	5.00	5.20	4.90	5.00	5.30	0.00	0.00	0.00	5.20	5.20	5.00	5.00	
	SFC, kg of coal/TR	0.70	0.73	0.69	0.71	0.75	0.00	0.00	0.00	0.73	0.73	0.70	0.73	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Baseline Emissions,T CO2	745.09	719.45	500.11	490.96	189.06	0.00	0.00	0.00	428.79	538.38	490.69	504.41	
VAC G	SSC,kg of steam/TR	4.60	4.70	4.50	4.50	0.00	4.60	4.50	4.70	4.70	4.70	4.50	4.50	
	SFC, kg of coal/TR	0.65	0.66	0.63	0.64	0.00	0.65	0.63	0.66	0.66	0.66	0.63	0.66	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Baseline Emissions,T CO2	651.23	634.78	495.07	10.93	0.00	166.24	418.92	553.29	586.98	592.31	606.71	643.20	
VAC H	SSC,kg of steam/TR	4.60	4.60	4.50	4.50	4.70	4.60	4.50	4.70	4.70	4.70	4.50	4.50	
	SFC, kg of coal/TR	0.65	0.65	0.63	0.64	0.66	0.65	0.63	0.66	0.66	0.66	0.63	0.66	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Baseline Emissions,T CO2	621.26	572.57	562.89	514.60	212.69	427.41	454.37	616.65	637.26	610.04	802.66	974.67	
	Total Baseline emissions,TCO_2	1452.14	1688.54	1329.37	931.55	189.06	0.00	337.75	7.82	699.98	1063.69	1177.89	1352.51	**10230.29**
	Project Emissions													
	Project Emissions,													
VAC A	Project SSC, kg of steam/TR	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	
	SFC, kg of coal/TR	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.57	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Project Emissions,T CO2	403.28	336.21	288.32	135.01	0.00	0.00	253.31	5.65	195.86	379.39	395.53	331.07	
VAC B	Project SSC, kg of steam/TR	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	
	SFC, kg of coal/TR	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.57	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Project Emissions,T CO2	150.27	350.96	357.12	200.63	0.00	0.00	0.00	0.00	0.00	0.00	142.68	305.01	
VAC F	Project SSC, kg of steam/TR	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	
	SFC, kg of coal/TR	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.57	
	Eff of (LP 1 or LP2)$_{MAX}$	0.85	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.81	
	Project Emissions,T CO2	581.17	539.59	398.05	382.95	139.12	0.00	0.00	0.00	321.60	403.79	382.74	393.44	
	Total Project emissions,TCO_2	1134.72	1226.76	1043.49	718.58	139.12	0.00	253.31	5.65	517.46	783.18	920.96	1029.51	**7772.736**
	Emission Reductions,T Co2	317.42	461.78	285.88	212.97	49.94	0.00	84.44	2.17	182.53	280.52	256.93	322.99	**2457.6**