



**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006**

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**SECTION A. General description of project activity****A.1 Title of the project activity:**

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Effective utilization of waste heat by installing vacuum pre-concentrator in urea section at Indo Gulf Fertilisers (A Unit of Aditya Birla Group), Jagdishpur.

Version: 09

Date: 01/11/2007

A.2. Description of the project activity:

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Indo Gulf Fertilisers (IGF), Jagdishpur (A Unit of Aditya Birla Group) is one of the largest and most cost-efficient private sector fertiliser company in India. IGF manufactures and markets Urea in the brand name of “Birla Shaktiman Urea”.

Purpose of project activity:

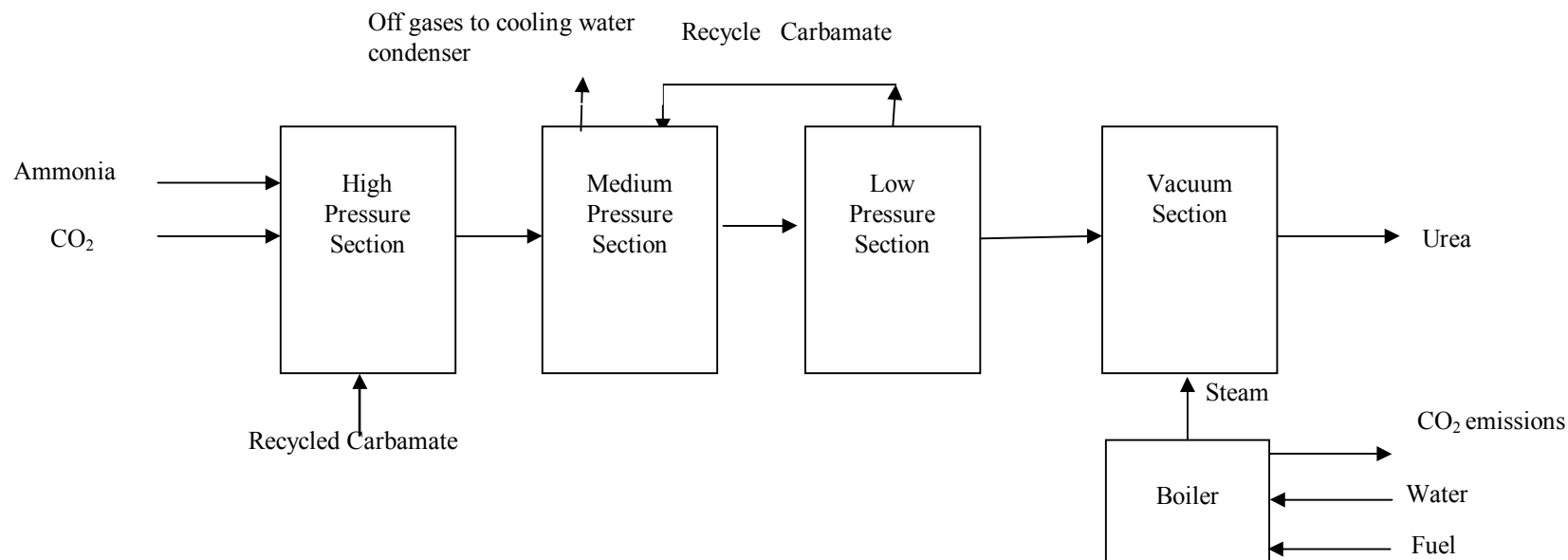
The purpose of the project activity is to install Vacuum pre-concentrator (VPC) in two stream of urea section and thereby reduce the Specific Steam Consumption Ratio (SSCR) of Urea section. The reduction in SSCR of urea section would lead to low pressure (LP) steam consumption reduction in urea section. The steam savings in urea section subsequently reduces fossil fuel consumption in the boiler. Therefore the project activity leads to CO₂ emission reduction due fossil fuel combustion.

IGF being an energy conscious organization continuously explores possibility for achieving energy efficiency. IGF felt good potential exists in utilizing enthalpy of process stream, which is dumping in cooling tower of urea section. With this objective IGF conducted extensive technical studies like process mapping, comprehensive energy and mass balance, Pinch analysis etc. of various process streams available at urea section. By putting meticulous efforts IGF identified that the off gases (containing CO₂ and ammonia) from Medium Pressure (MP) decomposer contained substantial amount of enthalpy can be used; which was dumping in to cooling water. IGF decided to install vacuum pre-concentrator and to utilise the enthalpy of off gases to pre-concentrate urea solution from 71% to 85% in vacuum pre-concentrator before feeding the solution to vacuum concentrator. Therefore reduce the consumption of low pressure steam used for concentrating the urea solution in vacuum concentrator of urea section.



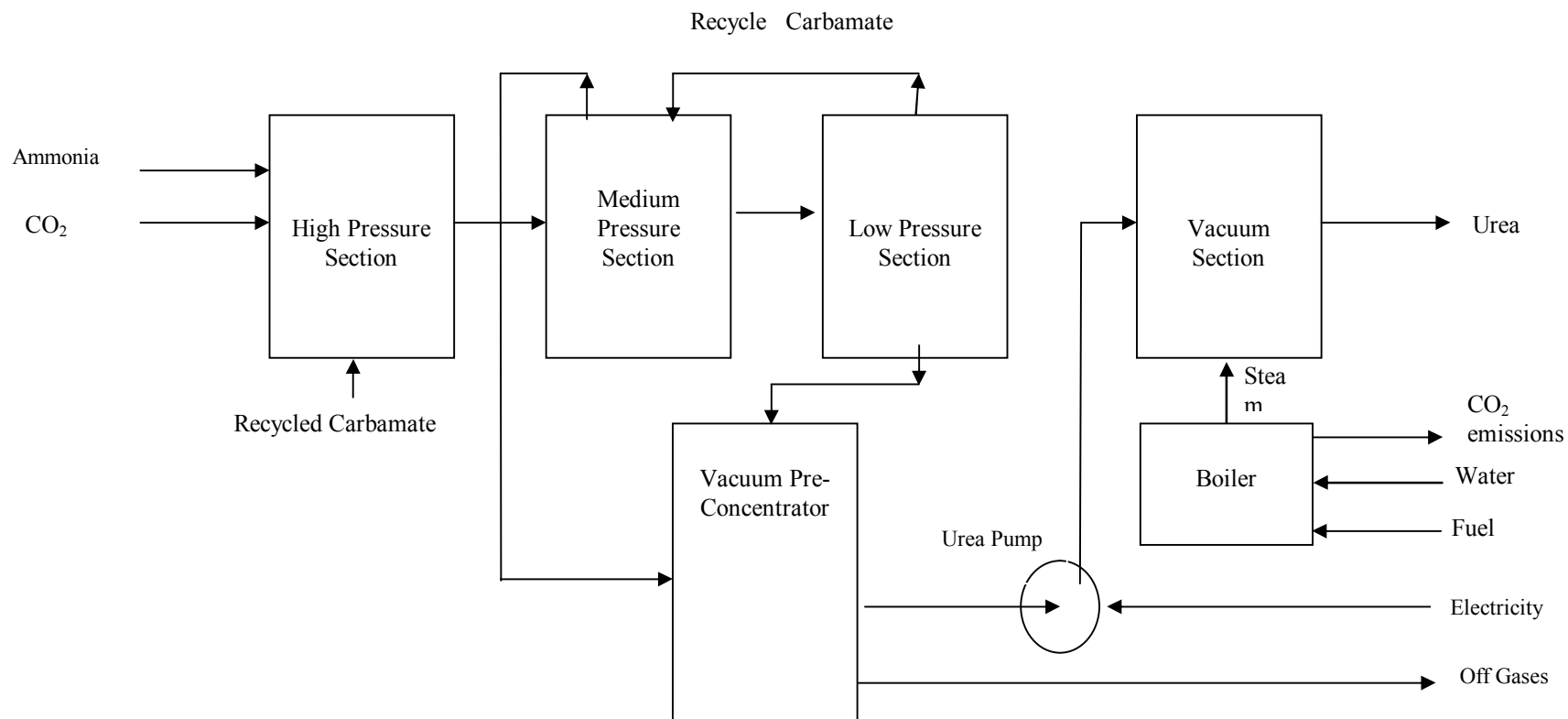
At IGF urea complex high pressure steam is generated by service boiler and low pressure steam is produced by reducing the pressure (process of letdown) of High Pressure steam. Hence reducing the consumption/requirement of low pressure steam in urea section would subsequently reduce the high pressure steam generation in service boiler, resulting in fuel savings in boiler and subsequently reduces CO₂ emissions.

Pre-Project Scenario





Post- project Scenario





The project schedule of vacuum pre-concentrator is detailed below:

- 1) Work order given to M/s PDIL for Detailed engineering (feasibility study), procurement services etc related to project activity on 17.03.2000. This date is considered as start date, since feasibility study of project is considered as imperative step (real action) before the decision making on project implementation.
- 2) Letter of Intent for supply of Vacuum Pre-concentrator to M/s. Patel Airtemp Ltd., on 14.06.2000
- 3) Work order for erection of Vacuum Pre-concentrator to M/s Oriental Insurance company Ltd on 07.06.2001
- 4) Internal communication on commissioning of Vacuum Pre-concentrator on 01.07.2001

Project's Contribution to Sustainable Development

Environment Wellbeing: The IGF project activity is to mainly aim to use energy efficient technology in urea section and reduce fossil fuel consumption in boiler. Thus resulting in benign environment (CO₂ emission reduction) and conserving non-renewable resources. Hence, the project aids in environmental well being.

Social wellbeing: Project activity provides employment opportunity for semi-skilled, skilled labour and professionals in the region during construction phase. Therefore contributing social well being aspects. The project creates a business opportunity for local stakeholders such as suppliers, contractors etc. contributing to economic well-being aspects.

Technological wellbeing: The project helps the IGF to maintain its status of being one of the most progressive companies of India due to adoption of latest technology and its efforts for sustainability.

This project activity is located in a rural setting and contributes to the environmental and social issues locally and globally through:

- Reducing consumption of fossil fuels by adopting energy efficient technologies
- Conserving Natural gas /Naphtha, thereby reducing the pace of depletion of natural resources.
- Reducing Green House Gases (Carbon Dioxide)



- Helping in capacity building of higher technology for employees
- Providing a highly replicable, efficient model to other fertilizer plants in the country

A.3. Project participants:

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| Name of Party involved (*) ((host) indicates a host Party) | Private and/or public entity(ies) project participants (*) (as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|--|--|
| India | Indo Gulf Fertilisers (IGF) (A Unit of Aditya Birla Group) | No |

A.4. Technical description of the project activity:**A.4.1. Location of the 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.:**

>>

Uttar Pradesh

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

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Jagdishpur, Distt. Sultanpur

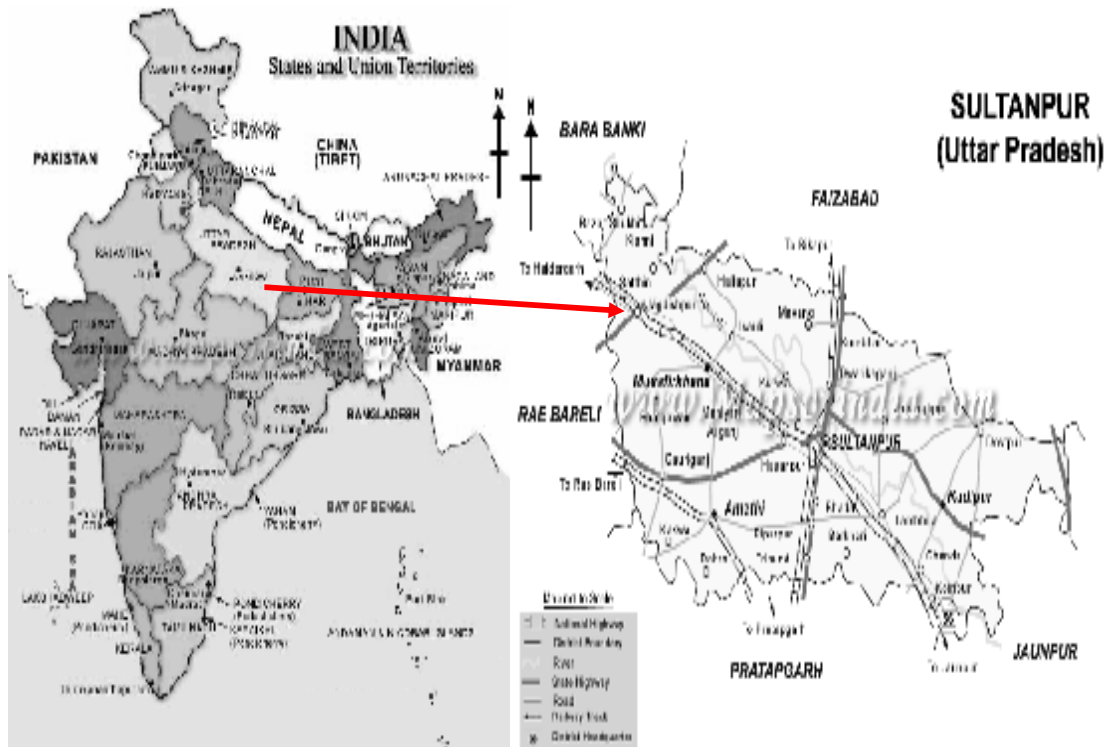
A.4.1.4.**Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):**

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Project activity implemented at IGF-Jagdishpur. Jagdishpur located at a distance of 60 km from Dist. Sultanpur on National Highway no. 56. The nearest railway station Nihalgarh is 10 km and airport Lucknow is 90 km away from Site. Maximum rainfall is around 337mm and in a day 272.4mm.

The geographical position is –

Geographical Coordinates: 26° 29' 15" North, 81° 33' 30" East



A.4.2. Category(ies) of project activity:

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As per the scope of the project activity enlisted in the ‘list of sectoral scopes and approved baseline and monitoring methodologies (version 02/28.11.03)’, project activity can principally be categorized in Scope Number 3, Sectoral Scope – Energy Demand.

A.4.3. Technology to be employed by the project activity:

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The project activity employs the unique technology for reduction of LP steam consumption in urea section by installing of vacuum pre-concentrator (VPC). This technology is developed by M/s Snam progetti, Italy (the technology supplier of Urea section of IGF). Technology employed in the IGF leads to energy efficiency in urea complex. The applied technology is environmental friendly.

Technical Details



Vacuum Pre-concentrator is installed between the Low Pressure concentrator and Vacuum concentrator. The outlet urea solution from LP concentrator contains 71% of Urea which is concentrated up to 85% of urea in Vacuum Pre-concentrator and finally concentrated up to 99.97% of urea in vacuum concentrator. The off gases from the MP decomposer contain mainly Ammonia, carbon dioxide and small amount of water Vapor. In the project activity, the thermal energy of off gases (which was earlier unutilised) from the MP decomposer is used to concentrate the urea solution from 71% to 85% in vacuum pre-concentrator. In the vacuum pre-concentrator heat exchanger off gases flows in shell side and urea solution is circulated in tube side of the heat exchanger.

Technical specification of the vacuum pre-concentrator including the mass flow rate of the fluids, inlet-outlet temperature of the both the streams and operating temperature-pressure is given in table below:

Specifications of VPC Exchanger ME-54:

| Parameter | Shell Side | | Tube Side | |
|---|--|--------|---------------|----------|
| Fluid Circulated | Mixed Phase (NH ₃ , CO ₂ , H ₂ O) | | Urea Solution | |
| Total Fluid Entering (kg/hr) | 62943 | | 84640 | |
| | Inlet | Outlet | Inlet | Outlet |
| Liquid (kg/hr) | 22147 | 35895 | 84640 | 73110 |
| Vapour (kg/hr) | 40796 | 27048 | | 11530 |
| Operating Temperature °C | 126 | 106 | 80 | 100 |
| Operating Pressure kg/cm ² (g) | 17.2 | | | 0.3 abs. |
| Heat Exchanged, Kcal/hr | 7.29 X 10 ⁶ | | | |

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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| Years | Annual estimation of emission reductions in tones of CO ₂ e |
|---|--|
| 2007-2008 | 32800 |
| 2008-2009 | 32800 |
| 2009-2010 | 32800 |
| 2010-2011 | 32800 |
| 2011-2012 | 32800 |
| 2012-2013 | 32800 |
| 2013-2014 | 32800 |
| 2014-2015 | 32800 |
| 2015-2016 | 32800 |
| 2016-2017 | 32800 |
| Total estimated reductions (tones of CO ₂ e) | 328000 |
| Total number of crediting years | 10 years |
| Annual average over the crediting period of estimated reductions (tones of CO ₂ e) | 32800 |

A.4.5. Public funding of the project activity:

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No public funding is involved from the parties included in Annex I.

**SECTION B. Application of a baseline and monitoring methodology****B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:**

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**Title: Approved baseline and monitoring methodology AM0018 (version 01.1, 6 December 2004)
“Baseline and Monitoring methodology for steam optimization systems”**

Reference: AM0018, UNFCCC website

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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Justification for why is the approved baseline methodology AM-0018 is applicable to project activity.

As per the paragraph 48 of decision-17/CP –7 of Modalities and Procedures for CDM as defined in article 12 of KP, project participants shall select baseline methodology for a project activity from the following three alternative approaches mentioned, the one deemed most appropriate for the project activity, taking into account any guidance by executive board and justify the appropriateness of their choice.

- a) Existing actual or historical emissions, as applicable; **or**
- b) Emissions from a technology that represents an economically attractive course of action, taking into barriers to investment; **or**
- c) The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 percent of their category.

Out of above options, Option-(a) is most suitable choice for selection of baseline methodology. This is because the new CDM project scenario can be directly compared with emission scenario of the old processes (Please refer approved methodology AM0018 for approach 48-(a) in similar case).

The methodology is applicable for 48-(a) approach only.

Justification for why is the approach 48-a applicable to project activity.

Both the scenarios before and after the implementation of the project activity are as follows:

Scenario 1



Non-project option: In the business-as-usual scenario, IGF would have continued to consume higher LP steam in urea section by maintaining the earlier technology status and not carrying out energy efficiency measures. This scenario would lead to higher carbon dioxide emissions.

Scenario 2

CDM Project option: In the project activity scenario, the energy efficiency project-installation of vacuum pre-concentrator in urea section is implemented. This will reduce the LP steam consumption in urea plant leading to GHG emission reductions.

This will be based on recorded data. As per the Kyoto Protocol (KP) baseline should be in accordance with the additionality criteria of article 12, paragraph 5(c), which states that the project activity must reduce emissions that are additional to any that would occur in the absence of the certified project activity.

Moreover, the project activity is of the first type in India, therefore any other project activity is not available for comparison. On the basis of this, it can be justified that most suitable baseline methodology for this application would be based on “Existing actual or historical emissions”.

The methodology applied for the project activity (AM0018) uses three -point approach for the estimation of CO₂ emission reduction due to project activity. In this approach, actual data shall be collected for direct comparison of baseline and project specific steam consumption and thus estimating reduction in CO₂ emissions.

1. Baseline Fixation: As a first step, the specific steam consumption ratio (SSCR-Tonne of LP steam consumed / Tonne of Urea Produced) of Urea section at baseline scenario is calculated from the daily data records for one year period (July 2000- June 2001). The value of “Urea Produced” used is the average representative value of normal range of output¹ (Urea Production) measured in a day. The corresponding steam consumption values would need to be selected and the average representative value

In India, Fertiliser is a controlled commodity and each year government allows plant to produce certain quantity of urea only and it is called allowed urea production quantity. Hence verifiable name plate capacity of the plant (Tonnes/day) in the PDD is determined as ratio of allowed urea production quantity of the year and operating days of that year. This approach is adopted since it is more representing the capacity of the plant.

Specification of steam at IGF Urea complex:

| | |
|------|---|
| KS - | Very high pressure superheated steam (at 510°C and 105 kg/cm ²) |
| HS - | High pressure steam (at 385°C and 38 kg/cm ²) |
| MS - | Medium pressure steam (at 225°C and 25 kg/cm ²) |
| LS - | Low pressure steam (at 145°C and 3.5 kg/cm ²) |



has to be calculated (refer section-B.4 for details). As the online monitoring is available, the daily average value is automatically calculated in integrator and deems to be more accurate and representative.

2. **Estimation of Specific Steam Consumption after Project Implementation:** In the project scenario, specific steam consumption (Tonne of LP steam/ Tonne of Urea Produced) of Urea section shall be calculated based on the ratio of actual values of LP steam consumption and Urea Production.
3. **Estimation of Emission Reduction:** By multiplying the reduction in specific steam consumption and total urea produced, reduction in LP steam consumption of urea section due to project activity shall be calculated. Subsequently the reduction in emission shall be calculated by estimating the fuel required for the generation of additional LP steam in the boiler. The efficiency of boiler and net enthalpy of steam is monitored to estimate the savings in natural gas.

The applicability conditions of methodology “for production processes with homogeneous and relatively constant output and continuous monitoring of steam outputs.” These conditions are perfectly applicable to CDM project activity of IGF.

IGF produces urea in relatively constant manner. In fact, the production rate of Fertilizer Industry in India is controlled by the government allotment based on the plant’s capacity and the plant can produce only the allotted quantity. This factor ascertains the constant nature of the production output of a fertilizer plant. IGF has state-of-the-art monitoring technology for steam output, which monitors and records steam output continuously. The project activity is a steam optimization project since it reduces the SSCR of Urea section by installing vacuum pre-concentrator in Urea section. Hence, IGF project activity meets all the applicability criteria of AM0018 methodology.

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|---|
| B.3. Description of the sources and gases included in the project boundary |
|---|

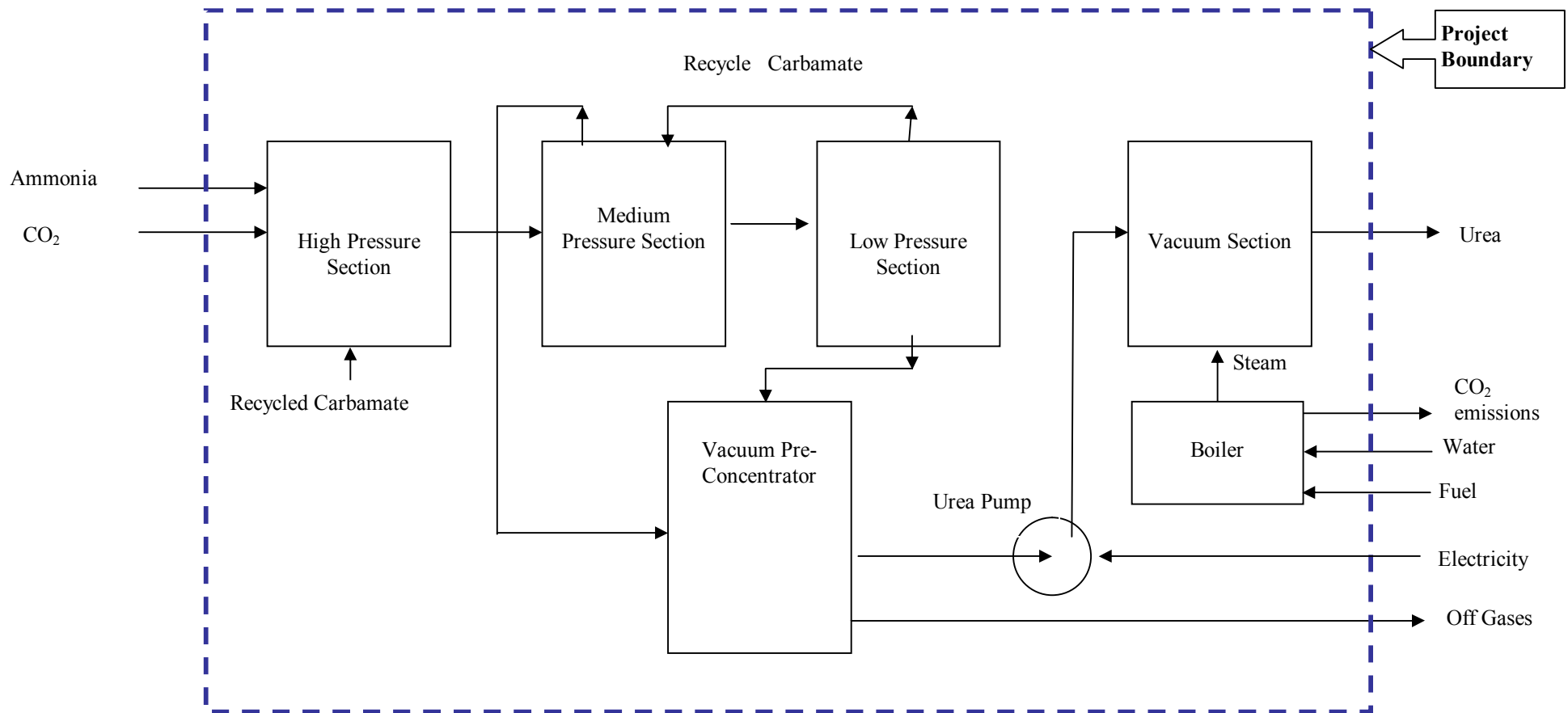
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As per definition of project boundary “it will encompass all anthropogenic emissions by sources of Green House Gases (GHGs) under the control of project participants that are significant and reasonably



attributable to the CDM project activity.” Based on the definition as per the approved methodology, the project boundary covers the modified system with vacuum pre-concentrator. The project boundary consist-

- Steam generator - The actual baseline CO₂ emissions take place in this boiler
- Process area – Urea section





The description of sources included in the project boundary is summarised in the following table:

| | Source | Gas | Included? | Justification / Explanation |
|------------------|------------------------------------|------------------|-----------|-----------------------------|
| Baseline | Steam Generation in service boiler | CO ₂ | Included | Main emission source |
| | | CH ₄ | Excluded | Minor emission source |
| | | N ₂ O | Excluded | Minor emission source |
| Project Activity | Steam Generation in service boiler | CO ₂ | Included | Main emission source |
| | | CH ₄ | Excluded | Minor emission source |
| | | N ₂ O | Excluded | Minor emission source |
| | Electricity Consumption | CO ₂ | Included | Main emission source |
| | | CH ₄ | Excluded | Minor emission source |
| | | N ₂ O | Excluded | Minor emission source |

The project boundary consist steam generator (service boiler) and process area of urea section. Service boiler is the main source of CO₂ emissions for this project activity, the electricity consumption for the project activity is also a source of the CO₂ emission. Hence both used for calculating project emissions and baseline emissions.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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The IGFL project activity leads to improvement of energy efficiency by reducing steam consumption in urea manufacturing processes, as discussed in the section B.2 the most likely baseline scenario is the continuation of production using current processes and efficiencies.

The baseline is based on historical data from the existing process, a benchmark Specific Steam Consumption Ratio (SSCR, steam consumption per ton of Urea) is defined as the baseline energy efficiency. The improvement of the benchmark after the implementation of vacuum pre-concentrator (VPC) is monitored and the corresponding steam savings and CO₂ emission reductions from fuel combustion in the boiler are determined.

The baseline Specific Steam Consumption Ratio SSCR is determined in 3 steps.

Step 1: Benchmarking baseline output

The representative output rate (Urea Production) for the day (Prep) is determined by the representative output values for Urea production within the normal production range. The normal production rate has been defined as +5% of nameplate capacity. Verifiable name plate capacity of the plant (Tonnes/day) is



determined as ratio of allowed urea production quantity of the year and operating days of that year . This approach is adopted since it is more representing the capacity of the plant.

Normal urea Production rate for year 2000-2001 and 2001-2002 is 2619 MTPD and 2564 MTPD respectively. The representative output values for Urea production is determined which are within the above normal production range.

For the days when the Urea production is not in normal range $\pm 5\%$ of nominal output, minimum value of SSCR for the month is taken. This is conservative value to estimate CER.

Step 2: Benchmarking baseline steam consumption

From the historical data for steam consumption, the values corresponding to the representative production or output values determined above need to be determined.

Step 3: Benchmarking of Process Specific Steam Consumption Ratio (SSCR)

The SSCR is determined by the ratio of above two parameters.

$$SSCR = \frac{S_{rep}}{P_{rep}}$$

Where

SSCR = Specific Steam Consumption Ratio in the baseline

S_{rep} = Representative steam consumption for the day/batch

P_{rep} = Representative production for the day/batch

SSCR = 0.65 t LP steam/t urea (*please refer Base case sheet of CER calculation excel sheet*)

The specific steam consumption ratio (SSCR-Tonne of LP steam consumed / Tonne of Urea Produced) of Urea section at baseline scenario is calculated from the daily data records for one year period (July 2000- June 2001) before implementation of the project activity.

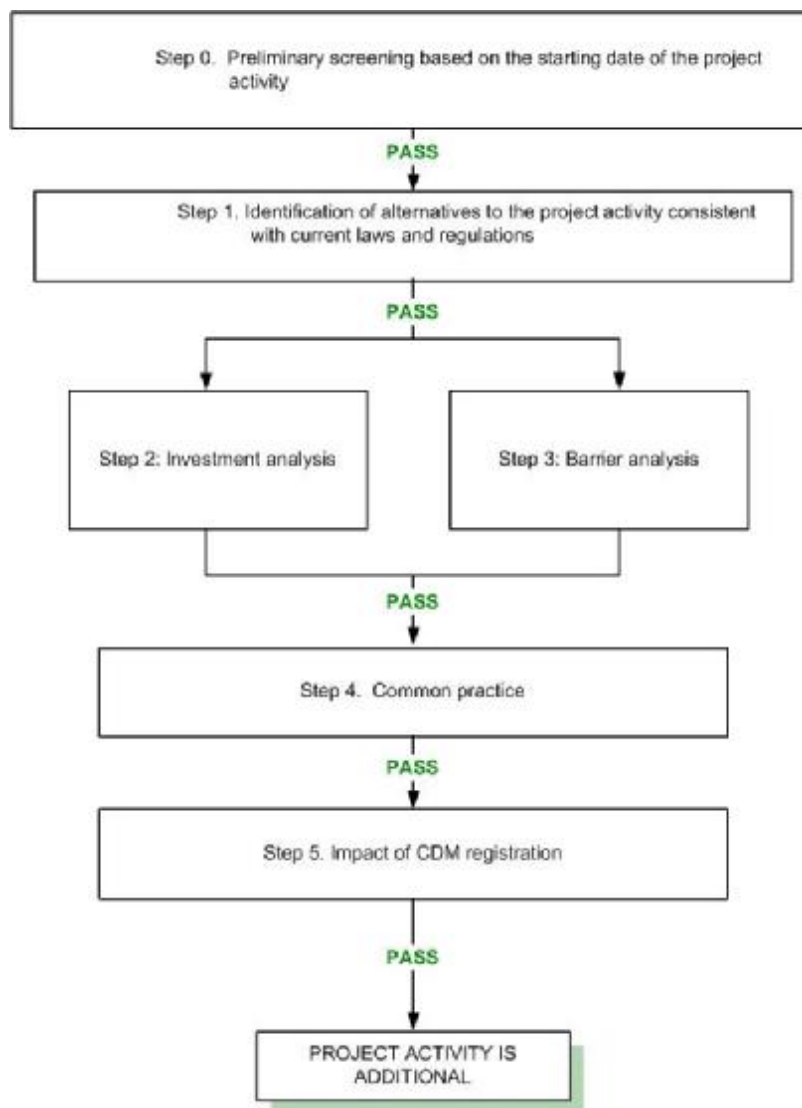
B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

The project activity is to install VPC in two stream of urea section and reduce Specific Steam Consumption Ratio (SSCR) of Urea section. The reduction in SSCR of urea section would lead to LP steam savings and consequently reduce fossil fuel consumption in the boiler. Therefore the project activity leads to CO₂



emission reduction. In absence of the project activity, urea section of IGF would continue to have higher SSCR leading to higher GHG emissions.

As per the decision 17/cp.7 para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity. The project activity is energy efficiency improvement activity and results in net reduction in CO₂ emissions of facility. Following steps of additionality test are followed for demonstration of additionality:



**Step 0: Preliminary screening based on the starting date of the project activity**

If the project proponents wish to have the crediting period starting prior to the registration of their project activity, they shall

- (a) Provide evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of the registration of a first CDM project activity, bearing in mind that only CDM project activities submitted for registration before 31 December 2005 may claim for a crediting period starting before the date of registration; and
- (b) Provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity.

IGF's management took the decision of carrying out the project activity, considering the incentive from the CDM. Also CDM was seriously considered in the decision to proceed with the project activity. The following documents substantiate CDM was seriously considered during inception of the project.

- Internal communication to top management of Indo Gulf fertilisers regarding the project
- Minutes of Meeting (MoM) of Monthly Progress Review (MPR) held on 06/03/2000
- Minutes of Meeting (MoM) of Monthly Progress Review (MPR) held on 05/05/2000

The schedule of the inception to implementation of the project activity is given as follows:

| Date/Month | Activity |
|--|---|
| March 2000 (17/03/2000 Start date of project activity) | Engineering services like feasibility study, detailed engineering etc. started |
| March 2000 (23/03/2000) | Brief Techno-commercial feasibility study jointly carried out by IGF and M/s PDIL is submitted to executive president for review and approval to forward to chairman of the group |
| April 2000 | Project progress report is submitted by M/s PDIL |
| | CAPEX initiative report to Chairman of the group during Planning & Budgeting meeting (Planning and budgeting for years 2000-03 Vacuum Pre-concentrator project considered for financial year 2001-02) |
| June 2000 | LOI for supply of 2 Nos. Vacuum Pre-Concentrator with separator and Holder along with spares invited |



| | |
|------------------|--|
| July 2000 | LOI for supply of condensers, interconnected piping and instruments for Vacuum Pre-Concentrator in Urea Plant. |
| | LOI for Supply of Urea solution Pumps for Vacuum Pre-Concentrator in Urea Plant. |
| May 2001 | Stakeholder consultation |
| June 2001 | Installation of Vacuum Pre-concentrator completed in 11 Unit of urea plant and pre commissioning activity started. |
| July 2001 | Installation of Vacuum Pre-concentrator completed in both the urea stream. |

Step1: Identification of alternatives to the project activity consistent with current laws and regulations.

Define realistic and credible alternative scenarios to the CDM project activity that can be (part of) the baseline scenario through the following sub-steps.

Sub-step 1a. Define alternatives to the project activity:

Alternative 1: Continuation of current practice

Continuation of current practice: In the business-as-usual scenario, IGF would have continued to consume higher quantity of LP steam in Urea section leading to higher GHG emissions and maintaining the earlier technology status and not carrying out energy efficiency measure in Pre-concentrator of urea section.

Alternative 2: Implementation of the project activity not undertaken as a CDM project activity.

Implementation of the project activity not undertaken as a CDM project activity. All these Alternatives are in compliance with all applicable legal and regulatory requirements. There is no legal binding on IGF to implement any of the alternatives or the CDM project activity. There is no regulation or act which is adequate to stimulate implementation of the project activity in absence of CDM.

Alternative 2 is not a feasible option for IGF since the project activity faces the same barrier (technological, prevailing practice etc.,) as that of CDM project activity. Without CDM revenue which would provide additional coverage to the risks faced by the project, this alternative would not be a feasible option for IGF.

Sub-step 1b. Enforcement with applicable laws and regulations:

All these Alternatives are in compliance with all applicable legal and regulatory requirements. There is no legal binding on Indo Gulf Fertilisers to implement the CDM project activity.



The alternative 1 to project activity (continuing the current practice) does not face any barriers. Therefore the barriers to IGF 's project activity detailed in step-3 does not exist for Alternative 1 so as to prevent its wide spread implementation.

Therefore alternative: 1 continuation of the current practice is found to be the most appropriate and conservative baseline scenario.

Step 2. Investment analysis

IGF does not follow this step to demonstrate additionality, but follows step-3 for barrier analysis.

Step 3. Barrier analysis

Barrier Analysis of "Tool for the demonstration and assessment of additionality (version 03) EB 29" is used to demonstrate that the proposed project activity faces barriers that prevent the baseline scenario from occurring and therefore the project activity is additional. In this step it has been shown that the project activity faces barriers that:

- (c) Prevent the implementation of this type of proposed project activity; and*
- (d) Do not prevent the implementation of at least one of the alternatives.*

The identified barriers are only sufficient grounds for demonstration of additionality if they would prevent potential project proponents from carrying out the proposed project activity undertaken without being registered as a CDM project activity. If the CDM does not alleviate the identified barriers that prevent the proposed project activity from occurring, then the project activity is not additional.

The project activity is a retrofit measure for reduction of LP steam consumption in urea section by installing a unique technology of vacuum pre-concentrator (VPC) in between the Low Pressure (LP) concentrator and Vacuum concentrator in the urea section. The VPC uses the enthalpy of off gases (which was earlier unutilized) from the Medium Pressure (MP) decomposer to pre-concentrate urea solution from 71% (outlet of LP concentrator) to 85% in vacuum pre-concentrator before feeding the solution to vacuum concentrator. Thus, the project activity serves the two fold objective of reduction of low pressure (LP) steam consumption in Urea plant and thereby the fossil fuel consumption in the boiler.

As defined in Sub Step 1(a) of the PDD, there are two alternatives to the project activity, namely Alternative 1: Continuation of existing scenario and Alternative 2: Implementation of the project without CDM consideration.



The project activity “Effective utilization of waste heat by installing vacuum pre-concentrator in urea section” is “first of its kind” in Indian fertiliser industry. There are no similar measures that have been implemented in the Indian Fertilizer industry. Being a novel concept with no precedence, the proponent had to take a huge technological risk by implementing the project activity. Hence, during the planning stages itself, IGF had to face many barriers due to unfamiliarity of technology, unavailability of relevant technical expertise and the uncertainty of the impact of project activity (retrofit measure) on existing process (alternative/ base case).

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity:

Establish that there are realistic and credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a CDM activity. Such realistic and credible barriers may include, among others:

Technological barriers, inter alia:

- *Skilled and/or properly trained labour to operate and maintain the technology is not available, which leads to an unacceptably high risk of equipment disrepair and malfunctioning or other underperformance;*
- *Risk of technological failure: the process/technology failure risk in the local circumstances is significantly greater than for other technologies that provide services or outputs comparable to those of the proposed CDM project activity, as demonstrated by relevant scientific literature or technology manufacturer information.*
- *The particular technology used in the proposed project activity is not available in the relevant region.*

Barriers due to prevailing practice, inter alia:

- *The project activity is the “first of its kind”.*

Other barriers, preferably specified in the underlying methodology as examples.

Technological barriers



The following section describes the technological risk IGF had to undertake, while going ahead with the decision of implementing the project. These risks pose as a serious barrier to implementation of the project activity.

Retrofitting of vacuum pre-concentrator before vacuum concentrator is not a common practice in the Indian fertilizer industry and IGF has done a pioneering effort in taking the initiative in implementing this technology for their project.

During project inception and design stage itself, several technological issues were anticipated by IGF, involving:

- ***Designing of Vacuum pressure:*** The vacuum pressure of the vacuum pre-concentrator plays a vital role in salubrious operation of pre-concentrator and down-stream sections as well as urea plant itself. IGF and the technology supplier M/s Snam Progetti spent considerable time for designing the appropriate vacuum pressure for IGF process condition.
- ***Transfer of urea solution:*** In VPC technology / process, the urea solution is to be transferred from the Vacuum pre-concentrator to the vacuum Concentrator section employing a urea solution pump due to following reasons:
 - In the baseline scenario, urea solution (71% concentration) would get transferred from LP decomposer to Vacuum concentrator due to pressure gradient ($P=4.62$ ata). In project activity case, urea solution (85% concentration) there is no or negligible pressure gradient between Vacuum pre-concentrator and Vacuum concentrator, hence it requires installation of a urea solution pump

Technological Problems envisaged from urea solution pump

The transfer of the urea solution from the vacuum pre-concentrator to the vacuum section is one of the biggest technical challenges inveighed by the team.

Considerable time was spent in selecting an appropriate Pump for urea solution transportation. Since in the project scenario, the urea solution is concentrated up to 85% in the Vacuum pre-



concentrator, for this specific requirement, pumps were not readily available in the market. IGF has contacted few of the pump suppliers for their specific requirement and after various discussion and technical analysis; pump was selected for the urea solution transfer. Still, IGF was wary about the performance of the pump in transferring urea solution of such concentration. Thus, proper operations of the urea solution pump become a vital component in the plant operations.

Moreover, installation of the urea solution pump poses a huge technological risk for the VPC technology on account of its failure due to tripping / malfunctioning.

The urea solution which is transferred by using urea solution pump is 85% concentrated and highly viscous in nature. The temperature of solution is around 104°C to 107°C. The seal of the pump is exposed to the high temperature urea solution on one side and air on the other side. Hence, there is a chance of heat loss of the urea solution through the seal. For this purpose, the seal is kept at a temperature equivalent to urea solution temperature by steam heating. At 85% concentration, the urea solution gets solidified at a temperature of 92°C. If urea solution gets solidified, then the pump trips thus affecting the operations of VPC and vacuum concentrator and subsequently affecting urea production process.

Hence, the technology for steam heating of the seal poses a huge technical risk. The urea solution pump gets tripped on account of failure of this technology, thus affecting the urea production process.

With this apprehension in mind, IGF consulted PDIL (Engineering consultant to IGF) on this issue. PDIL is a reputed and leading government agency which offers design engineering and consultancy to fertilizer industry in India. This problem and associated risks was also discussed during the Monthly Progress Review (MPR) meeting held on 06/03/2000. During these discussions, it was envisaged that the Carbon revenues generated from this project would help in covering up these risks.

Bearing this risk of technological failure of urea solution pump and associated repercussions, IGF had a long deliberation with PDIL about providing a by-pass arrangement to VPC (project activity). IGF provided this suggestion in case of operational failure of the urea solution pump. However, PDIL did not favour this suggestion and by-pass arrangement was not implemented thus exposing the VPC project to a huge technical risk.



Apart from urea solidification problem, the other technological failure risks associated with the pump is malfunctioning of discharge valve. The discharge valve of the pump (which is electronically controlled by DCS) is used to control the flow of urea solution to the vacuum concentrator. This technology (control of discharge valve) poses a huge risk on account of failure of function of discharge valve. If the function of the discharge valve fails, the flow of the urea solution gets affected both in upstream (vacuum pre-concentrator) and downstream (vacuum concentrator), as well as leading to the problem of cavitation. This scenario may again pose risk to the technology leading to disruption in process parameters and operation, which may lead to shut down of the plant and also to cavitation of the pump, which in turn would trip the pump.

The alternative to the project activity i.e. the baseline scenario does not have this equipment (urea solution pump) and thus these barriers do not prevent the implementation of Alternative 1 i.e. continuation of current practice.

- ***Polymer deposition and Lute Choking:*** In VPC technology, urea solution is concentrated to 85% and fed to Vacuum concentrator. In the baseline scenario (Alternative 1), the urea solution concentration fed to Vacuum concentrator was 71%. In vacuum concentrator, the urea solution is further concentrated by means of flashing in flash vessels (MV6 and MV7). The rate of formation of polymer during flashing is dependent on the temperature and concentration of the urea solution. Higher the temperature and concentration of the solution, higher is the rate of formation of polymer. Hence, the technology of concentrating urea solution to 85% and subsequently using in vacuum concentrator poses a huge technical risk, that may lead to disruption of plant operations and thereby production losses.

As discussed above, the rate of polymer formation increases manifold with the increase in concentration. The polymer formation inside the walls of the vacuum concentrator leads to the following problems:



- The polymer deposition on the inner surface of the vessel would affect the vacuum maintained in the vacuum concentrator. Any decrease in vacuum may affect the urea production process and may lead to production losses consequently.
- Further, over a period of time, the polymers formed would coagulate to form lumps, which may choke the outlet of the vacuum concentrator and the transmission line (lute) from vacuum section to prilling tower. This may lead to shutdown of the vacuum concentrator, thereby impacting the urea production.

This problem and associated risks was discussed during the Monthly Progress Review (MPR) meeting held on 06/03/2000. During these discussions, it was envisaged that the Carbon revenues generated from this project would help in covering up these risks.

In addition, the cleaning of the transfer line may also create many difficulties and in case of complete solidification of urea solution inside the transfer line, the pipeline may have to be cut for solid deposition removal, leading to additional requirement of maintenance cost.

The retrofitting of vacuum pre-concentrator technology before vacuum concentrator is not a common practice in the Indian fertilizer industry and IGF is the first plant to retrofit such technology in India.

As mentioned above, the project activity has many operating risks, which may severely impact the urea production process and subsequently production. Under these circumstances, IGF may also incur heavy financial losses and hence CDM revenues would help in covering up the operating risks of the project activity due to technological failure.

Barrier due to prevailing practice:

The retrofit measures taken by IGF in their project activity “Effective utilization of waste heat by installing vacuum pre-concentrator in urea section” is “first of its kind” in Indian fertilizer industry. IGF lacked experience in such a technology and thus have taken a huge risk by implementing the project.

Other Barriers

Barrier to innovation



IGF being an energy conscious organization continuously explores possibility for achieving energy efficiency. IGF felt good potential exists by utilizing enthalpy of process stream which was dumped in cooling tower. With this objective IGF conducted extensive technical studies like process mapping, comprehensive Energy and Mass balance, Pinch analysis etc. in various process streams of urea section. By putting meticulous efforts IGF identified that the off gases (containing unconverted CO₂ and ammonia) from MP decomposer contained substantial amount of enthalpy which was dumped in to cooling water. IGF decided to utilise the enthalpy of off gases to pre-concentrate urea solution from 71% to 85% in vacuum pre-concentrator before feeding the solution to vacuum concentrator.

Since retrofitting of pre-concentrator before vacuum concentrator was not a common practice and IGF was pioneer in implementing the project in Indian fertiliser industry. IGF contacted technology supplier M/s Snam Progetti for implementing the project activity. The team formed for implementing the project conducted many brainstorming sessions for

- Perfect designing of vacuum pre-concentrator
- Optimising the vacuum pre-concentrator operation according to prevailing process conditions

IGF faced many barriers/difficulties during project designing:

- The vacuum pressure of the pre-concentrator plays a vital role in salubrious operation of pre-concentrator and down-stream sections as well as urea plant itself. IGF spent substantial time for designing the appropriate vacuum pressure for IGF process condition
- The various critical parameters like polymer deposition in pre-concentrator, biuret component in urea, transfer (flow rate, suction head) of urea solution from pre-concentrator to vacuum section etc. were to be considered while designing and which increased the IGF efforts manifold

By implementing the project activity, IGF has faced such barriers which would not be faced in the baseline scenario.

The gestation period of the project activity was about 1 year; hence the project was to be implemented along with the plant operation. The urea section contains highly flammable and hazardous material. IGF faced many difficulties during project construction and fabrication; due care and extra safety precautions were needed during foundation laying, welding, piping and other stages of project implementation. IGF needed highly skilled and trained manpower for project commissioning.



Sub-step 3b. Show that the identified barriers would not prevent a wide spread implementation of at least one of the alternatives (accepted the proposed project activity already considered in step 3a):

As defined in Sub Step 1(a), there are two alternatives to the project activity, namely continuation of existing scenario and implementation of the project without CDM consideration.

Alternative 1 for the proposed project activity “Effective utilization of waste heat by installing vacuum pre-concentrator in urea section” is the continuation of current practice. In the existing system, urea solution (71 % concentrated) is transferred to vacuum section using the pressure gradient between the low pressure and vacuum section and hot off gases from the medium pressure section is cooled by cooling water from cooling tower before recycling to high pressure urea section. The barriers identified in sub-step 3 (a) like problems associated with urea solution pump, polymer deposition, lute choking etc. are relevant only if the project activity is implemented. Hence in case of Alternative 1 i.e. continuation of current practice, these barriers do not exist and thus would not prevent its implementation.

Step 4 : Common Practice Analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Provide an analysis of any other activities implemented previously or currently underway that are similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities are not to be included in this analysis. Provide documented evidence and, where relevant, quantitative information. On the basis of that analysis, describe whether and to which extent similar activities have already diffused in the relevant region.

IGF being an energy conscious and responsible organization realizes that energy conservation and environmental benign activities are key parameters for better future of the businesses and continuously explores the possibility implementing certain schemes to achieve better energy efficiency.

Urea Fertiliser plants are based on complex and integrated processes and retrofitting energy efficient technology like VPC technology in existing operating system has high risk as this may affect the existing



process parameters and equipments and may lead to malfunctioning of equipments and disruption in operation.

Out of 33 urea plants in India, IGF is the first plant to retrofit the VPC technology in their existing urea production process. PDIL is a reputed and leading government agency which offers design engineering and consultancy to fertilizer industries in India. PDIL has vast experience in providing consulting for many energy saving projects in the fertilizer industry.

This substantiates that implementing VPC project in existing plant is not a common practice in India, due to unforeseen risks associated with VPC project which may lead to malfunctioning of equipment, stoppage of plant, resulting in heavy financial losses.

Sub-step 4b. Discuss any similar options that are occurring:

If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive (as contended in Step 2) or faces barriers (as contended in Step 3). Therefore, if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially unattractive or subject to barriers. This can be done by comparing the proposed project activity to the other similar activities, and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially attractive (e.g., subsidies or other financial flows) and which the proposed project activity cannot use or did not face the barriers to which the proposed project activity is subject.

Essential distinctions may include a serious change in circumstances under which the proposed CDM project activity will be implemented when compared to circumstances under which similar projects were carried out. For example, new barriers may have arisen, or promotional policies may have ended, leading to a situation in which the proposed CDM project activity would not be implemented without the incentive provided by the CDM. The change must be fundamental and verifiable.

Since the project activity is “first of kind” in India, therefore this step is not applicable.



Step 5. Impact of CDM Registration

CDM fund will help in mitigating the effects of barriers identified above. Following impacts of CDM fund are identified from the point of view of removal of barriers discussed above.

1. Supplementary coverage will be provided to the operating risk due to failure of project, shut down of plant and loss of production.
2. Training can be provided to the employees of IGF for understanding operational accuracies and mitigation of risks associated.
3. Research and Development activities will be encouraged in the field of mitigation measures, technology replication and GHG abatement.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The methodology used for the project activity addresses the improvement of energy efficiency by reducing steam consumption in industrial processes. Methodology uses three -point approach. In this approach, based on historical data (One year data before implementation of the project) from the existing process, a benchmark Specific Steam Consumption Ratio (SSCR, steam consumption per product output) is defined as the baseline energy efficiency. The improvement of the benchmark after project implementation is monitored and the corresponding steam savings and CO₂ emission reductions from fuel combustion in the boiler are determined. The effect of possible increases in electricity consumption as a result of the project activity and the impact of future retrofits are captured. Also their impact on steam and CO₂ savings accounted.

Estimation of Emission Reduction:

The Specific Steam Consumption Ratio in the *project scenario* is estimated as per the methodology as follows:

Step 1: Monitor actual output²

² Urea production is calculated on the basis of ammonia consumption in urea plant (which is monitored by online integrator using flow meter) and ammonia to urea conversion factor. The Ammonia to Urea conversion factor is verified time to time.



Actual output (P_{act}) is monitored and analyzed.

Step 2: Determine representative output

The representative output rate (Urea Production) for the day (Prep1) is determined by the representative output values for Urea production within the normal production range. The normal production rate has been defined as +5% of nameplate capacity. Verifiable name plate capacity of the plant (Tonnes/day) is determined as ratio of allowed urea production quantity of the year and operating days of that year. This approach is adopted since it is more representing the capacity of the plant.

Step 3: Monitor steam consumption

Steam consumption is measured through online monitoring system (integrator) with respect to urea production.

Step 4: Determine representative steam consumption

Representative steam consumption for the day (Srep1) is determined with respect to representative Urea Production for the day (Prep1).

Step 5: Estimation of Specific Steam Consumption Ratio in the project scenario ($SSCR_1$)

$$SSCR_1 = \frac{S_{rep1}}{P_{rep1}}$$

Where

$SSCR_1$ = Specific Steam Consumption Ratio for the project activity

S_{rep1} = Representative steam consumption for the day (corresponding to P_{rep1}) (TPD)

P_{rep1} = Representative Urea production for the day (TPD)

For the days when the Urea production is not in normal range $\pm 5\%$ of nominal output, maximum value of $SSCR_1$ for the month is taken. As well as when urea production is not within the normal range of $\pm 5\%$ of rated capacity for all the days in a month (say x month), then maximum $SSCR$ of the previous month prior to the referenced month (x month) would be considered for estimating $SSCR_1$. This is conservative value to estimate CER.

Step 6: Estimate the difference in $SSCR$ of baseline and project scenarios ($SSCR_{diff}$)

$$SSCR_{diff} = SSCR - SSCR_1$$



Where

$SSCR_{diff}$ = difference in SSCR of baseline and project scenario

$SSCR$ = Specific Steam Consumption Ratio in the baseline

$SSCR_j$ = Specific Steam Consumption Ratio for the project activity

Step 7: Estimate net daily reduction in LP steam consumption (S_{net})

$$S_{net} = SSCR_{diff} \times P_{act}$$

Where

S_{net} = Net reduction in LP steam consumption per day (Tonnes/day)

$SSCR_{diff}$ = difference in SSCR of baseline and project scenario

P_{act} = Actual value of urea production for the day (Tonnes).

Step 8: Estimate the net daily reduction in energy due to reduction in steam consumption (E_{net})

$$E_{net} = S_{net} \times E_s$$

Where

E_{net} = Net reduction in LP steam energy consumption per day (kcal/day)

S_{net} = Net reduction in LP steam consumption per day (Tonnes/day)

E_s = Net enthalpy of LP steam consumed in urea section (kcal/kg).

And

$$E_s = E_{tot} - E_{CW}$$

Where

E_s = Net enthalpy of LP steam consumed in urea section (kcal/kg)

E_{tot} = Enthalpy of LP steam of urea section (kcal/kg)

E_{CW} = Enthalpy of condensate of urea section (kcal/kg)

Step 9: Estimate daily reduction in input energy to the boiler (E_{in})

$$E_{in} = E_{net} / \eta_b$$

Where

E_{in} = Energy input for LP steam reduction in boiler

E_{net} = Net reduction in LP steam energy consumption per day (kCal/day)



η_b = Efficiency of boiler

Step10: Estimate CO₂ emission reductions (C_{er}) in the boiler per day

$$C_{er} = E_{in} \times \sum (F_{fuel} \times \%H_{fuel})$$

Where

C_{er} = CO₂ emission reductions in the boiler per day

E_{in} = Energy input for LP steam in boiler

F_{fuel} = Carbon emission factor for fuel

$\%H_{fuel}$ = % of hours per day of fuel.

(Assumption – The fuel (used in the boiler) having Lowest emission factor is considered for all emission reduction calculation to maintain conservativeness)

Step 11: Estimate additional CO₂ emissions due to additional electrical load in project scenario (C_{add})

Following steps are followed to estimate the additional CO₂ emissions due to electric motor.

Sub-step 1: The maximum rating / Nameplate data of the motor is taken.

Sub-step 2: Estimate the average daily electricity consumption (E_{avg}).

Sub-step 3: Estimate daily input energy (E_{add}) to the electrical energy source

The emission is resulted due to operation of some additional new motor installed during implementation of the energy savings scheme. The formulae used to calculate the emissions are given below:

$$E_{add} = ((P_{to} \times H_d) \times 0.0036) / (\eta_g)$$

Where:

E_{add} = Daily input energy to the electrical energy source (GJ/day)

H_d = No of operating hours in a day (24 hrs/day)

P_{tot} = Capacity of additional motors (kW)

η_g = Efficiency of captive power plant based on historical data

Sub-step 4: Estimate CO₂ emissions

$$C_{add} = E_{add} \times D_y \times F_n$$

Where:



C_{add} = Increase in CO₂ emissions due to increase in power consumption (TCO₂e/day)

E_{add} = daily input energy to the electrical energy source (GJ/day)

D_y = No of working days in a year (day/year)

F_n = Emission factor of fuel (Natural gas as per IPCC-guidelines) (TCO₂e / GJ)

Step 12: Estimate the net CO₂ emission reductions due to project

$$C_{emet} = C_{er} - C_{add} - \text{Leakage}$$

Where

C_{emet} = net CO₂ emission reductions due to the project (t CO₂/day)

C_{er} = CO₂ emission reductions in the boiler per day (t CO₂/day)

C_{add} = CO₂ emissions due to additional electrical load in project scenario (t CO₂/day)

Leakage

No leakage is envisaged for this type of projects.

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

| Data / Parameter: | Representative Urea Production Rate |
|---|--|
| Data unit: | Ton/day |
| Description: | Urea Production Rate |
| Source of data used: | PRC Report |
| Value applied: | 2575 Ton/day |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Urea production is calculated on the basis of measured ammonia consumption in urea plant (which is monitored by online integrator using flow meter) and ammonia to urea conversion factor. The ammonia to Urea conversion factor is verified time to time. |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |



| | |
|---|---|
| Data / Parameter: | Low Pressure (LP) Steam Consumption |
| Data unit: | Ton/Day |
| Description: | Low pressure Steam Consumption in Urea Plant |
| Source of data used: | Log sheet |
| Value applied: | 1698 Ton/day |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | <p>This parameter is measured through online monitoring system (integrator). Steam flow rate is measured using the flow meter of Accuracy $\pm 0.3\%$.</p> <p>This parameter is used to calculate the representative steam consumption for the day corresponding to representative output rate (Urea production) in the baseline scenario.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|---|--|
| Data / Parameter: | Power consumption by additional Pump / motors |
| Data unit: | GJ/day |
| Description: | Power consumption by additional Pump / motors |
| Source of data used: | Design specification of the Motor |
| Value applied: | 3.8 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Power consumption by additional Pump / motors is estimated on the basis of design data supplied by the equipment supplier. This parameter is used to calculate the equivalent CO ₂ emissions due to additional power requirement for running the pump/motor in the post project scenario. |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|--------------------------|--|
| Data / Parameter: | Efficiency of power generation system |
|--------------------------|--|



| | |
|---|--|
| Data unit: | % |
| Description: | Efficiency of power generation system (NG based gas turbine) |
| Source of data used: | Plant Record |
| Value applied: | 72.20 % |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Efficiency of power generation system (Natural gas based gas turbine) is calculated. This parameter is used to calculate the additional power requirement due to project activity. |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|---|---|
| Data / Parameter: | Natural gas Emission factor |
| Data unit: | tCO ₂ /GJ |
| Description: | Emission factor of Natural gas (fuel used in power generation system) |
| Source of data used: | IPCC |
| Value applied: | 0.0561 tCO ₂ /GJ |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | IPCC default value. This parameter is used to calculate the equivalent CO ₂ emissions due to additional power requirement due to project activity. |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|--|---|
| Data / Parameter: | Natural gas Emission factor |
| Data unit: | tCO ₂ /GJ |
| Description: | Emission factor of Natural gas (fuel used in service boiler) |
| Source of data used: | IPCC |
| Value applied: | 0.0561 tCO ₂ /GJ |
| Justification of the choice of data or | IPCC default value. This parameter is used to emission reduction calculation. |



| | |
|--|---|
| description of measurement methods and procedures actually applied : | |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs late |

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

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Baseline Specific Steam Consumption Ratio (SSCR)

Specific Steam Consumption Ratio in the baseline scenario is estimated as per the methodology as follows:

$$SSCR = \frac{S_{rep}}{P_{rep}}$$

Where

$SSCR$ = Specific Steam Consumption Ratio for the project activity

S_{rep} = Representative steam consumption for the day (corresponding to P_{rep}) (TPD)

P_{rep} = Representative Urea production for the day (TPD)

For the days when the Urea production is not in normal range $\pm 5\%$ of nominal output, minimum value of SSCR for the month is taken. This is conservative value to estimate CER.

SSCR of the Baseline case = 0.65 Ton of LPsteam consumed/ Ton of Urea produced (*please refer Base case sheet of CER calculation excel sheet*)

The specific steam consumption ratio (SSCR-Tonne of LP steam consumed / Tonne of Urea Produced) of Urea section at baseline scenario is calculated from the daily data records for one year period (July 2000-June 2001) before implementation of the project activity.

Project Activity Specific Steam Consumption Ratio (SSCR₁)

The Specific Steam Consumption Ratio in the project scenario is estimated as per the methodology as follows:

$$SSCR_1 = \frac{S_{rep1}}{P_{rep1}}$$

Where



$SSCR_I$ = Specific Steam Consumption Ratio for the project activity

S_{rep1} = Representative steam consumption for the day (corresponding to P_{rep1}) (TPD)

P_{rep1} = Representative Urea production for the day (TPD)

For the days when the Urea production is not in normal range $\pm 5\%$ of nominal output, maximum value of $SSCR_I$ for the month is taken. As well as when urea production is not within the normal range of $\pm 5\%$ of rated capacity for all the days in a month (say x month), then maximum $SSCR$ of the previous month prior to the referenced month (x month) would be considered for estimating $SSCR_I$. This is conservative value to estimate CER.

SSCR of the Project case = 0.45 Ton of LP steam consumed/Tonne of Urea produced (please refer Project case sheet of CER calculation excel sheet)

Estimate net daily reduction in LP steam consumption (S_{net})

$$S_{net} = SSCR_{diff} \times P_{act}$$

Where

S_{net} = Net reduction in LP steam consumption per day (kg/day)

$SSCR_{diff}$ = difference in $SSCR$ of baseline and project scenario

P_{act} = Actual value of urea output on the day.

Reduction in LP steam consumption due to project activity = 576.90 Ton of LP steam /day

= 24.03 Ton of LP steam /hour

Estimate the net daily reduction in energy due to reduction in steam consumption (E_{net})

$$E_{net} = S_{net} \times E_s$$

Where

E_{net} = Net reduction in LP steam energy consumption per day (kcal/day)

S_{net} = Net reduction in LP steam consumption per day (kg/day)

E_s = Net enthalpy of LP steam consumed in urea section (kcal/kg).

And

$$E_s = E_{tot} - E_{CW}$$

Where



E_s = Net enthalpy of LP steam consumed in urea section (kcal/kg)

E_{tot} = Enthalpy of LP steam of urea section (kcal/kg)

E_{CW} = Enthalpy of condensate of urea section (kcal/kg)

Net reduction in LP steam energy consumption per day = 353211413.55 kcal/day

Estimate daily reduction in input energy to the boiler (E_{in})

$$E_{in} = E_{net} / \eta_b$$

Where

E_{in} = Energy input for LP steam reduction in boiler (kCal/day)

E_{net} = Net reduction in LP steam energy consumption per day (kCal/day)

η_b = Efficiency of boiler

Energy input for LP steam reduction in boiler = 399108941.9 (kCal/day)

| | | | |
|---|---|--------------|--|
| Amount of LP steam saved | = | 24.03 | TPH |
| Enthalpy LP steam (3.5kg/cm2 and 145 °C) | = | 655 | kcal/kg |
| Enthalpy value of Process condensate (43°C and atmospheric Pressure) | = | 43 | kcal/kg |
| Net Enthalpy of LP Steam saved | = | 612 | kcal/kg |
| SSCR of the Baseline case | = | 0.65 | Ton of LP steam consumed/ Ton of Urea produced |
| SSCR of the Project case | = | 0.45 | Ton of LP steam consumed/ Ton of Urea produced |
| SSCR Difference | = | 0.20 | Ton of LP steam consumed/ Ton of Urea produced |
| Daily Reduction in LP Steam Consumption | = | 576902.46 | kg/day |
| Daily energy reduction due to reduction in LP Steam Consumption | = | 353211413.55 | kcal/ day |
| Daily reduction in energy Input to Boiler | = | 399108941.9 | kcal/ day |

Estimate CO₂ emission reductions (C_{er}) in the boiler per day



$$C_{er} = E_{in} \times \sum (F_{fuel} \times \%H_{fuel})$$

Where

C_{er} = CO₂ emission reductions in the boiler per day

E_{in} = Energy input for LP steam in boiler

F_{fuel} = Carbon emission factor for fuel

$\%H_{fuel}$ = % of hours per day of fuel.

(Assumption – The fuel (used in the boiler) having Lowest emission factor is considered for all emission reduction calculation to maintain conservativeness)

Estimate additional CO₂ emissions due to additional electrical load in project scenario (C_{add})

The emission is resulted due to operation of some additional new motor installed during implementation of the energy savings scheme. The formulae used to calculate the emissions are given below:

$$C_{add} = (P_{to} \times F_n \times H_d) / (1000 \times \eta_g)$$

Where:

C_{add} = Increase in CO₂ emissions due to increase in power consumption (Te/day)

F_n = Emission factor of fuel _n used (as per IPCC-guidelines (IPCC) (Te / GJ)

H_d = No of operating hours in a day (24 hrs/day)

P_{tot} = Power consumption of additional motor (GJ/day)

η_g = Efficiency of electricity generating system based on historical data (assumed constant)

CO₂ emission due to operation of additional motor = 104 tCO₂ / year

| | | |
|---|---------------|-----------------------------|
| Power consumption by additional motor (2 No) | 44 | kW |
| Efficiency of GTG | 72.20% | |
| Emission factor of NG | 0.0561 | tCO₂ / GJ |
| Operating hours | 24 | Hrs/day |



| | | |
|---|------------|-------------------------------|
| Operating days | 351 | Day/year |
| Daily input energy to the electrical energy source | 3.8 | GJ/day |
| CO₂ emission due to operation of additional motor | 104 | tCO₂ / year |

Estimate the net CO₂ emission reductions due to project

$$C_{\text{emet}} = C_{\text{er}} - C_{\text{add}}$$

Where

C_{emet} = net CO₂ emission reductions due to the project (t CO₂/day)

C_{er} = CO₂ emission reductions in the boiler per day (t CO₂/day)

C_{add} = CO₂ emissions due to additional electrical load in project scenario (t CO₂/day)

Estimated leakage

There is no leakage due to this project activity

Baseline Emission

Baseline emission (tCO₂) = 108607 t CO₂ / year (Please refer CER Calculation)

Project Activity Emission

Yearly Project emissions³ in tones of CO₂e = 75704 tCO₂

CO₂ emission due to operation of additional motor = 104 tCO₂ / year

Yearly Project activity Emission (tCO₂ / y) = 75704 + 104 = 75807 tCO₂ / y

Annual Emission Reduction

$$\begin{aligned} \text{Annual Emission Reduction (tCO}_2 \text{ / year)} &= \text{Baseline Emission} - \text{Project Emission} - \text{Leakage} \\ &= 108607 - 75807 - 0 \\ &= \mathbf{32800 \text{ tCO}_2 \text{ / year}} \end{aligned}$$

³ Please Refer CER Calculation excel sheet for detail calculation

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

>>

| Year | Estimation of Project Activity Emissions (tCO ₂ e) | Estimation of Baseline Emissions (tCO ₂ e) | Estimation of Leakage (tCO ₂ e) | Estimation of Overall Emission Reductions (tCO ₂ e) |
|--|---|---|--|--|
| 2007-2008 | 75807 | 108607 | 0 | 32800 |
| 2008-2009 | 75807 | 108607 | 0 | 32800 |
| 2009-2010 | 75807 | 108607 | 0 | 32800 |
| 2010-2011 | 75807 | 108607 | 0 | 32800 |
| 2011-2012 | 75807 | 108607 | 0 | 32800 |
| 2012-2013 | 75807 | 108607 | 0 | 32800 |
| 2013-2014 | 75807 | 108607 | 0 | 32800 |
| 2014-2015 | 75807 | 108607 | 0 | 32800 |
| 2015-2016 | 75807 | 108607 | 0 | 32800 |
| 2016-2017 | 75807 | 108607 | 0 | 32800 |
| Total estimated reductions for 10 years (tonnes of CO₂e) | 758070 | 1086070 | 0 | 328000 |

B.7 Application of the monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:**

| | |
|--|--------------------------------|
| Data / Parameter: | Representative Urea Production |
| Data unit: | Ton/day |
| Description: | Urea Production Rate |
| Source of data to be used: | PRC Report |
| Value of data applied for the purpose of | 2944.2 Ton/day |



| | |
|--|---|
| calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | Urea production is calculated on the basis of ammonia consumption in urea plant (which is monitored by online integrator using flow meter) and ammonia to urea conversion factor. The ammonia to Urea conversion factor is verified time to time. |
| QA/QC procedures to be applied: | <p>The parameter is calculated on the basis of hot ammonia consumption in Urea plant which is measured by integrator and logged in PRC Report (which is a controlled ISO document). Based on the logged data and ammonia to urea conversion factor a report on urea production is prepared by Process (MIS) Engineer in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The PRC Report which is ISO document is audited regularly according to ISO procedure.</p> <p>The instruments used for monitoring data are calibrated once in a year.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|----------------------------|--|
| Data / Parameter: | LP Steam Flow Rate |
| Data unit: | Ton/day |
| Description: | Low Pressure steam consumption in urea plant |
| Source of data to be used: | Log sheet |
| Value of data applied | 1291.37 Ton/day |



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| for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | LP Steam flow rate is measured through online monitoring system (integrator). LP steam consumption in urea plant is measured using the flow meter with accuracy of $\pm 0.3\%$. This parameter is used to calculate the representative steam consumption for the day corresponding to representative Urea production of the day. |
| QA/QC procedures to be applied: | <p>The parameter is monitored and logged in log sheets (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting an inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The control panel log sheet which is ISO document is audited regularly according to ISO procedure.</p> <p>The instruments used for monitoring data are calibrated once in a year and calibration procedure no INM-P-09 is used for calibrating instruments.</p> |
| Any comment: | The data would be archived until 2 years after end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. |

| | |
|----------------------------|--------------------------------|
| Data / Parameter: | LP Steam Pressure |
| Data unit: | kg/cm ² (g) |
| Description: | Pressure of low pressure steam |
| Source of data to be used: | Log sheet |



| | |
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| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 3.5 kg/cm ² |
| Description of measurement methods and procedures to be applied: | LP Steam Pressure is measured in the plant premises, using pressure gauge with accuracy of ± 0.3 %. This parameter is used to calculate the Net enthalpy of LP steam. |
| QA/QC procedures to be applied: | <p>The parameter is monitored and logged in log sheets (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The control panel log sheet which is ISO document is audited regularly according to ISO procedure.</p> <p>The instruments used for monitoring data are calibrated once in a year and calibration procedure no INM-P-09 is used for calibrating instruments.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

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|--|-----------------------------------|
| Data / Parameter: | LP Steam Temperature |
| Data unit: | °C |
| Description: | Temperature of low pressure steam |
| Source of data to be used: | Log sheet |
| Value of data applied for the purpose of | 145 °C |



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| calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | LP Steam Temperature is measured in the plant premises by using temperature sensor, with accuracy of $\pm 1\%$. This parameter is used to calculate the Net Enthalpy of LP steam. |
| QA/QC procedures to be applied: | <p>The parameter is monitored and logged in log sheets (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The control panel log sheet which is ISO document is audited regularly according to ISO procedure.</p> <p>The instruments used for monitoring data are calibrated once in a year and calibration procedure no INM-P-09 is used for calibrating instruments.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|--|---|
| Data / Parameter: | Process Condensate water Temperature |
| Data unit: | $^{\circ}\text{C}$ |
| Description: | Temperature of Process Condensate water |
| Source of data to be used: | Log sheet |
| Value of data applied for the purpose of calculating expected emission reductions in | 43°C |



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| section B.5 | |
| Description of measurement methods and procedures to be applied: | Process Condensate water Temperature is measured in the plant premises by using temperature sensor of accuracy $\pm 0.6\%$. This parameter is used to calculate the useful heat transfer in process by LP steam. |
| QA/QC procedures to be applied: | <p>The parameter is monitored and logged in log sheets (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The control panel log sheet which is ISO document is audited regularly according to ISO procedure.</p> <p>The instruments used for monitoring data are calibrated once in a year and calibration procedure no INM-P-09 is used for calibrating instruments.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

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|--|---|
| Data / Parameter: | Steam Generation Rate of Boiler |
| Data unit: | Ton/day |
| Description: | High pressure steam generated by the boiler |
| Source of data to be used: | Log sheet |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 1774.8 Ton/day |



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| Description of measurement methods and procedures to be applied: | HP Steam generation by the boiler is measured in the plant premises by using flow meter of accuracy $\pm 0.6\%$. This parameter is used to calculate the boiler efficiency. |
| QA/QC procedures to be applied: | <p>The parameter is monitored and logged in log sheets (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The control panel log sheet which is ISO document is audited regularly according to ISO procedure.</p> <p>The instruments used for monitoring data are calibrated once in a year and calibration procedure no INM-P-09 is used for calibrating instruments.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

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|--|--|
| Data / Parameter: | HP Steam Pressure |
| Data unit: | kg/cm ² (g) |
| Description: | Pressure of HP steam generated by boiler |
| Source of data to be used: | Log sheet |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 109 kg/cm ² (g) |
| Description of measurement methods and procedures to be applied: | Pressure of HP steam is measured in the plant premises by using pressure gauge of accuracy $\pm 0.6\%$. This parameter is used to calculate the efficiency of boiler. |



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| QA/QC procedures to be applied: | <p>The parameter is monitored and logged in log sheets (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The control panel log sheet which is ISO document is audited regularly according to ISO procedure.</p> <p>The instruments used for monitoring data are calibrated once in a year and calibration procedure no INM-P-09 is used for calibrating instruments.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

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|--|---|
| Data / Parameter: | HP Steam Temperature |
| Data unit: | °C |
| Description: | Temperature of HP steam generated by boiler |
| Source of data to be used: | Log sheet |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 514 °C |
| Description of measurement methods and procedures to be applied: | Temperature of HP steam generated by boiler is measured in the plant premises by using temperature sensor; with accuracy of $\pm 1\%$. This parameter is used to calculate the efficiency of boiler. |
| QA/QC procedures to be applied: | The parameter is monitored and logged in log sheets (which is a controlled ISO |



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| | <p>document). Based on the logged data and a report consisting of the parameter is prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The control panel log sheet which is ISO document is audited regularly according to ISO procedure.</p> <p>The instruments used for monitoring data are calibrated once in a year and calibration procedure no INM-P-09 is used for calibrating instruments.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

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|--|--|
| Data / Parameter: | Boiler Feed Water Temperature |
| Data unit: | °C |
| Description: | Boiler Feed Water Temperature |
| Source of data to be used: | Log sheet |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 124 °C |
| Description of measurement methods and procedures to be applied: | Boiler feed water temperature is measured in the plant premises by using temperature sensor with accuracy of $\pm 0.6\%$. This parameter is used to calculate the efficiency of boiler. |
| QA/QC procedures to be applied: | The parameter is monitored and logged in log sheets (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is |



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| | <p>prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The control panel log sheet which is ISO document is audited regularly according to ISO procedure.</p> <p>The instruments used for monitoring data are calibrated once in a year and calibration procedure no INM-P-09 is used for calibrating instruments.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

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|--|--|
| Data / Parameter: | Quantity of fuel (s) used in the boiler(s) |
| Data unit: | Nm ³ /day for Natural gas, kL/day for Naphtha |
| Description: | Quantity of fuels used in the boiler (Natural gas/ Naphtha) |
| Source of data to be used: | PRC Report |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 117801 Nm ³ /day (Natural gas) 48 kL/day (Naphtha) |
| Description of measurement methods and procedures to be applied: | This parameter is measured in the plant premises by using flow meter of accuracy $\pm 0.6\%$. This parameter is used to calculate the efficiency of boiler. |
| QA/QC procedures to be applied: | The parameter is monitored and logged in PRC Report (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Process (MIS) Engineer in soft copy and is forwarded to CDM Coordinator through email on monthly basis. |



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| | <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The PRC Report which is ISO document is audited regularly according to ISO procedure.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|--|--|
| Data / Parameter: | Boiler Efficiency |
| Data unit: | % |
| Description: | Efficiency of boiler |
| Source of data to be used: | Calculated |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 88.5% |
| Description of measurement methods and procedures to be applied: | Boiler efficiency calculated monthly, direct method (based on heat balance) is used for the efficiency calculation. |
| QA/QC procedures to be applied: | <p>This parameter is calculated and logged in log sheets (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for</p> |



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| | <p>Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The control panel log sheet which is ISO document is audited regularly according to ISO procedure.</p> |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|--|--|
| Data / Parameter: | Calorific value of Natural gas |
| Data unit: | kcal/Nm ³ |
| Description: | NCV of Natural gas used in the boiler |
| Source of data to be used: | PRC Report |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 8230 kcal/Nm ³ |
| Description of measurement methods and procedures to be applied: | NCV of the Natural gas is estimated by ultimate analysis of Natural gas. This parameter is used for Boiler efficiency calculation. |
| QA/QC procedures to be applied: | <p>The parameter supplied with every delivery of fuel by fuel supplier is logged in PRC Report (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Process (MIS) Engineer in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The PRC Report which is ISO document is audited regularly according to ISO procedure.</p> |



| | |
|--------------|---|
| | The instruments used for monitoring data are calibrated once in a year and calibration procedure no GAIL/JAG/FTL/2006/02 is used for calibrating instruments. |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|--|--|
| Data / Parameter: | Calorific value of Naphtha |
| Data unit: | kcal/kg |
| Description: | NCV of Naphtha used in the boiler |
| Source of data to be used: | PRC Report |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 10600 kcal / kg |
| Description of measurement methods and procedures to be applied: | NCV of the Naphtha is estimated by ultimate analysis of Naphtha. This parameter is used for Boiler efficiency calculation. |
| QA/QC procedures to be applied: | <p>The parameter supplied with every delivery of fuel by fuel supplier is logged in PRC Report (which is a controlled ISO document). Based on the logged data and a report consisting of the parameter is prepared by Process (MIS) Engineer in soft copy and is forwarded to CDM Coordinator through email on monthly basis.</p> <p>The data used is reviewed by conducting a inter department review meeting once in 3 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.</p> <p>The PRC Report which is ISO document is audited regularly according to ISO procedure.</p> |



| | |
|--------------|---|
| | The instruments used for monitoring data are calibrated once in a year and calibration procedure no GAIL/JAG/FTL/2006/02 is used for calibrating instruments. |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

| | |
|--|--|
| Data / Parameter: | Retrofit |
| Data unit: | - |
| Description: | Event as and when occur |
| Source of data to be used: | Plant Record |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | - |
| Description of measurement methods and procedures to be applied: | Follow Retrofit Monitoring Test as given in monitoring methodology of AM0018. |
| QA/QC procedures to be applied: | As per the methodology |
| Any comment: | The data will be archived until 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later |

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|--|
| B.7.2 Description of the monitoring plan: |
|--|

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Approved monitoring methodology “Monitoring methodology for steam optimization systems” AM0018 / Version 01.1, Sectoral Scope: 3 (6 December 2004) is applied for the project activity.

As per the requirement of monitoring methodology, following parameters are monitored:

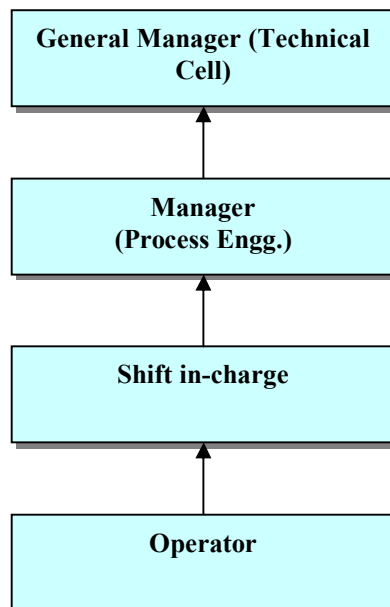
- Urea Production
- LP Steam consumption in urea plant
- LP Steam Temperature
- LP Steam Pressure
- Process Condensate water Temperature



- HP Steam Temperature
- HP Steam Pressure
- Boiler Feed Water Temperature
- Steam Generation Rate of Boiler
- Fuel consumption in the Boiler
- Net calorific value of fuel
- Boiler efficiency (Calculated)

Detailed Monitoring plan is given in Annex-4.

Structure of IGF Staff



IGF is an ISO-9001 as well as ISO-14001 company. The above parameters are monitored by the operator according to procedure prescribed in ISO manual. The parameters (mentioned above table) are monitored and logged log sheets (which is a controlled ISO document). Based on the logged data and recorded in panel log sheets, a report consisting of above parameters is prepared by Shift in charge in soft copy and is forwarded to CDM Coordinator through email on monthly basis. The report received from the respective department through e-mail is compiled by Coordinator CDM. The reports will be retained till 2 years after the end of crediting period or the last issuance of CERs for this project activity, which ever occurs later. A



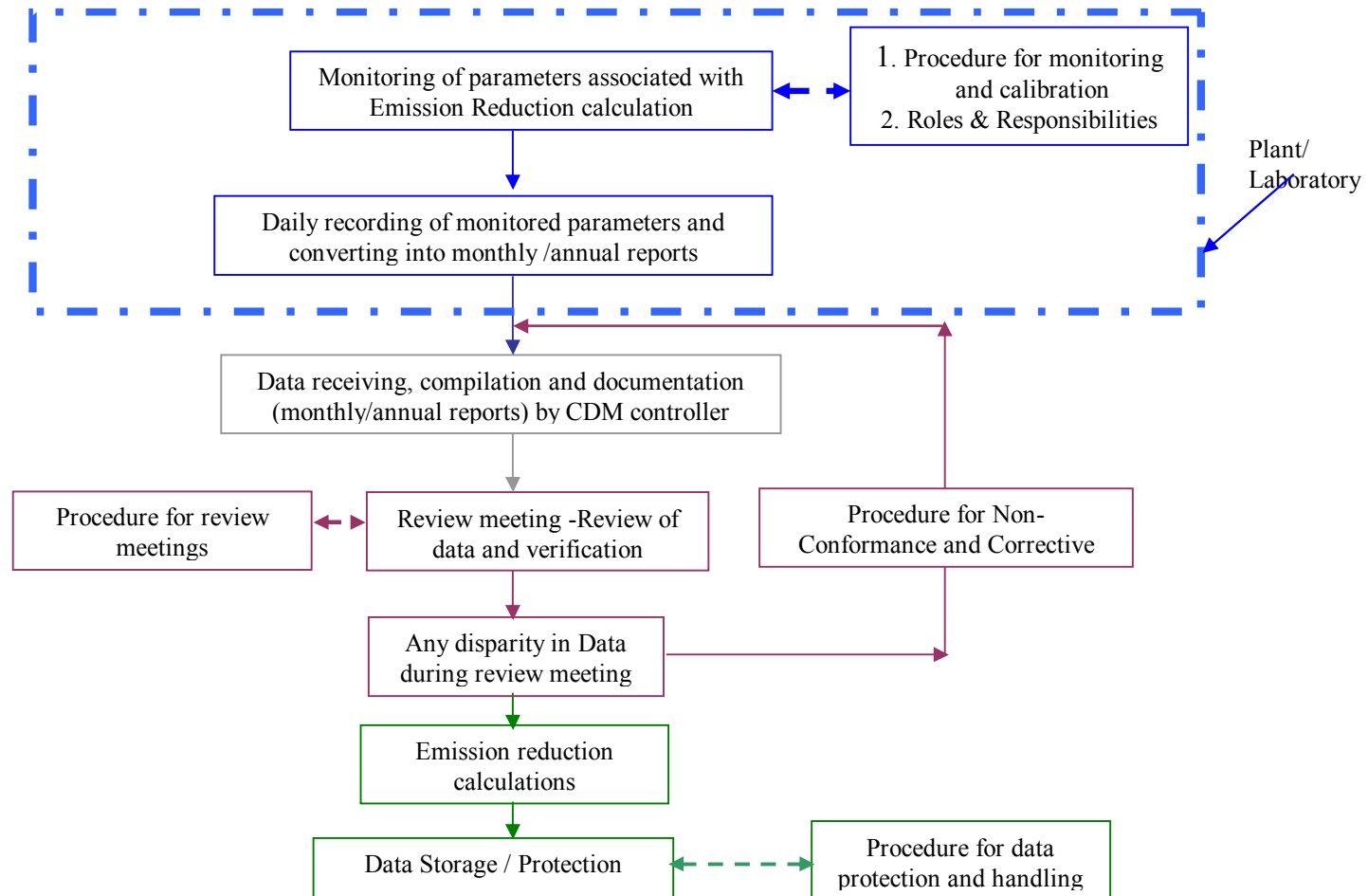
CDM manual is prepared, which illustrates the detailed roles and responsibilities of individuals involved in project activity.

To ascertain the Quality Control and Quality Assurance of the monitored parameters following procedure is adopted:

- The data used is reviewed by conducting a inter department review meeting once in 6 months. The Coordinator CDM will discuss the data (received from respective departments) with CDM Team member of concerned departments. Once the data is compiled and checked, it will be handed over to Verifier (IGF official) for Verification. After data verification, Auditor (IGF official) will be informed to carry out the Audit for concerned data.
- The control panel log sheet which is ISO document is audited regularly according to ISO procedure.
- The instruments used for monitoring data are calibrated once in a year and calibration procedure no INM-P-09 is used for calibrating instruments.



The flow chart for CDM data monitoring, recording and storage is given below:



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

>>

Approved baseline and monitoring methodology AM0018 (version 01.1, 6 December 2004) “Baseline and Monitoring methodology for steam optimization systems” is used for baseline calculation and monitoring plan for the project activity.

Date of completion of the application of the methodology to the project activity study (DD/MM/YYYY)

30/06/2006

Contact information of the persons(s)/entity (ies) responsible for the application of the baseline and monitoring methodology to the project activity:

Mr. C.K. Dutta

Indo Gulf Fertilisers (A Unit of Aditya Birla Group)

Jagdishpur Industrial Area,

Jagdishpur-227817,

Distt. Sultanpur

Uttar Pradesh (India)

The person / entity is also a project participant as listed in Annex-1 of this document.

**SECTION C. Duration of the project activity / crediting period****C.1 Duration of the project activity:****C.1.1. Starting date of the project activity:**

>>

17/03/2000

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

>>

20 year 0 months

C.2 Choice of the crediting period and related information:**C.2.1. Renewable crediting period**

Not opted

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

>>

Not opted

C.2.1.2. Length of the first crediting period:

>>

Not opted

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

>>

15/10/2007 or the date of registration, which ever occurs later.

The project participant hereby confirms that the crediting period will not commence prior to the date of registration.

C.2.2.2. Length:

>>

10 year 0 months

**SECTION D. Environmental impacts**

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D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

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IGF project activity does not require EIA to be conducted as the activity is not included in schedule I of the Environment Impact Assessment Notification vide S.O. 60 (E) dated 27/01/94 issued by the Ministry of Environment and Forests (MoEF), Government of India.

Article 12 of the Kyoto Protocol requires that a CDM project activity contributes to the sustainable development of the host country. Assessing the project activity's positive and negative impacts on the local environment and on society is thus key element for each CDM project.

The project activity reduces LP steam consumption in urea section and subsequently reduces fuel consumption in boiler, leading to GHG emission reduction. The project activity does not have any significant negative impact on environment. The GHG emission reductions of the project activity benefit the global environment which is a step towards sustainability.

IGF is an ISO 14001 and OHSAS 18001 certified company and IGF religiously follows the norms of Environmental Management, Health and Safety Management Systems. IGF also regularly submits environmental statement to Pollution Control Board (PCB) and has consent to operate the plant.

The nature of the impacts that are evident during the operational phase are discussed in detail in the table given below. The environmental impact during the construction phase is regarded as temporary or short term and hence does not affect the environment significantly.



| SL. NO. | ENVIRONMENTAL IMPACTS & BENEFITS | MITIGATION MEASURES / REMARKS |
|---------|--|--|
| A | CATEGORY: ENVIRONMENTAL – FOSSIL FUEL CONSERVATION | |
| 1 | Fossil fuel conservation: The project activity reduces consumption of fossil fuels like Natural gas, Naphtha used in the boiler. “Natural gas is a finite natural resource” used as fuel to generate power and for production processes. Since the project activity reduces Natural gas and Naphtha consumption it positively contributes towards conservation of Natural gas, Naphtha and making them available for other important applications. | The project activity is a step towards fossil fuel conservation. |
| B | CATEGORY: ENVIRONMENTAL – AIR QUALITY | |
| | The project activity reduces CO ₂ emission and associated environmental degradation. | The project activity reduces emission of CO ₂ -a GHG. |



| SL. NO. | ENVIRONMENTAL IMPACTS & BENEFITS | MITIGATION MEASURES / REMARKS |
|---------|--|-------------------------------|
| C | CATEGORY: ENVIRONMENTAL – WATER | |
| 1 | Water conservation -The project activity reduces LP steam consumption and subsequently reduces the requirement of demineralised water in the boiler. Hence conserving water. There is no possible water pollution arising due to project activity. | - |
| D | CATEGORY: ENVIRONMENTAL – LAND | |
| 1 | Industry has developed Green Belt in and around the plant premises. There is no possible soil or land pollution arising due to project activity. | - |



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:

>>

As discussed above, the project activity would not have any adverse environmental impacts. The project activity does not fall under the purview of the Environmental Impact assessment (EIA) notification of the ministry of Environment and Forest, Government of India. Hence, not required by the host party.

**SECTION E. Stakeholders' comments**

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

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The project activity primarily aims to reduce LP steam consumption in urea section. The project activity involves modifications within the existing operational plant and results in simultaneous benefits of conservation of fuel and achieving energy efficiency of the plant.

Stakeholders have been identified on the basis of their involvement at various stages of project activity. The list of relevant stakeholders includes all the organizations, which were communicated / applied to get necessary clearances. The stakeholders identified for the project are as under:

- Employees of IGF
- Ministry of Environment & Forest (MoEF), Government of India
- Uttar Pradesh Pollution Control Board (UPPCB)

IGF invited employees of various departments like Ammonia, Urea etc for a meeting. During the meeting the various activities carried out by IGF in field of energy efficiency and environment was explained to the employees. IGF informed about techno-economical benefits of the energy efficiency project.

E.2. Summary of the comments received:

>>

Employees appreciated IGF's initiatives and efforts to reduce energy consumption and being environmental friendly. There were no adverse comments received from stakeholders.

Ministry of Environment & Forests (MoEF) would be providing the host country approval for the project activity.

IGF has obtained consent to operate plant and submits regularly environmental statement to UPPCB.

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

>>

There were no adverse comments received from stakeholders.

As per UNFCCC requirement the PDD will be published at the validator's website for public comments.

Annex 1CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|------------------|--|
| Organization: | Indo Gulf Fertilisers (A unit of Aditya Birla Group) |
| Street/P.O.Box: | Jagdishpur Industrial area |
| Building: | |
| City: | Jagdishpur , District Sultanpur |
| State/Region: | Uttar Pradesh |
| Postfix/ZIP: | 227817 |
| Country: | India |
| Telephone: | 05361270032-38 |
| FAX: | (05361)270165-270595 |
| E-Mail: | dattac@adityairla.com |
| URL: | www.indo-gulf.com |
| Represented by: | |
| Title: | JP(Manufacturing & Operation) |
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved from the parties included in Annex I.



Annex 3

BASELINE INFORMATION

Please refer CER calculation excel sheet.



Annex 4

MONITORING INFORMATION

Description of the Monitoring Plan

The Monitoring and Verification (M&V) procedures define a project-specific standard (baseline of historical emissions) against which the project's performance (i.e. GHG reductions) and conformance with all relevant criteria will be monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions with specific focus on specific energy consumption parameters. It also allows scope for review, scrutinize and benchmark all this information against reports pertaining to M & V protocols (MVP).

The purpose of these procedures would be to direct and aegis continuous monitoring of project performance/key project indicators to determine project outcomes, GHG emission reductions. The MVP provides a range of data measurement, estimation and collection options/techniques consistent with good practices to allow project managers and operational staff, auditors, and verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures.

The project profitability is based on direct low pressure steam consumption reduction in Urea section. The steam meters are used to monitor and record the flow of steam used for the system. The project employs latest state of art monitoring and control equipment that measure, record, and control various key parameters.

Parameters monitored will be as follows:

1. The monitoring of quantity of low pressure steam used in Urea section and quantity of urea produced.
2. Monitoring of pressure and temperature of steam and feed water of boiler. Monitoring of quantity of steam generated, fuel consumed in boiler and estimation of boiler efficiency by direct method.
3. Monitoring of retrofits in the urea section for change in baseline and project emissions.

The instrumentation system used for the project is of reputed make, with day-wise recording and feedback facility with desired level of accuracy. All instruments will be calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time.



GHG SOURCES

Direct On-Site Emissions

Direct on-site emissions after implementation of the CDM project arise from net emissions due to use of steam in process and emission due to additional electrical motors. As discussed above, these emissions are monitored and taken into account while estimating net emission reductions of project.

Direct Off-Site Emissions

There is no off-site emission due to the project activity.

Indirect On-Site Emissions

There is no indirect on-site emission due to the project activity.

Indirect Off-Site Emissions

No indirect off-site emissions could occur due to CDM project.

Project Parameters affecting Emission Reduction

Monitoring Approach

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and reporting

As the emission reduction units from the project are determined by the reduction in steam quantity and subsequent reduction in consumption of fuel in service boiler, it is important to discuss the monitoring principles in context of monitoring these parameters.

Frequency of monitoring

The project developer has installed all metering facilities within the plant premises. The measurements is, monitored and controlled through DCS on continuous basis and recorded day-wise in log sheets by operator, duly authenticated by head of plant



Reliability

The amount of emission reduction units is proportional to the net energy reduction due to project. Thus the steam meter reading is imperative parameter. All measurement devices are of digital type meters having best accuracy and is procured from reputed manufacturers. Since the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment for reproducibility, all instruments are calibrated at regular intervals. Therefore it ensures the monitoring system is highly reliable.

Registration and reporting

Registration is done on the basis of day-wise data logging in computer. Daily, weekly and monthly reports are prepared stating the steam reduction.

The following reports will be generated for monitoring and controlling emissions.

The daily report of data on LP steam used in urea section and urea production. The specific steam consumption per ton of Urea is worked out. The net reduction in steam consumption is thus estimated by multiplying difference in specific steam consumption and representative urea production.

Verification

The reduction in LP steam consumption leads to the CO₂ emission reductions. The project control system comprises sophisticated monitoring system like on-line display meters, Integrator, Distributed Control Systems (DCS) which measures, collects the information about various process parameters, monitors and controls on a continuous basis and record. Fully functional management information is built, which is generated through DCS in pre-decided daily reports formats so that accessing and verification of actual data are possible at any point of time. A computerised MIS can is generated and distributed among decision makers of the project. The major activities to be verified are as under

- Verification of various measurement and monitoring methods
- Verification of instrument calibration methods
- Verification of data generated through on-line meters and DCS
- Verification of measurement accuracy



Monitoring of boiler efficiency

Following guidelines are used to decide the periodicity for monitoring and estimation of boiler efficiency by direct method.

1. The fuel test certificate including calorific value is supplied by reputed supplier (with good testing facility) with every delivery of fuel. In case of Natural Gas (which is supplied by pipeline), these parameters are tested every day (data supplied by supplier).
2. The generated steam enthalpy parameters (steam temperature, pressure and quantity) is continually monitored and entered in log-book on daily basis.
3. The fuel meters are available, which record the fuel flow on continual basis.
4. The efficiency is estimated on monthly basis by direct method.

**Appendix-1****Abbreviations**

| | |
|-----------------|---|
| CDM | Clean Development Mechanism |
| CER | Certified Emission Reductions |
| CO ₂ | Carbon di-oxide |
| Cum | Cubic Meter |
| DM | Demineralised |
| EB | Executive Board |
| EIA | Environmental Impact Assessment |
| GHG | Green House Gases |
| GJ | Giga Joules |
| GoI | Government of India |
| IGF | Indo Gulf Fertilisers |
| IPCC | Intra-governmental Panel for Climate Change |
| KP | Kyoto Protocol |
| LP | Low Pressure |
| MoEF | Ministry of Environment & Forests |
| MoP | Ministry of Power |
| MT | Metric Ton |
| NCV | Net Calorific Value |
| NG | Natural Gas |
| NH ₃ | Ammonia |
| OHSAS | Occupational Health and Safety Management System |
| PDD | Project Design Document |
| TPD | Tonnes per Day |
| UNFCCC | United Nations Framework Convention on Climate change |
| UPPCB | Uttar Pradesh Pollution Control Board |
| VPC | Vacuum Pre-Concentrator |

**Appendix –2****References**

| S.No. | Particulars of the references |
|--------------|---|
| | Kyoto Protocol / UNFCCC Related |
| 1 | Kyoto Protocol to the United Nations Framework Convention on Climate change. |
| 2 | Website of United Nations Framework Convention on climate Change (UNFCCC). |
| 3 | UNFCCC Decision 17/CP.7: Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol. |
| 4 | UNFCCC document, Clean Development Mechanism – Project Design Document (CDM-PDD) version 03.1 |
| 5 | UNFCCC document: Approved baseline methodology AM0018 and Approved monitoring methodology AM0018 /Version 01.1, Sectoral Scope: 3, 6 December 2004. |
| 6 | Intergovernmental Panel on Climate Change (IPCC) document on emission factors. IPCC – 1996 – Rev. |
| | Project Related |
| 7 | Project scheme documents, data, information, internal documents, notes, invoices etc. related to the project activity from IGF records. |
| 8 | Design data supplied by IGF |
