# Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT

**Title:** 20.5 MW Waste Heat to Power Bundled Project by M/s. Panoli Intermediates (India) Pvt Ltd. in Gujarat, India

Version 1.3

Date: 10/09/2025

First CoU Issuance Period: 5 years and 6 months

Monitoring Period: 01/07/2019 to 31/12/2024

Monitoring Report (MR)
CARBON OFFSET UNIT (CoU) PROJECT

| Monitoring Report | |
|---|---|
| Title of the project activity | 20.5 MW Waste Heat to Power Bundled Project by M/s. Panoli Intermediates (India) Pvt Ltd. in Gujarat, India |
| UCR Project Registration Number | 455 |
| Version | 1.3 |
| Completion date of the MR | 10/09/2025 |
| Monitoring period number and duration of this monitoring period | Monitoring Period Number: 01<br>Duration of this monitoring Period: 5 years and 6 months (first and last days included)<br>01/07/2019 to 31/12/2024 |
| Project participants | **Representator**<br>Advait Greenergy Private Limited<br>**Developer**<br>M/s. Panoli Intermediates (India) Pvt Ltd. |
| Host Party | India |
| Applied methodologies and standardized baselines | Applied Methodologies: UNFCCC Approved Large Scale Consolidated Methodology "ACM0012, Waste Energy Recovery", Version – 06.0<br><br>Standardized Baselines: N/A |
| Sectoral scopes | 01 Energy industries (Renewable/NonRenewable Sources)<br>04 Manufacturing Industries |
| Actual amount of GHG emission reductions for this monitoring period in the registered PCN | 2019: 13,087 CoUs (13,087 $tCO_{2eq}$) |
| | 2020: 33,769 CoUs (33,769 $tCO_{2eq}$) |
| | 2021: 43,717 CoUs (43,717 $tCO_{2eq}$) |
| | 2022: 52,927 CoUs (52,927 $tCO_{2eq}$) |
| | 2023: 51,094 CoUs (51,094 $tCO_{2eq}$) |
| | 2024: 48,273 CoUs (48,273 $tCO_{2eq}$) |
| **Total:** | **242,867 CoUs (242,867 $tCO_{2eq}$)** |

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity >>

#### a) Purpose of the project activity and the measures taken for GHG emission reductions >>

The project activity, implemented by M/s. Panoli Intermediates (India) Pvt Ltd., involves the recovery of waste heat from the sulphuric acid production process for electricity generation. This initiative displaces a portion of grid electricity, which is predominantly sourced from fossil fuel-based power plants.

A Heat Recovery System (HRS) has been installed to capture waste heat, which is utilized to generate steam. The steam is then supplied to a turbine for power generation. The system has a generation capacity of 20.5 MW, during the first Crediting or Monitoring Period, the actual total emission reductions achieved amount to 242,867 $tCO_2e$. The gross electricity generation during this period stands at 280,020.93 MWh.

The waste heat recovery process is a clean technology, as it does not involve fossil fuel combustion or direct GHG emissions. Since the project generates electricity from waste heat, it has no adverse environmental impact and contributes to climate change mitigation by reducing dependence on fossil fuel-based power generation.

#### b) Brief description of the installed technology and equipment>>

The Waste Heat Recovery (WHR) based Captive Power Plant at the PIPL site has a total power generation capacity of 20.5 MW. The system consists of a boiler, steam turbine, and generator, where waste heat from the sulphuric acid production process is recovered using a Heat Recovery System (HRS) to generate steam. This steam is utilized to drive a Siemens Turbine Unit, which efficiently converts thermal energy into mechanical energy, subsequently generating electricity through a generator. In the project activity, the waste heat from sulphuric acid production processes will be recovered by HRS to generate steam for turbine.

The Siemens Turbine Units operate with high efficiency, extracting significant power from the steam, resulting in 10–20% water (condensed steam) in the exhaust, depending on load conditions and exhaust pressure. This is a standard feature of high efficiency condensing turbines, where partial condensation occurs due to substantial energy extraction before reaching the condenser. The installed technology is proven, reliable, and equipped with HRS systems, auxiliary equipment, and advanced monitoring instrumentation to ensure optimal performance and emission reduction.

#### c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.)>>

The duration of the crediting period corresponding to the monitoring period covered in this monitoring report.

| | |
|---|---|
| UCR Project ID or Date of Authorization | : 455 |
| Start Date of Crediting Period | : 01/07/2019 |
| Project Commissioned | : 24/05/2018 |

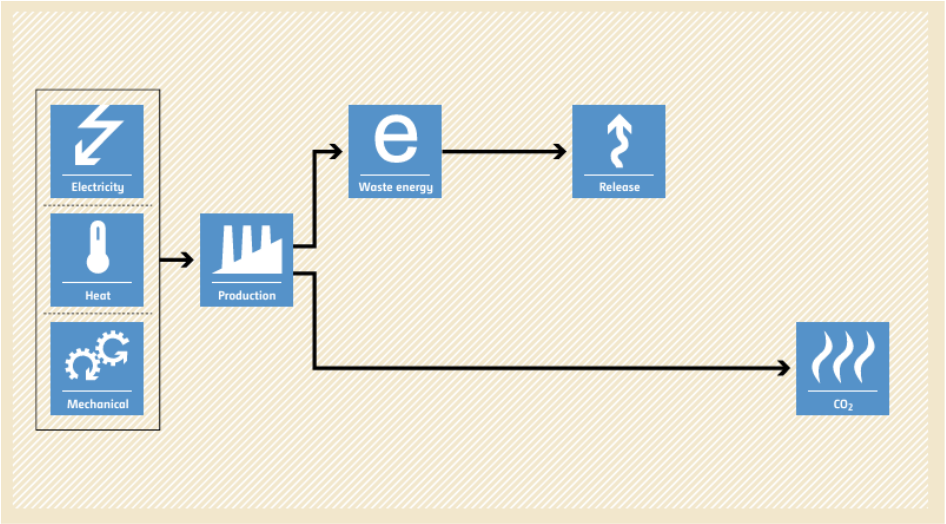
#### d) Total GHG emission reductions achieved or net anthropogenic GHG removals by sinks achieved in this monitoring period>>

The total GHG emission reductions achieved in this monitoring period is as follows:

| ERs Generated for the Monitoring Period | |
|---|---|
| Start date of this Monitoring Period | 01/07/2019 |
| Carbon credits claimed up to | 31/12/2024 |
| Total ERs generated ($tCO_{2eq}$) | 242,867 $tCO_{2eq}$ |
| Leakage | 0 $tCO_{2eq}$ |

## e) Baseline Scenario>>

In the absence of the project activity, the equivalent amount of electricity would have been sourced from the Indian grid, which are predominantly based on fossil fuels[1], hence the baseline scenario for the project activity is the grid electricity mix obtained from the Indian grid. since the project utilizes waste heat recovery (WHR) technology to generate power, it operates without direct fossil fuel consumption and does not contribute to GHG emissions. Therefore, the project leads to a net reduction in emissions by displacing grid-based electricity with clean energy generation.




## A.2. Location of project activity>>

| Project Proponent | M/s. Panoli Intermediates (India) Pvt Ltd. | |
|---|---|---|
| Capacity | 6.5 $MW_{AC}$ | 14 $MW_{AC}$ |
| District | Vadodara | Vadodara |
| Village | Nandesari | Nandesari |
| Taluka | Vadodara | Vadodara |
| State | Gujarat | Gujarat |
| Country | India | India |
| Pin Code | 391340 | 391340 |
| Latitude | 22.40309° N | 22.40246° N |
| Longitude | 73.09843° E | 73.0989° E |

[1] http://www.cea.nic.in/installed_capacity.html

The representative location map is included below:

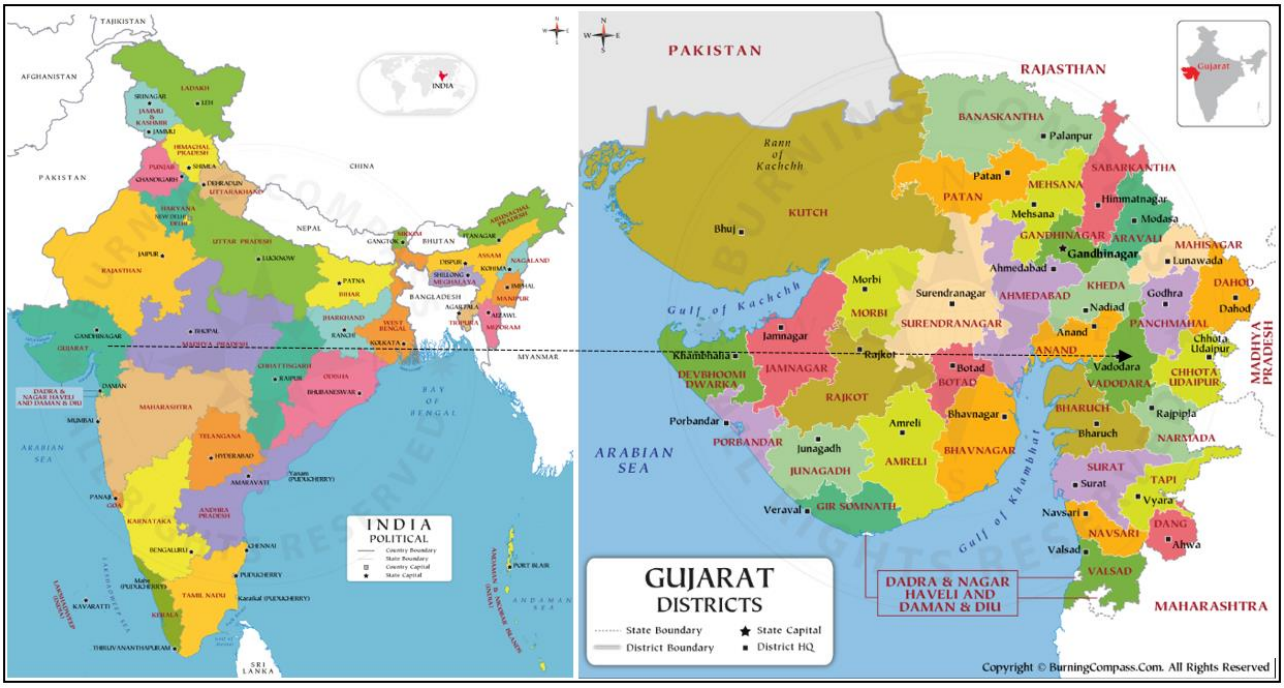



**Figure 1: Project Location**

*(Courtesy: google images, www.burningcompass.com)*

## A.3. Parties and project participants >>

| Party (Host) | Participants |
|---|---|
| Government of India | **Representor**<br>Advait Greenergy Private Limited<br>**Project Proponent (Developer)**<br>M/s. Panoli Intermediates (India) Pvt Ltd. |

## A.4. References to methodologies and standardized baselines >>

**SECTORAL SCOPE:** 01, Energy Industries (Renewable - / Non-Renewable Sources)
04, Manufacturing Industries

**TYPE:** III – Energy Efficiency (Waste Energy Recovery)

**CATEGORY:** CDM approved Large-scale Consolidated Methodology; ACM0012: **Waste energy recovery, Version 6.0**

## A.5. Crediting period of project activity >>

This monitoring report covers 1st monitoring period.

Length of the crediting period corresponding to this monitoring period: 05 Years, 06 Months
01/07/2019 to 31/12/2024

## A.6. Contact information of responsible persons/entities >>

| **Representator** | |
|---|---|
| Name | Advait Greenergy Private Limited |
| Contact Person | Ms. Avantika Gupta |
| Mobile | +91 9079765066 |
| E-mail | avantika.gupta@advaitgroup.co.in |
| Address | Advait Energy Transitions Limited,<br>1st Floor, KIFS Corporate House, Iskcon Ambli Road, Beside Hotel Planet Landmark, Near Ashok Vatika, Ambli, Ahmedabad – 380058 |
| **Project Proponent (Developer)** | |
| Name | M/s. Panoli Intermediates (India) Pvt Ltd. |
| Contact Person | Mr. Anupam Chaturvedi |
| Mobile | +91 9737586359 |
| E-mail | anupam@kcil.co.in |
| Address | "Saraniwas" 20-21, Hari Nagar Co-Op - Society,<br>Gotri Road, Vadodara - 390 007, Gujarat (INDIA) |

## SECTION B. Implementation of project activity

### B.1. Description of implemented registered project activity >>

a) Provide information on the implementation status of the project activity during this monitoring period in accordance with UCR PCN>>

The project activity is a bundled project activity of total capacity of 20.5 MW (6.5 MW and14 MW), and was installed & operated in Nandesari Village of Vadodara district in the Indian state of Gujarat are per details listed below:

| Project Developer | Capacity ($MW_{AC}$) | Commissioning Date | Location | Status |
|---|---|---|---|---|
| M/s. Panoli Intermediates (India) Pvt. Ltd. | 6.5 | 24/05/2018 | District: Vadodara<br>Village: Nandesari<br>Taluka: Vadodara<br>State: Gujarat<br>Country: India | Non – Operational |
| | 14 | 18/08/2021 | | Operational |

The start date of the project activity is the earliest commissioning date among both WHRS's, which is 24/05/2018. The power generated from the waste heat recovery system, displaces equivalent amount of power from the Indian grid. The project activity results in reduced carbon emissions by avoiding generation of this power in coal-based (fossil fuel based) grid connected power stations.

Since the project activity generates electricity through waste heat recovery system, a clean renewable energy source it will not cause any negative impact on the environment and thereby contributes to climate change mitigation efforts. The 14 MW Waste Heat Recovery (WHR) plant is currently operational. The 6.5 MW WHR plant is in standby mode due to a technical fault in the Air-Cooled Condenser (ACC) unit. The unit will remain non-operational until the completion of the necessary repair or replacement activities.

b) For the description of the installed technology(ies), technical process and equipment, include diagrams, where appropriate>>

The Waste Heat Recovery (WHR) based Captive Power Plant is installed at PIPL site with a total capacity of 20.5 MW power generation. The process involved in the project activity includes a boiler and a turbine. The boiler generates steam at high pressure and high temperature. The steam turbine converts the heat energy of steam into mechanical energy. The generator then converts the mechanical energy into electric power.

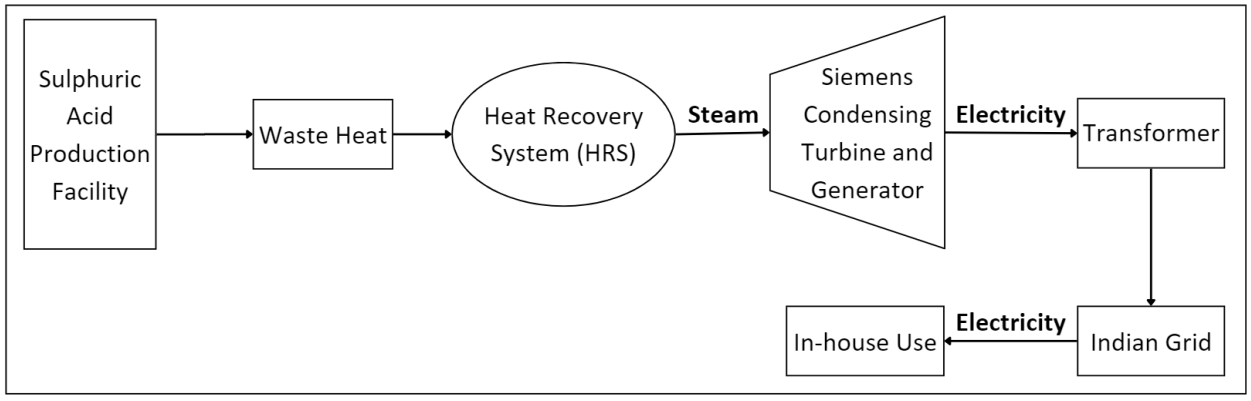


**Figure 2: Technique Process**

In the project activity, waste heat from the sulphuric acid production process is recovered using a Heat Recovery System (HRS) to generate steam for the turbine.

The technology is proven and reliable, incorporating HRS systems, auxiliary equipment, and with monitoring instrumentation to ensure efficient operation. The installed Siemens Turbine Units operate with high efficiency, converting steam's enthalpy into power. Due to this efficiency, the exhaust steam may contain 10–20% condensed water, depending on load conditions and exhaust pressure.

This is a standard characteristic of high-efficiency condensing turbines, where significant power extraction leads to partial condensation before the steam reaches the condenser. In the project activity, monitoring equipment was installed during plant installation or commissioning, ensuring accurate tracking of operational parameters and performance throughout the project activity.

**A) Details of the installation of monitoring equipments at 6.5 MW capacity plant are;**

| **Equipment** | **Make** | **Capacity** | **Serial No.** | **Voltage Level/ Voltage ratio (KV)** |
|---|---|---|---|---|
| **Transformer** | Prolec GE | 2500.0 KVA | IT-53842 | 11/0.433 |
| **HT Breaker** | Seimens | 800.00 AMP | NB 30205 | 12.0 |
| | | | | |
| **Transformer** | Prolec GE | 2500.0 KVA | IT-53843 | 11/0.433 |
| **HT Breaker** | Seimens | 800.00 AMP | N8 30203 | 12.0 |
| | | | | |
| **HT Motor** | Jeumont | 1400.0 KW | IA 1053_20_01 | 11 |
| **HT Motor** | Jeumont | 730.0 KW | IA 1053_10_01 | 11 |
| | | | | |
| **No.** | **Particular** | **CGP** | | |
| | | **Engine** | **Alternator** | **Energy Meter** |
| 1 | Make | Triveni Turbine Ltd | TDPS | Secure |
| 2 | Capacity | 8500.00 KW | 6125.0 KVA | ----- |
| 3 | Sr. No. | TST-2060-181 | T-04143 | XC451758 |
| 4 | Volt | ----- | 11000 | 11.0 |
| 5 | RPM | 8226 | ----- | ----- |
| 6 | C.T. Ratio | ----- | ----- | 500/5-5A |
| 7 | P.T. Ratio | ----- | ----- | 11000/110 |
| 8 | Dial M.F. | ----- | ----- | 1.0 |
| 9 | Final M.F. | ----- | ----- | 1.00 |
| 10 | Reading | ----- | ----- | 5 |
| 11 | Seal No. of Terminal Cover | ----- | ----- | 1471001.02 |
| 12 | Seal No. of MMB | ----- | ----- | 1066395.96 |

**B) Details of the installation of monitoring equipment at 14 MW capacity plant are;**

| **Equipment** | **Make** | **Capacity** | **Serial No.** | **Voltage Level/** |
|---|---|---|---|---|

| | | | | Voltage ratio (KV) |
|---|---|---|---|---|
| **Transformer** | Indo Tech | 3000.0 KVA | IT-55507 | 11/0.433 |
| **HT Breaker** | Siemens | 1250.00 AMP | NB 40665 | 11.0 |
| | | | | |
| **Transformer** | Indo Tech | 3000.0 KVA | IT-55508 | 11/0.433 |
| **HT Breaker** | Siemens | 1250.00 AMP | NB 39150 | 11.0 |
| | | | | |
| **HT Motor** | Jeumont | 730.0 KW | IA 1140_M10_01 | 11 |
| **HT Motor** | Jeumont | 2300.0 KW | IA 1140_M20_01 | 11 |

| **No.** | **Particular** | **CGP** | | |
|---|---|---|---|---|
| | | **Engine** | **Alternator** | **Energy Meter** |
| 1 | Make | Siemens | TD Power Systems | Secure |
| 2 | Capacity | 1400.00 KW | 17500.0 KVA | ----- |
| 3 | Sr. No. | 3,21,19,686 | T-05210 | X1576928 |
| 4 | Volt | ----- | 11000V | 11.0 |
| 5 | RPM | 9400 | ----- | ----- |
| 6 | C.T. Ratio | ----- | ----- | 1200/5 |
| 7 | P.T. Ratio | ----- | ----- | 11000/110 |
| 8 | Dial M.F. | ----- | ----- | 1.0 |
| 9 | Final M.F. | ----- | ----- | 1000.00 |
| 10 | Reading | ----- | ----- | 45 |
| 11 | Seal No. of Terminal Cover | ----- | ----- | 7643292 |
| 12 | Seal No. of MMB | ----- | ----- | 7643295 |

| **Boiler Specifications** | **6.5 MW CPP Boiler** | **14 MW CPP Boiler** |
|---|---|---|
| Registry Number | GT-9930 | GT-11549 |
| Client | Panoli Intermediates (India) Pvt. Ltd. | Panoli Intermediates (India) Pvt. Ltd. |
| Manufacturer | Thermax Systems (Hyderabad) Pvt. Ltd. | Thermax Systems (Hyderabad) Pvt. Ltd. |
| Equipment | Steamdrum | Steamdrum |
| Maker's Number | B401.01 | B540.01 |
| Code of Construction | IBR 1950 | IBR 1950 |
| Boiler Rating | 7,948.00 $m^2$ | 10,669.00 $m^2$ |
| Steam Generation | 35,560 kg/hr | 49,230 kg/hr |
| Operating Pressure | 71.0 $kg/cm^2g$ | 71.0 $kg/cm^2g$ |
| Design Pressure | 78.5 $kg/cm^2g$ | 78.5 $kg/cm^2g$ |
| Test Pressure | 117.75 $kg/cm^2g$ | 117.75 $kg/cm^2g$ |
| Operating Temp. | 286 °C | 286 °C |
| Design Temp. | 295 °C | 295 °C |
| Safety Valve Set Pressure | 77.5 $kg/cm^2g$ & 78.5 $kg/cm^2g$ | 77.5 $kg/cm^2g$ & 78.5 $kg/cm^2g$ |

| **Turbine Specifications** | **6.5 MW TG** | **14 MW TG** |
|---|---|---|
| Client | Panoli Intermediates | Panoli Intermediates (India) Pvt. Ltd. |

| | | |
|---|---|---|
| | (India) Pvt. Ltd. | |
| Manufacturer | Triveni Turbine Limited | Siemens Ltd. |
| Turbine Number | TST-2060-181 | 3,21,19,666 |
| Year of Construction | 2017 | 2019 |
| Power Output | 5,820 kW (5.82 MW) | 10,800 kW (10.8 MW) |
| Speed | 8,226 RPM | 9,400 RPM |
| Inlet Pressure | 67 kg/cm$^2$g | 66.001 ata |
| Inlet Temperature | 490 °C | 490 °C |
| Exhaust Pressure | 0.2 ata | 0.200 ata |

**B.2 Do no harm or Impact test of the project activity>>**

An Environmental Impact Assessment (EIA) study was conducted prior to the commencement of operations to evaluate the potential environmental effects of the project activity. The assessment considered the overall impact of the project on the surrounding environment. The project is designed to support long-term sustainability goals by ensuring environmental protection, energy efficiency, and economic benefits while reducing reliance on fossil fuel-based power generation.

The project activity will also achieve;

- Improvement of local environment through particulate emission reduction.
- Technological up – gradation.
- Fulfilling power requirement without adding to the transmission and distribution losses of the grid, as the power will be consumed at the place where it will be generated, and PP will not import power from the grid.
- Reducing the difference between demand and supply of power locally.
- Sustainable –economic growth.

It has been envisaged that the project shall contribute to sustainable development in the following ways:

**Social well-being:**

There have been good employment opportunities created for the local workforce during the project construction phase. The project after implementation has also continued to provide employment opportunities for the local populace in a sustained manner and the same would be continued over the project lifetime. The employment opportunities created will contribute towards alleviation of poverty in the surrounding area throughout the lifetime of the project activity.

**Economic well-being:**

The project is a clean technology investment decided based on carbon revenue support, which signifies flows of clean energy investments into the host country. The project activity requires temporary and permanent, skilled and semi-skilled manpower at the project location; this will create additional employment opportunities in the region. In addition, success of this kind of project will provide new opportunities for industries and economic activities to be setup in the area. Apart from getting better employment opportunities, the local people will get better prices for their land, thereby resulting in overall economic development.

**Technological well-being:**

The successful operation of project activity would lead to promotion of waste heat recovery (WHR) based power generation and would encourage other entrepreneurs to participate in similar projects.

Increased interest in WHR energy projects will further push R&D efforts by technology providers to develop more efficient and better machinery in future. The project activity leads to the promotion and demonstrates the success of WHR projects in the region which further motivate more investors to invest in these types of power projects. Hence, the project activity leads to technological well-being.

**Environmental well-being:**

The project activity will generate power using zero emissions WHR based power generation facility which helps to reduce GHG emissions and specific pollutants like SOx, NOx, and SPM associated with the conventional thermal power generation facilities. The project utilizes waste heat energy for generating electricity which is a clean source of energy. It reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. The impact on land, water, air and soil is negligible. Thus, the project causes no negative impact on the surrounding environment contributing to environmental well- being.

**With regards to ESG credentials:**

At present specific ESG credentials have not been evaluated, however, the project essentially contributes to various indicators which can be considered under ESG credentials. Some of the examples are as follows:

**Under Environment:**

Environmental criteria may include a company's energy use, waste, pollution, natural resource conservation, and treatment of waste & animals etc. For PP, energy use pattern is now based on clean energy due to the project and it also contributes to GHG emission reduction and conservation of depleting energy sources associated with the project baseline. Also, the criteria can be further evaluated based on any environmental risks which the company might face and how those risks are being managed by the company. Here, as the power generation will be based on waste heat recovery system, the risk of environmental concerns associated with non-renewable power generation and risk related to increasing cost of power etc. are now mitigated. Hence, project contributes to ESG credentials.

**Under Social:**

Social criteria reflect on the company's business relationships, qualitative employment, working conditions regarding its employees' health and safety, interests of other stakeholders' etc. With respect to this project, the PP has robust policies in place to ensure equitable employment, health & safety measures, local jobs creation etc. Also, the organizational CSR activities directly support local stakeholders to ensure social sustainability. Thus, the project contributes to ESG credentials.

**Under Governance:**

Governance criteria relate to overall operational practices and accounting procedure of the organization. With respect to this project, the Project Proponent practices a good governance practice with transparency, accountability and adherence to local and national rules & regulations etc. This can be further referred from the company's annual report. Also, the project activity is a waste heat recovery project owned and managed by the PP for which all required NOCs and approvals are received. The electricity generated from the project can be accurately monitored, recorded and further verified under the existing management practice of the company. Thus, the project and the proponent ensure good credentials under ESG.

It aligns with other contributions as:

- Reducing GHG emissions compared to a business-as-usual scenario;
- Reducing energy waste and facilitating the technology development of integrated resource utilization in sulfuric acid industry.
- Reducing the emission of other pollutants resulting from the power generation industry in India, compared to a business-as-usual scenario.

| SDG | Relevant SDG Target | Project Contributions |
|---|---|---|
| SDG7: Affordable and Clean Energy   | Target 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix. | The project supports Sustainable Development Goal 7 (Affordable and Clean Energy) by promoting clean energy generation through the conversion of industrial waste heat into electricity.<br><br>The recovered energy is used to generate power with a capacity of 20.5 MW, which is supplied back to the manufacturing facility for captive consumption.<br><br>This approach not only reduces dependence on fossil fuel-based grid electricity but also enhances overall energy efficiency by utilizing heat that would otherwise be wasted.<br><br>During the monitoring period, the project generated 2,80,020.93 MWh of electricity, significantly contributing to sustainable and efficient energy use. |
| SDG13: Climate Action   | Target 13.2: Integrate climate change measures into national policies, strategies and planning. | By recovering and utilizing waste heat for power generation, the project significantly reduces greenhouse gas emissions that would otherwise result from conventional fossil-fuel-based electricity generation.<br><br>The project achieved a total GHG emission reduction of 242,867 tonnes of $CO_2$ equivalent ($tCO_2e$).<br><br>This directly supports Sustainable Development Goal 13 (Climate Action) by |

| | | |
|---|---|---|
| | | contributing to climate change mitigation and promoting the adoption of low-carbon industrial practices |

## B.3. Baseline Emissions>>

The project activity involves the installation of a waste heat recovery system (WHR) for power generation with a total capacity of 20.5 MW. The recovered energy from waste heat, waste gas, or waste pressure within the industrial facility is utilized for in-house consumption or export, achieved through the installation of new energy generation equipment, replacement with more efficient systems, or upgrading existing equipment to improve waste energy recovery efficiency.

The project activity achieves GHG emissions reduction through energy efficiency by utilizing waste energy recovery. By capturing and reusing waste heat, the project displaces more carbon-intensive energy sources from the grid, thereby reducing reliance on fossil fuel-based power generation and lowering overall GHG emissions.

In the absence of the project activity, the equivalent amount of electricity would have been sourced from the Indian grid, which is predominantly fossil fuel-based. Since the project activity generates electricity through waste heat recovery, it does not involve fossil fuel combustion and does not emit GHG emissions into the atmosphere. Thus, the project effectively reduces emissions by displacing grid-based electricity with clean energy.

**Schematic diagram showing the baseline and project scenario:**

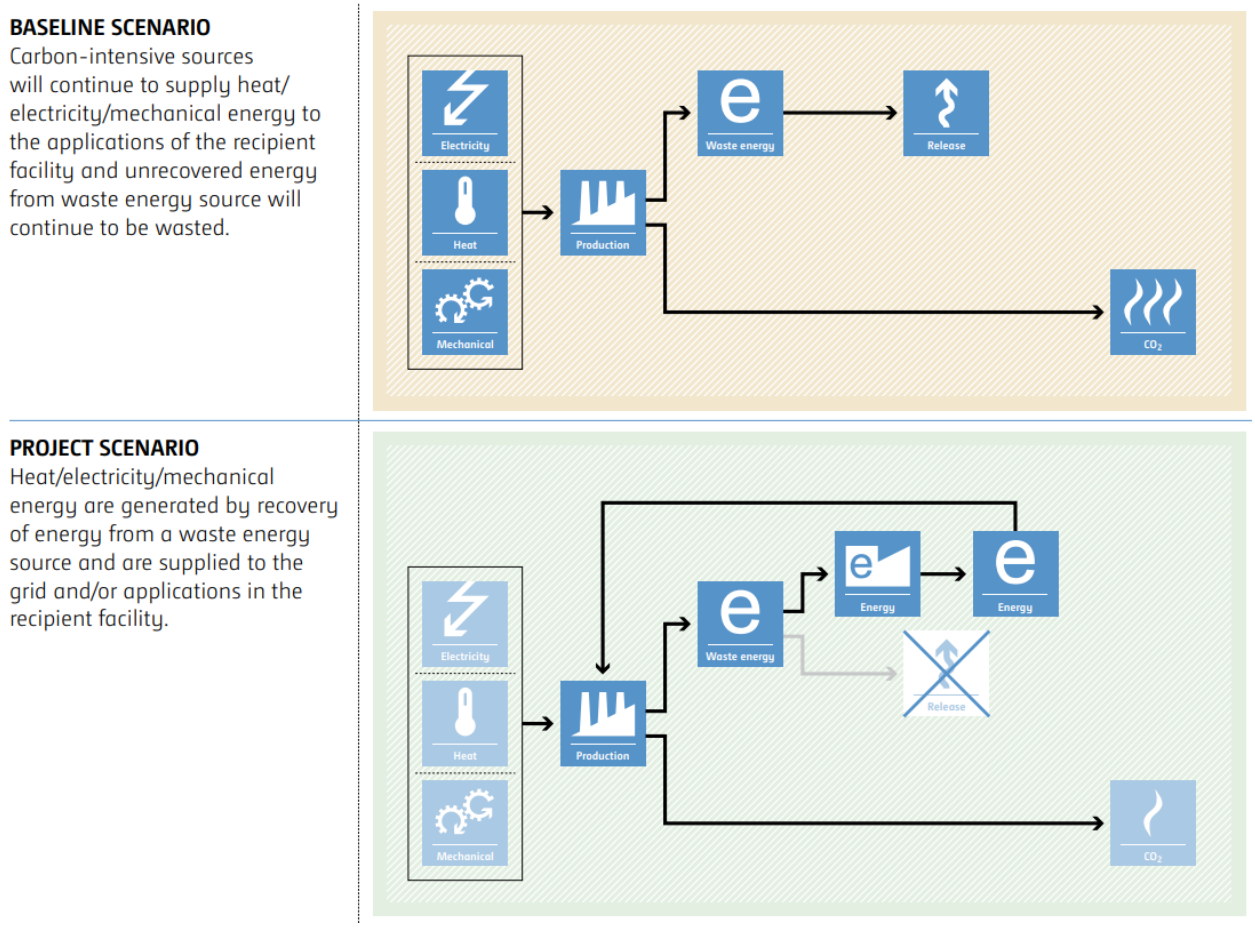



**Figure 3: Baseline and Project Scenario**

## B.4. Debundling>>

The 20.5 MW Waste Heat to Power Bundled Project by M/s. Panoli Intermediates (India) Pvt Ltd. in Gujarat, India is not a debundled component of a larger carbon or GHG registered project activity.

## SECTION C. Application of methodologies and standardized baselines

### C.1. References to methodologies and standardized baselines >>

**SECTORAL SCOPE:** 01, Energy industries (Renewable/Non-renewable sources)
04, Manufacturing Industries

**TYPE:** III – Energy Efficiency

**CATEGORY:** CDM approved Large-scale Consolidated Methodology; ACM0012: **Waste energy recovery, Version 6.0**[2]

### C.2. Applicability of methodologies and standardized baselines >>

The consolidated methodology is applicable to project activities implemented in an existing or Greenfield waste energy generation (WEG) facility converting waste energy carried in identified waste energy carrying medium (WECM) stream(s) into useful energy (i.e. power, mechanical or thermal) consumed in an existing or Greenfield recipient facility(ies) and/or supplied to the grid in the case of electricity generation. The WEG facility may be one of the recipient facilities. The project status is corresponding to the methodology ACM0012, version 6.0 and applicability of methodology is discussed below:

| Applicability Condition | Justification |
|---|---|
| 1) The useful energy generated from the utilization of waste energy carried in the WECM stream(s) for a project activity may be one or a combination of the below:<br>a) Generation of electricity;<br>b) Cogeneration;<br>c) Direct use as process heat source in as unit process/chemical reactor;<br>d) Generation of heat in element process;<br>e) Generation of mechanical energy; or<br>f) Supply of heat of reaction with or without process heating. | The useful energy generated from the utilization of waste energy carried in the WECM stream will be used for generation of electricity in project scenario. |
| 2) In the absence of the project activity, the following situations for the WECM stream(s) would occur:<br>a) WECM would not be recovered and therefore would remain unutilized (e.g. flared or released to the atmosphere) at the existing or Greenfield WEG facility; or<br>b) WECM would be partially recovered and/or recovered in less efficient equipment of recipient facility, and the unrecovered portion of WECM stream would remain unutilised at the existing or Greenfield WEG facility. In this case, the type of useful energy produced from this WECM by the project activity shall be the same type of useful energy that is produced in the absence of project activity implementation using partially recovered | In absence of the project activity, the WECM carrying the waste heat would have been vented to atmosphere after passing through ESP and cooling tower (a) released to atmosphere. |

[2] https://cdm.unfccc.int/UserManagement/FileStorage/3KHXY4AC52ILPV6URQB0E1TONWM789

| | |
|---|---|
| WECM and/or less efficient use of WECM (e.g. if the WECM is partially used to produce electricity in the absence of project activity then the methodology is only applicable if the WECM is recovered in the project to produce electricity). | |
| 3) This methodology applies to the following two categories of project activities:<br>a) Category 1: Project activities that involve recovery of WECM as per situation in paragraph 4(a) above; and<br>b) Category 2: Project activities that involve enhanced/improved energy recovery of the WECM as compared to the baseline scenario as per situation in paragraph 4(b) above. | The project applies to condition (a) i.e. Category 1. |
| 4) Project activities under category 2 would include improving the WECM recovery that may: (i) capture and utilise a larger quantity of WECM stream as compared to the historical situation in an existing WEG facility, or capture and utilise a larger quantity of WECM stream as compared to a "reference waste energy generating facility" for a Greenfield facility; and/or (ii) apply better energy efficient equipment to replace/modify/expand waste energy recovery equipment in an existing recipient facility, or implement a better energy efficient equipment than the "reference energy generation facility" for a Greenfield facility. | This criterion is not applicable to project activity, as project activity falls in category-1. |
| 5) The methodology is applicable under the following conditions:<br>a) Regulations do not require the WEG facility to recover and/or utilize the waste energy prior to the implementation of the project activity;<br>b) For project activities which recover waste pressure, the methodology is applicable where waste pressure is used to generate electricity only and the electricity generated from waste pressure is measurable;<br>c) If the production capacity of the WEG facility is expanded as a result of the project activity, the added production capacity shall be treated as a Greenfield facility;<br>d) WECM that is released under abnormal operation (for example, emergencies, shut down) of the WEG facility shall not be included in the emission reduction calculations. | a) There are no regulations in India requires to recover and utilize the waste energy prior to implementation of the project activity.<br>b) The project activity does not involve the use of waste pressure.<br>c) The project activity was implemented at new facility. There is no expansion in production capacity of the project facility due to project activity.<br>d) Waste energy released under abnormal operation will not be accounted for emission reduction calculation. |
| 6) For project activities which supply useful energy from recovery and use of waste energy to existing recipient facilities, the methodology is applicable to those project activities that generate electricity and/or mechanical energy to supply up to and beyond the maximum capacity of the pre-project equipment of existing recipient facilities. The methodology, however, is not applicable to | The project activity involves electricity generation only by utilization of waste heat and does not supply thermal energy. |

| | |
|---|---|
| project activities that supply additional thermal energy beyond the maximum pre-project capacity of existing recipient facility(ies). | |
| 7) The methodology is not applicable to cases where a WECM stream is partially recovered in the absence of the CDM project activity to supply the heat of reaction, and the recovery of this WECM stream is increased under the project activity to replace fossil fuels used for the purpose of supplying heat of reaction. | There was no partial recovery of WECM stream in the absence of the project activity to supply the heat of reaction and thus there will not be any increase in recovery of WECM stream under the project activity to replace fossil fuels used to supply heat of reaction. |
| 8) This methodology is also not applicable to project activities where the waste gas/heat recovery project is implemented in a single-cycle power plant (e.g. gas turbine or diesel generator) to generate power. However, projects recovering waste energy from single cycle and/or combined cycle power plants or any power only generation plant for the purpose of generation of heat only can apply this methodology. | The project activity does not recover waste energy from single cycle or combined cycle power plants for the purpose of generation of heat. |
| 9) No emission reduction credits can be claimed at and beyond the end of the lifetime of the waste energy generation equipment. | The emission reduction from the project will be claimed for a period of full crediting period, i.e., the average lifetime of the project activity. |
| 10) In case the equipment at recipient facility(ies) that will be displaced by the project activity reaches end of its lifetime during the crediting period, separate guidance is provided in the section on the identification of baseline scenario below. | The emission reduction from the project will be claimed for a period of full crediting period, i.e., the average lifetime of the project activity. |
| 11) The extent of use of waste energy from the WEG facilities in the absence of the CDM project activity will be determined in accordance with the procedures to this methodology provided in:<br>a) Appendix 1 for Greenfield project facilities; and<br>b) Appendix 2 for existing project facilities. | The extent of use of waste energy from the waste energy generation facilities in the absence of the project activity will be determined in accordance with the procedures provided in Appendix 1 (for Greenfield project facilities) to the methodology ACM0012. |
| 12) If multiple WECM are available in the WEG facility and can be used interchangeably for various applications as part of the energy sources in the WEG facility, the implementation of the CDM project activity shall not result in the reduction of the recovery of any WECM, which would be totally or partially recovered in the absence of the project activity. This shall be demonstrated by use of the guidance provided in appendix 3 of this methodology. | The project activity is utilizing waste gas streams for power generation in the installed facility and it will not impact any other process. |

**C.3 Applicability of double counting emission reductions >>**

There is no double accounting of emission reductions in the project activity due to the following reasons:

- Project is uniquely identifiable based on its location coordinates,
- Project has dedicated commissioning certificate and connection point and plant operation data on power generation in project activity is taken from energy meters installed at project site,
- Project is associated with distinct and unique energy meters which are dedicated to the consumption point for PP.

## C.4. Project boundary, sources and greenhouse gases (GHGs)>>

The geographical extent project boundary shall include the relevant WECM stream(s), equipment and energy distribution system in the following facilities:

1. The WEG facility;
2. The recipient facility (ies), which may be the same as the WEG facility.

The spatial extent of the grid is as defined in the "Tool to calculate the emission factor for an electricity System". The relevant equipment and energy distribution system cover:

- In a project facility, the WECM stream(s), waste energy recovery and useful energy generation equipment, and distribution system(s) for useful project energy;
- In a recipient facility, the equipment which receive useful energy supplied by the project, and distribution system(s) for useful project energy.
-

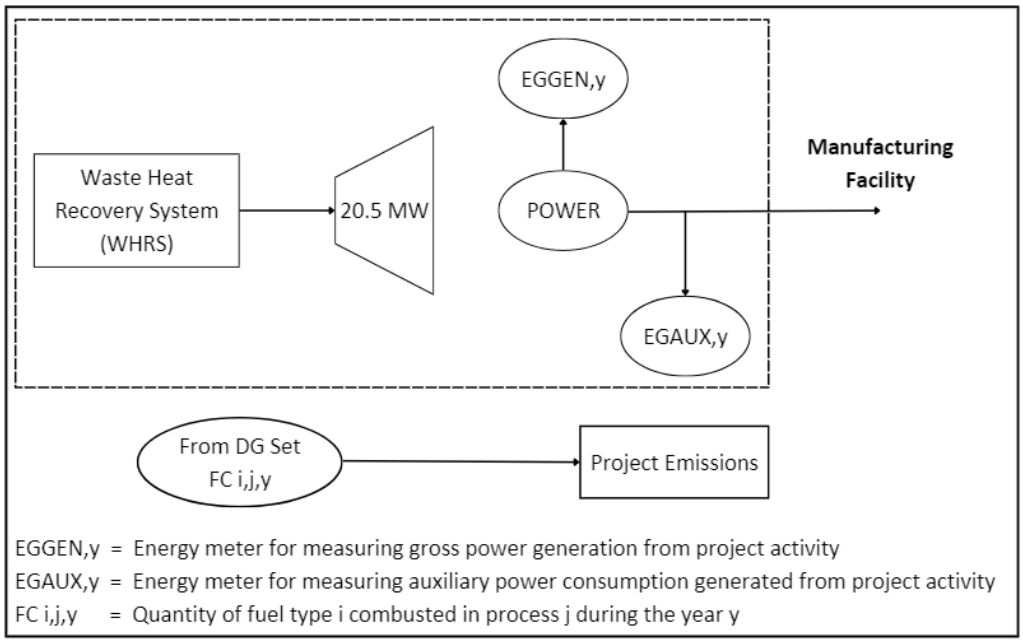



**Figure 4: Project Boundary**

As per applicable methodology ACM0012, Waste energy recovery, Version 6.0, the project boundary is defined as: Table below illustrates which emissions sources are included and which are excluded from the project boundary for determination of baseline scenario and project emissions.

| Source | | Gas | Included | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Electricity consumption, grid or captive source | $CO_2$ | Included | Main emission source |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative |
| | Fossil fuel consumption in element process for thermal energy | $CO_2$ | Excluded | Project activity does not involve production of thermal energy |
| | | $CH_4$ | Excluded | |
| | | $N_2O$ | Excluded | |
| | Fossil fuel consumption in cogeneration plant | $CO_2$ | Excluded | Project activity does not involve cogeneration |
| | | $CH_4$ | Excluded | |
| | | $N_2O$ | Excluded | |
| | Fossil fuel consumption for generation of steam used in the flaring process, if any | $CO_2$ | Excluded | Flaring is not being done in the baseline |
| | | $CH_4$ | Excluded | |
| | | $N_2O$ | Excluded | |
| Project activity | Fossil fuel consumption for supply of process heat and/or reaction heat | $CO_2$ | Excluded | Project activity does not involve production of process heat |
| | | $CH_4$ | Excluded | |
| | | $N_2O$ | Excluded | |
| | Supplemental fossil fuel consumption at the project plant | $CO_2$ | Excluded | No supplemental fossil fuel is being used |
| | | $CH_4$ | Excluded | |
| | | $N_2O$ | Excluded | |
| | Supplemental electricity consumption | $CO_2$ | Excluded | No supplemental electricity is being consumed in the project activity |
| | | $CH_4$ | Excluded | |
| | | $N_2O$ | Excluded | |
| | Electricity imports to replace captive electricity, which was generated using waste energy in absence of project activity[3] | $CO_2$ | Excluded | In the absence of project activity, waste energy was not being used for electricity generation |
| | | $CH_4$ | Excluded | |
| | | $N_2O$ | Excluded | |
| | Energy consumption for gas cleaning | $CO_2$ | Excluded | No gas cleaning is being done in the project activity |
| | | $CH_4$ | Excluded | |
| | | $N_2O$ | Excluded | |

## C.5. Establishment and description of baseline scenario (UCR Protocol) >>

[3] Applicable in the scenario where the facility captures and utilizes a portion of waste gas produced at the site for captive power generation in the absence of the project activity.

Baseline emissions include only $CO_2$ emissions from electricity generation in power plants that are displaced due to the project activity. The baseline emissions corresponding to electricity supplied by the project activity to recipient facilities is estimated for each recipient facility in accordance with the case established as above and in the case of the project activity is as follows:

***(a)*** **Case 1a*:*** Recipients whose project level electricity consumption is less than or up to the maximum capacity of the existing pre-project equipment at the recipient facility to use below equation.

$$BE_{EL,j,y} = \sum_{i} \left( EG_{i,j,y} \times EF_{Elec,i,j,y} \right)$$

Where;

$BE_{EL,j,y}$ = Baseline emissions corresponding to the electricity supplied in year y by the project activity to the recipient facility j as per case (1a) and case (1b) described below during the year y ($tCO_2$)

$EG_{i,j,y}$ = The power supplied by the project activity to the recipient facility j, which in the absence of the project activity would have been sourced from baseline source i (e.g. 'gr' for the grid or 'is' for an identified source) during the year y as per the identified baseline scenario for recipient facility j (MWh)

$EF_{Elec,i,j,y}$ = The $CO_2$ emission factor for the baseline electricity source i (e.g. 'gr' for the grid, and 'is' for an identified source), corresponding to baseline scenario for the recipient facility j, during the year y (t $CO_2$/MWh)

***(b)*** If the electricity displaced by the project activity in the recipient facility is supplied by a connected Indian grid system, the $CO_2$ emission factor of the electricity is modified from the UNFCCC CDM methodology and instead shall be determined following the guidance provided by the UCR CoU protocol for conservativeness.

| | | |
|---|---|---|
| **Power Generation Capacity** | MW | 20.5 |
| **Auxiliary Power Consumption** | % | 10% |

**Estimated Annual Baseline Emission Reductions:**

$$BE_{EL,j,y} = EG_{BL,y} \times EF_{CO2,\,grid,y}$$

Where;

| | |
|---|---|
| $BE_{EL,j,y}$ | Baseline emissions corresponding to the electricity supplied in year y by the project activity to the recipient facility j as per case (1a) and case (1b) described below during the year y ($tCO_2$) |
| $EG_{BL,y}$ | Net power generation from turbine in year y (MWh/yr) |
| $EF_{CO2,grid,y}$ | UCR recommended emission factors of 0.9 tCO2/MWh and 0.757 tCO2/MWh has been considered. |

A "grid emission factor" refers to a $CO_2$ emission factor ($tCO_2$/MWh) which will be associated with each unit of electricity provided by an electricity system. The UCR recommends an emission factor of 0.9 $tCO_2$/MWh for the 2013–2023 years as a fairly conservative estimate for Indian projects not previously verified under any GHG program. The UCR recommends a grid emission factor of 0.757 $tCO_2$/MWh for the 2024 vintage year as a fairly conservative estimate for Indian projects not previously verified under any GHG program.

In this project activity, the emission factor is determined in two distinct phases. For the period year up to 2023, a grid emission factor of 0.9 $tCO_2$/MWh is applied and for the year 2024, a grid emission factor of 0.757 $tCO_2$/MWh in accordance with the updated UCR guidelines.[4]

$$EG_{BL,y} = EG_{GEN,y} - EG_{AUX,y}$$

Where;

| | |
|---|---|
| $EG_{BL,y}$ | Net power generation from turbine in year y (MWh/yr) |
| $EG_{GEN,y}$ | Gross power generation from turbine in year y (MWh/yr) |
| $EG_{AUX,y}$ | Auxiliary power consumption in power generation plant in year y (MWh/yr) |

Baseline Emission Reduction table based on actual generation

| **Baseline Emissions Table** | |
|---|---|
| **Year** | **(tCO2e)** |
| 2019 | 13,087 |
| 2020 | 33,769 |
| 2021 | 43,717 |
| 2022 | 52,927 |
| 2023 | 51,094 |
| 2024 | 48,273 |

**Project Emissions:**
As per ACM0012 Version 6.0, paragraph 122, Project Emissions include emissions due to (1) combustion of auxiliary fuel to supplement waste gas/heat and (2) electricity emissions due to consumption of electricity for cleaning of gas before being used for generation of energy or other supplementary electricity consumption.

Since no auxiliary fuels will be fired in the project activity, project activity emissions are not applicable. Also, there is no additional cleaning of gas for the project activity.

Further, the electricity consumption of the project activity will be accounted for in $EG_{BL,y}$ and hence no separate calculation of project emissions due to electricity consumption is required.

Therefore, $PE_y = 0$.

**Leakage Emissions:**
No leakage is applicable under this methodology, hence, $LE_y = 0$.

**Emission Reductions:**
The emission reduction $ER_y$ by the project activity during a given year y is the difference between the baseline emissions through substitution of electricity generation by captive coal based thermal power plant ($BE_y$) and project emissions ($PE_y$), as follows:

$$ER_y = BE_y - PE_y$$

Where;

| | | |
|---|---|---|
| $ER_y$ | = | Emission reductions of the project activity during the year y in tonnes of $CO_2$ |
| $BE_y$ | = | Baseline emissions due to the displacement of electricity during the year y in tonnes of |

[4] UCR Standard Update

| | | |
|---|---|---|
| | | $CO_2$ |
| $PE_y$ | = | Project emissions during the year y in tonnes of $CO_2$ |

Since the project emissions are non-existent in the project activity so the emission reductions ($ER_y$) are equal to the baseline emissions due to the displacement of electricity ($BE_y$).

$$ER_y = BE_y$$

Total Emission reduction by the project for the current monitoring period is calculated as below:

Emission Reduction table based on actual generation

| Year | Baseline Emissions | Project Emissions | Leakage Emissions | Emission Reduction |
|---|---|---|---|---|
| | ($tCO_2e$) | ($tCO_2e$) | ($tCO_2e$) | ($tCO_2e$) |
| 2019 | 13,087 | 0 | 0 | 13,087 |
| 2020 | 33,769 | 0 | 0 | 33,769 |
| 2021 | 43,717 | 0 | 0 | 43,717 |
| 2022 | 52,927 | 0 | 0 | 52,927 |
| 2023 | 51,094 | 0 | 0 | 51,094 |
| 2024 | 48,273 | 0 | 0 | 48,273 |
| **Total** | **242,867** | **0** | **0** | **242,867** |

## C.6. Prior History>>

The project activity has never been applied under any other GHG mechanism prior to this registration with UCR. Also, the capacities or the total project as a whole has not been applied for any other environmental crediting or certification mechanism. Hence project will not cause double accounting of carbon credits (i.e., CoUs).

## C.7. Monitoring period number and duration>>

First Monitoring Period: 5 years and 6 months – 01/07/2019 to 31/12/2024

## C.8. Changes to start date of crediting period >>

There is no change in start date of the crediting period. Crediting period start date is 01/07/2019.

## C.9. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>

There are no permanent changes from registered PCN monitoring plan and applied methodology.

## C.10. Monitoring plan>>

Various departments at PIPL are headed by respective HOD (Head of Department) supported by shift-in-charges & support staff. Departments are mainly divided into projects, mechanical, electrical & instrumentation, production and administration. Mechanical & electrical department are responsible for the overall upkeep of plant, plant machinery and instruments.

To ensure that the data is reliable and transparent, the PP has established Quality Assurance and

Quality Control (QA&QC) measures to effectively control and manage data reading and recording as well as archiving data and all relevant documents. The data is monitored on a daily basis and is submitted to PPs on a daily basis.

Key Data Monitored: Net power supplied to manufacturing facility due to waste heat recovery

**1. Monitoring Plan Objective and Organization**

PP is the project implementer and monitors the electricity generated from the turbines within the project activity. The data is already archived electronically and is stored since 2018.

Director is responsible for the overall functioning of the plant. PIPL has adopted the following procedures to assure the completeness and correctness of the data needed to be monitored for the UCR project activity.

On a monthly basis, the monitoring reports are checked and discussed by the senior project activity team members. In case of any irregularity observed by any of the team members, it is informed to the concerned person for necessary actions. Further these reports are then forwarded to the management monthly.

- Unit Head: Overall responsibility of compliance with the project activity monitoring plan.
- Power plant In-charge: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation.
- Shift In-charge: Responsibility of data monitoring & recording daily.
- Data collection and record keeping: Plant data collected on operation under the supervision of the respective Shift-in-charge and records are kept in daily logs.

**Reliability of data collected**

The reliability of the meters is checked by testing the meters on yearly basis. Documents pertaining to testing of meters are maintained. PPs have implemented QA&QC measures to calibrate and ensure the accuracy of metering and safety aspects of the project operation. The metering devices are calibrated and inspected properly and periodically, according to state electricity board's specifications and requirements to ensure accuracy in the readings.

**Operational status**

**Emergency preparedness**

The project activity does not lead to any unintentional emissions. So, there is no need for any emergency preparedness in project activity.

**Data and Parameters available at validation (ex-ante values):**

| Data/Parameter | **$EF_{CO2, GRID}$** |
|---|---|
| Data unit | $tCO_2$ /MWh |
| Description | A "grid emission factor" refers to a CO2 emission factor (tCO2/MWh) which will be associated with each unit of electricity provided by an electricity system.<br><br>The UCR recommends an emission factor of 0.9 $tCO_2$/MWh for the 2013–2023 years as a fairly conservative estimate for Indian projects not previously verified under any GHG program.<br><br>The UCR recommends a grid emission factor of 0.757 |

| | |
|---|---|
| | tCO2/MWh for the 2024 vintage year as a fairly conservative estimate for Indian projects not previously verified under any GHG program. |
| Source of data | UCR CoU Standard Update |
| Value(s) applied | Emission Factor (Till 2023): 0.90<br>Emission Factor (2024 Onwards): 0.757 |
| Measurement methods and procedures | - |
| Monitoring frequency | Yearly |
| Purpose of data | Calculation of baseline emissions |

## Data and Parameters to be monitored (ex-post monitoring values):

| | |
|---|---|
| Data / Parameter: | **EGy** |
| Data unit: | MWh |
| Description: | Net power supplied to manufacturing facility due to waste heat recovery |
| Source of data: | Measured |
| Measurement procedures (if any): | Gross power generation is directly measured using an energy meter installed at the site. |
| Monitoring frequency: | Recording frequency: Monthly<br>Calculated based on daily gross power generation and auxiliary power consumption in the power generation plant. |
| Value applied | 252,018.83 |
| QA/QC procedures: | As per Section C.10 |
| Purpose of data: | Calculation of baseline emissions |
| Any comment: | NA |

| | | |
|---|---|---|
| Data / Parameter: | $EG_{GEN,y}$ | |
| Data unit: | MWh | |
| Description: | Gross power generation from project activity | |
| Source of data: | Measured | |
| Measurement procedures (if any): | Gross power generation is measured directly using energy meter installed at the site. | |
| | **Capacity**: $6.5\ MW_{AC}$ | $14\ MW_{AC}$ |
| | **Meter No.**: XC451758 | X1576928 |
| Monitoring frequency: | Frequency of measurement – Continuous | |
| Value applied | 280,020.93 | |
| QA/QC procedures: | As per Section C.10 | |
| Purpose of data: | Calculation of baseline emissions | |
| Any comment: | NA | |

| | |
|---|---|
| Data / Parameter: | $EG_{AUX,y}$ |
| Data unit: | MWh |
| Description: | Auxiliary power consumption in project activity |
| Source of data: | Measured |
| Measurement procedures (if any): | Plant operation data on power generation in project activity |
| Monitoring frequency: | Frequency of measurement – Continuous |
| Value applied | 28,002.09 |
| QA/QC procedures: | As per Section C.10 |
| Purpose of data: | Calculation of baseline emissions |
| Any comment: | NA |