



**Verified Carbon
Standard**

NATURAL GAS BASED COMBINED CYCLE
POWER PROJECT AT VALANTHARAVAI
VILLAGE, RAMANATHAPURAM DISTRICT,
TAMIL NADU BY PENNA ELECTRICITY
LIMITED [FORMERLY ARKAY ENERGY
LIMITED]



DOCUMENT PREPARED BY EKI ENERGY SERVICES LIMITED

Project Title	Natural Gas based Combined Cycle Power Project at Valantharavai Village, Ramanathapuram District, Tamil Nadu by Penna Electricity Limited [Formerly Arkay Energy Limited]
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¹ <https://registry.terra.org/app/projectDetail/VCS/508>

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The purpose of the project activity is to set up a Natural Gas based Combined cycle power plant with a total installed capacity of 58.15 MW to meet the contract capacity i.e. net electricity generation of 52.8 MW. The plant consists of one gas turbine of 38.15 MW and steam turbine of 20 MW. Electricity are sold to the State utility company i.e. Tamil Nadu State Electricity Board (TNEB). This Power plant are operate on the cleaner fuel like Natural gas will lead lower the carbon dioxide (GHG) emissions for producing equivalent amount of power as compared to the other power plants in the region operating on other fuels like coal/ lignite/oil/naphtha.

The project increased the installed electricity generating capacity of Tamil Nadu State Electricity Board (TNEB), thereby helping in bridging the gap between demand and supply of electrical energy in the state. The project are also enhance the economic growth and development of the area.

At the optimum year, the project are consume around 243,042 SCMD of Natural Gas from the Cauvery Asset, Ramanathapuram Zone of Oil and Natural Gas Corporation (ONGC). The Natural Gas are piped by GAIL from the Gas Collecting Station of ONGC, which is located at about 500 meters away from the plant site.

Brief description of the installed technology and equipment:

The project activity is a combined cycle (gas and steam cycles) power plant with an installed capacity of 58.15 MW consisting of one Gas Turbine Generating Unit of 38.15 MW rated capacity, one Heat Recovery Steam Generator Unit of 67 TPH rated capacity coupled to a Steam Turbine Generating Unit of 20 MW rated capacity along with all electrical systems, controls and Instrumentation, Civil, Structural and Architectural works. The rating of the power plant is 38.15 MW at PF: 0.8 in Open Cycle and about 58.15 MW at PF: 0.8 in Combined Cycle.

The relevant implementation dates

After obtaining all necessary statutory approvals, the Plant has commenced its commercial operations in 01-July-2006 and started exporting clean power to grid.

The total GHG emission reductions or removals generated in this monitoring period.

The total emission reductions achieved in this monitoring period i.e. from 01-July-2012 to 30-June-2016 (first and last date included) is 508,306 tCO₂ e.

1.2 Sectoral Scope and Project Type

Type: Energy Industries (Renewable & Non-Renewable Sources)

Sectoral Scope: 1 Energy industries (renewable - / non-renewable sources)

Project is not grouped project activity as per VCS guidelines.

1.3 Project Proponent

Organization name	Pioneer Power Limited ² (formerly Penna Electricity Limited)
Contact person	Mr. P Pratap Reddy
Title	Managing Director
Address	Plot No. 703, Sriniketan Colony, Road No.3, Banjara Hills, Hyderabad, Andhra Pradesh 500 034
Telephone	NA
Email	NA

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the Project	Project Consultant
Contact person	Anant Ladukar
Title	Senior Manager
Address	Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010, India
Telephone	9770900205
Email	anant@enkingint.org / registry@enkingint.org

1.5 Project Start Date

Project Start date: 01-July-2006

(Commencement of Commercial operation i.e. the day project activity started reducing GHG emissions)

1.6 Project Crediting Period

Project Crediting Period Start date: 01-July-2006

Project Crediting Period End date: 30-June-2016

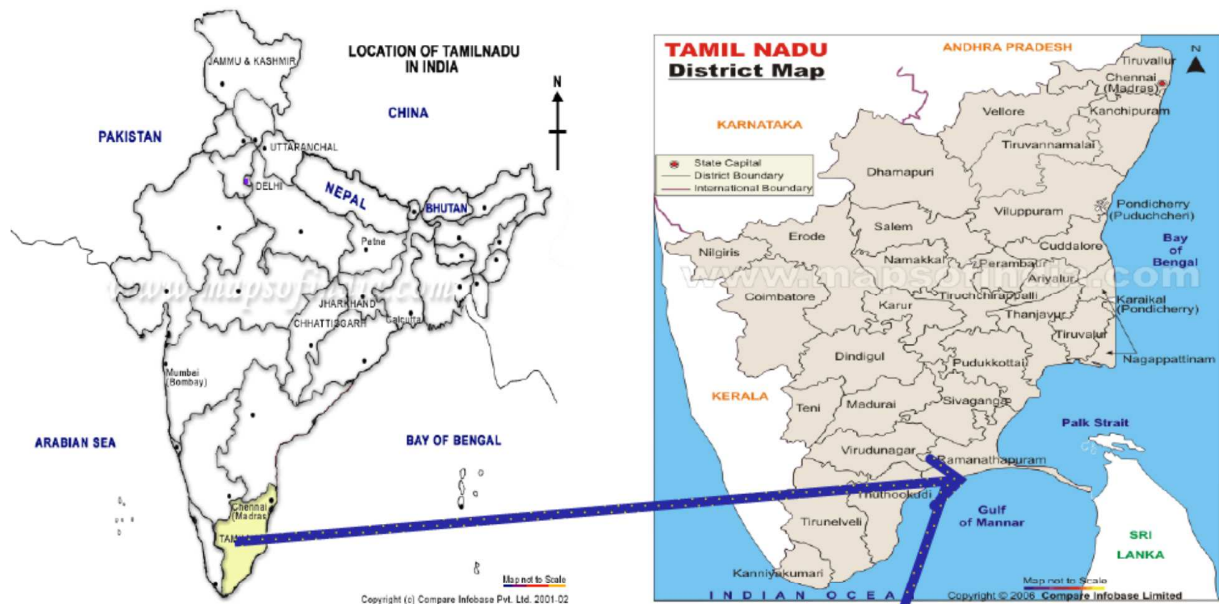
Total Crediting Period: 10 Years (Fixed)

Verification for period 01-July-2006 to 30-June-2012 are under progress by TUV SUD & till date ongoing. Once completed documents will be submitted to VERRA.

1.7 Project Location

The power plant are located at Survey Nos. 203 & 204 of Valantharavai Village, Ramanathapuram District, Tamil Nadu State. The site is approximately 12 km from Ramanathapuram Town and 40 km from Rameswaram. The site is easily approachable by National Highway No. 49. The nearest airport is Madurai, which is at a distance of 150 km from the site. The nearest Railway Station is Ramanathapuram, which is at a distance of 12 Kms. from the site. The latitude and longitude of the site are 09°19'24" N and 78°54'42" E. The power plant site including infra-structural facilities, green belt, open space etc. encompasses a total area of 18.89 acres. The location is indicated in the maps below.

² The name of Penna Electricity Limited has changed to Pioneer Power Limited on dated 22/09/2010. Incorporation certificate is attached for verification.



Map 1: Location of Tamil Nadu in India

Map 2: Location of Ramanathapuram District in the Tamil Nadu



1.8 Title and Reference of Methodology

Title: “Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas” Version 03³

³ <https://cdm.unfccc.int/methodologies/DB/WW4I82DG7LJUQE5E5YGT1NZE4PNS60>

Reference: Approved baseline methodology AM0029

Methodology refers to the tool for calculating baseline CO₂ emission factor.

Tool to calculate the emission factor for an electricity system, version 1.1⁴

1.9 Participation under other GHG Programs

The project has neither been registered nor seeking registration under any other GHG programs. The project is seeking registration only in VCS program.

PP has provided undertaking that in current monitoring period, it has not claim GHG emission reduction credits in any GHG program other than in VERRA. There is no double counting of GHG emission reductions

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits: The project proponent is not participating in any other emission trading program and other binding limits.

The project activity is not availing any REC benefits and the same can be confirmed from publicly available link of REC generators.

https://www.recregistryindia.nic.in/index.php/publics/registered_regens

Other Forms of Environmental Credit: The project activity neither has nor intends to generate any other form of GHG related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

1.11 Sustainable Development Contributions

The expected contribution from the project to sustainable development can be studied under four broad heads, viz.

- Environment Wellbeing
- Technical Wellbeing
- Social Wellbeing, and
- Economic Wellbeing

Environment Wellbeing:

A substantial portion of energy generated in India is through coal and lignite. Power plants based on coal and lignite account for more than half of the installed capacity. Lignite, being mined in the State of Tamil Nadu, is used as one of the major fuels for power generation in the State. Therefore, increase in demand for energy places stress on the environment. The stress can be relieved only through reduction of wastages and optimum use of Clean Energy sources, like Natural Gas, Water and Wind.

The project activity is use Natural Gas, a cleaner fuel as compared to fossil fuels like lignite (brown coal) and sub-bituminous coal. The plant are help replace this fuel, which is environmentally less clean. As the emission due to combustion of Natural Gas is substantially less as compared to combustion of coal or lignite, the project are reduce SO_x, NO_x as well as GHG emissions. Further, since Natural Gas power projects do not lead to production of huge quantities of solid waste like ash in thermal power plants, the project are also reduce the burden on the environment. Finally, generation of power through Natural

⁴ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v1.1.pdf>

Gas by this plant would also go to reduce the demand for coal and lignite, which is used by other industries / sectors.

Technical Wellbeing

The project are employing the latest combined cycle technology. The technology are

- recovering flue gases through Heat Recovery Steam Generation (HRSG) and using the same for generation of energy;
- providing turbines with electro hydraulic governing system to regulate turbine speed during normal on-load operation and during turbine run-up control;
- use of forced draft air-cooled condenser with a frame structure supporting fin tube heat exchanger bundles;
- use of brushless or static type of excitation system for generators;
- use of DM water desalination plant instead of water from the river; and
- Reducing the water requirement to the bare minimum by recirculation of water.
- The project activity is least water intensive. In the first place it does not use water for cooling. Instead, it uses Air-cooled condenser, which cost as much as 4 times more than the Water-cooled condenser. Water Cooled Condenser requires additional water as much as 2050 cu.m per day. Secondly, the water used for (waste heat recovery) boiler is recycled and additional water requirement is only to take care of evaporation losses.
- Finally, the project activity is a zero discharge effluent plant. It does not discharge any effluent – gas, or solid or liquid and thus does not cause any harm to the environment.
- These kinds of facilities exist in very few gas based power plants in the country. Thus, this type of projects are not common in India and more particularly, Southern region.

The project are also offer possibility of collaboration with the local engineering and technical schools, which are mutually beneficial.

Social Well being

The project are confer benefits on the society as a whole and the nearby areas in particular, both directly and indirectly. The project are provide employment to about 70 persons directly. The employed are represent an amalgam of both skilled and unskilled workers and engineering graduates. Direct employment apart, the project are give rise to ancillary economic activity in the vicinity of the project site as well as in the proximity. The direct employment provided by the project apart, the industrial units using the energy generated by the project are provide employment to thousands of skilled and unskilled workforce. The spread and demonstration effect the project are confer on the country in general and the State in particular and the contribution it make to the hinterland development are substantial.

Economic well being

The project is essentially an infrastructure projects. As such, its contribution is not restricted to only direct contribution, but also extends to contribution derived indirectly from the economic activity arising out of this project. Setting up of this project in Valuthur Village in Ramanathapuram District would give rise to development of social and physical infrastructure in and around the area. Besides, being an infrastructure project, the resultant industrialization (consequent upon this project) are also contribute to the development of physical, social and institutional infrastructure in the State as a whole. The successful operation of this project are lead to the setting up of socially desirable projects like schools, colleges, technical institutes, hospitals, clinics etc. among others by the project proponents. The project proponent has already taken up a project to construct a community hall in the village and the Panchayat building to start with.

In sum, the project activity are contribute to the environment, social and economic issues both locally and globally by

- Net generating power 52.8 MW through relatively clean fuel and augment the power supply in the country;
- reducing GHG emissions;
- conserving lignite/coal for other sectors, which cannot use natural gas;
- providing employment both directly as well as indirectly;
- contributing to the overall development of the area nearby and the State as a whole; and
- space requirements per MW for a gas based stations are less than coal based stations

Hence the project is not likely to have any significant adverse negative environmental effects during execution/after commissioning /during the operational lifetime of the project.

Further the project are support to establish, promote the development, manage and safeguard the rational and sustainable exploitation and utilization of renewable energy resources for social and economic development, and can play a critical role in improving the overall energy scenario of the country, particularly of the remote and inaccessible areas. There by support the global climate change programme by cleaner energy.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	7.2.1: Renewable energy share in the total final energy consumption	Implemented activities to increase	About 1,298,708 MWh renewable electricity has supplied to Indian grid during the reported period that helps to increase the renewable energy share in the energy mix.	Overall, 3,405,249 (2,106,541 + 1,298,708) MWh renewable electricity has supplied to Indian grid throughout the project lifetime that helps to increase the renewable energy share in the energy mix.
2)	13.0	13.2.2: Total greenhouse gas emissions per year	Implemented activities to increase	By supplying 1,298,708 MWh clean electricity (generated through Natural Gas based Combined cycle power plant) to Indian grid, the project avoided release of 508,306 tCO ₂ e in to the atmosphere during the reporting period.	Overall prevented the release of 1,016,350 (508,044 + 508,306) tCO ₂ e into the atmosphere since project commissioning.
3)	8.6	8.6.1 Proportion of youth (aged 15-24 years) not in education, employment or training	Implemented activities to increase	The Project organize 01 training/ year for the staff on the monitoring of the plant operation, and the emergency and safety procedures.	Overall, 10 trainings are provided since project commissioning.

2 SAFEGUARDS

2.1 No Net Harm

As per the Indian Government rule and regulations, the project activity are get an environmental clearance in the form of “No Objection Certificate” from the Tamil Nadu Pollution Control Board. Besides, the project site are approved from the environmental angle.

A comprehensive environmental impact assessment study are conducted for the project and the study reveals that the impact of the project activity on the environment is not significant. The major findings of the study are given below:

Topography: The present topography of the study area is a coastal plain sandy terrain and nearly 30% of the buffer zone is occupied by sea. In the core zone, few small sand dunes are noted. The construction of the combined cycle power project are affect the existing land surface of 18.89 acres acquired by Penna Electricity Limited. Planting of a thick canopy of trees at a width of 5 mtrs. Along the periphery of the core zone and proper formation of roads and other infrastructural facility would upgrade and preserve topography. Due to the project, there are not any change in the topography of the buffer zone.

Climate: Normally, the regional factors such as monsoon and depressions are the main factors that govern the climatic conditions like temperature variations, wind direction and velocity, rainfall and humidity. The gas based power generation are not tend to influence the existing climatic conditions. Though exit gas temperature through the stack is slightly higher than the atmospheric temperature, it is not affect the local climate due to high dispersion through suitably designed stack.

Air Environment: Dispersion of different pollutants released into the atmosphere have significant impacts on surrounding environment of any industrial project and forms an important part of impact assessment studies. The collection of baseline information with respect to air pollutants comprises of Suspended Particulate Matter (SPM), Oxides of Nitrogen (NOx) and Carbon Monoxide (CO). Anticipated impacts with respect to air pollutants are super imposed on the present ambient air quality parameters to find out the net impacts in the air environment.

Air Pollution Potential – Fugitive emissions: Since the fuel for the power generation, natural gas, is transported through pipeline from the nearby ONGC gas gathering station, there is no chance of fugitive dust generation to raw material transportation. However to avoid dust generation, all roads inside the power plant are concreted. In addition, water spray are done regularly to avoid fugitive dust generation.

Air Pollution Potential – Impact due to the usage of natural gas: The gaseous emission generated during the ignition process is exhausted through a 34.50 mtr. main stack. Natural gas comprises Methane, which is the combustible component. The natural gas is an environmental friendly fuel and hence the quantum of emission would be negligible and there are no impact on air quality.

Air Pollution Potential – Air quality model and predictions: The study reveals that the increase in Ground Level Concentration value for the pollutant NOx is very low and well within the prescribed standards for ambient air quality. When compared to other fuels such as coal, furnace oil, LSHS, the natural gas does not generate any solid waste. Though by

virtue of its gaseous fractions, the emitted flue gas contains the gaseous pollutants such as NO_x, the anticipated increase in the ground level concentration of SO₂ and NO_x is well below the standard prescribed by CPCB/TNPCB.

Noise Environment- Noise pollution potential: Generally, GT, STG and GEs are noise generating. These are housed in concrete hollow block civil structure, which is suitably located on the site to ensure compliance with the industrial noise norms of 55 DB (A) during day time and 45 DB (A) during night time. The noise level outside the plant are lower because noise intensity decreases as the distance from the noise source increases. The time of exposure to these noise levels outside plant premises are less than for the workers inside the plant. Thus, the impact of the project on the ambient environment and consequently on the human are minimal.

Land Use: About 18.89 acres of uncultivable land are purchased by Penna Electricity Limited (PEL) for the power generation projects. 34% of the land are utilized for project activities and 30% for developing green belt. Since there are no vehicle movement either for supply of raw material or for transportation of finished goods, the fugitive emissions from the project activity is nil. Since the project activity are using radiator type cooling, noise generation are also be very low. The green belt around the power plant are reduce the noise propagation around the proposed power plant. The green belt are also reduce, to a certain extent, the air pollution impact.

Ecological Factors: The core zone does not present a picture of natural species of vegetation due to the limitation in the agricultural activities. Hence, except for change in land use, there is no perceptible effect by the project. Use of natural gas for power generation are generate any suspended particulate matter, gaseous pollutants, and solid waste and hence the question of project activity affecting the available cropland or vegetations over the buffer zone is nil. Moreover, since natural gas are not discharge any metal pollution, oil pollution, pesticide pollution and microbiological pollution, the project would not affect the biosphere.

Socio Economic Environment: The project activity are go to augment the power supply of the State through relatively clean and efficient technology for power generation without significantly affecting the environment. The project activity are provide employment to a few skilled workers and also push other industrial/commercial avenues in the region.

Environmental Pollution: The project activity are not generate any trade effluent. The waste water generated are from the domestic usage of water and DM plant reject. This effluent are also be treated to meet the standard prescribed by CPCB and the same are used for green belt development. Hence, there are not be any deterioration in water quality. Since the project activity are utilizing most eco-friendly natural gas for power generation, though there are a marginal increase in the gaseous pollutant such as NO_x, it is well within the limit prescribed by the CPCB.

During the construction phase, there are a chance for noise propagation due to the movement of vehicles and construction activities. However, the noise propagation are controlled through regulated movement of vehicles. During the operational phase, the development of green belt are reduce the noise level. GT, STG & GE are located in a hollow brick walled construction are ensure the noise level is maintained within the prescribed limit.

2.2 Local Stakeholder Consultation

The stakeholder meeting was conducted on during registration of the project activity. PP took due care of the comments received during LSC.

The process of local stakeholder consultation is continuous. During the current monitoring period, the project proponent has kept grievance register in plant site office and sought comments/grievances/suggestions from local stakeholders including local community, government agencies and NGOs. However, no comments/grievances/suggestions have been received from the aforementioned stakeholders during the current monitoring period.

2.3 AFOLU-Specific Safeguards

Not applicable as this is not an AFOLU project activity.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project activity is a combined cycle (gas and steam cycles) power plant with an installed capacity of 58.15 MW consisting of one Gas Turbine Generating Unit of 38.15 MW rated capacity, one Heat Recovery Steam Generator Unit of 67 TPH rated capacity coupled to a Steam Turbine Generating Unit of 20 MW rated capacity along with all electrical systems, controls and Instrumentation, Civil, Structural and Architectural works. The rating of the power plant is 38.15 MW at PF: 0.8 in Open Cycle and about 58.15 MW at PF: 0.8 in Combined Cycle.

The steam turbine generator are of the condensing non-reheat type, designed to operate with steam at 65 kg/sq.m @ 500°C.

The exhaust system consists of exhaust ducting from the turbine/engine connected to the chimney through, gas silencer and an exhaust gas duct. The system is designed suitably to limit the back pressure. The silencer is installed in the exhaust gas ducting for reducing the noise level. The DM water for the Plant is sourced from a Water Desalination plant being installed close to the site.

The generators are of the air cooled type. The excitation system for the generators are brushless or static type. It is envisaged to step up the power to 110 kV and evacuate the power through the Tamil Nadu Power grid through at 110 kV line to various consumers. The switchyard is outdoor air insulated type and has a nominal voltage of 110 kV.

As the plant are using clean fuel in the form of natural gas, it is not discharge any effluents, solid, liquid or gaseous; the technology is environmentally safe and sound as it is operate well within the prescribed environmental norms.

There is no technology transfer in the project activity.

The Technical details of the project as follows:

Contract Capacity (MW)	52.8
Aux. consumption	4%

Gross electricity generation	55.0
Plant Load Factor (%)	85
Gross energy generation (GWh)	409.53
Auxiliary Consumption(GWh)	16.38
Net electricity generated(GWh)	393.15
Heat rate (kcal/kWh)	1980
Calorific value of fuel (kcal/scm)	8775
Fuel requirement, (scm)	92406769
(SCMD)	253169

The project has been under operation since commissioning, without any major breakdowns. The breakdown details are provided in Appendix II: Breakdown Details

3.2 Deviations

2.1.1 Methodology Deviations

There is no request for methodology deviation applied during current monitoring period

2.1.2 Project Description Deviations

There is no Project description deviations applied during current monitoring period- and first verification is ongoing.

3.3 Grouped Projects

This project activity is not a grouped project activity. Hence not applicable.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	EF _{CO₂,NG,y}
Data unit	tCO ₂ /GJ
Description	Emission factor of Natural Gas
Source of data	IPCCC Default Value or Appendix B of vide web link https://cea.nic.in/wp-content/uploads/baseline/2020/07/database_4.zip
Value applied	54.3
Justification of choice of data or description of measurement methods and procedures applied	The data published in CEA is the authenticated and represents the national average values. Hence, the emission factor value is considered from CEA.
Purpose of Data	Calculation of project emissions

Comments	The above value are applied for estimation of project emissions during the crediting period.
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Data / Parameter	OXID _{NG}
Data unit	-
Description	Oxidation factor of Natural gas
Source of data	Latest IPCC default value
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	100% of the data are monitored annually
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	EF _{NG, upstream, CH₄}
Data unit	tCH ₄ /PJ
Description	Emission factor for upstream fugitive methane emissions of natural gas from production, transportation and distribution.
Source of data	IPCC Values as indicated in Table 2 of AM0029 ver.3
Value applied	160 [Production: 72 Processing, transport and distribution: 88]
Justification of choice of data or description of measurement methods and procedures applied	As the fuel supplier (GAIL) adopted international standards like American Society of Mechanical Engineers (ASME) and European Norms for laying pipelines for transportation of natural gas, pipeline coating, a gas metering system, etc.
Purpose of Data	Calculation of project emissions
Comments	GAIL is maintaining all its processing plants and gas transmission lines matching the international standards. GAIL also formulating guidelines for the pipelines along with the BIS for development of uniform standards for high pressure oil and gas transmission pipeline systems ¹⁵ . Also GAIL conducts the regular safety audits to maintain the international safety standards with some reputed international firms

4.2 Data and Parameters Monitored

Data / Parameter	FC _i
Data unit	scm
Description	Annual quantity of Natural gas consumed in the project activity
Source of data	Reading of Gas flow meters; The gas supplied to the project are metered at project site and accordingly billed by Gas Authority of India.
Description of measurement methods and procedures to be applied	Natural gas consumption are measured on daily basis at project site. The total gas consumption are monitored by GAIL and PEL and are cross verified by PEL fortnightly
Frequency of monitoring/recording	Measured on daily basis at project site.
Value monitored	332,662,102 (after application of error factor)
Monitoring equipment	Gas Flow Meter
QA/QC procedures to be applied	The meter are subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing at least once in year to ensure accuracy. The readings are double checked by the gas supply company.
Purpose of the data	Calculation of project and leakage emissions
Calculation method	Not Applicable
Comments	Proportion of data monitored are 100% and archived electronically / on paper as available. The archived data are stored up to two years from the end of crediting period or the last issuance, whichever occurs later.

Data / Parameter	NCV _{i,y}
Data unit	GJ/m ³ (or Kcal/scm)
Description	Net calorific value of natural gas (Fuel f)
Source of data	The calorific value of natural gas is provided by the gas supplier in the fortnightly invoices. This are converted into the units required for estimation of project emissions i.e. TJ/scm. Besides Invoices of GAIL, the NCV will also be measured periodically independent of GAIL.
Description of measurement methods and procedures to be applied	The calorific value of the gas are provided by the supplier in the gas invoice and recorded and verified by the project participant
Frequency of monitoring/recording	Recording Frequency: Fortnightly
Value monitored	2012: 8790.17 2013: 8791.47 2014: 8783.40 2015: 8789.70 2016: 8790.12
Monitoring equipment	Not Applicable
QA/QC procedures to be applied	Additional QA/QC procedure is not planned
Purpose of the data	Calculation of project and leakage emissions
Calculation method	Not Applicable

Comments	The data are archived electronically/ on paper as available. The archived data are stored up to two years from the end of crediting period or the last issuance, whichever occurs later.
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Data / Parameter	EG _{Gross}
Data unit	kWh
Description	Total quantity of Electricity generated from the project activity during the year y
Source of data	On-site measurements from the readings of meter installed at plant site.
Description of measurement methods and procedures to be applied	Measured daily using calibrated meters and aggregated monthly.
Frequency of monitoring/recording	Measured daily and aggregated monthly
Value monitored	1,367,117,000
Monitoring equipment	Energy Meter
QA/QC procedures to be applied	The consistency of metered electricity generation are cross-checked with the quantity of fuel fired. The Meters used for reading the Gross electricity generation are calibrated as per industry standards of host country (India) and calibration of meters are carried out annually.
Purpose of the data	Calculation of baseline emissions
Calculation method	Not Applicable
Comments	Data archived: Crediting period + two years.

Data / Parameter	EG _{Import}
Data unit	kWh
Description	Onsite electricity consumption of the project activity imported from the grid system during the year y
Source of data	Main meters and Check meters provided by project proponent at Project site.
Description of measurement methods and procedures to be applied	Measured monthly using calibrated meters of accuracy class 0.2 and aggregated annually. Meters are calibrated as per industry standards/PPA. Sales records to the grid and other records are used to ensure consistency.
Frequency of monitoring/recording	Measured monthly
Value monitored	280,228,000
Monitoring equipment	Energy Meter
QA/QC procedures to be applied	Electric power imported from grid are measured by Main Meter and Check Meter by both project proponent and TNEB as specified in the PPA and records maintained. To cross-checked with monthly invoices or receipts of payments.
Purpose of the data	Calculation of baseline emissions
Calculation method	Not Applicable
Comments	Data archived: Crediting period + two years.

Data / Parameter	EG _{PJ,y}
Data unit	kWh

Description	Net quantity of electricity generated (exported) to the grid by the project activity.
Source of data	Main meters and Check meters provided by project proponent at Project site.
Description of measurement methods and procedures to be applied	Measured monthly using calibrated meters of accuracy class 0.2 and aggregated annually. Meters are calibrated as per industry standards/PPA. Sales records to the grid and other records are used to ensure consistency.
Frequency of monitoring/recording	Measured monthly
Value monitored	1,298,708,000
Monitoring equipment	Energy Meter
QA/QC procedures to be applied	Electric power imported from grid are measured by Main Meter and Check Meter by both project proponent and TNEB as specified in the PPA and records maintained. To cross-checked with monthly invoices or receipts of payments.
Purpose of the data	Calculation of baseline emissions
Calculation method	Not Applicable
Comments	Data archived: Crediting period + two years.

Data / Parameter	EF _{BL, upstream, CH4}
Data unit	tCH ₄ /GWh
Description	Emission factor for upstream fugitive methane emissions of natural gas from production, transportation and distribution.
Source of data	Latest CEA data Base
Description of measurement methods and procedures to be applied	EF _{BL,upstream,CH4} is calculated for power plants included in the Build Margin of Southern Regional grid, inline with the baseline emission factor selection. Therefore in line with the AM0029 requirement of ex-post determination of the Build Margin, the Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity electricity generation (tCH ₄ or tCO _{2e} /MWh) will also be determined ex-post.
Frequency of monitoring/recording	Annually
Value monitored	2012 :13.72 2013 :13.00 2012 :13.05 2015 :13.14 2016 :12.72
Monitoring equipment	Not Applicable
QA/QC procedures to be applied	No additional QA/QC procedures need to be applied since it is a officially published data
Purpose of the data	Calculation of baseline emissions
Calculation method	Not Applicable
Comments	This is monitored ex-post as required by the methodology

Data / Parameter	EF _{BL,CO2,y}
Data unit	tCO ₂ /GWh
Description	Emission factor of the plants included in the build margin
Source of data	Latest CEA data Base

Description of measurement methods and procedures to be applied	Calculated as the Build Margin (BM) emission factor for the Southern Regional Grid as per the CEA CO ₂ Baseline Database for the Indian Power Sector. When published data for the ex-post calculation of emission factor is not available for a particular year, the factor calculated for the previous year would be adopted
Frequency of monitoring/recording	Annually
Value monitored	2012: 947.2 ⁵ 2013: 952.0 ⁶ 2014: 928.4 ⁷ 2015: 908.2 ⁸ 2016: 872.3 ⁹
Monitoring equipment	Not Applicable
QA/QC procedures to be applied	No additional QA/QC procedures need to be applied since it is a officially published data
Purpose of the data	Calculation of baseline emissions
Calculation method	Not Applicable
Comments	This will be monitored ex-post as required by the methodology

4.3 Monitoring Plan

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

The M&V Protocol provides a range of data measurement, estimation and collection options/techniques in each case indicating preferred options 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 purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.

The project revenue is based on the units exported as measured by energy meters installed at project site. The monitoring and verification system are mainly comprise of these meters as far as net electricity export to grid is concerned. The natural gas input are also be monitored. The export of electricity are also counter checked are sales bills/receipts. The invoices, based on meter readings are also covered in the regular finance audit.

The measurement of the quantity of natural gas used are produce evidence that the energy is being generated with reduced CO₂ emissions as compared to selected grid emissions. The project employed latest state of art monitoring and control equipment that measure, record, report, monitor and control various key parameters. Parameters monitored are quantity and

⁵ https://cea.nic.in/wp-content/uploads/baseline/2020/07/database_10.zip

⁶ https://cea.nic.in/wp-content/uploads/baseline/2020/07/database_10.zip

⁷ https://cea.nic.in/wp-content/uploads/baseline/2020/07/database_11.zip

⁸ https://cea.nic.in/wp-content/uploads/baseline/2020/07/database_12.zip

⁹ https://cea.nic.in/wp-content/uploads/baseline/2020/07/database_13.zip

quality of fuel used, total power generated, power exported to the grid from the project, etc. These monitoring and controls are part of the Distributed Control System (DCS) of the entire Plant. All monitoring and control functions are done as per the internally accepted standards and norms.

The instrumentation and control system available comprises of microprocessor-based instruments of reputed make with desired level of accuracy. All instruments are calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time.

The quantity of emission reduction units claimed by the project are only a fraction of the total generated emissions, which depends on the actual generation in a particular year. Required information about the performance of power generation units of Southern grid (which includes both private and public sector generation units of the grid) is available in the yearly publication of Central Electric Authority (CEA) of India. Hence, authentic data related to the measurements, recording, monitoring and control of the generation mix of the Southern network are ensured.

The CEA report contains all information regarding type of generation like hydro, thermal, nuclear, renewable etc., installed capacity, de-rated capacity, performance of generating unit, actual generation, capacity additions during the year, etc. which are used for verification of generation mix and emission factors for baseline calculation for a particular year.

Emission reductions: The project activity are reduce the CO₂ emissions. The emission reduction is directly proportional to the PLF. If the project operates at high efficiency level and exports more electricity to the grid, the project are contribute to more emission reduction. The sophisticated DCS would measure; collect data on various process parameters, records, monitor and control on a continuous basis.

Therefore, the verification are involve

- Verification of various measurement and monitoring methods.
- Verification of instrument calibration methods
- Verification of data generated by DCS
- Verification of measurement accuracy
- Verification of invoices raised by TNEB and GAIL

The above verification are enable to arrive at the exact quantity of Natural gas used, efficiency and heat rate of the power plant, total power generation and auxiliary consumption, and power exported to the grid.

a) Direct off-site Emission:

Direct off-site emissions are those emissions, which are significant and reasonably attributable to the project activity, but are not included in the project boundary. These emissions are also called as leakages. As per the boundary defined for the project, direct on-site emission arises during the transport of natural gas. However, in the baseline of power generation, fuel transport are take place, which has to be taken into account. On an average, the distance over which fuels are transported are larger for fossil fuel-fired power stations, contributing to baseline emissions because of a large distance to coal mines and ports. As against natural gas transportation (by pipeline) are contribute to negligible emission of CO₂ (due to operation of gas blowers at gas terminal point). Transport emissions of the baseline are much more than the transport emissions related to the project activity. To provide a conservative estimate of the emission reductions, the reduction in transport emissions in the project compared to the

transport emissions in the baseline is not taken into consideration for CO₂ emission reduction estimate of the project. Transport emissions are therefore not taken into account.

b) Indirect On-Site Emissions:

The indirect on site GHG source is the consumption of energy and the emission of GHGs involved in the construction of natural gas based combined cycle power plant. Considering the life cycle assessment of the total power generated and the emissions to be avoided in the life span of 15 –20 years, emissions from the above-mentioned source are too small and hence neglected. No other indirect on-site emissions are anticipated from the project activity.

d) Indirect Off-Site Emissions:

The indirect off-site GHG source is the emission of GHGs that are involved in the process, construction and erection of the transmission lines from the nearest sub station, up to the point from where the project wheels the power. This is an emission leakage. Considering the life cycle assessment of the total power generated and the emissions to be avoided in the life span of project, emissions from this source is also too small and hence neglected. The electricity generated, less the auxiliary consumption, are exported to the southern grid through TNEB to meet the increasing demand of electricity services, and there are no creation of new activities or demand in other places / sites caused by the project.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Baseline emissions are calculated by multiplying the electricity generated in the project plant ($EG_{PJ,y}$) with a baseline CO₂ emission factor ($EF_{BL,CO_2,y}$), as follows:

$$BE_y = EG_{PJ,y} * EF_{BL,CO_2,y}$$

Where

- BE_y : Baseline emissions in year y.
- $EG_{PJ,y}$: Electricity generated in the project plant J in year y.
- $EF_{BL,CO_2,y}$: Baseline CO₂ emission factor in year y.

As per the methodology the Baseline emission factor is chosen as the minimum of the following three

Option 1. The build margin, calculated according to “Tool to calculate emission factor for an electricity system”

Option 2. The combined margin, calculated according to “Tool to calculate emission factor for an electricity system”, using a 50/50 OM/BM weight

Option 3. The emission factor of the technology (and fuel) identified as the most likely baseline scenario under “Identification of the baseline scenario” above, and calculated as follows:

$$EF_{BL,CO_2} (tCO_2 / MWh) = \frac{COEF_{BL}}{\eta_{BL}} * 3.6 GJ / MWh$$

Where:

- COEF_{BL} = fuel emission coefficient (tCO₂e/GJ), based on national average fuel data, if available, Otherwise IPCC defaults can be used
- η_{BL} = The energy efficiency of the technology, as estimated in the baseline scenario analysis above.

Further, the methodology states that this determination are made once at the validation stage based on an ex ante assessment and if either option 1 (BM) or option 2 (CM) are selected, they are estimated ex post, as described in “Tool to calculate emission factor for an electricity system”.

As per the registered PD, “the lower value of BM, CM, EF_{BL,CO₂y} (tCO₂/MWh) has to be chosen as the baseline emission factor” and hence the project proponent has considered Build margin as the baseline emission factor. The value of the build margin, taken from CEA database is as follows:

	CEA Version	Version 10	Version 10	Version 11	Version 12	Version 13	Unit	
Option 1	The Build Margin	947.2	952.0	928.4	908.2	872.3	tCO ₂ /GWh	Determined Ex-post
Option 2	Combined Margin	954.1	969.3	961.3	946.2	922.4	tCO ₂ /GWh	Determined Ex-post
Option 3	Baseline Emission Factor of the Technology Identified	1064.0	1064.0	1064.0	1064.0	1064.0	tCO ₂ /GWh	Determine at the time of registration
	Estimation of Baseline Emission Factor on conservative basis	947.2	952.0	928.4	908.2	872.3	tCO ₂ /GWh	Min of (BM, CM, EF _{BLCO₂y})

Estimation of Baseline Emission Factor:

So as to have conservative emissions, lower value of BM, CM and the value as per equation above has to be chosen as baseline emission factor

$$BEF = \text{lowest of (BM, CM, } EF_{BL,CO_2} (tCO_2 / MWh))$$

BEF	CEA Version 10	CEA Version 10	CEA Version 11	CEA Version 12	CEA Version 13
	tCO ₂ /GWh	tCO ₂ /GWh	tCO ₂ /GWh	tCO ₂ /GWh	tCO ₂ /GWh
Estimation of Baseline Emission Factor on conservative basis	947.2	952.0	928.4	908.2	872.3

Baseline Emission are calculated as follows

Year	Net Export to grid (Export to Grid - Import from Grid)	Emission Factor of Grid	Baseline Emissions
	GWh	tCO ₂ /GWh	tCO ₂
01-July-2012 to 31-December 2012	193.29	947.2	183,087
01-January-2013 to 31-December-2013	357.41	952.0	340,256
01-January-2014 to 31-December-2014	388.14	928.4	360,347
01-January-2015 to 31-December-2015	199.90	908.2	181,552
01-January-2016 to 30 June-2016	159.96	872.3	139,534
Total	1298.71		1,204,776

5.2 Project Emissions

The project activity is on-site combustion of natural gas to generate electricity and no start up fuels is required. The CO₂ emissions from electricity generation (PE_y) are calculated as follows:

$$PE_y = \sum FC_{f,y} * COEF_{f,y}$$

Where:

- FC_{f,y} = Is the total volume of natural gas or other fuel 'f' combusted in the project plant or other Start up fuel (m³ or similar) in year(s) y.
- COEF_{f,y} = Is the CO₂ emission coefficient (tCO₂/m³ or Similar) in year(s) for each fuel and is obtained as

$$COEF_{f,y} = \sum NCV_y * EF_{CO_2,f,y} * OXID_f$$

Where:

- NCV_y : Is the net calorific value (energy content) Per volume unit of natural gas in Year 'y' (GJ/m³) as determined from the fuel supplier, Wherever possible, otherwise from local or national data;
- EF_{CO₂,f,y} : Is the CO₂ emission factor per unit of energy of natural gas in year y (tCO₂/GJ) as determined from the fuel supplier, wherever Possible, otherwise from local or national data;
- OXID_f : is the oxidation factor of natural gas

Project Emission are calculated as follows

Year	Gas Consumption	Avg. Net Calorific value of gas	Emission factor of Gas (IPCC)	Oxidation Factor of Gas	COEF of Gas	Project Emissions
	SCM	kcal/SCM	tCO ₂ /GJ		tCO ₂ /m ³	tCO ₂
01-July-2012 to 31-December 2012	48,799,139	8790.17	0.0543	1	0.0019981	97,506
01-January-2013 to 31-December-2013	91,646,201	8791.47	0.0543	1	0.0019983	183,137

01-January-2014 to 31-December-2014	99,340,860	8783.40	0.0543	1	0.0019965	198,335
01-January-2015 to 31-December-2015	51,633,302	8789.70	0.0543	1	0.0019979	103,159
01-January-2016 to 30 June-2016	41,242,600	8790.12	0.0543	1	0.0019980	82,403
Total	332,662,102					664,540

5.3 Leakage

Leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive CH₄ emissions and CO₂ emissions from associated fuel combustion and flaring. In this methodology, the following leakage emission sources shall be considered

Fugitive CH₄ emissions associated with fuel extraction, processing, liquefaction, transportation, regasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity.

The leakage emissions are calculated as follows:

$$LE_y = LE_{CH_4,y} + LE_{LNG,CO_2,y}$$

Where

- LE_y : Leakage emissions during the year y in tCO₂e
- LE_{CH₄,y} : Leakage emissions due to fugitive upstream CH₄ emissions in the year y in tCO₂e
- LE_{LNG,CO₂,y} : Leakage emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in tCO₂e

Since, the plant is based on use of natural gas directly from wells of ONGC, which are be piped to the project site and that there is no consumption of LNG in the project activity, the equation in the approved methodology AM0029 are a simple equation and represented by.

$$LE_y = LE_{CH_4,y}$$

Fugitive methane emissions

For the purpose of estimating fugitive CH₄ (methane) emissions, the quantity of natural gas consumed by the project in year y is multiplied with an emission factor for fugitive CH₄ emissions (EF_{NG,upstream,CH₄}) from natural gas consumption and subtract the emissions occurring from fossil fuels used in the absence of the project activity, as follows

$$LE_{CH_4,y} = [FC_y * NCV_y * EF_{NG,upstream,CH_4} - EG_{PJ,y} * EF_{BL,upstream,CH_4}] * GWP_{CH_4}$$

Where

- LE_{CH₄,y} : Leakage emissions due to fugitive upstream CH₄ emissions in the year y in tCO₂e

FC_y	: Quantity of natural gas combusted in the project plant during the year y in m^3
$NCV_{NG,y}$	: Average net calorific value of the natural gas combusted during the year y in GJ/m^3
$EF_{NG,upstream,CH_4}$	: Emission factor for upstream fugitive methane LNG, emissions of natural gas from production, transportation, distribution, and, in the case of liquefaction, transportation, re gasification and compression into a transmission or distribution system, in t CH_4 per GJ fuel supplied to final consumers
$EG_{PJ,y}$	: Electricity generation in the project plant during the year in MWh
$EF_{BL,upstream,CH_4}$	: Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH_4 per MWh electricity generation in the project plant, as defined below
GWP_{CH_4}	: Global warming potential of methane valid for the relevant commitment period

The emission factor for upstream fugitive CH_4 emissions occurring in the absence of the project activity ($EF_{BL,upstream,CH_4}$) has been calculated consistent with the baseline emission factor (EF_{BL,CO_2}) i.e. Option I Build Margin

$$EF_{BL,upstream,CH_4} = \frac{\sum_j FF_{j,k} * EF_{k,upstream,CH_4}}{\sum_j EG_j}$$

Where

$EF_{BL,upstream,CH_4}$	: Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH_4 per MWh electricity generation in the project plant
J	: Plants included in the build margin
$FF_{j,k}$	: Quantity of fuel type k (a coal or oil type) combusted in power plant j included in the build margin
$EF_{k,upstream,CH_4}$	: Emission factor for upstream fugitive methane emissions from production of the fuel type k (coal or oil type) in t CH_4 per PJ fuel produced
EG_j	: Electricity generation in the plant j included in the build margin in MWh/a

The value has been calculated using the latest version of the CO_2 Baseline Database for the Indian Power Sector, made available by the Central Electricity Authority, Ministry of Power, Govt. of India.

Year	$EF_{BL,upstream,CH_4}$	Reference
	Fugitive Emission Factor in Baseline (t CO_2 /GWh)	
2012	13.72	CO_2 Baseline Database for Indian Power Sector, published by Central Electricity Authority, Ministry of Power, Government of India, Version 12, Mar 2017
2013	13.00	CO_2 Baseline Database for Indian Power Sector, published by Central Electricity Authority, Ministry

Year	EF _{BL,upstream,CH4}	Reference
	Fugitive Emission Factor in Baseline (tCO ₂ /GWh)	
		of Power, Government of India, Version 13, June 2018
2014	13.05	CO ₂ Baseline Database for Indian Power Sector, published by Central Electricity Authority, Ministry of Power, Government of India, Version 14, Dec 2018
2015	13.14	CO ₂ Baseline Database for Indian Power Sector, published by Central Electricity Authority, Ministry of Power, Government of India, Version 15, Dec 2019
2016	12.72	CO ₂ Baseline Database for Indian Power Sector, published by Central Electricity Authority, Ministry of Power, Government of India, Version 16, March 21

Leakage Emission are calculated as follows

Year	Gas Consumption	Avg. Net Calorific value of gas	Total Energy Content of Gas Consumed	Fugitive Emission Factor for NG	Global warming potential of methane	Fugitive Emissions for NG
	SCM	kcal/SCM	GJ	tCH ₄ /GJ		tCO ₂
01-July-2012 to 31-December 2012	48,799,139	8,790.17	1,795,595.93	0.00016	25	7,182.38
01-January-2013 to 31-December-2013	91,646,201	8,791.47	3,372,679.48	0.00016	25	13,490.72
01-January-2014 to 31-December-2014	99,340,860	8,783.40	3,652,495.92	0.00016	25	14,609.98
01-January-2015 to 31-December-2015	51,633,302	8,789.70	1,899,778.47	0.00016	25	7,599.11
01-January-2016 to 30 June-2016	41,242,600	8,790.12	1,517,539.04	0.00016	25	6,070.16

Year	Net Export to grid	Fugitive Emission Factor in Baseline	Fugitive Emission in Baseline	Net Leakage Attributable to the project activity
	GWh	tCO ₂ /GWh	tCO ₂	Fugitive Emissions for NG - Fugitive Emission in Baseline
01-July-2012 to 31-December 2012	193.29	13.72	2,651.98	4,531

Year	Net Export to grid	Fugitive Emission Factor in Baseline	Fugitive Emission in Baseline	Net Leakage Attributable to the project activity
				Fugitive Emissions for NG - Fugitive Emission in Baseline
	GWh	tCO ₂ /GWh	tCO ₂	tCO ₂
01-January-2013 to 31-December-2013	357.41	13.00	4,646.35	8,845
01-January-2014 to 31-December-2014	388.14	13.05	5,065.20	9,545
01-January-2015 to 31-December-2015	199.90	13.14	2,626.73	4,973
01-January-2016 to 30 June-2016	159.96	12.72	2,034.71	4,036
			Total	31,930

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01-July-2012 to 31-December-2012	183,087	97,506	4,531	81,050
01-January-2013 to 31-December-2013	340,256	183,137	8,845	148,274
01-January-2014 to 31-December-2014	360,347	198,335	9,545	152,467
01-January-2015 to	181,552	103,159	4,973	73,420

31-December-2015				
01-January-2016 to 30 June-2016	139,534	82,403	4,036	53,095
Total	1,204,776	664,540	31,930	508,306

During the current monitoring period, the project achieved net emission reductions of 508,306 tCO₂ compared to the estimated emission reduction of 361,604 tCO₂ which is 40.57% higher as compared to estimated. A detailed explanation for the same is given below.

Details comparison of Actual V/s estimated Net Export to grid and Gas Consumption for 1,461 days of current monitoring plan are as follows

Parameter	Net Export to grid		Gas Consumption	
Description	For Monitoring Period	As Per registered PDD	For Monitoring Period	As Per registered PDD
Year	kWh	kWh	SCM	SCM
01-July-2012 to 31-December 2012	193,293,226	198,190,080	48,799,139	46,583,138
01-January-2013 to 31-December-2013	357,411,806	393,148,800	91,646,201	92,406,769
01-January-2014 to 31-December-2014	388,137,935	393,148,800	99,340,860	92,406,769
01-January-2015 to 31-December-2015	199,903,161	393,148,800	51,633,302	92,406,769
01-January-2016 to 30 June-2016	159,961,871	198,190,080	41,242,600	46,076,800
Total	1,298,708,000	1,575,826,560	332,662,102	369,880,245
	Ratio of Million kWh to Million SCM for Monitoring Period	Ratio of Million kWh to Million SCM as per registered PDD		
	3.90	4.26		

Form above table it has been observed that there has no increase in Net Export to grid and Gas Consumption during the current monitoring period as compared to the estimated in registered PDD. Hence there has no impact on the additionality.

The Ratio of Million kWh to Million SCM for Monitoring Period is 3.90 and Ratio of Million kWh to Million SCM for registered PDD estimation is 4.26. This is the main reason for increasing the Emission reduction. The electricity generation / gas consumption ratio is depended upon availability of natural gas. During this monitoring period plant run on optimum load thus there was less gas consumption & higher generation.

Also, other reason for increase in the actual emission reduction achieved during the current monitoring period as compared to registered CDM PDD is due to the increase in the Build Margin emission factor for current monitoring period (Please refer table below) against **713.3 tCO₂/GWh** (registered VCS PD) which is ex-post and PP don't have control over it.

	Applied on year	2012	2013	2014	2015	2016		
	CEA Version	CEA Version 10	CEA Version 10	CEA Version 11	CEA Version 12	CEA Version 13	Unit	Remark
Option 1	The Build Margin	947.2	952.0	928.4	908.2	872.3	tCO ₂ /GWh	Determined Ex-post
Option 2	Combined Margin	954.1	969.3	961.3	946.2	922.4	tCO ₂ /GWh	Determined Ex-post
Option 3	Baseline Emission Factor of the Technology Identified	1,064.0	1,064.0	1,064.0	1,064.0	1,064.0	tCO ₂ /GWh	Determine at the time of registration
Estimation of Baseline Emission Factor on conservative basis		947.2	952.0	928.4	908.2	872.3	tCO ₂ /GWh	Min of (BM, CM, EF _{BLCO₂y})

APPENDIX I: <CALIBRATION DETAILS>

Energy Meter Calibration

Feeder	GTG	STG	Valuthur Feeder	Kavanoor Feeder	Due date of Calibration
Meter Details	Main meter	Main meter	Main meter	Main meter	
Make	Secure Meters	Secure Meters	Secure Meters	Secure Meters	
Model	E3M021	E3M021	E3M021	E3M021	
Accuracy Class	0.2s	0.2s	0.2s	0.2s	
Calibration Frequency	Annually	Annually	Annually	Annually	
Serial Number	ABB00271	ABB00273	ABB00268	ABB00278	
Date of Calibration	28-March-2012				28-March-2013
	28-March-2013				28-March-2014
	25-March-2014				25-March-2015
	24-March-2015				24-March-2016
	22-March-2016				22-March-2017
Meter Details	Check meter	Check meter	Check meter	Check meter	Due date of Calibration
Make	Secure Meters	Secure Meters	Secure Meters	Secure Meters	
Model	E3M021	E3M021	E3M021	E3M021	
Accuracy Class	0.2s	0.2s	0.2s	0.2s	
Calibration Frequency	Annually	Annually	Annually	Annually	
Serial Number	ABB00272	ABB00274	ABB00276	ABB00277	
Date of Calibration	21-March-2012				21-March-2013
	21-March-2013				21-March-2014
	19-March-2014				19-March-2015
	18-March-2015				18-March-2016
	17-March-2016				17-March-2017

Gas Flow Meter Calibration

Parameter	DPT	PT	TT/TE	Due date of calibration
Model	SISD2G3	-	PT-100	
Serial No.	2468817	-	-	
Accuracy Class	± 0.075%	± 0.075%	± 1.0%	
Frequency	Once in a Year			
Date of Calibration	14-Feb-2011			13-Feb-2012
	25-Feb-2012			24-Feb-2013
	26-Feb-2013			25-Feb-2014
	03-April-2014			02-April-2015
	21-April-2015			20-April-2016
	13-April-2016			12-April-2017

There are delay in calibration of gas flow meter hence application of error factor 0.075% on gas consumption has been applied on the respective months (Please refer Gas consumption sheet for more details of ER sheet).

APPENDIX II: < BREAKDOWN DETAILS >

GTG SHUTDOWN / TRIP REPORT

Shutdown / Trip		Sync. Back		Outage	Reason for shutdown / Trip
Date	Time	Date	Time	Hrs	
21.07.12	12:35	21.07.12	19:58	7.38	GT tripped due to GAIL gas pressure low. GAIL closed the gas main valve due to fire near GAIL/ONGC area.
14.08.12	03:49	14.08.12	11:52	8.05	Grid voltage surge observed same time CCW pump tripped due to under voltage protection. GBC tripped on CCW pressure low. GT tripped on Gas pressure low.
25.09.12	02:05	25.09.12	08:52	6.78	1. At 0205 hrs GT tripped due to loss of flame. 2. At 0227 hrs GT start command given & at 0234 hrs tripped due to Fail to ignite. 3. At 0543 hrs GT start command given & at 0556 hrs tripped on BB # 1 & BB # 2 vibration high.
09.10.12	19:55	09.10.12	23:30	3.58	1. GT tripped due to loss of flame. 2. At 2011 hrs GT start command given & at 2019 hrs tripped due to Fail to ignite.
11.10.12	11:56	11.10.12	16:25	4.48	1. GT tripped while checking the circuitry on failed flame detector # 1 & 2 and disconnecting the flame scanner # 3 wire caused GT tripped on "Gas control valves not following - trip".
30.01.13	22:42	31.01.13	03:12	4.50	GAIL instructed to stop the GT as gas leak was detected at ONGC terminal, GT was manually stopped as GBC # 2 tripped on suction gas pressure low.
07.04.13	18:48	07.04.13	20:57	2.15	GTG tripped due to GTG 110 KV bay breaker tripped on non directional over current 51R HV side relay acted.
14.04.13	12:22	14.04.13	14:40	2.30	GTG tripped due to GBC # 2 tripped as auxiliaries (CCW & IAC) tripped due to disturbance in Valuthur 110 KV feeder.
10.05.13	11:48	10.05.13	16:05	4.28	GTG tripped due to rotor earth fault relay operated.
25.05.13	00:23	26.05.13	03:35	27.2	GTG was manually stopped for pre shut down performance test preparation. (Before M.I)
02.06.13	00:12	23.06.13	21:31	525.32	GTG was stopped for major inspection.
27.06.13	05:45	27.06.13	08:22	2.62	GTG tripped on Valuthur 110 KV feeder breaker PPL end tripped due to Directional Over Current relay (E/F) operated & Kavanoor 110 KV feeder both end breaker tripped due to distance protection.
10.07.13	05:44	11.07.13	19:51	38.12	GTG tripped due to 110 KV bus bar protection.(GT came on cool down status but turbine shaft found not rotating even by local jog push button HR 43, machine put on natural cool down)
02.09.13	14:39	04.09.13	02:05	35.43	1. GTG was stopped as requested by GAIL. 2. When GT on cool down status at mark V, ratchetting mechanism was found not working. Machine put on natural cool down.
07.09.13	20:29	07.09.13	22:38	2.15	GTG tripped on Generator rotor earth fault. Stage # 1 & 2 acted.
19.11.13	10:20	19.11.13	12:10	1.83	GTG tripped due to Aux. power transformer # 2 tripped on local emergency push button relay acted, caused instrument air compressor & CCW pump tripped. CCW pressure low caused GBC # 1 trip.
20.11.13	19:09	20.11.13	20:20	1.18	GTG tripped on Generator rotor earth fault. Stage # 1 & 2 acted.
26.11.13	01:34	26.11.13	04:44	3.17	GTG tripped on Generator rotor earth fault. Stage # 1 & 2 acted.

Shutdown / Trip		Sync. Back		Outage	Reason for shutdown / Trip
Date	Time	Date	Time	Hrs	
30.11.13	10:46	30.11.13	12:25	1.65	GTG tripped due to GTG 110 KV breaker tripped on 51 Non directional over current relay operated at the same time Valuthur 110 KV feeder pioneer end breaker tripped.
07.12.13	03:23	07.12.13	08:53	5.50	GTG tripped with alaram GT class A trip relay 86 U 1 operated & AVR faulty.
21.01.14	10:01	23.01.14	04:03	42.03	GTG was stopped for, GT main hydraulic oil pump coupling changing & GT off line wash.
14.05.14	19:25	15.05.14	06:44	11.31	Sudden drop in GAIL gas pressure to 1.5 bar caused GBC trip, resulting GT trip.
17.05.14	19:02	17.05.14	20:58	1.93	GTG tripped due to GTG 110 KV bay breaker tripped on 'Y' phase Non directional over current protection.(Y phase jumper cut in Valuther 230 SS)
18.05.14	04:06	20.05.14	18:29	62.38	GTG was stopped as per GAIL gas shutdown permit. (GT off line water wash was don)
07.09.14	01:51	07.09.14	02:35	0.73	GTG trip on protection 'remote breaker' (11 KV) open.(GT in FSNL)
07.09.14	08:57	07.09.14	10:59	2.03	GTG trip on protection 'remote breaker' (11 KV) open.
18.10.14	19:53	19.10.14	00:07	4.24	GTG tripped due to tripping of 110 KV valuther (Pioneer end) & Kavanoor feeder both end breakers tripped.
28.10.14	05:40	28.10.14	09:55	4.25	GTG tripped due to tripping of 110 KV valuther (Pioneer end) & Kavanoor feeder both end breakers tripped.
29.10.14	05:55	29.10.14	08:12	2.28	GTG tripped due to tripping of 110 KV valuther (Pioneer end) & Kavanoor feeder both end breakers tripped.
30.10.14	05:52	30.10.14	08:37	2.75	GTG tripped due to tripping of 110 KV valuther (Pioneer end) & Kavanoor feeder both end breakers tripped.
31.10.14	05:54	31.10.14	08:34	2.67	GTG tripped due to tripping of 110 KV valuther (Pioneer end) & Kavanoor feeder both end breakers tripped.
22.11.14	06:41	22.11.14	08:52	2.18	GTG tripped due to loss of flame. Checked the flame scanner JB found rain water accumulation inside the JB
11.02.15	05:29	11.02.15	07:52	2.38	GTG tripped with alarm of generator lock out trip due to tripping of 110 KV Kavanoor (Pioneer end) & Valuthur feeder both end breakers tripped.
24.03.15	19:54	-	-	172.10	GTG stopped because of GAIL / Ramanad closed the gas supply valve to our plant at 1953 hrs.
01.04.15	00:00	22.04.15	09:55	513.92	GTG stopped because of GAIL / Ramanad closed the gas supply valve to our plant at 1953 hrs on 24.03.15
28.04.15	13:26	28.04.15	13:54	0.47	GTG came to FSNL due to Generator breaker tripped on directional power relay 32 acted because of GAIL gas pressure suddenly dropped.
30.04.15	14:42	30.04.15	15:35	0.88	GTG was stopped to arrest the air leak in gas turbine CPD pressure line.
17.05.15	20:02	20.05.15	00:07	52.09	GTG tripped on gas fuel pressure low due to GAIL gas pressure suddenly dropped. ONGC closed the gas supply valve due to gas leak in ONGC pipe line.
19.06.15	14:34	19.06.15	16:05	1.52	GTG tripped on 51 V-phase over current & 21 phase distance protection due to heavy fault on 110 KV valuthur feeder.
07.07.15	15:05	07.07.15	17:56	2.85	GTG tripped on GTG 110 KV bay transformer breaker tripped. Alarm appeared on window alarm panel 'STAND BY EARTH

Shutdown / Trip		Sync. Back		Outage	Reason for shutdown / Trip
Date	Time	Date	Time	Hrs	
					FAULT' operated. In RET 521 & RET 670 relay panel 'DIFF WAVV BLAK, HV EF LS TRIP' alarm registered.
07.07.15	18:02	07.07.15	19:13	1.18	Kavanoor 110 KV feeder breaker was closed, same time GTG tripped on GTG 110 KV bay breaker tripped due to 'STAND BY EARTH FAULT' operated. In RET 521 relay panel CONDUCTOR BROKEN, FUSE FAILD alarm registered.
07.07.15	19:30	07.07.15	21:34	2.07	GTG tripped on GTG 110 KV bay breaker tripped due to 'STAND BY EARTH FAULT' operated.
14.07.15	11:17	14.07.15	13:56	2.65	GTG tripped due to GTG 11 KV breaker tripped on phase distance protection, same time Line # 2 110 KV Kavanoor feeder both end breakers tripped on distance protection. (3.2 KM)
24.07.15	03:10	24.07.15	06:24	3.23	GTG tripped due to GTG 11 KV breaker tripped on 81/ 81 R frequency / Recof relay acted. Same time Line # 2 Kavanoor feeder 110 KV both end breakers tripped on distance protection (15.6 KM) and 110 KV Valuthur feeder both end breakers tripped.
03.08.15	13:25	03.08.15	15:50	2.42	GTG tripped due to GAIL gas pressure suddenly dropped from 9 bar to 1.5 bar, ONGC gas regulation problem.
06.08.15	19:13	-		604.78	GTG tripped on "High Exhaust temperature Spread trip" due to heavy flue gas leak at Exhaust Plenum.
01.09.15	00:00	30.09.15	24:00	720.00	GTG tripped on " High Exhaust temperature Spread trip" due to heavy flue gas leak at Exhaust Plenum at 1913 hrs on 06.08.15
1.10.15	00:00	31.10.15	24:00	744.00	GTG tripped on " High Exhaust temperature Spread trip" due to heavy flue gas leak at Exhaust Plenum at 1913 hrs on 06.08.15
1.11.15	00:00	30.11.15	24:00	720.00	GTG tripped on " High Exhaust temperature Spread trip" due to heavy flue gas leak at Exhaust Plenum at 1913 hrs on 06.08.15
01.12.15	00:00	31.12.15	24:00	744.00	GTG tripped on " High Exhaust temperature Spread trip" due to heavy flue gas leak at Exhaust Plenum at 1913 hrs on 06.08.15
01.01.16	00:00	30.01.16	09:19	705.68	GTG tripped on " High Exhaust temperature Spread trip" due to heavy flue gas leak at Exhaust Plenum at 1913 hrs on 06.08.15
25.03.16	14:12	25.03.16	16:32	2.33	GTG tripped on 86 U1, G1 & U2 relay acted & opened the 11 KV breaker, due to Valuthur 110 KV feeder disturbance.
20.05.16	4:47	24.05.16	08:50	100.05	GTG stopped manually due to ONGC - GCS shut down work.

STG SHUTDOWN/ TRIP REPORT

Shutdown / Trip		Sync. Back		Outages	Reason for shutdown / Trip
Date	Time	Date	Time	Hrs	
08.07.12	23:53	09.07.12	00:05	0.20	STG tripped due to STG bay 110 KV breaker tripped on Non directional over current relay operated.
09.07.12	01:36	09.07.12	01:47	0.18	STG tripped due to STG bay 110 KV breaker tripped on Non directional over current relay operated.
19.07.12	04:07	19.07.12	05:17	1.17	STG tripped on HRSG trip. HRSG tripped due to malfunction of HP drum high level switch.
21.07.12	12:35	21.07.12	23:25	10.83	STG tripped due to GT trip.
26.07.12	11:42	26.07.12	11:48	0.10	STG tripped on reverse power due to safety impulse water pressure low.
14.08.12	00:56	14.08.12	01:10	0.23	STG tripped due to STG bay 110 KV breaker tripped on Non directional over current relay operated.
14.08.12	03:49	14.08.12	15:07	11.30	STG tripped due to GT trip.
22.08.12	14:54	22.08.12	15:36	0.70	STG tripped due to STG bay 110 KV breaker tripped on Non directional over current relay operated.

Shutdown / Trip		Sync. Back		Outages	Reason for shutdown / Trip
Date	Time	Date	Time	Hrs	
24.08.12	10:23	24.08.12	11:05	0.70	STG tripped on HRSG trip. HRSG tripped due to malfunction of HP drum high level switch.
31.08.12	01:45	31.08.12	04:21	2.6	STG manually stopped due to BY & RB voltages dropped to 6 KV and load dropped to 9 MW.
03.09.12	23:06	03.09.12	23:17	0.18	STG tripped on control water header pressure low due to control water pump # 2 tripped.
25.09.12	02:05	25.09.12	12:49	10.73	STG tripped due to GT trip.
27.09.12	23:20	27.09.12	24:00	0.67	STG tripped due to STG bay 110 KV breaker tripped on Non directional over current relay operated.
09.10.12	19:55	10.10.12	02:07	6.20	STG tripped due to GT trip.
11.10.12	11:56	11.10.12	18:45	6.82	STG tripped due to GT trip.
13.10.12	00:19	13.10.12	00:36	0.28	STG tripped due to STG bay 110 KV breaker tripped on Non directional earth fault relay operated.
13.10.12	01:28	13.10.12	01:58	0.50	STG tripped due to STG CEIG 11 KV breaker tripped on over current and earth fault relay operated.
06.12.12	05:51	06.12.12	06:25	0.57	STG tripped due to STG bay 110 KV breaker tripped on Non directional earth fault relay operated.
29.12.12	10:27	29.12.12	14:00	3.55	STG was stopped to replace exciter carbon brushes.
30.12.12	15:57	30.12.12	18:35	2.63	STG was stopped due to STG UAT transformer (5 MVA) oil leak & conservator level below minimum level.
01.01.13	04:04	01.01.13	10:40	6.60	STG was manually stopped due to DCS Black out. DCS supply disturbed due to UPS inverter tripped on over load & stand by UPS supply came on auto. In spite of UPS supply resumption, DCS engineering station not able to communicate and also communication failure alarm appeared.
16.01.13	03:43	16.01.13	04:10	0.45	STG tripped due to STG bay 110 KV breaker tripped on Non directional over current relay 51R HV side operated.
23.01.13	14:45	23.01.13	15:24	0.65	STG load dropped suddenly due to control valve closed, STG tripped same time HRSG tripped.
23.01.13	23:24	23.01.13	23:40	0.27	STG tripped due to safety impulse water pressure low
24.01.13	10:51	24.01.13	11:06	0.25	STG tripped due to safety impulse water pressure low
24.01.13	16:54	24.01.13	17:28	0.57	STG tripped due to safety impulse water pressure low
25.01.13	01:52	25.01.13	02:14	0.36	STG tripped due to safety impulse water pressure low
25.01.13	09:21	25.01.13	10:07	0.77	STG tripped due to safety impulse water pressure low
25.01.13	15:38	25.01.13	16:38	1.00	STG tripped due to safety impulse water pressure low
30.01.13	22:37	31.01.13	06:11	7.57	STG was stopped manually as GAIL instructed to stop the GT as gas leak detected at ONGC terminal
31.01.13	06:28	31.01.13	08:10	1.7	STG tripped on reverse power due to sudden load rejection
31.01.13	09:45	:	10:00	0.25	STG tripped due to safety impulse water pressure low
31.01.13	10:06	31.01.13	10:21	0.25	STG tripped due to safety impulse water pressure low
31.01.13	10:31	31.01.13	11:11	0.66	STG tripped due to safety impulse water pressure low
31.01.13	12:03	31.01.13	12:40	0.61	STG tripped due to safety impulse water pressure low.
31.01.13	13:05	02.02.13	02:45	37.67	STG tripped due to safety impulse water pressure low.
27.02.13	13:25	27.02.13	14:47	1.37	STG manually stopped due to Y-B & B-R voltages dropped to 6.4 KV in STG synchronizing panel and load dropped to 9 MW.
07.04.13	8:48	08.04.13	00:08	5.33	STG tripped due to STG 110 KV bay breaker tripped on non-directional over current 51R HV side relay acted. STG synchronized at 0008 hrs on 08.04.13.
14.04.13	2:22	14.04.13	17:05	4.72	STG tripped due to STG 110 KV bay breaker tripped on non-directional over current 51R HV side relay acted.

Shutdown / Trip		Sync. Back		Outages	Reason for shutdown / Trip
Date	Time	Date	Time	Hrs	
10.05.13	1:48	10.05.13	18:21	6.55	STG tripped due to GTG tripped.
25.05.13	0:08	26.05.13	07:23	31.25	STG was manually stopped for GTG pre shut down performance test preparation .
02.06.13	00:03	25.06.13	21:12	573.15	STG was stopped for GT MI
27.06.13	05:45	27.06.13	10:25	4.67	STG tripped due to GTG tripped.
10.07.13	5:44	12.07.13	01:30	43.77	STG tripped due to 110 KV bus bar protection.
18.07.13	1:35	18.07.13	22:24	0.82	DCS communication error appeared, DCS monitors were blinking same time STG tripped on HP steam pressure low & found HP dump opened.
01.08.13	1:38	01.08.13	12:01	0.38	STG tripped due to DCS communication error.
07.08.13	22:45	07.08.13	23:42	0.95	STG tripped due to DCS communication error.
12.08.13	2:14	13.08.13	00:38	2.40	STG tripped due to safety impulse water pressure low.
28.08.13	1:48	28.08.13	17:31	5.72	STG was manually stopped to arrest oil leak in 110 KV side CT at transformer end & STG bay end.
02.09.13	4:27	04.09.13	06:53	40.43	STG was stopped as requested by GAIL.
07.09.13	0:29	08.09.13	01:02	4.55	STG was tripped as GTG tripped.
30.09.13	14:38	30.09.13	15:44	1.10	STG was stopped due to heavy spark from exciter carbon brushes.
12.10.13	14:28	12.10.13	16:22	1.90	STG was stopped due to heavy spark from exciter carbon brushes.
17.10.13	21:34	17.10.13	23:26	1.87	STG was stopped due to, in STG LAVT panel R phase PT failed.
26.10.13	07:15	26.10.13	12:27	5.20	STG was stopped due to heavy spark from exciter carbon brushes.
28.10.13	09:43	28.10.13	10:25	0.7	STG was stopped due to heavy spark from exciter carbon brushes.
31.10.13	18:23	31.10.13	19:24	1.02	STG was stopped due to heavy spark from exciter carbon brushes.
03.11.13	02:55	03.11.13	03:43	0.80	STG tripped due to rotor earth fault.
03.11.13	03:55	05.11.13	20:00	64.08	1. STG was stopped due to heavy spark from exciter carbon brushes. 2. While exciting found Voltage was not building up.
07.11.13	20:22	07.11.13	21:19	0.95	STG was stopped due to heavy spark from exciter carbon brushes.
08.11.13	16:11	08.11.13	16:40	0.48	STG was stopped due to heavy spark from exciter carbon brushes.
08.11.13	22:44	09.11.13	01:52	3.14	STG was stopped due to heavy spark from exciter carbon brushes.
11.11.13	15:49	11.11.13	16:26	0.62	STG was stopped due to heavy spark from exciter carbon brushes.
13.11.13	23:07	14.11.13	00:27	1.33	STG was stopped due to heavy spark from exciter carbon brushes.
15.11.13	16:25	15.11.13	20:29	4.07	STG was stopped due to heavy spark from exciter carbon brushes. While stopping the STG black smoke come out of AVR panel.
19.11.13	10:20	19.11.13	13:43	3.38	STG tripped due to GTG tripped.
20.11.13	19:09	20.11.13	21:57	2.80	STG tripped due to GTG tripped.
26.11.13	01:34	26.11.13	06:49	5.25	STG tripped due to GTG tripped.
30.11.13	10:46	30.11.13	16:17	5.52	STG tripped due to GTG tripped & STG 110 KV breaker tripped on 51 N earth fault relay operated.
07.12.13	03:23	07.12.13	11:24	8.02	STG tripped due to GTG tripped
10.12.13	03:23	10.12.13	04:39	1.27	STG was stopped due to heavy spark from exciter carbon brushes.
10.12.13	14:55	10.12.13	19:05	4.16	STG was stopped due to heavy spark from exciter carbon brushes.
12.12.13	12:24	12.12.13	13:06	0.70	STG was stopped due to heavy spark from exciter carbon brushes.
12.12.13	13:25	15.12.13	04:00	62.58	STG was stopped due to the problem on excitation system.
21.01.14	10:01	25.01.14	21:47	107.83	STG was stopped for GT work. While rolling STG after GTG synchronizing, STG tripped at 83 % speed due to safety impulse water pressure low on 23.01.14 .
26.01.14	17:53	26.01.14	18:54	1.02	STG was stopped due to rotor earth fault alarm.
06.02.14	13:48	06.02.14	14:18	0.50	STG tripped due to AVR voltage problem.

Shutdown / Trip		Sync. Back		Outages	Reason for shutdown / Trip
Date	Time	Date	Time	Hrs	
04.04.14	15:07	04.04.14	15:40	0.55	STG tripped as STG 110 KV bay breaker tripped due to nondirectional earth fault really operated, (at the same time 110 KV Kavanoor feeder both end breakers tripped due to distance protection.)
06.05.14	14:14	06.05.14	15:15	1.02	STG tripped as STG 110 KV bay breaker tripped due to nondirectional earth fault really operated, at the same time 110 KV Kavanoor feeder both end breakers tripped due to distance protection.
14.05.14	19:25	15.05.14	09:28	14.05	STG tripped due to GTG tripped.
17.05.14	19:02	17.05.14	20:40	3.63	STG tripped due to STG 110 KV bay breaker tripped on 'Y' phase Non directional over current protection.
18.05.14	03:08	20.05.14	23:13	68.09	STG stopped due to GTG stopped.
18.06.14	23:11	21.06.14	08:01	56.84	STG was stopped for Annual Boiler Inspection by Dy. Director of Boiler
07.09.14	01:51	07.09.14	06:37	4.77	STG trip due to GTG trip as per logic.
07.09.14	08:57	07.09.14	13:35	4.63	STG trip due to GTG trip as per logic.
18.10.14	19:53	19.10.14	03:03	7.17	STG tripped due to tripping of 110 KV valuther (Pioneer end) & Kavanoor feeder both end breakers tripped.
28.10.14	05:40	28.10.14	17:55	12.25	STG tripped due to tripping of 110 KV valuther (Pioneer end) & Kavanoor feeder both end breakers tripped.
29.10.14	05:55	29.10.14	11:21	5.43	STG tripped due to tripping of 110 KV valuther (Pioneer end) & Kavanoor feeder both end breakers tripped.
30.10.14	05:52	-		42.13	STG tripped due to tripping of 110 KV valuther (Pioneer end) & Kavanoor feeder both end breakers tripped.
01.11.14	00:00	01.11.14	09:40	9.67	-
22.11.14	06:41	22.11.14	11:37	4.93	STG tripped due to GTG trip as per logic.
12.01.15	19:08	12.01.15	22:24	3.27	STG tripped due to 11KV LAVT PT 'B' phase failure.
11.02.15	05:29	11.02.15	12:59	7.50	STG tripped due to tripping of 110 KV Kavanoor (Pioneer end) & Valuthur feeder both end breakers tripped.
12.02.15	21:14	12.02.15	23:07	1.88	STG was manually tripped due to control water pump common discharge line gasket leak
24.03.15	19:23	-		172.62	STG stopped because of GAIL / Ramanad closed the gas supply valve to our plant
01.04.15	00:00	22.04.15	18:07	522.12	-
23.04.15	12:23	23.04.15	13:46	1.38	STG tripped on HP steam pressure low due to DCS connection time out.
28.04.15	13:26	28.04.15	15:26	2.00	STG tripped due to GTG 11 KV breaker tripped & STG generator protection relay 86 - 2A operated.
30.04.15	14:18	30.04.15	18:55	4.62	STG was stopped to arrest the air leak in gas turbine.
15.05.15	14:14	15.05.15	14:56	0.70	STG tripped on HP steam pressure low due to DCS connection time out.
17.05.15	19:51	20.05.15	05:21	57.5	STG tripped on HP steam pressure low due to low GTG load because of GAIL gas pressure low.
15.06.15	15:27	17.06.15	18:45	51.3	STG was stopped for BOILER annual inspection.
19.06.15	14:34	19.06.15	17:37	3.05	STG tripped on interlock of GTG trip. Beside class 2 & 3 Generator protection relay acted.
07.07.15	15:05	08.07.15	00:21	9.27	STG tripped on STG 110 KV bay transformer breaker tripped. Alarm appeared on window alarm panel 'STAND BY EARTH FAULT' operated. In RET 521 & RET 670 relay panel 'DIFF WAWW BLAK, HV EF LS TRIP' alarm register.

Shutdown / Trip		Sync. Back		Outages	Reason for shutdown / Trip
Date	Time	Date	Time	Hrs	
14.07.15	11:17	14.07.15	16:12	4.92	STG tripped on interlock of GTG trip.
24.07.15	03:10	24.07.15	09:04	5.90	STG tripped on interlock of GTG trip.
03.08.15	13:25	03.08.15	17:37	4.20	STG tripped on interlock of GTG trip. Beside class 2 & 3 Generator protection relay acted.
06.08.15	19:13	-		604.78	STG tripped on interlock of GTG trip. Beside class 2 & 3 Generator protection relay acted.
01.09.15	00:00	30.09.15	24:00	720.00	STG tripped on interlock of GTG trip at 1913 hrs on 06.08.15
1.10.15	00:00	31.10.15	24:00	744.00	STG tripped on interlock of GTG trip at 1913 hrs on 06.08.15
1.11.15	00:00	30.11.15	24:00	720.00	STG tripped on interlock of GTG trip at 1913 hrs on 06.08.15
1.12.15	00:00	31.12.15	24:00	744.00	STG tripped on interlock of GTG trip at 1913 hrs on 06.08.15
01.01.16	00:00	31.01.16	16:28	736.47	STG tripped on interlock of GTG trip at 1913 hrs on 06.08.15
06.02.16	23:57	07.02.16	00:38	0.68	STG tripped due to DCS connection time out (Communication error).
25.03.16	14:12	25.03.16	19:50	5.63	STG tripped on interlock of GTG trip
20.05.16	04:12	24.05.16	17:35	109.38	STG stopped manually due to ONGC - GCS shut down work.
27.05.16	22:17	27.05.16	23:55	1.63	STG tripped due to DCS communication error.
21.06.16	14:37	24.06.16	00:00	57.38	STG was stopped for BOILER annual inspection.