GRID CONNECTED ELECTRICITY GENERATION USING NATURAL GAS BY LANCO KONDAPALLI POWER PRIVATE LIMITED

Document Prepared by EKI Energy Services Limited

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Project ID	1261
Monitoring Period	01-August-2012 to 31-December-2012 (inclusive of both start and end dates)
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity involves implementation and operation of a new natural gas fired grid-connected Combined Cycle Power Plant (CCPP) of 366 MW capacity at Kondapalli near Vijayawada, Andhra Pradesh by Lanco Kondapalli Power Private Limited (LKPPL).

The CCPP project operates on Brayton Cycle (Compressor & Gas Turbine) at top and Rankine Cycle (Heat Recovery Steam Generator & Steam Turbine) at bottom. The power generated from the project activity is sold on merchant basis to the state utilities in Southern, Western & Northern India.

The project activity uses natural gas as main fuel for power generation. Natural gas is sourced from the Krishna Godavari basin of Reliance Industries Limited (RIL). Gas Supply & Transportation Agreements have been executed with Reliance Industries Limited and Reliance Gas Transportation Infrastructure Limited, respectively, in this regard.

The power generated is stepped up to 400 kV level by using 15/420 kV generator transformers by means of a 400 kV Gas Insulated Switchgear (GIS) type substation located at the project site. Project activity is connected to the grid by a double circuit 400 kV transmission line which is commissioned to export power to 400 kV receiving end substation of the Power Grid Corporation of India Limited (PGCIL) located at Nunna.

The project activity commenced operation on 01-August-2010.

Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period: of 01-August-2012 to 31-December-2012 are 114,254 tCO_2e.

1.2 Sectoral Scope and Project Type

Sectoral scope 1: Energy Industries (renewable / non-renewable sources).

Project type: Renewable energy project

The project activity is not a grouped project.

1.3 Project Proponent

Organization name	Lanco Kondapalli Power Private Limited.
Contact person	Mr. Panduranga Rao
Title	Director & CEO
Address	Lanco House, Plot No. 4, Software Units Layout, HITEC City, Madhapur, Hyderabad, Andhra Pradesh
Telephone	+91-40 4009 0400

Email	lkpl@lancogroup.com

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the Project	Project Consultant
Contact person	Mr. Souvik Mitra
Title	Project Manager
Address	Enking Embassy, Office no. 201, Plot 48, Scheme 78 part 2, Vijay Nagar, Indore-452010 (M.P, India)
Telephone	+91 7489924005
Email	souvik@enkingint.org registry@enkingint.org

1.5 Project Start Date

Start date of the project activity is 01-August-2010 the date that corresponds to the start date of commercial operation of the project activity power plant.

Project Start Date: 01-August-2010

1.6 Project Crediting Period

Crediting Period Start date: 01-August-2010

Crediting Period End date: 31-July-2020

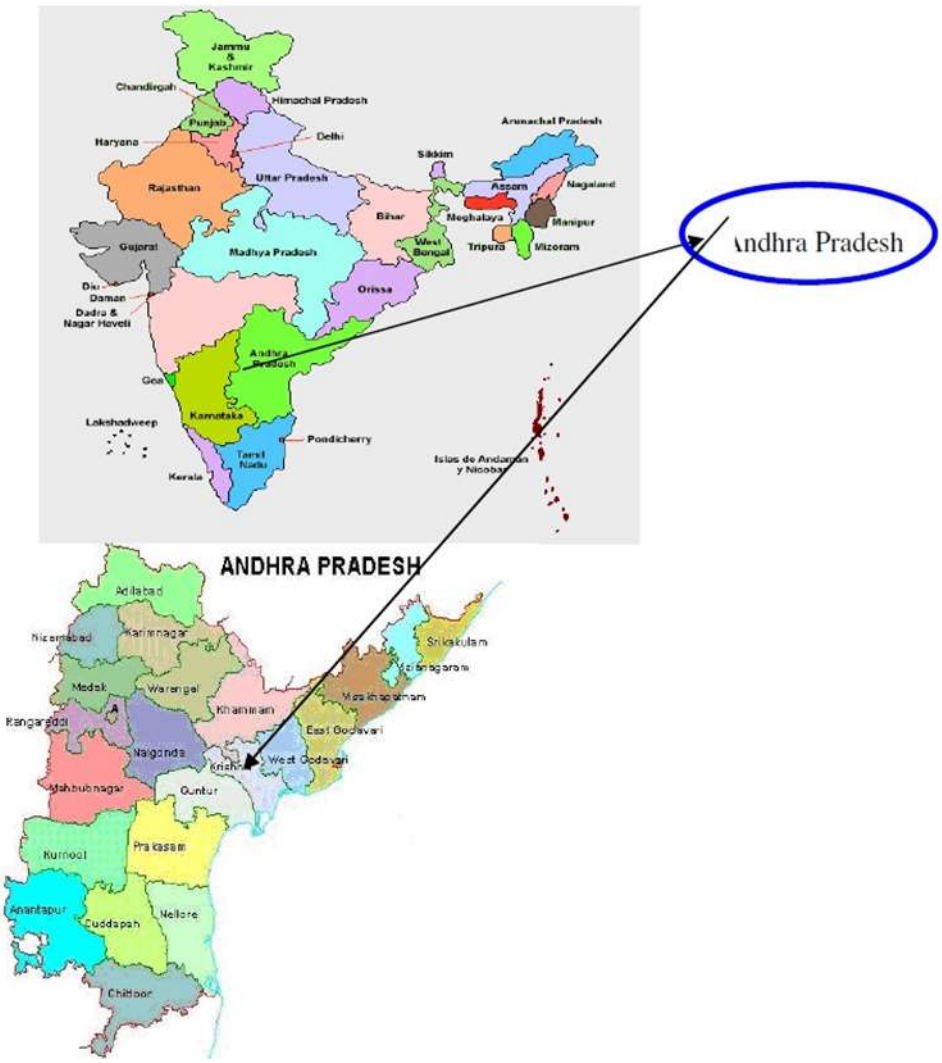
The project activity adopts fixed crediting period of 10 years 00 months.

1.7 Project Location

The project activity is located at Kondapalli Industrial Development Area in Andhra Pradesh – it is spread in a plot of area 132 acres. Kondapalli railway station is approximately 1km from the site and the nearest Airport is at Gannavaram at about 35 kms from the plant.

Geo-coordinates of the project site are
Latitude 16°38'30.10" N and Longitude of 80°33'05.33" E

Project Location Map



1.8 Title and Reference of Methodology

The approved baseline and monitoring methodologies applied for the project activity are:

AM0029 Version 03- Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas (EB 39, Annex 3)[1]

Tools referenced by the methodology and applicable for the project activity:

[1] https://cdm.unfccc.int/methodologies/DB/WW4I82DG7LJUQE5E5YGT1NZE4PNS60

- Tools to calculate the emission factor for an electricity system (Version 02.2.1, EB 63; Annex-19)
- Tool for the demonstration and assessment of additionality (Version 06.0.0, EB 65, Annex 21)

1.9 Participation under other GHG Programs

The project is also registered in another GHG programe - under Clean Development Mechanism with UNFCCC reference No: 5554) and is accessible in the following link

http://cdm.unfccc.int/Projects/DB/RWTUV1323884893.28/view.

.Monitoring Report for the monitoring period 05-September-2012 to 31-December-2012 is already webhosted in UNFCCC CDM webpage
https://cdm.unfccc.int/Projects/DB/RWTUV1323884893.28/view

However, project proponent has provided undertaking that it will not claim any GHG credits for this monitoring period under any GHG program other than that under VERRA in order to avoid double counting.

1.10 Other Forms of Credit

The project activity neither has nor intends to generate any other form of GHG credits or any other environmental credits including Renewable Energy Certificate (REC) for this monitoring period.

1.11 Sustainable Development

The contribution of this project activity towards sustainable development as per the four indicators prescribed by India's National CDM Authority (" Ministry of Environment and Forests ("MoEF")[2] is presented below.

Social well being:

• The project activity has generated employment for the local population during the construction as well as operational phases of the project activity, both direct and indirect.

• It has also provided an opportunity for secondary small scale entrepreneurs' development near the project site, such as small shops, etc. Overall, there has been employment creation as a result of the project activity.

Economic well being:

[2]Now Ministry of Environment, Forest and Climate Change

• By creating employment in the area, as described above, the project activity has brought in economic improvement for the local population.

Environmental well being:

• The project activity avoids use of any other thus reduces emissions of GHGs, oxides of sulphur and nitrogen, particulate matters and unburned carbon, fly ash (in case of coal and lignite), etc.

Technological well being:

• The project activity is a natural gas based combined cycle power plant and would result in improved power generation efficiency as compared to an open cycle CCGT or coal or lignite based thermal power plant of similar capacity

2 SAFEGUARDS

2.1 No Net Harm

The project activity uses natural gas in preference over other fossil fuels such as coal and hence results in lower GHG emissions. Other air and liquid pollutants are minimal. There are no significant solid wastes such as fly ash. The EIA study revealed that there are no substantial environmental impacts.

2.2 Local Stakeholder Consultation

Before implementation of the project activity, the project proponent did thorough consultation with stakeholders – identifying the stakeholders, consultation with the stakeholders in number of phases and through number of media – focus group discussion, detailed social mapping and fieldwork, inclusion of local stakeholders from all sections of community , explanation of project activity – purpose and details to them and resolving the comments/ grievances along with seeking suggestions from them. The PP has engaged a number of local NGOs for local stakeholder consultations by applying various strategies to engage them in project and for taking care of their complaints/grievances/suggestions. The process is ongoing and continuous; this process is undertaken throughout the year.

During the current monitoring period, the project proponent has kept grievance register in plant site office seeking complaints/grievances from local community. There has also been the provision of receiving letters from local community for any suggestion/comment/complaint

2.3 AFOLU-Specific Safeguards

Not applicable to this as this is not an AFOLU project activity.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

Construction for the project activity started on 01-Februiary-2008 and it started commercial operation on 01-August-2010.

The project activity is implemented and operated as described in the VCS PD.

The project comprises of the following major equipments

1. Gas Turbine Generator 234 MW capacity

2. Steam Turbine Generator 132 MW

3. GT/ST Generator & Unit aux. transformers

4. Auxiliary equipments of Gas Turbine & Generator - Lube oil system, Air intake system, Evaporative cooling system, Exhaust system, Heat Recovery Steam Generator Circulation Pumps, valves, HP/LP Bypass system, Piping etc.

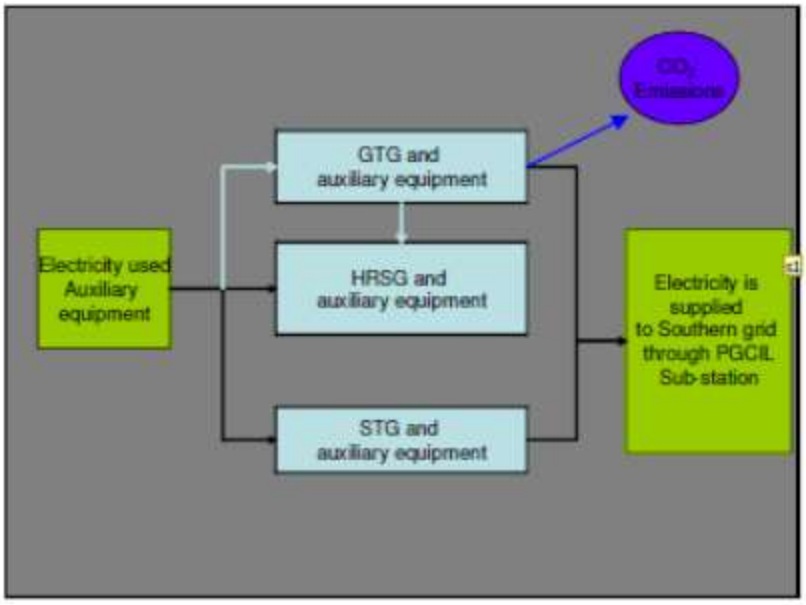
5. Auxiliary equipments of Steam Turbine & Generator – Hydraulic and lube oil system condenser, Feed Pumps, Condensate extraction pumps.

Technical specification of equipments involved in the project activity is as below

S.No	Equipment	Specifications	Special Features
1.	GTG	Make : GE, USA GTG is of advanced class industrial heavy-duty type (Model 9FA) with dry low NO_x technology capable of operating in combined cycle mode, Nominal output capacity: 234 MW at site conditions (Dry Bulb Temperature - 32 deg. C; Design Wet Bulb Temperature - 25 deg. C; Relative Humidity (RH) = 70%)	Low NO_x technology along with state of the art cooling. Thermal efficiency close to 53 - 58% (LHV)

2.	STG	Make: Harbin, China One steam turbine generator of output capacity 132 MW at site condition (Dry Bulb Temperature - 32 deg. C; Design Wet Bulb Temperature - 25 deg. C; Relative Humidity (RH) = 70%)	• Multistage, intermediate injection, condensing type steam turbine. • State of the art DCS control system
3.	HRSG	Make: : Thermax , India Capacity: : HP/IP/LP Flow 282.79/ 42/34.26 TPH; temperature 567.3/567/286.6 DegC ; pressure 98.47/22.4/3.1 Bar	• Horizontal flue gas flow and natural circulation. • HRSGs are designed with three pressure stages to improve thermal efficiency, against conventional two pressure stages for similar application. • State of the art DCS control system.

The schematic diagram of project activity is as below:



There are no such any event or situation occurred during current monitoring period which impact the applicability of methodology.

3.2 Deviations

2.3.1 Methodology Deviations

No methodology deviation is applied during the monitoring period.

2.3.2 Project Description Deviations

No deviation in project description is applied during the monitoring period.

3.3 Grouped Projects

Not applicable as this is not grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{BM,y}$
Data unit	tCO_2e/MWh
Description	Build Margin Emission Factor of Southern Regional Electricity Grid
Source of data	"CO_2 Baseline Database for Indian Power Sector" Version 5.0 dated 1st November 2009 published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for the Indian Power sector is available at www.cea.nic.in
Value applied	0.818
Justification of choice of data or description of measurement methods and procedures applied	Build Margin Emission Factor has been calculated by the Central Electricity Authority in accordance with "Tool to calculate the emission factor for an electricity system". Refer Appendix A
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{OM,y}$
Data unit	tCO_2e/MWh
Description	Operating Margin Emission Factor of Southern Regional Electricity
Source of data	"CO_2 Baseline Database for Indian Power Sector" Version 5.0

	dated 01st November 2009 published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for the Indian Power sector" is available at www.cea.nic.in
Value applied	<table><tr><th>Year</th><th>Operating margin</th></tr><tr><td>2006-07</td><td>0.999</td></tr><tr><td>2007-08</td><td>0.991</td></tr><tr><td>2008-09</td><td>0.973</td></tr></table>
Justification of choice of data or description of measurement methods and procedures applied	Operating Margin Emission Factor has been calculated by the Central Electricity Authority using the simple OM approach in accordance with "Tool to calculate the emission factor for an electricity system". Refer Appendix A
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	**Carbon Emission Factor of Natural Gas ($EF_{CO2,f,y}$)**
Data unit	tCO_2/GJ
Description	The CO_2 emission factor per unit of energy of natural gas in year 'y'
Source of data	IPCC default value has been applied (Source: Chapter-2 IPCC 2006 Guidelines for National Greenhouse Gas Inventories)
Value applied	56.1 tCO_2/TJ (= 0.0561 tCO_2/GJ)
Justification of choice of data or description of measurement methods and procedures applied	As there are no national data available for the emission factor of the fuel used, default value based on Table 2.2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories has been applied.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	**Oxidation Factor of Natural Gas ($EF_{CO2,f,y}$)**
Data unit	--
Description	Oxidation factor of natural gas
Source of data	IPCC default value has been applied (Source: Chapter-2

	IPCC 2006 Guidelines for National Greenhouse Gas Inventories)
Value applied	1.0
Justification of choice of data or description of measurement methods and procedures applied	As there are no national data available for the emission factor of the fuel used, default value based on Table 2.2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories has been applied.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	**Station Heat Rate of the Project activity**
Data unit	kCal/kWh
Description	Station Heat Rate has been used to calculate the quantity of Natural Gas consumption associated with the expected electricity generation from the project activity. This data is used as an input for calculating Project Emissions
Source of data	Detailed Project Report (DPR) The CERC tariff order dated 26-March-2004[3] has also specified the SHR of combined cycle gas based power plant with advanced class machines 1850 kCal/kWh
Value applied	1850
Justification of choice of data or description of measurement methods and procedures applied	Data published by Central Electricity Regulatory Commission (CERC) under Ministry of Power in Government of India
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	**Carbon Emission Factor of Coal, Lignite, Diesel, Oil, Natural Gas**
Data unit	tCO_2/TJ
Description	Emission factor of Coal, Lignite, Diesel, Oil, Natural Gas. This data is used as an input for calculating the fugitive CH_4

[3] http://www.cercind.gov.in/13042007/Terms_and_conditions_of_tariff.pdf

	emissions occurring in the absence of the project activity
Source of data	Carbon Emission Factor for Coal, Lignite & Oil: Table 2.3 - India specific CO2 emission coefficients, India's first National Communication to the United Nations Carbon Emission Factor for Diesel & Natural Gas: Table 1.4, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1, Volume 2, Energy
Value applied	Refer to ER calculation sheet
Justification of choice of data or description of measurement methods and procedures applied	As per AM0029, the fuel emission coefficient is to be determined based on national average fuel data if available. Accordingly we have used the data available in India's first national communication to the United Nations for our calculations where available, otherwise IPCC default values have been used
Purpose of Data	Calculation of leakage emissions
Comments	-

Data / Parameter	**Oxidation Factor of Coal, Lignite, Diesel, Oil, Natural Gas**
Data unit	--
Description	Oxidation factor of coal which has been identified as the baseline scenario fuel. This data is used as an input for calculating the fugitive CH_4 emissions occurring in the absence of the project activity
Source of data	Table 1.4, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1, Volume 2, Energy
Value applied	Refer to ER calculation sheet
Justification of choice of data or description of measurement methods and procedures applied	Only IPCC valuers are available
Purpose of Data	Calculation of leakage emissions
Comments	-

Data / Parameter	**Calorific values of Coal, Lignite, Diesel, Oil and Natural Gas Naphtha**
Data unit	kCal/kg or kCal/SCM

Description	This data is used as an input for calculating the Energy efficiency of coal fired power plants and the fugitive CH_4 emissions occurring in the absence of the project activity
Source of data	NCV of Coal – Table 6.3, CEA General Review 2006 NCV of Natural Gas, Diesel: CEA Data on Petroleum fuels used by various Gas Turbines and Diesel Engine Power Plants in India in 2003-04
Value applied	Refer to ER calculation sheet
Justification of choice of data or description of measurement methods and procedures applied	Central Electricity Authority, Government of India mandated to publish information on performance of power sector in India by the Electricity Act 2003.
Purpose of Data	Calculation of leakage emissions
Comments	-

Data / Parameter	**η_{BL} – Efficiency of coal fired power generating stations using sub-critical technology**
Data unit	--
Description	Energy efficiency of coal fired power plant using sub-critical technology which has been identified as the baseline scenario
Source of data	Calculated value based on fuel consumption, NCV of Coal and electricity generation data of coal fired power stations published in CEA carbon di oxide emission database, version 05
Value applied	34.60%
Justification of choice of data or description of measurement methods and procedures applied	Central Electricity Authority, Government of India mandated to publish information on performance of power sector in India by the Electricity Act 2003.
Purpose of Data	Calculation of leakage emissions
Comments	-

Data / Parameter	**Fuel consumption in coal fired power generating stations using sub-critical technology in the Southern Region**
Data unit	Million Tonnes (MT)
Description	The data is used as an input for calculating the Energy efficiency of coal fired power plants
Source of data	CEA CO_2 Baseline Database version 05

Value applied	<table><tr><td>Coal Based Power Station using sub-critical technology</td><td>Fuel Consumption Million Tonnes</td></tr><tr><td>RAYAL SEEMA</td><td>1045.8</td></tr><tr><td>RAYAL SEEMA</td><td>1012.6</td></tr><tr><td>R_GUNDEM STPS</td><td>2574.4</td></tr><tr><td>SIMHADRI</td><td>2544.5</td></tr><tr><td>SIMHADRI</td><td>2774.7</td></tr><tr><td>RAICHUR</td><td>1115.0</td></tr><tr><td>BELLAEY TPS</td><td>1016.3</td></tr></table>
Justification of choice of data or description of measurement methods and procedures applied	CEA CO_2 Baseline Database version 05
Purpose of Data	Calculation of leakage emissions
Comments	-

Data / Parameter	**Electricity Generation from coal fired power plants using sub-critical technology in Southern region**
Data unit	GWh
Description	This data is used as an input for calculating the Energy efficiency of coal fired power plants
Source of data	CEA CO_2 Baseline Database version 05
Value applied	<table><tr><td>Coal Based Power Station using sub-critical technology</td><td>Generation GWh</td></tr><tr><td>RAYAL SEEMA</td><td>1,577</td></tr><tr><td>RAYAL SEEMA</td><td>1,527</td></tr><tr><td>R_GUNDEM STPS</td><td>3,919</td></tr><tr><td>SIMHADRI</td><td>3,865</td></tr><tr><td>SIMHADRI</td><td>4,215</td></tr><tr><td>RAICHUR</td><td>1,540</td></tr><tr><td>BELLAEY TPS</td><td>1,106</td></tr></table>
Justification of choice of data or description of measurement methods and procedures applied	CEA CO_2 Baseline Database version 05
Purpose of Data	Calculation of leakage emissions

Comments	-

Data / Parameter	**CO_2 emissions from Build Margin Power plants in the in Southern region**
Data unit	tCO_2e
Description	This data is used as an input for calculating the fugitive CH4 emissions occurring in the absence of the project activity
Source of data	CEA CO_2 Baseline Database version 05
Value applied	Values are already provided in the Appendix 2 of the registered CDM PDD[4]
Justification of choice of data or description of measurement methods and procedures applied	CEA CO_2 Baseline Database version 05
Purpose of Data	Calculation of leakage emissions
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	**$FC_{f,y}$**
Data unit	SCM (standard cubic metre)
Description	Total volume of natural gas combusted in the project plant in year y
Source of data	Fuel supplier data
Description of measurement methods and procedures to be applied	The value is taken from gas tickets received from RGTIL (fuel supplier). Fuel flow meter is installed at plant site (RGTIL) and readings are recorded daily. The values are crosschecked with fortnight joint ticket received from RGTIL fortnightly. The mode of archiving data is both electronic and paper.
Frequency of monitoring/recording	Continuous
Value monitored	57,977,500.25[5]

[4] https://cdm.unfccc.int/filestorage/f/s/9DTQ0CKWZ4VSBO3R8NMX5APJUYFGE7.pdf/5554%20PDD.pdf?t=Y3J8cjg5ZXRofDDhm9HQYmPmHzXOUxY2ovnN

Monitoring equipment	Gas Flow meter. Please refer to section 4.3 for details.
QA/QC procedures to be applied	The meters are to be calibrated on annual basis as per monitoring plan and the accuracy is maintained at 1.0%. The Annexure –calibration details is provided as documents to indicate the Joint calibration carried out by RGTIL and LANCO on a monthly basis.
Purpose of the data	Calculation of project and leakage emissions
Calculation method	Not applicable
Comments	100% of data are monitored.

Data / Parameter	**$NCV_{f,y}$**
Data unit	kCal/SCM
Description	The net calorific value (energy content) per volume unit of natural gas in year 'y'
Source of data	Fuel supplier data
Description of measurement methods and procedures to be applied	The average net calorific value of natural gas consumed is provided by gas supplier (RGTIL) and recorded by LKPPL for verification.
Frequency of monitoring/recording	Daily
Value monitored	8199.165
Monitoring equipment	Not applicable since Fuel supplier data is acceptable
QA/QC procedures to be applied	Not applicable since Fuel supplier data is acceptable
Purpose of the data	Calculation of project and leakage emissions
Calculation method	Not applicable
Comments	-

Data / Parameter	**$EF_{co2,f,y}$**

[5] Conservative error factor of 0.23% has been applied on the values of Natural Gas Consumption for the entire monitoring period due to delays in calibration of gas flow meters

Data unit	tCO_2e/GJ
Description	CO_2 Emission Factor of Natural Gas
Source of data	IPCC 2006 default values for Carbon Emission Factor
Description of measurement methods and procedures to be applied	Default values for Carbon Emission Factor of Natural Gas as per Table 1.3 2006 IPCC Guidelines for National Greenhouse Gas Inventories, (Chapter 1, Volume 2, Energy) has been considered. This is also in conformity with the recommendations of the GHG inventory information report submitted by India's Initial National Communication (Chapter 2) where in it is mentioned that in the case of petroleum products and natural gas, the use of default emissions would be fairly accurate due to relatively low variation in quality of these fuels across the globe, as compared to coal. This data is recorded annually based on latest IPCC information available and are archived in electronic/paper form. Archived data are kept up to two years from the end of crediting period or the last issuance, whichever occurs later.
Frequency of monitoring/recording	Annually
Value monitored	0.0561
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Since IPCC data is used, no additional QA/QC procedures are planned.
Purpose of the data	Calculation of project emissions
Calculation method	Not applicable
Comments	Carbon Emission factor of natural gas is updated as per the latest guidelines available from IPCC on national greenhouse gas inventory on year to year basis.

Data / Parameter	**$OXID_f$**
Data unit	-
Description	Oxidation Factor of Natural Gas
Source of data	IPCC
Description of measurement methods and procedures to be applied	Default values as per Table 1.4 Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual has been considered This is also in conformity with the recommendations of the GHG inventory information report submitted by India's Initial National Communication (Chapter 2) where in it is mentioned that in

	the case of petroleum products and natural gas, the use of default emissions would be fairly accurate due to relatively low variation in quality of these fuels across the globe, as compared to coal. This data is recorded annually based on latest IPCC information available and are archived in electronic/paper form. Archived data are kept up to two years from the end of later.
Frequency of monitoring/recording	Annually
Value monitored	1.0
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Since IPCC data is used, no additional QA/QC procedures are planned.
Purpose of the data	Calculation of project emissions
Calculation method	Not applicable
Comments	Oxidation factor of natural gas is updated as per the latest guidelines available from IPCC on national greenhouse gas inventory on year to year basis.

Data / Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Net electricity generation in the project plant during the monitoring period
Source of data	From the electronic meters installed at the grid inter-connection point at 400 kV PGCIL Nunna sub-station.
Description of measurement methods and procedures to be applied	As per actual meter readings taken jointly by LKPPL and PGCIL. The daily reading is archived electronically. Monthly joint meter reading is archived in paper form.
Frequency of monitoring/recording	Continuous
Value monitored	244,040
Monitoring equipment	Electronic energy meters of 0.2 accuracy class
QA/QC procedures to be applied	The meters are calibrated as per the standard procedures and documents for the same are maintained throughout the crediting period plus two years.
Purpose of the data	Calculation of baseline emissions

Calculation method	Not applicable, its measured value. Net electricity = Export - Import
Comments	--

Data / Parameter	**$EF_{BM,y}$**
Data unit	tCO_2/GWh
Description	Build Margin Emission factor for Southern grid
Source of data	"CO_2 Baseline Database for Indian Power Sector" Version 8.0 dated January 2013 published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for the Indian Power sector" is available at www.cea.nic.in
Description of measurement methods and procedures to be applied	Build Margin Emission Factor is taken from the CO_2 baseline database published by CEA. This data is computed annually based on latest available in formation and are archived in electronic/paper form. Archived data are kept up to two years from the end of crediting period or the last issuance, whichever occurs later.
Frequency of monitoring/recording	Actually
Value monitored	0.9717 (2012-13)
Monitoring equipment	Not applicable
QA/QC procedures to be applied	No additional QA/QC procedures are planned.
Purpose of the data	Calculation of baseline emissions
Calculation method	Not applicable, the value is taken from CEA database
Comments	-

Data / Parameter	**$EF_{BL,upstream,CH4}$**
Data unit	tCO_2e/GWh
Description	Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity electricity generation
Source of data	CEA CO_2 baseline database or calculated value based on available CEA data in case the database is not updated
Description of measurement methods	$EF_{BL,upstream,CH4}$ is calculated for power plants included in the Build Margin, inline with the baseline emission factor

and procedures to be applied	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) is determined ex-post. This data is computed annually based on latest available information and are archived in electronic/paper form. Archived data are kept up to two years from the end of crediting period or the last issuance, whichever occurs later.
Frequency of monitoring/recording	Annually
Value monitored	0.0561
Monitoring equipment	Not applicable
QA/QC procedures to be applied	No additional QA/QC procedures are planned.
Purpose of the data	Calculation of leakage emissions
Calculation method	Not applicable
Comments	-

Data / Parameter	**$COEF_{f,y}$**
Data unit	tCO_2/ cum
Description	CO_2 emission factor of Natural Gas - Quantity
Source of data	Calculated
Description of measurement methods and procedures to be applied	CO_2 emission factor of Natural Gas - Quantity ($COEF_{f,y}$) is calculated using (i) calorific value of natural gas *(ii)* CO_2 Emission coefficient for natural gas in energy units as follows: $COEF_{f,y}$: CO_2 emission factor of Natural Gas – energy (tCO_2e/TJ) * Calorific value of Natural Gas (kJ/SCM)
Frequency of monitoring/recording	Not applicable, it's a calculated value
Value monitored	0.002051
Monitoring equipment	Not applicable, it's a calculated value
QA/QC procedures to be applied	No additional QA/QC procedures are planned

Purpose of the data	Calculation of project emissions
Calculation method	Not applicable
Comments	-

Data / Parameter	**PE_y**
Data unit	tCO_2
Description	Project emission due to combustion of fuel
Source of data	Calculated
Description of measurement methods and procedures to be applied	Project emission due to combustion of fuel is calculated using (i) total volume of natural gas combusted in the project plant and (ii) CO2 emission coefficient of natural gas as follows $PE_y = \sum_f FC_{f,y} \times COEF_{f,y}$
Frequency of monitoring/recording	Not applicable, it's a calculated value
Value monitored	111,660.00
Monitoring equipment	Not applicable, it's a calculated value
QA/QC procedures to be applied	No additional QA/QC procedures are planned
Purpose of the data	Calculation of project emissions
Calculation method	Not applicable
Comments	-

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 is monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emission 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 monitoring plan is prepared considering in following areas of Project Activity:

1. Establishing and maintaining the appropriate monitoring systems for consumption of NG and electricity generated by the proposed project.

2. Quality control at Project Activity and measurements.

3. Assigning monitoring responsibilities to personnel.

4. Data storage and filing system

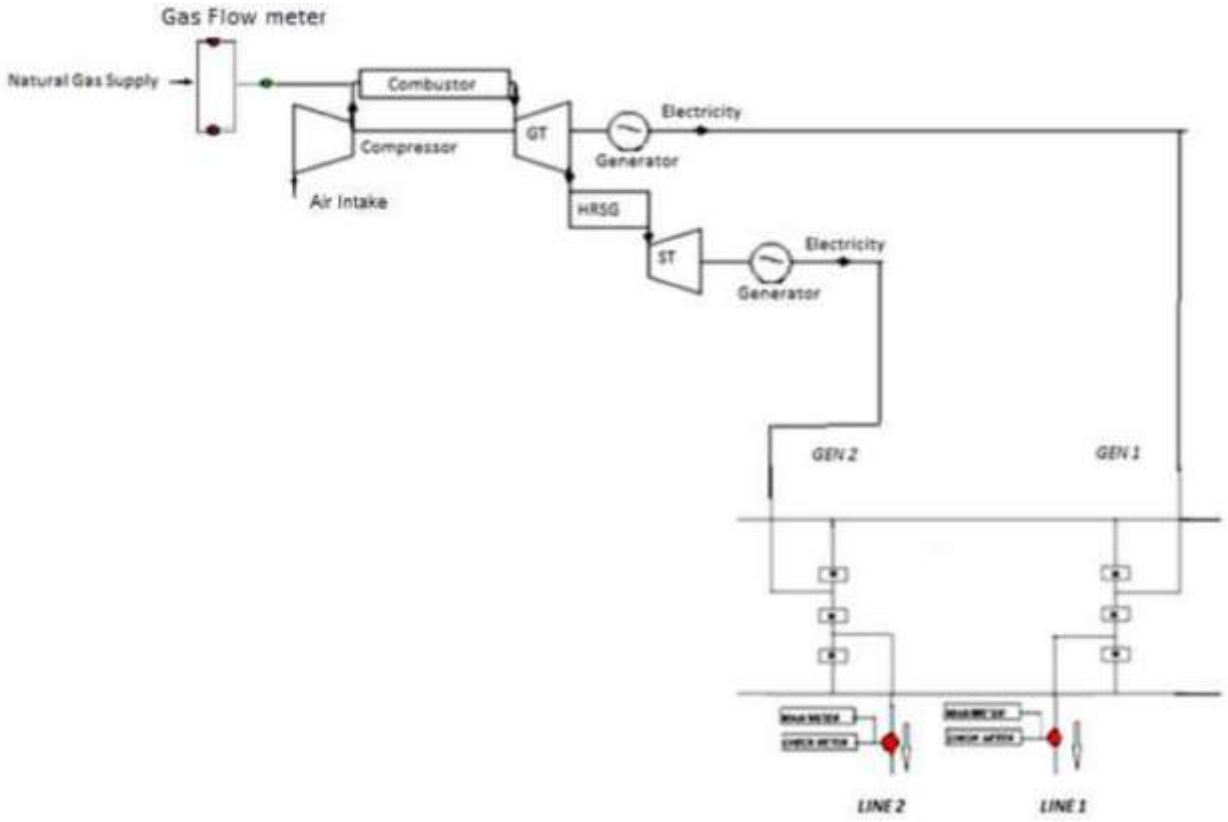
Project Management team structure follows below operations.

At the power plant level the project management team is basically engaged performing day to day activities related to operation and maintenance of the project. The team at the power plant level is primarily collecting the CDM data and maintaining all records related to CDM activities of the project.

The shift engineers is primarily responsible for primary data collection at the respective verticals & calibration. Shift engineer reports to Plant shift Manager (Operation). The Plant shift Manger (operation) review the data and reports to the Sr. Manager (operations). If the data reported by the shift engineers are found satisfactory the same is recorded in the Management Information System (MIS). In the event of any discrepancy, Sr. Manager (Operation) proposes the corrections in discussion with General Manager (O&M)-Plant. General Manager (O&M) reports to the Vice President (Operations).

The project management at the corporate level is basically engaged in overall project monitoring. The team at corporate level reviews power plant operations and also the data related to CDM activity of the project. General Manager-Finance (corporate is responsible for overall project coordination between the plant level and corporate office. Information pertaining to plant operation including CDM related data is reviewed by GM Finance. GM – Finance reports to whole time Director. In the event of any disconnect, GM – Finance suggest the corrective action to the plant officials in discussion with the whole time Director.

Schematic line diagram for metering locations:



The main meters involved in the project are 2 gas flow meter at supplier side, 1 check gas flow meter of PP, Gas chromatograph under supplier scope, electricity energy meters at substation.

The meter and calibration details involved in the project activity are as below:

Export/Import Energy Meter calibration details:

Lanco Line 1

Details	Main Meter	Check Meter
Serial No.	NP-5533 A	NP 5627 A
Make	L & T	L & T
Accuracy class	0.2s	0.2s
Calibration frequency	Once in 5 years	Once in 5 years
Last Calibration date	08-May-2012	09-May-2012
Calibration due date	07-May-2017	08-May-2017

Lanco Line 2

Details	Main Meter	Check Meter
Serial No.	NP-5543 A	NP 5489 A
Make	L & T	L & T
Accuracy class	0.2s	0.2s
Calibration frequency	Once in 5 years	Once in 5 years
Last Calibration date	09-May-2012	08-May-2012
Calibration due date	08-May-2017	07-May-2017

All the meters are located in the PGCIL substation meters and these are used for ER calculations and invoice is raised based on PGCIL substation meters. There is no any delay in calibration for energy meters and once in five years calibration frequency is followed during current monitoring period

Gas flow Meter Calibration details:

Location/Type	Meter Serial No.	Make	Accuracy Class	Last Calibration date	Valid till
Reliance Gas Flow Meter Stream 1	08-040024	Emerson Process	±0.23%	20-February-2008	19-February--2009
				30-September-2015	29-September-2016
Reliance Gas Flow Meter Stream 2	08-040025	Emerson Process	±0.23%	20-February-2008	19-February-2009
				30-September-2015	29-September-2016
PP side Check Meter	9090448	Daniel Measurement	±0.3%	20-February-2008	19-February-2009
				30-September-	29-September-

				2015	2016

Considering the annual calibration frequency as mentioned in registered VCS PD, there are gaps in calibration in the entire monitoring period of 01-August-2012 to 31-December-2012.

Pressure Transmitter and Temperature Transmitter and Gas chromatograph calibration Details:

Pressure transmitter and temperature transmitter calibration details

Location/Type	Meter Serial No.	Make	Accuracy Class	Last Calibration datel	Valid till
Pressure Transmitter for Reliance Gas Flow Meter Stream 1	1793074	Rosemount	+/-0.075%	20-February-2008	19-March-2008
				30-September-2015	29-October-2015
Pressure Transmitter for Reliance Gas Flow Meter Stream 2	1793066	Rosemount	+/-0.075%	20-February-2008	19-March-2008
				30-September-2015	29-October-2015
Temperature Transmitter Reliance Gas Flow Meter Stream 1	1793065	Rosemount	± 0.1 °C	20-February-2008	19-March-2008
				30-September-2015	29-October-2015
Temperature Transmitter Reliance Gas Flow Meter Stream 2	1793985	Rosemount	± 0.1 °C	20-February-2008	19-March-2008
				30-September-2015	29-October-2015

Gas Chromatograph calibration details

Location/Type	Meter Serial No.	Calibration date	Valid till
Gas Chromatograph	21482-1	20-February-2008	19-March-2008

		30-September-2015	29-October-2015

As per registered VCS PD, there is no any calibration frequency mentioned for Pressure Transmitter, Temperature Transmitter and Gas chromatograph. Thus, gas supplier follows calibration once in a month and for operational period only. The above calibration details are for project activity operational period only. Gas data and NCV of gas is taken directly from Gas Supplier. The NCV of gas is measured by using online gas chromatograph installed by gas supplier. As per OEM guidelines, the metering equipment's are installed and maintained. Since PD does not mention any specific calibration frequency, The calibration is in supplier scope and PP do not have any control on it.

So, considering the calibration frequency as once in a month, there have been gaps in calibration during the current monitoring period.

Therefore, there have been gaps in calibration for gas flow meters as well as for the pressure and temperature transmitter and gas chromatograph for the entire monitoring period of 01-August-2012 to 31-December-2012. Hence conservative error factor of 0.23% (accuracy class of gas flow meters) have been applied on the values of natural gas consumption for the monitoring period (01-August-2012 to 31-December-2012).

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As per the approved methodology AM0029 (Version 3.0) equation (2),

Baseline emissions are calculated as below

$BE_y = EG_{PJ,y} * EF_{BL,CO2,y}$

Where

$EG_{PJ,y}$ is the Net electricity generation in the project plant during the year y (MWh)

$EF_{BL,CO2,y}$ is the baseline CO_2 emission factor (tCO_2e/MWh)

For this monitoring period, $EG_{PJ,y}$ = 244,040 MWh

$EF_{BL,CO2,y}$ = 0.9717 tCO2 /MWh

Therefore, $BE_y = EG_{PJ,y} * EF_{BL,CO2,y}$ = 244,040*0.9717= 237,133 tCO_2

Total Baseline Emissions (BE_y) = 237,133 tCO_2 (round-down value)

5.2 Project Emissions

As per applied methodology AM0029 (Version 3.0), equation (1) and (1a), project emissions are calculated as below

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

and

$COEF_{f,y} = NCV_{f,y} * EF_{CO2,f,y} * OXID_f$

$FC_{f,y}$ is the total volume of natural gas or other fuel 'f' combusted in the project plant or other startup fuel (m^3 or similar) in year(s) y

$COEF_{f,y}$ is the CO2 emission coefficient ($tCO2/m^3$ or similar) in year(s) for each fuel

$NCV_{f,y}$ is the net calorific value (energy content) per volume unit of natural gas in year y (GJ/m^3) 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 (tCO_2/GJ) as determined from the fuel supplier, wherever possible, otherwise from local or national data

$OXID_f$ is the oxidation factor of natural gas

$NCV_{f,y}$ = 8199.165 kCal/sm^3 or 0.034330 GJ/sm^3

$EF_{CO2,f,y}$ = 0.0561 tCO2/GJ

$OXID_f$ = 1

Hence,

$COEF_{f,y}$ = $NCV_{f,y}$ * $EF_{CO2,f,y}$ * $OXID_f$ = 0.034330*0.0561*1= 0.001925908 tCO_2/ sm^3

In this monitoring period, $FC_{f,y}$ = 57, sm^3

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

= 57,977,500.25 sm^3 * 0.001925908 tCO_2/ sm^3

=111,660 tCO_2

Therefore, Project Emissions (PE_y)= 111,660 tCO_2e (round-up value)

5.3 Leakage

As per the applied methodology AM0029, version 3.0 , total leakage emissions are Leakage emissions due to fugitive upstream CH4 emissions ($LE_{CH4,y}$) and 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 ($LE_{LNG,CO2,y}$) are calculated as below Thus, $LE_y = LE_{CH4,y} + LE_{LNG,CO2,y}$

Where,

$LE_{CH4,y}$ is Leakage emissions due to fugitive upstream CH4 emissions in the year y in t CO_2e

$LE_{LNG,CO2,y}$ is 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 t CO_2e

Leakage emissions due to fugitive upstream CH_4 emissions are calculated as below $LE_{CH4,y} = [FC_{f,y} * NCV_{f,y} * EF_{NG,\ upstream,CH4} - EG_{PJ,y} * EF_{BL,\ upstream,\ CH4}]*GWP_{CH4}$ =[57,977,500.25 sm^3 *0.034330 GJ/m^3 *0.000296 tCH_4/GJ – 244,040 MWh *0.0005698 tCH_4/MWh] $*25^6$ = 11,219tCO_2

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 ($LE_{LNG,CO2,}y$) is calculated as below:

$LE_{LNG,CO2,y} = FC_{LNG\ y} * EF_{CO2,\ upstream,LNG}$

= 0.00 TJ* 6 t CO_2/ TJ =0 tCO_2

$LE_y = LE_{CH4,y} + LE_{LNG,CO2,y}$

=11,185 tCO_2 + 0 tCO2 =11,219 tCO_2 (round-up value)

Therefore, Leakage Emissions (LE_y) = 11,219 tCO_2e (round-up value)

5.4 Net GHG Emission Reductions and Removals

This section will be completed during the Verification

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
01-August-2012 to 31-December-	237,133	111,660	11,219	114,254

[6] Though the value of GWPCH4 for this monitoring period correspond to 21, conservative value of 25 have been used to arrive conservative leakage emission

2012				
Total	**237,133**	**111,660**	**11,219**	**114,254**

It is to be noted here that as per the estimated emission reduction to be achieved from the project activity for the current monitoring period is 347,974 tCO_2e, whereas actual emission reductions achieved are 114,254 tCO_2e, which is approximately 67.17% lower than the estimated emission reductions.

This variation is majorly due to the operation of the project activity power plant with plant load factor that is attributed to lack of availability of natural gas.