

FIRST MONITORING REPORT

Document Prepared By (Lanco Kondapalli Power Private Limited.)

Project Title	"Grid Connected Electricity Generation Using Natural Gas By Lanco Kondapalli Power Private Limited."
Version	02
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Date of Issue	13-01-2014
Project ID	-
Monitoring Period	01-08-2010 to 31-07-2012
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Table of Contents

1	Project Details	3
1.1	Summary Description of the Implementation Status of the Project	3
1.2	Sectoral Scope and Project Type.....	4
1.3	Project Proponent.....	4
1.4	Other Entities Involved in the Project.....	4
1.5	Project Start Date.....	4
1.6	Project Crediting Period	4
1.7	Project Location	5
1.8	Title and Reference of Methodology	5
1.9	Other Programs.....	6
2	Implementation Status	6
2.1	Implementation Status of the Project Activity	6
2.2	Deviations	6
2.2.1	Methodology Deviations.....	6
2.2.2	Project Description Deviations.....	7
2.3	Grouped Project.....	7
3	Data and Parameters	7
3.1	Data and Parameters Available at Validation	7
3.2	Data and Parameters Monitored	13
3.3	Monitoring Plan	19
4	Quantification of GHG Emission Reductions and Removals....	23
4.1	Baseline Emissions	23
4.2	Project Emissions	24
4.3	Leakage	25
4.4	Net GHG Emission Reductions and Removals.....	28
APPENDIX 1: < 1 LEAKAGE CALCULATIONS>.....		29

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 employs state of the art technology with estimated project life of 20 years.

The project comprise of the following major equipments:

- One advanced class, heavy duty, Gas turbine generator with a nominal output of about 234 MW at site condition and with Gas turbine Inlet air-cooling system under operation.
- One Heat Recovery, natural circulation, three pressure vertical type Steam Generator.
- One Steam Turbine Generator of around 132 MW (@ 30 deg C, 60% RH), multistage, intermediate injection, condensing, type.

The project activity is designed to use 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. Project activity implemented as described in the VCS PD.

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.

Project milestones:

- Date on which project activity achieved COD (Commercial Operation Date): 01st August 2010
- The project activity is in continuous operation since commissioning

Total operating hours: 16310.25 hours – GTG, 15318.66 Hours - STG

- The total GHG emission reductions or removals generated in this monitoring period (01st August 2010 to 31st July 2012 including both dates): **1460844 tCO₂e**

1.2 Sectoral Scope and Project Type

Type : Grid connected electricity generation
 Sectoral Scope : 1 Energy industries (renewable - / non-renewable sources)
 Project Type : Grid connected natural gas based combined cycle power plant
 Scale : Large

The project is not a grouped project.

1.3 Project Proponent

Organization name	Lanco Kondapalli Power Private Limited.
Contact person	Panduranga Rao
Title	Director & CEO
Address	Lanco House, Plot No. 4, Software Units Layout, HITEC City, Madhapur, Hyderabad, Andhra Pradesh, PIN-500 081 India.
Telephone	+91-40- 4009 0400
Email	lkpl@lancogroup.com

1.4 Other Entities Involved in the Project

No other entities are involved in the Project.

1.5 Project Start Date

Project start date is 01st August 2010 (Date on which project activity achieved COD (Commercial Operation Date)).

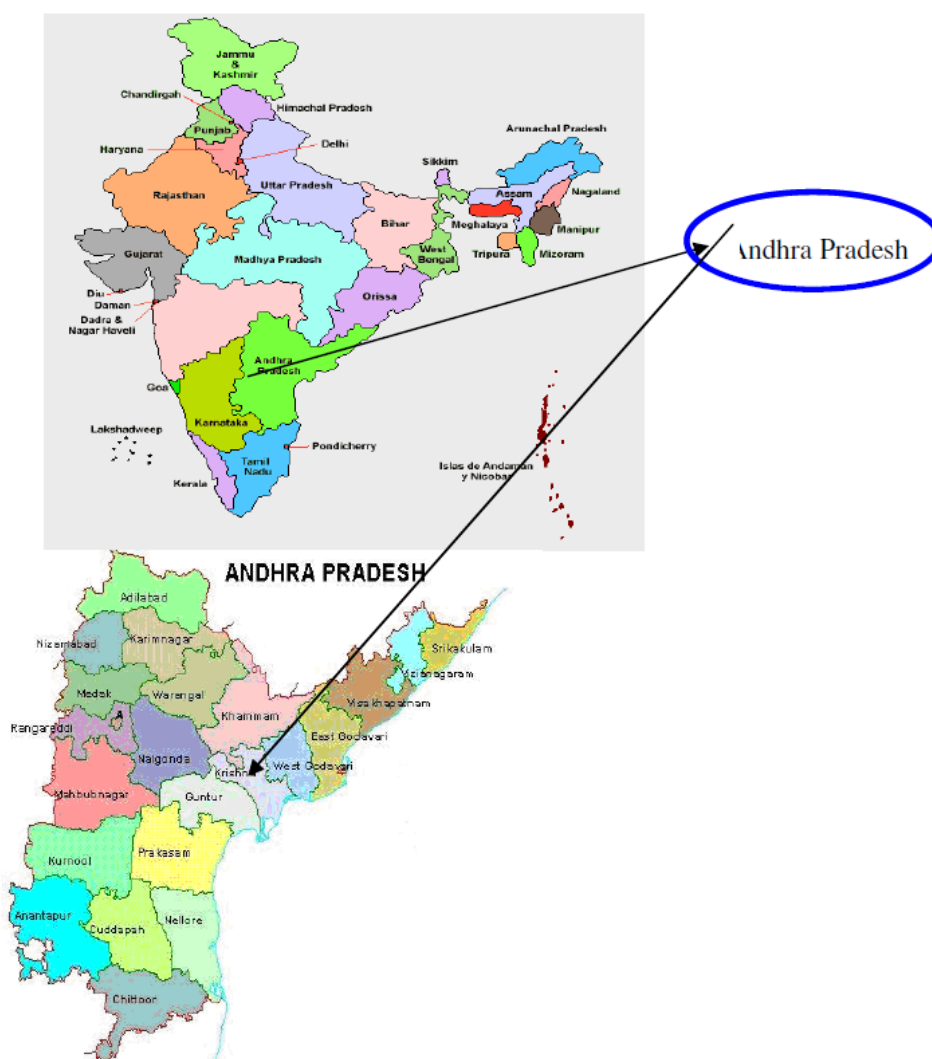
1.6 Project Crediting Period

Crediting Period Start Date : 01/08/2010
 End Date : 31/07/2020
 VCS project crediting period : 10 years of crediting period, which will be renewed once.

1.7 Project Location

The proposed project activity is located at Kondapalli Industrial Development Area in Andhra Pradesh. The project activity is located 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. The proposed project site is at latitude of 16°38'30.10" N and at a longitude of 80°33'05.33" E.

Project Location Map



1.8 Title and Reference of Methodology

Methodology:-

Title : Approved baseline methodology AM0029 “Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas”

Reference : <http://cdm.unfccc.int/methodologies/DB/WW4I82DG7LJUQE5E5YGT1NZE4PNS60>

Version : 03

Sectoral Scope : 01

Tools:-

Title : “Tool to calculate emission factor for an electricity system”

Version : Version 02.2.1

Title : “Tool for the demonstration and assessment of additionality”

Version : Version 06

1.9 Other Programs

The project is registered under Clean Development Mechanism (CDM Regd No: 5554) with UNFCCC on 05th Sep 2012 and is accessible in the following link <http://cdm.unfccc.int/Projects/DB/RWTUV1323884893.28/view>. The project has not sought any other form of GHG related environmental credit for this monitoring period. The validation has been completed on March 1st 2010 as indicated in the Final Validation report.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project activity achieved COD on 01/08/2010. The project activity is implemented and operated as described in the VCS PD and there have been no major changes or damages to the project activity during this monitoring period.

2.2 Deviations

2.2.1 Methodology Deviations

Not applicable, as deviations are not observed for this project activity during this monitoring period.

Monitoring of data and parameters and results applied in the quantification of GHG emission reductions, are as per the applied baseline and monitoring methodology AM0029 (version 03) and procedures defined in the registered PD. The detailed information on calibration for the monitoring instrument viz gas meters, electric meters are provided in Annex 2 of this report.

2.2.2 Project Description Deviations

Not applicable since there are no deviations observed in the project description for this monitoring period and the project activity is as per registered PD.

2.3 Grouped Project

Not applicable, this is not a Grouped Project.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	EF _{BM,y}
Data unit	tCO ₂ e/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 1 st 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 the data	To calculate baseline emissions
Comments	-

Data / Parameter	EF _{OM,y}
Data unit	tCO ₂ e/MWh
Description	Operating Margin Emission Factor of Southern Regional Electricity

	Grid								
Source of data	"CO ₂ Baseline Database for Indian Power Sector" Version 5.0 dated 01 st 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 border="1"> <thead> <tr> <th>Year</th><th>Operating margin</th></tr> </thead> <tbody> <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> </tbody> </table>	Year	Operating margin	2006-07	0.999	2007-08	0.991	2008-09	0.973
Year	Operating margin								
2006-07	0.999								
2007-08	0.991								
2008-09	0.973								
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 the data	To calculate 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 the data	To calculate project emissions
Comments	-

Data / Parameter	Oxidation Factor of Natural Gas (OXIDf)
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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 the data	To calculate project 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 generations from the project activity.
Source of data	Detailed project report (DPR)
Value applied:	1850
Justification of choice of data or description of measurement methods and procedures applied	The CERC tariff order dated 26 th March, 2004 has also specified the SHR of combined cycle gas based power plant with advanced class machines as 1850 kCal/kWh. (Reference http://www.cercind.gov.in/13042007/Terms_and_conditions_of_tariff.pdf)
Purpose of the data	To calculate project emissions
Comments	-

Data / Parameter	Carbon Emission Factor of Coal, Lignite, Diesel and Oil
Data unit	tCO ₂ /TJ
Description	Emission factor of Coal, Lignite, Diesel and Oil. 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	Carbon Emission Factor for Coal, Lignite & Oil: Table 2.3 - India specific CO ₂ 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 Appendix 1
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, the data available in India's first national communication to the United Nations for our calculations where available, otherwise IPCC default values are used.
Purpose of the data	To calculate leakage emissions
Comments	-

Data / Parameter	Oxidation Factor of Coal, Lignite, Diesel and Oil
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 Appendix 1
Justification of choice of data or description of measurement methods and procedures applied	IPCC Guidelines for National Greenhouse Gas Inventories has been applied.
Purpose of the data	To calculate leakage emissions
Comments	-

Data / Parameter	Calorific values of Coal, Lignite, Diesel, Oil, Natural Gas and 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 Appendix 1
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 the data	To calculate 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 the 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 the data	To calculate baseline and leakage emissions
Comments	-

Data / Parameter	Fuel consumption in coal fired power plants using sub-critical technology in the southern region				
Data unit	Million tonnes (MT)				
Description	This data is used as an input for calculating the Energy efficiency of coal fired power plants				
Source of data	CEA CO2 Baseline database, version - 05				
Value applied:	<table border="1"> <thead> <tr> <th>Coal Based Power Station using sub-critical technology</th><th>Fuel Consumption, Million Tonnes</th></tr> </thead> <tbody> <tr> <td>RAYAL SEEMA</td><td>1045.8</td></tr> </tbody> </table>	Coal Based Power Station using sub-critical technology	Fuel Consumption, Million Tonnes	RAYAL SEEMA	1045.8
Coal Based Power Station using sub-critical technology	Fuel Consumption, Million Tonnes				
RAYAL SEEMA	1045.8				

		RAYAL SEEMA	1012.6	
		R_GUNDEM STPS	2574.4	
		SIMHADRI	2544.5	
		SIMHADRI	2774.7	
		RAICHUR	1115.0	
		BELLARY TPS	1016.3	
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 the data	To calculate baseline emissions			
Comments	-			

Data / Parameter	Electricity Generation from coal fired power plants using sub-critical technology in the 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 CO2 baseline database, version -05			
Value applied:		Coal Based Power Station using sub-critical technology	Generation, GWh	
		RAYAL SEEMA	1,577	
		RAYAL SEEMA	1,527	
		R_ GUNDEM STPS	3,919	
		SIMHADRI	3,865	
		SIMHADRI	4,215	
		RAICHUR	1,540	
		BELLARY TPS	1,106	
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. In order to facilitate baseline emissions relating to electricity generation activities, CEA has published a database of CO2 emission factors, version -05 for all the regional grids in India.			

	This database also contains information on electricity generation from all major thermal power stations in the country.
Purpose of the data	To calculate baseline emissions
Comments	-

Data / Parameter	CO ₂ emissions from Build Margin Power plants in the southern region
Data unit	tCO ₂ e
Description	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	CEA CO ₂ Baseline database, version 5.0
Value applied:	Refer Appendix 1
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. In order to facilitate baseline emissions relating to electricity generation activities, CEA has published a database of CO ₂ emission factors, version -05 for all the regional grids in India. This database also contains information on electricity generation from all major thermal power stations in the country.
Purpose of the data	To calculate leakage emissions
Comments	-

3.2 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:	850666966.00
Monitoring equipment	Gas Flow meter
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:	8185
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}
Data unit	tCO2e/GJ
Description	CO2 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 crediting period or the last issuance, whichever occurs

	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:	3968888.29
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	As per Central Energy Authority regulation, 2006 calibration of energy meters are to be done once in five years from the date of installation. Since the monitoring period is for two years from the COD the energy meters are not required to be calibrated. Cross-check of the data is done by the recorded data available at SRPC website which is publically accessible.

Data / Parameter	EF <i>BM,y</i>						
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 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:	<table border="1"> <thead> <tr> <th>Year</th><th>Value</th></tr> </thead> <tbody> <tr> <td>2010-11</td><td>734</td></tr> <tr> <td>2011-12</td><td>852</td></tr> </tbody> </table>	Year	Value	2010-11	734	2011-12	852
Year	Value						
2010-11	734						
2011-12	852						
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 <i>BL,upstream,CH₄</i>
Data unit	tCO ₂ e/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	EF <i>BL,upstream,CH₄</i> is calculated for power plants included in the Build Margin, inline with the baseline emission factor

methods 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 ₂ e/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:	As per CEA database Version 08 the calculated values are, <table border="1"> <thead> <tr> <th>Year</th><th>Value</th></tr> </thead> <tbody> <tr> <td>2010-11</td><td>21.18</td></tr> <tr> <td>2011-12</td><td>15.15</td></tr> </tbody> </table>	Year	Value	2010-11	21.18	2011-12	15.15
Year	Value						
2010-11	21.18						
2011-12	15.15						
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	Refer annex 2						
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 ₂ e/TJ) * Calorific value of Natural Gas (kJ/SCM)
Frequency of monitoring/recording	Not applicable, it's a calculated value
Value monitored:	0.001923
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	Refer annex 2
Comments	-

Data / Parameter	PE _y
Data unit	tCO ₂
Description	Project emissions due to combustion of fuel in the project activity
Source of data	Not applicable, it's a calculated value
Description of measurement methods and procedures to be applied	Not applicable, it's a calculated value
Frequency of monitoring/recording	Not applicable, it's a calculated value
Value monitored:	1634406
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	Project emission due to combustion of fuel is calculated using (i) Total volume of natural gas combusted in the project plant and (ii) CO ₂ Emission coefficient for natural gas as follows: $PE_y = \sum FC_{f,y} \cdot COEF_{f,y}$
Comments	-

3.3 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 will be monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions with specific focus on 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.

Monitoring Plan for CDM activity:

The general conditions set out in this monitoring plan for metering, recording, meter inspections, test & checking; and communication shall be applicable for both electrical energy and natural gas, where relevant and applicable.

Data for Calculation of CER:

The Emission Reductions (ER_y) will be calculated based on calculations for Project Emissions (PE_y), Baseline Emissions (BE_y) and Leakage (LE_y)

$$ER_y = BE_y - PE_y - LE_y$$

The parameters that would be monitored for PE_y are:

Natural Gas Consumption ($FC_{t,y}$): Based on daily meter readings for the total natural gas consumption archived electronically

Net Calorific Value of Natural Gas ($NCV_{t,y}$): Based on daily arithmetic average value of net calorific value, archived electronically

The parameters that are monitored for BE_y are:

Net Electricity Generation (EG_y): Based on the energy meter readings at the grid interconnection point at 400kV PGCIL substation.

Emission Factor based on Build Margin ($EF_{BM,y}$) for the Southern regional grid of India:

This value is taken from the database published annually by Central Electric Authority (CEA) on their website <http://cea.nic.in>. In case for any particular year CEA does not publish the value then $EF_{BM,y}$ are calculated based on the electricity generation and other relevant data published by CEA.

I. Monitoring for Net Electricity Generation (EG_y):

Metering Plan: The Energy (kWh) delivered to the grid is measured by energy meters (0.2 class accuracy) at the grid interconnection point at the 400 kV PGCIL Nunna substation. The meter

reading will be recorded by PGCIL.

Meter Test / Checking for Energy Meter Reading (Gross Energy Generated):

All the related energy meters used to record energy delivered to the grid will undergo periodical calibration (i.e. once in every five year) as per Central Electricity Authority regulations, 2006 on installation and operation of energy meters.

II. Monitoring for Natural Gas Consumption ($FC_{t,y}$):

Metering Plan

The natural gas consumed is metered by the Project Proponent at the following locations

1. Main meter - Measurement are recorded at the M&R (receiving and measurement) station of RIL RGTIL located within the plant boundary. RIL RGTIL would subsequently issue a daily (06 to 06 hrs) gas ticket to LKPPL clearly specifying total flow. The meter reading is archived by LKPPL on daily basis.
2. Check meter - The similar measurement facility is available at LKPPL gas conditioning skid.

RGTIL issues a joint ticket to LKPPL every fortnight. The fortnight joint ticket is also considered for the purpose of cross verification.

Metering Equipment for Natural Gas Consumption:

Metering equipments for natural gas consumption consists of ultrasonic meters along with, pressure transmitters and temperature transmitters. The Natural Gas Consumption metering is done using a main meter. The main meter is located at the supplier gas conditioning/metering skid. The main meter is installed and owned by the Gas Supplier. The metering equipment is maintained in accordance with OEM guidelines as per relevant standards. The accuracy of the ultrasonic meters is maintained at less than 1.0%.

The measurement shall include all corrections in installations practices recommended for accurate metering of gas by the AGA as applicable and shall be binding to Gas supplier as well as project proponent.

Metering Equipment for Natural Gas Gross/Net Calorific Value: Gross / Net calorific value of the natural gas is measured by using an online chromatograph installed by Gas supplier. The

metering equipment is maintained in accordance with OEM guidelines as per relevant standards. The measurements are obtained daily by Gas Supplier and are transmitted to Project Proponent on daily and every fortnight basis.

Meter Test Checking for Natural Gas Meter Reading (Natural Gas Consumed): The natural gas meters are tested at site for accuracy periodically against an accepted laboratory standard meter in accordance with prescribed standards. The consumption registered by the meter will hold well as long as the error in the meters is within the permissible limits. The calibration frequency of natural gas flow meters are maintained at once in a year.

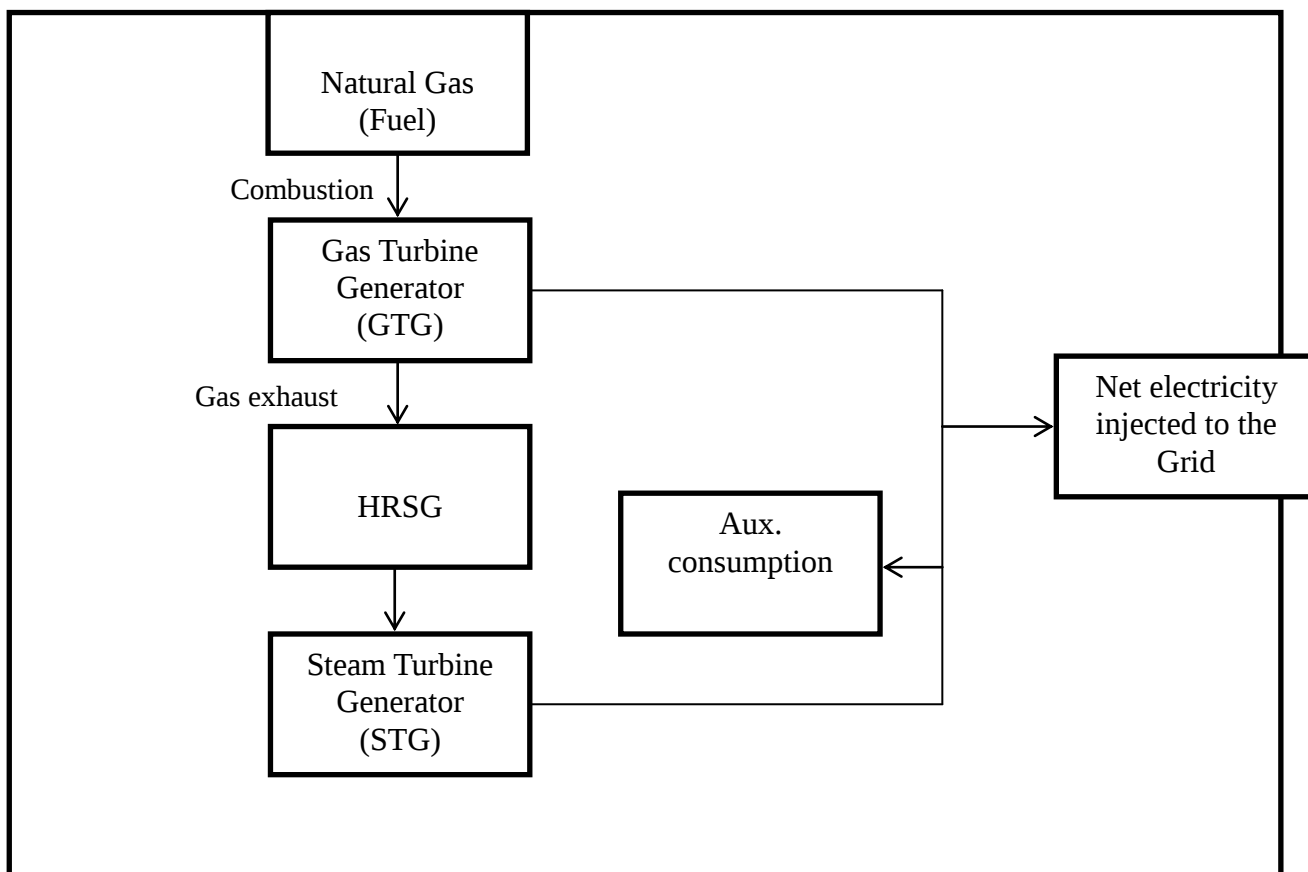
If on calibration, the Gas Supplier's meter registers a variation of more than + 2 (two) percent or if the Gas Supplier's meter is out of service, the procedure for the quantity of Gas during the period between the last calibration and the present shall be followed as per the provisions of GSA:

- I. By using recording by the meter of the Project Proponent and accurately registering: or
- II. By correcting the error if the percentage of error is ascertainable by calibration, test or mathematical calculation: or
- III. By estimating the volume of Gas delivered by comparison with deliveries during the period under similar conditions when the Gas supplier's meter was registering accurately.

Project Management Structure

At the power plant level the project management team is basically engaged in performing day to day activities related to operation and maintenance of the project. The team at the power plant level collects the CDM data and maintaining all records related to CDM activities of the project. The shift engineers are primarily responsible for primary data collection at the respective verticals & calibration. Shift engineer reports to Manager (Operation). The Manager (Operation) is responsible for reviewing the data and in turn reports to the Executive Director – Project (Plant). 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, Manager (Operation) proposes the corrective action in discussion with ED – Project (Plant). ED (Plant) reports to COO (Chief Operating Officer). The project management at the corporate level is basically engaged in overall project monitoring. The team at corporate level review power plant operations and also the data related to CDM activity of the project. AGM – 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 AGM Finance. AGM – Finance will report to CFO. In the event of any disconnect, AGM – Finance suggests the corrective action to the plant officials in discussion with the COO and CFO. Director and CEO is responsible for overall plant operation. COO and CFO will report to the Director.



4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Parameter	Description	Source	Total Monitoring Period (01 st August 2010 to 31 st July 2012)
EG _y	Electricity generation	Refer to Data under	3968.888

	in the project plant	sec. 3.2 “Data and parameters monitored”	GWh
$EF_{BM,CO_2,y}$	The Build Margin emission factor of Southern grid	Refer to data detailed under sec. 3.2 “Data and parameters monitored”	734 tCO ₂ /GWh (2010 -11) 852 tCO ₂ /GWh (2011 -12)
BE_y	Emissions in the Baseline Scenario	Calculated as per equation number 2 of the AM0029 version 03 $BE_y = EG_{PJ,y} * EF_{BL,CO_2,y}$	3207311 tCO ₂ e

4.2 Project Emissions

Parameter	Description	Source	Total Monitoring Period (01 st August 2010 to 31 st July 2012)
$FC_{NG,y}$	Quantity of NG consumed in the project activity	Refer to Data detailed under sec. 3.2 “Data and parameters monitored”	850666966.00 SCM
$NCV_{Natural Gas,y}$	Net Calorific Value of Natural Gas	Refer to Data detailed under sec. 3.2 “Data and parameters monitored”	0.03427 GJ/SCM
$EF_{CO_2,NG}$	Emission Factor of Natural Gas	Refer to Data detailed under sec. 3.1 “Data and parameters at validation.	0.0561 tCO ₂ /GJ

OXID _{NG}	Oxidation factor of natural gas	Refer to Data detailed under sec. 3.1 "Data and parameters at validation.	1.00
COEF _{f,y}	CO ₂ emission coefficient of natural gas	Calculated as per equation no. 2a of AM 0029- version 3.0. Refer to Data detailed under section 3.2 "Data and Parameters monitored".	0.001923 tCO ₂ /SCM
PE _y	Emissions in the Project Scenario	Calculated as per equation no. 2 of AM 0029- version 3.0. Refer to Data detailed under sections 3.2 "Data and Parameters monitored".	1634406 tCO ₂ e

4.3 Leakage

Parameter	Description	Source	Total Monitoring Period (01 st August 2010 to 31 st July 2012)
FC _{NG,y}	Quantity of NG consumed in the project activity	Refer to Data detailed under section 3.2 "Data and Parameters monitored".	850666966 SCM
NCV _{f,y}	Net Calorific Value of Natural Gas	Refer to Data detailed under section 3.2 "Data and Parameters Monitored".	0.03427 GJ/SCM
EF _{NG, upstream, CH₄}	Emission factor for upstream fugitive methane emissions of natural gas from	Refer to Data detailed under section 3.1	0.000296 tCH ₄ /GJ

	production, transportation, distribution, and, in the case of LNG, liquefaction, transportation, regasification and compression into a transmission or distribution system, in tCH ₄ per GJ fuel supplied to final consumers		
EG _{PJ,y}	Electricity exported by the project plant	Refer to Data detailed under sec. 3.2 "Data And Parameters monitored"	3968.888GWh
EF _{BL,upstream,C} H ₄	Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity electricity generation	Refer to Data detailed under sec. 3.2 "Data And Parameters monitored"	0.001009 tCH ₄ /MWh (2010 -11) 0.000721 tCH ₄ /MWh (2011 -12)
GWP _{CH₄}	Global warming potential of methane valid for the relevant commitment Period		21
LE _{CH₄,y}	Leakage emissions due to fugitive upstream CH ₄ emissions	Calculated as per equation number-5 of AM 0029- version 3.0 as contained in section 4 of the registered PD Leakage emissions due to fugitive upstream CH ₄ emissions (LE _{CH₄,y})	112061 tCO ₂ e
LE _{LNG,CO₂,y}	Leakage emissions	Calculated as per the	0.00

	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 ($LE_{LNG,CO2,y}$)	methodology, AM 0029- version 3.0 as contained in of section 4 of the registered PD 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 ($LE_{LNG,CO2,y}$) $LE_{LNG,CO2,y} = FC_{LNG,y} * EF_{CO2,upstream,LNG}$	
LE_y	Total Leakages	Calculated as per equation number-5 of AM 0029- version 3.0 as contained in Section 4 of registered PD $LE_y = LE_{CH4,y} + LE_{LNG,CO2,y}$	112061 tCO ₂ e

4.4 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)
Year 2010	737196	407411	23868	305917
Year 2011	1865131	891567	61785	911779
Year 2012	604984	335428	26408	243148
Total	3207311	1634406	112061	1460844

APPENDIX 1: < 1 LEAKAGE CALCULATIONS>

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

where:

LE_y Leakage emissions during the year y in tCO₂e

$LE_{CH_4,y}$ Leakage emissions due to fugitive upstream CH₄ emissions in the year y in t CO₂e

$LE_{LNG,CO_2,y}$ 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 t CO₂e

$$LE_{CH_4,y} = FC_y \cdot NCV_y \cdot EF_{NG, upstream, CH_4} - EG_{PJ,y} \cdot EF_{BL, upstream, CH_4} \cdot GWP_{CH_4}$$

where:

$LE_{CH_4,y}$ Leakage emissions due to fugitive upstream CH₄ emissions in the year y in t CO₂e

FC_y Quantity of natural gas combusted in the project plant during the year y in m³

$NCV_{NG,y}$ Average net calorific value of the natural gas combusted during the year y in GJ/m³

$EF_{NG,upstream,CH_4}$ Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, and, in the case of LNG, liquefaction, transportation, re-gasification and compression into a transmission or distribution system, in tCH₄ 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 CH₄ 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

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

where:

$EF_{BL,upstream,CH_4}$ Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH₄ 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 (a coal or oil type) in t CH₄ per MJ fuel produced

EG_j Electricity generation in the plant j included in the build margin in MWh/a

For this monitoring period only NG is used as fuel. Hence leakage 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 is ignored.

Upstream fugitive emissions on account of use of LNG by the project activity

There is no LNG consumption in the CDM project activity for this monitoring period.

Calculation of $EF_{BL,upstream,CH_4}$ is shown in the table below:

Year 2010-11							
	Emissions	Emission factor	Fuel consumption		Fugitive emission factor		Fugitive emissions
	tCO ₂ e	tCO ₂ e/1000 t or Mcum	1000 t	PJ	tCH ₄ /1000t	tCH ₄ /PJ	tCO ₂ e
Coal	21,409,343	1,431	14,962		0.8		251,354
Lignite	0	1,150	0		0.8		0
Diesel	0	3,093		0		4.1	0
Natural gas	4,473,543	1,860		80		296	495,678
Oil	0	3,108		0		4.1	0
Total							747,032

Year 2011-12							
	Emissions	Emission factor	Fuel consumption		Fugitive emission factor		Fugitive emissions
	tCO ₂ e	tCO ₂ e/1000 t or Mcum	1000 t	PJ	tCH ₄ /1000t	tCH ₄ /PJ	tCO ₂ e
Coal	31,520,023	1,431	22,027		0.8		370,057
Lignite	21,151	1,150	18		0.8		309
Diesel	0	3,093		0		4.1	0
Natural gas	2,046,908	1,860		36		296	226,802
Oil	0	3,108		0		4.1	0
Total							597,168

List of Thermal Plants in Southern grid that is included in the build margin:

NAME	UNIT_NO	DT_COMM	CAPACITY MW AS ON 31/03/2012	STATE	FUEL 1	FUEL 2	2010-11 Absolute Emissions t CO2	2010-11 Net Generation GWh	2011-12 Absolute Emissions t CO2	2011-12 Net Generation GWh
K_GUDEM NEW	3	26-Jun-11	500	ANDHRA PRADESH	COAL	OIL			1,547,542	1,668
RAYAL SEEMA	3	25-Jan-07	210	ANDHRA PRADESH	COAL	OIL	1,305,108	1,399	1,417,544	1,505
RAYAL SEEMA	4	20-Nov-07	210	ANDHRA PRADESH	COAL	OIL	1,348,964	1,447	1,435,590	1,528
RAYAL SEEMA	5	31-Dec-10	210	ANDHRA PRADESH	COAL	OIL	137,361	145	1,307,576	1,364
R_GUNDE M STPS	7	26-Sep-04	500	ANDHRA PRADESH	COAL	OIL	3,636,656	3,811		
SIMHADRI	3	31-Mar-11	500	ANDHRA PRADESH	COAL	OIL			3,075,647	3,230
SIMHADRI	4	30-Mar-12	500	ANDHRA PRADESH	COAL	OIL			8,426	9
RAICHUR	7	11-Dec-02	210	KARNATAKA	COAL	OIL	402,989	357		
RAICHUR	8	26-Jun-10	250	KARNATAKA	COAL	OIL			925,777	862
BELLARY TPS	1	3-Dec-07	500	KARNATAKA	COAL	OIL	2,892,224	2486.20	3,284,016	2,905
BELLARY TPS	2	23-Mar-12	500	KARNATAKA	COAL	OIL			2,904	3
VIJAYWADA TPP-IV	1	8-Oct-09	500	ANDHRA PRADESH	COAL	OIL	3,207,143	3584.89	3,629,703	3,924
TORANGALLU EXT	1	27-Apr-09	300	KARNATAKA	COAL	OIL	2,068,406	2309.78	1,778,533	1,935
TORANGALLU EXT	2	24-Aug-09	300	KARNATAKA	COAL	OIL	2,068,406	2309.78	1,777,661	1,934
STERLITE TPP	1	29-Dec-10	600	ORISSA	COAL	OIL	374,456	317	2,933,119	2,891
STERLITE TPP	2	14-Oct-10	600	ORISSA	COAL	OIL	683,790	579	1,975,039	1,838
STERLITE TPP	3	16-Aug-11	600	ORISSA	COAL	OIL			1,033,956	975

KAKATIYA TPP	1	27-May-10	500	ANDHRA PRADESH	COAL	OIL	1,653,023	1,694	2,090,072	2,270
UDUPI TPP	1	23-Jul-10	600	KARNAT AKA	COAL	OIL	1,630,817	1,596	3,006,507	2,942
UDUPI TPP	2	17-Apr-11	600	KARNAT AKA	COAL	OIL			290,412	262
Total Coal							21,409,343	22,037	31,520,023	32,046
KONDAPALLI GT	4	5-Dec-09	233	ANDHRA PRADESH	GAS	NAPT	554,060	1,271	551,170	1,343
KONDAPALLI ST	5	19-Jul-10	133	ANDHRA PRADESH	GAS	NAPT	316,266	726	314,616	767
VALUTHUR GT	3	1-Sep-08	58.5	TAMIL NADU	GAS	n/a			134,614	329
VALUTHUR GT	4	1-Sep-08	33.7	TAMIL NADU	GAS	n/a			77,547	189
VALUTHUR GT	5	6-May-08	59.8	TAMIL NADU	GAS	n/a			0	0
VALANTHARVI GT	1	29-Oct-05	52.8	TAMIL NADU	GAS	n/a	145,937	305		
VALANTHARVI GT	2	15-Apr-06	14.8	TAMIL NADU	GAS	n/a	40,907	86		
VEMAGIRI CCCP	1	13-Jan-06	251.5	ANDHRA PRADESH	GAS	n/a	645,279	1,767		
VEMAGIRI CCCP	2	8-Jun-06	137	ANDHRA PRADESH	GAS	n/a	351,504	963		
GAUTAMI CCCP	1	3-May-09	152	ANDHRA PRADESH	GAS	n/a	423,828	1,088		
GAUTAMI CCCP	2	3-May-09	152	ANDHRA PRADESH	GAS	n/a	423,828	1,088		
GAUTAMI CCCP	3	3-May-09	164	ANDHRA PRADESH	GAS	n/a	456,646	1,172		
KONASEEMA CCCP	1	31-Mar-09	280	ANDHRA PRADESH	GAS	n/a	773,234	1,636	624,161	1,425
KONASEEMA CCCP ST	2	30-Jun-10	165	ANDHRA PRADESH	GAS	n/a	342,054	724	344,800	787
Total Gas							4,473,543	10,825	2,046,908	4,839
NEYVELI TPS EXP - II	1	4-Feb-12	250	TAMIL NADU	LIGN	OIL			21,151	17

Total Lignite							0	0	21,151	17
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Type of FUEL	Net Calorific Value (TJ/ 103 tonnes or TJ/Mcum)	Carbon Emission Factor (t CO ₂ / TJ)	Fraction of Carbon Oxidised Oxidation Factor	Emission Factor (tCO ₂ / 103 tonnes or tCO ₂ /Mcum)
Coal	14.94	26.13	1.00	1,431
Diesel	41.76	20.20	1.00	3,093
Lignite	10.83	28.95	1.00	1,150
Natural Gas	33.16	15.30	1.00	1,860
Oil	40.17	21.10	1.00	3,108