Monitoring report form for CDM project activity
(Version 07.0)

MONITORING REPORT		
Title of the project activity	Grid Connected Gas based Combined Cycle Power Project in Andhra Pradesh	
UNFCCC reference number of the project activity	8323	
Version number of the PDD applicable to this monitoring report	05	
Version number of this monitoring report	01	
Completion date of this monitoring report	18/02/2021	
Monitoring period number	01	
Duration of this monitoring period	31/01/2014 to 31/12/2016	
Monitoring report number for this monitoring period	Not Applicable	
Project participants	M/s Lanco Kondapalli Power Limited.	
Host Party	India	
Applied methodologies and standardized baselines	AM0029 ver. 3 - Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas Standardized Baseline: Not Applicable	
Sectoral scopes	Sectoral Scope:-01, Energy industries (renewable / non-renewable sources)	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0	998,516 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	1,624,138 tCO_2e	

SECTION A. Description of project activity

A.1. General description of project activity

The scope of the project activity involves implementation and operation of a new natural gas fired grid-connected Combined Cycle Power Plant (CCPP) of 2*371 MW capacity at Kondapalli near Vijayawada, Andhra Pradesh by Lanco Kondapalli Power Limited (LKPL). The proposed CCPP would operate on Brayton Cycle (Compressor & Gas Turbine) at top and Rankine Cycle (Heat Recovery Steam Generator & Steam Turbine) at bottom. The project employs state of the art technology with estimated project life of 20 years.

The project activity comprises of the following major equipments:

- Two advanced class, heavy duty, Gas turbine generators with a nominal output of about 241 MW capacity each at site condition and with each having a Gas turbine Inlet air-cooling system.
- Two Heat Recovery, natural circulation, three pressure vertical type Steam Generator.
- Two Steam Turbine Generators of around 130 MW capacity each (@ 30 deg C, 60% RH), which is multistage, intermediate injection, condensing type.

The project activity is designed to use natural gas as fuel for power generation – natural gas is sourced from Krishan Godavari basin of Reliance Industries Limited (RIL) and gas is transported through Reliance Gas Transportation Infrastructure Limited (RGTIL).

The power generated from the proposed power plant is delivered to the existing substation of Power Grid Corporation of India Limited (PGCIL) at Nunna through existing 400kV double circuit transmission lines. The power generated is stepped up to 400 kV level by using 15/420 kV generator transformers. A 400 kV Gas Insulated Switchgear (GIS) type substation, which is available at the site, would be used for this process. The power generated from the project activity would be sold on merchant basis to the state utilities in Southern, Western & Northern India.

The project activity is a Greenfield new grid connected power plant - the pre-project scenario as well as baseline scenario is generation of power from existing or proposed new power plants connected to the Southern regional grid.

Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period: 998,516 tCO_2e.

A.2. Location of project activity

The project activity has been implemented at the following location:-

Village : Kondapalli
District : Krishna
State : Andhra Pradesh
Country : India

The project activity is located in the existing location of phase II which is at Kondapalli, Krishna District, Andhra Pradesh. The existing plant is adjacent to State highway connecting Kondapalli and Mylavaram. Kondapalli railway station is approximately 1km from the site and the nearest Airport is at Gannavaram at about 35 ki from the project site. The project site is at a latitude of 16.641694° N and at a longitude of 80.551481° E.

Project Location Map


Andhra Pradesh
ANDHRA PRADESH
Adilabad
Karimnagar
Nizamabad
Warangal
Medak
Khammam
Rangareddi
Nalgonda
East Godavari
West Godavari
Krishna
Mahbubnagar
Guntur
Kurnool
Prakasam
Nellore
Cuddapah
Chittoor
Srikakulam
Vizianagaram
Visakhapatnam


Khammam
Tiruvuru
Nalgonda
Makkapeta
Huzurnagar
Jaggayyapeta
Nandigama
Ponuganchiprolu
Janardanavaram
Vissannapeta
Kambhampadu
Ramanakkpeta
KRISHNA
West Godavari
Mallavaram
Nuzvid
Raghavapuram
Goliapalle
Chandralapadu
Kanchikacherla
Agtripalle
Krishna
Partiala
Konduru
Kondapalle
Viravalli
Pedda Avutapalle
Telaprolu
Kolleru
Kaikalur
Mandavalli
Gannavaram
Ventrapragada
Guntur
Kankipadu
Moturu
Mudinepalle
Gudivada
Vayyuru
Bantumilli
Pamarru
Kavutaram
Rajaleswarpuram
Pedana
Nidumolu
Gilduru
Bandar Fort
MACHILIPATNAM
Challapalle
Avanigadda
Koduru
Nagayalanka
Talagadadivi
Bay
of
Bengal
Prakasam
Yelatturubba

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host Party)	Private Entity: Lanco Kondapalli Power Limited.	No

A.4. References to applied methodologies and standardized baselines

The approved baseline and monitoring methodologies applied for the project activity are: AM0029 ver. 3 - Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas

Tools referenced by the methodology and applicable for the project activity:
"Tools to calculate the emission factor for an electricity system" (Version 02.2.1) EB 63 ; Annex-19

A.5. Crediting period type and duration

Type of crediting period: Fixed
Start date of Crediting Period: 31/01/2014
Length of Crediting Period: 10 Years
Duration of Crediting Period: 31/01/2014 to 30/01/2024

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

The project activity was commissioned on 31/08/2015 and actual commercial operation started on 01/11/2015.

The scope of the project activity involves implementation and operation of a new natural gas fired grid-connected Combined Cycle Power Plant (CCPP). The project proposes to employ state of the art technology with estimated project life of 20 years. There is no technology transfer in this project activity. The table below provides the details of main equipment of the power plant:

S.No.	Equipment	Specifications	Special Features

1	GTG (2 nos)	Make : GE, USA GTG is of advanced class industrial heavy duty type (Model 9FA) with dry low NOx technology capable of operating in combined cycle mode, Nominal output capacity: 241 MW (per unit) at site conditions	Low NO_x technology along with state of the art cooling. Thermal efficiency close to 53 – 58% (LHV)
2	STG (2 nos.)	Make: Harbin, China One steam turbine generator of output capacity 130 MW (per unit) at site condition	• Multistage, intermediate injection, condensing type steam turbine. • State of the art DCS control system
3	HRSG (2 Nos)	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.

In addition to the main plant equipment, auxiliary cooling water system, condenser cooling water system, electrical systems, evacuation of power, etc., are also parts of the power project. Also included are features for addressing environmental aspects and safety in operation and maintenance of the power project.

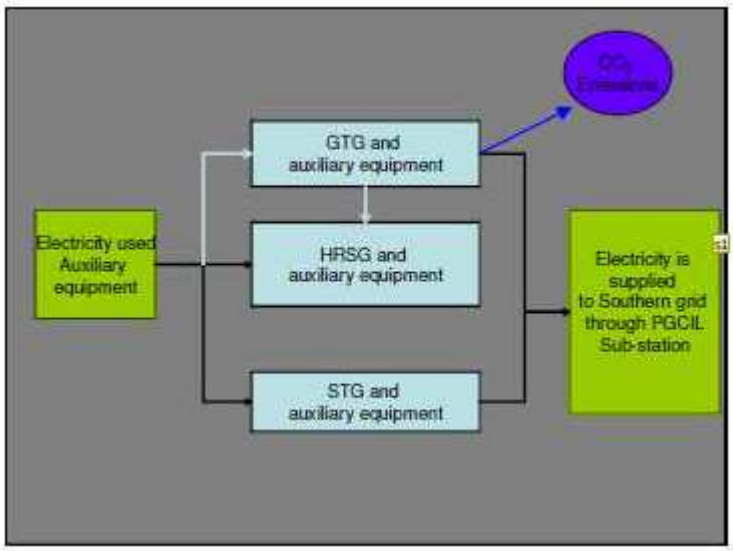
The power generated from the project activity power plant is delivered to the existing Nunna substation of Power Grid Corporation of India Limited (PGCIL) at Kondapalli through existing 400kV double circuit transmission lines. The power generated is stepped up to 400 kV level by using 15/420 kV generator transformers. A 400 kV Gas Insulated Switchgear (GIS) type substation, which is available at the site, is used for this process.

The necessary transmission lines for this purpose have y been installed by LKPL. The GTG is connected to the bus in the switchyard through a generator transformer that steps up voltage from 15 kV to 400 kV, provided with off load tap changers on the high voltage side. The STG is connected to the switchyard through a generator transformer that steps up voltage of 13.8 kV to 420 kV.

The project activity is designed to use natural gas as fuel for power generation. NG used as fuel for the project in future may be a combination of NG and Re-gassified- Liquid Natural Gas (“R-LNG”). Further, the gas allocation has not yet completed for the project activity. LKPL is likely to source the gas from RIL.

The greenhouse gases emitted from project activity include CO_2 emissions due to on-site fuel combustion; CO_2 and CH4 emissions due to Transportation of fuel to project site (inside the project boundary). The CO_2 emissions due to Processing and transportation of fuel outside the project boundary are being accounted for as leakage emissions.

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.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

Not Applicable

B.2.2. Corrections

Not Applicable

B.2.3. Changes to the start date of the crediting period

Not Applicable

B.2.4. Inclusion of monitoring plan

Not Applicable

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

Not Applicable

B.2.6. Changes to project design

Not Applicable

B.2.7. Changes specific to afforestation or reforestation project activity

Not Applicable

SECTION C. Description of monitoring system

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 would 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 for Energy Generation
The energy generated by the project activity would be supplied to the PGCIL grid through the Nunna Substation. A dedicated 400 kV double circuit line is available from LKPL"s facility to the substation. It is to be noted that the double circuit lines are common to both LKPL"s phase III (candidate project activity of 742 MW) and Phase II (366 MW). Hence an apportioning procedure is necessary for ascertaining the quantum of electricity that is being supplied by the candidate project activity.

Each GTG and STG in LKPL"s phase III and phase II projects have a meter to measure the net quantity of electricity supplied. Each of the 400 kV lines has a separate metering arrangement at the substation.

There are 3 meters maintained by the substation for each line. A main meter and a check meter are available at the sub-station and a third meter is available near LKPL"s facility, which will be used in case of failure of both the main and check meters at the substation. The apportioning procedure to be followed is illustrated as below. Consider the following:

<u>Lanco phase III (candidate CDM project activity of 742 MW)</u>

Electricity generated by GTG – 3(A) = a

Electricity generated by STG – 3(A) = b

Electricity generated by GTG – 3(B) = c

Electricity generated by GTG – 3(B) = d

Total generation by LKPL"s phase III project activity = a+b+c+d = $EG_{Phase - III}$

<u>Lanco phase II project activity (366 MW)</u>

Electricity generated by GTG – 2 = e

Electricity generated by STG – 2 = f

Total generation by LKPL"s phase II project activity = e+f = $EG_{Phase - III}$

Electricity received at the substation:

Through Line-1: X1

Through Line-2: X2

Total net energy supplied by both LKPL phase III and phase II projects as recorded at the substation = X1 + X1 = $EG_{Substation}$

Net energy supplied by LKPL phase III (candidate project activity)

$= (EG_{Phase - III} / (EG_{Phase - III} + EG_{Phase - II}))* EG_{Substation}$

The main and check meters installed at the site of the generating units of both phase II and candidate phase III (GTG 3(A) & 3(B) and STG 3(A) & 3(B)) are of accuracy 0.2 accuracy class. LKPL undertakes calibration of these meters once in 4 years. The meter readings recorded by the Nunna substation are the ones used for billing purpose; these meters are of accuracy class 0.2S and are calibrated by the PGCIL once in 4 years. These quantity of electricity supplied to the PGCIL grid (through Nunna substation) is reported in the website of the Southern Regional Load Despatch Centre.

Emergency provisions

Generator sets are available at site in case of emergencies and the plant to proceed to shut down; in case of a black-out, power would be drawn from the grid and the same is accounted for in auxiliary consumption.

Monitoring plan for gas consumption

Gas Quantity

Reliance Industries Limited (RIL), the gas supplier has established a receiving substation in the premises of LKPL. There are 2 lines for supply of gas to the candidate project activity from this sub station (steams A & B), although at any point in time gas would be supplied through only one line (the other line is for the purpose of redundancy). Each of these lines has a meter installed (main meter) to measure the quantum of gas being supplied; Joint calibration of these meters is carried out by Reliance and LPKL personnel. A check meter has also been installed by LKPL, for the purpose of cross checking.

Calorific Value

A gas chromatograph is also maintained on site by the gas supplier which monitors the calorific value of the gas being supplied. The gas supplied is monitored continuously and recorded in gas tickets on 24-hour cycles (06:00 AM to 06:00 AM). The gas supplier provided „gas tickets" the provide the quantity of gas supplied, NCV and the net energy supplied (in MMBTU terms).

The energy supplied by the project activity would be made available in the SRLDC (Southern Regional Load Despatch Center) website – providing day - wise values; although the invoicing is done by the gas supplier on a fortnightly basis, daily gas tickets would also be available and hence estimation of emission reductions from the date of registration would be possible. In the event that documentary sources for the purpose of estimation of CERs is not available due to date of registration not coinciding with the billing cycle, CERs would be conservatively estimated by excluding the partial billing cycle. This approach would be followed for the first and the last billing cycles in the crediting period.

Action Plan for Monitoring of 2% CER Revenue Committed Towards Sustainable Development

LKPL is committed to contribute a minimum of 2% of the CDM revenue realized from the sale of CERs towards sustainable development.
LKPL undertakes an annual review process of the actual CERs accrued and the price transacted. On the basis of the actual price and exchange rate, LKPL commits 2% of the revenue for sustainable development activities in the local areas.

LKPL implements these activities for sustainable development through its trust/foundation that has been established for undertaking CSR activities.

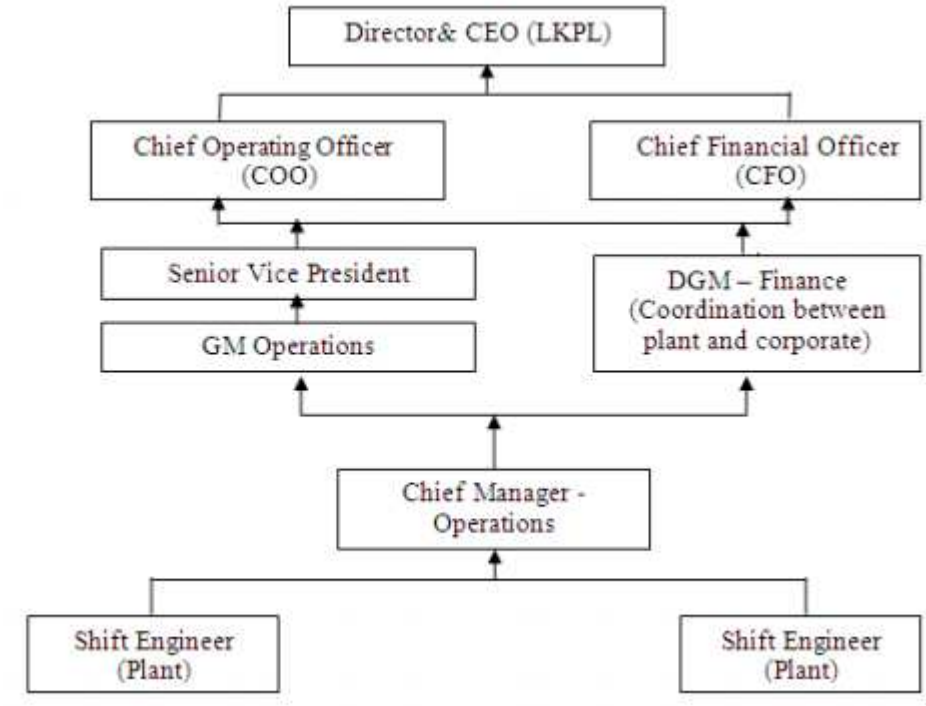
As part of the annual review, LKPL undertakes informal discussions with the locals at the project site and commit the revenue towards society / community developmental activities in areas that are

of most concern to the local population. These areas include health, education, sanitation, skill development, infrastructure development, etc. The annual review process provides the exact activities that would be undertaken using the 2% revenue and the detailed mode of implementation of the proposed activity.

LKPL commits that a CSR team is appointed to oversee the activities towards sustainable development and also that the activities are undertaken and concluded in a timely manner each year.

Project Management Structure

The schematic organogram of the project management team as maintained in LKPL is as follows



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 would primarily be collecting the CDM data and maintaining all records related to CDM activities of the project. The shift engineers would be primarily responsible for primary data collection at the respective verticals & calibration. Shift engineer would report to Chief Manager (Operation). The Chief Manager (Operation) would be responsible for reviewing the data and would report to the GM Operations. If the data reported by the shift engineers are found satisfactory the same wouldq be recorded in the Management Information System (MIS). In the event of any discrepancy, Manager (Operation) would propose the corrective action in discussion with GM Operations. GM Operations would report to COO.

The project management at the corporate level is basically engaged in overall project monitoring. The team at corporate level would review power plant operations and also the data related to CDM activity of the project. DGM – Finance (Corporate) would be responsible for overall project coordination between the plant level and corporate office. Information pertaining to plant operation including CDM related data would be reviewed by DGM Finance. DGM – Finance would report to CFO. In the event of any disconnect, DGM – Finance would suggest the corrective action to the plant officials in discussion with the COO & CFO. Director & CEO would be responsible for overall plant operation. COO & CFO would report to the Director.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	$EF_{BM,y}$
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 7 dated January 2012 published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in
Value(s) applied	0.7339
Choice of data or measurement methods and procedures	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".
Purpose of data/parameter	Calculation of Baseline Emissions
Additional comments	-

Data/Parameter	$EF_{OM,y}$
Unit	tCO_2e/MWh
Description	Operating Margin Emission Factor of Southern Regional Electricity Grid
Source of data	"CO_2 Baseline Database for Indian Power Sector" Version 7 dated January 2012 published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in
Value(s) applied	Average value of the three year data = 0.952 2008-09: 0.973 2009-10: 0.942 2010-11: 0.942 **Average: 0.952**
Choice of data or measurement methods and procedures	Operating Margin Emission Factor has been calculated by the Central Electricity Authority in accordance with "Tool to calculate the emission factor for an electricity system".
Purpose of data/parameter	Calculation of Baseline Emissions
Additional comments	-

Data/Parameter	Carbon Emission Factor of Natural Gas ($EF_{CO2,f,y}$)
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(s) applied	56.1 tCO_2/TJ (= 0.0561 tCO_2/GJ)
Choice of data or measurement methods and procedures	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/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	Oxidation Factor of Natural Gas ($OXID_f$)
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(s) applied	1.0
Choice of data or measurement methods and procedures	As there are no national data available, IPCC default value based on is considered
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**Station Heat Rate of the Project activity**
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. This data is used as an input for calculating Project Emissions.
Source of data	Detailed project report (DPR) The CERC tariff order of 2009 has also specified the SHR of 1850 kCal/ kWh for the combined cycle gas based power plant with advanced class machines.
Value(s) applied	1850
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**Carbon Emission Factor of Coal, Lignite, Diesel, Oil, Natural Gas**
Unit	tCO_2/TJ
Description	Emission factor of Coal, Lignite, Diesel, Oil, Natural Gas. This data would be used as an input for calculating the fugitive CH4 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(s) applied	(see table below)
Choice of data or measurement methods and procedures	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.

Type of FUEL	Net Calorific Value (TJ/ 103 tonnes or TJ/Mcum)	Carbon Emission Factor (t C/ TJ)	Fraction of Carbon Oxidised Oxidation Factor	Emission Coefficient (tCO_2/ 103 tonnes or tCO_2/Mcum)	Den sity (kg/ Lt)	Emission factor (tCO_2/1 000 t or tCO_2/Mcum)
(Non coking) Coal	15.16	26.20	1.00	1,452	1.00	1,452
Lignite	10.99	27.30	1.00	1,167	1.00	1,167
Natural Gas	33.16	15.30	1.00	1,860	1.00	1,860
Naphta	44.95	20.00	1.00	3,296	0.76	2,505

Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**Oxidation Factor of Coal, Lignite, Diesel, Oil, Natural Gas**
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 CH4 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(s) applied	Refer Appendix 2
Choice of data or measurement methods and procedures	Only IPCC default values are available.
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**Calorific values of Coal, Lignite, Diesel, Oil and Natural Gas Naphtha**
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 CH4 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(s) applied	Refer Appendix 2
Choice of data or measurement methods and procedures	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/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**η_{BL} – Efficiency of coal fired power generating stations using sub-critical technology**
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-dioxide emission database, version - 07
jValue(s) applied	34.72%
Choice of data or measurement methods and procedures	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/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**Fuel consumption in coal fired power plants using sub-critical technology in the southern region**
Unit	Thousand tons
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 - 07

Value(s) applied	<table><tr><th>Sub Critical Coal fired stations</th><th>Coal consumption 1000 tons</th></tr><tr><td>RAYAL SEEMA</td><td>896.41</td></tr><tr><td>RAYAL SEEMA</td><td>926.53</td></tr><tr><td>RAYAL SEEMA</td><td>94.35</td></tr><tr><td>R_GUNDEM STPS</td><td>2497.82</td></tr><tr><td>SIMHADRI</td><td>0</td></tr><tr><td>RAICHUR</td><td>276.79</td></tr><tr><td>BELLARY TPS</td><td>1986.51</td></tr><tr><td>VIJAYWADA TPP- IV</td><td>2202.81</td></tr><tr><td>TORANGALLU EXT</td><td>1420.67</td></tr><tr><td>TORANGALLU EXT</td><td>1420.67</td></tr><tr><td>STERLITE TPP</td><td>257.19</td></tr><tr><td>STERLITE TPP</td><td>469.66</td></tr><tr><td>KAKATIYA TPP</td><td>1135.37</td></tr><tr><td>UPUPI TPP</td><td>1120.12</td></tr></table>
Choice of data or measurement methods and procedures	CEA CO_2 Baseline database, version - 07
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**Electricity Generation from coal fired power plants using sub-critical technology in the Southern Region**
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 -06
Value(s) applied	<table><tr><th>Sub Critical Coal fired stations</th><th>Coal consumption GWh</th></tr><tr><td>RAYAL SEEMA</td><td>1398.64</td></tr><tr><td>RAYAL SEEMA</td><td>1447.22</td></tr><tr><td>RAYAL SEEMA</td><td>145.49</td></tr><tr><td>R_GUNDEM STPS</td><td>3811.14</td></tr><tr><td>SIMHADRI</td><td>0.00</td></tr><tr><td>RAICHUR</td><td>357.44</td></tr><tr><td>BELLARY TPS</td><td>2486.20</td></tr><tr><td>VIJAYWADA TPP- IV</td><td>3584.89</td></tr><tr><td>TORANGALLU EXT</td><td>2309.78</td></tr><tr><td>TORANGALLU EXT</td><td>2309.78</td></tr><tr><td>STERLITE TPP</td><td>317.14</td></tr><tr><td>STERLITE TPP</td><td>579.13</td></tr><tr><td>KAKATIYA TPP</td><td>1694.06</td></tr><tr><td>UPUPI TPP</td><td>1595.94</td></tr></table>
Choice of data or measurement methods and procedures	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 -07 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 data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**CO_2 emissions from Build Margin Power plants in the southern region**
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 7
Value(s) applied	Refer Appendix 2
Choice of data or measurement methods and procedures	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 for all the regional grids in India. This database also contains information on CO_2 emissions of all major thermal power stations in the country.
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

D.2. Data and parameters monitored

Data/Parameter	**$FC_{f,y}$**
Unit	m^3 (standard cubic meter)
Description	Total volume of natural gas combusted in the project plant in year y
Measured/calculated/ default	Measured
Source of data	Fuel supplier data
Value(s) of monitored parameter	352718799.2
Monitoring equipment	Flow meters. Please refer the section c for meter details like make , serial number, accuracy class, calibration date and validity etc.
Measuring/reading/recording frequency	Measuring Frequency: continuously Recording Frequency: daily (refer the ER sheet)
Calculation method (if applicable)	NA
QA/QC procedures	The main meters are maintained by the gas supplier and are calibrated at least once in a year. The same calibration frequency are followed for the check meter maintained by the PP. The meters are calibrated as per the standard procedures and documents for the same is maintained throughout.
Purpose of data/parameter	Calculation of project emissions
Additional comments	100% of data would be monitored.

Data/Parameter	**$NCV_{f,y}$**
Unit	kCal/scum
Description	The net calorific value (energy content) per volume unit of natural gas
Measured/calculated/ default	Measured
Source of data	Fuel supplier data
Value(s) of monitored parameter	Please refer ER spreadsheet for monthly values of parameter
Monitoring equipment	The average net calorific value of natural gas consumed would be provided by gas supplier and recorded by LKPPL for verification.
Measuring/reading/recording frequency	Measuring Frequency: continuously Recording Frequency: Daily (refer the ER sheet)
Calculation method (if applicable)	NA
QA/QC procedures	Since this parameter is supplied by gas supplier, no any QA/QC procedure is required

Purpose of data/parameter	This data is used to calculate the project emissions
Additional comments	The data would be archived electronically

Data/Parameter	**$EF_{CO2,f,y}$**
Unit	tCO_2/GJ
Description	CO_2 emission factor of natural gas
Measured/calculated/ default	Default
Source of data	IPCC 2006 Default values for carbon emission factor
Value(s) of monitored parameter	0.0561
Monitoring equipment	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 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 would be recorded annually based on latest IPCC information available and would be archived in electronic/paper form. Archived data would be kept up to two years from the end of crediting period or the last issuance, whichever occurs later.
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	NA
QA/QC procedures	No additional QA/QC procedures are planned.
Purpose of data/parameter	This data is used to calculate the project emissions
Additional comments	Carbon Emission factor of natural gas would be updated as per the latest guidelines available from IPCC on national greenhouse gas inventory on year to year basis

Data/Parameter	**$OXID_f$**
Unit	Nil
Description	Oxidation factor of Natural Gas
Measured/calculated/ default	Default
Source of data	IPCC
Value(s) of monitored parameter	1.0
Monitoring equipment	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 would be recorded annually based on latest IPCC information available and would be archived in electronic/paper form. Archived data would be kept up to two years from the end of crediting period or the last issuance, whichever occurs later.
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Not Applicable

QA/QC procedures	No additional QA/QC procedures are planned.
Purpose of data/parameter	Calculation of project emissions
Additional comments	Oxidation factor of natural gas would be updated as per the latest guidelines available from IPCC on national greenhouse gas inventory on year to year basis.

Data/Parameter	**$EG_{PJ,y}$**
Unit	MWh
Description	Net electricity generated in the project plant
Measured/calculated/ default	Measured
Source of data	From the electronic meters installed at the grid inter connection point at 400 kV PGCIL Nunna sub-station
Value(s) of monitored parameter	1882593.122
Monitoring equipment	As per actual meter readings taken jointly by LKPPL and PGCIL. The daily reading would be archived electronically. Monthly joint meter reading would be archived in paper form.
Measuring/reading/recording frequency	Measuring & Recording Frequency: Monthly
Calculation method (if applicable)	-
QA/QC procedures	The meters would be calibrated as per the standard procedures and documents for the same would be maintained throughout. The accuracy of energy meter is 0.2 class
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**$EF_{BM,y}$**
Unit	tCO_2/MWh
Description	Build Margin Emission factor for Southern grid
Measured/calculated/ default	Measured
Source of data	"CO_2 Baseline Database for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for Indian Power Sector" version 11
Value(s) of monitored parameter	0.9284
Monitoring equipment	Build Margin Emission Factor would be taken from the CO2 Baseline database published by CEA. In case the CEA database is not updated, the project proponent would calculate the Build Margin number using the available CEA data. This data would be computed annually based on latest available information and would be archived in electronic/paper form. Archived data would be kept up to two years from the end of crediting period or the last issuance which ever occurs later
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	-
QA/QC procedures	No additional QA/QC procedures are planned.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	$EF_{BL,upstream,CH4}$
Unit	tCO_2e/ MWh
Description	Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity electricity generation
Measured/calculated/ default	Calculated
Source of data	CEA CO_2 baseline database or calculated value based on available CEA data in case the database is not updated
Value(s) of monitored parameter	0.01393
Monitoring equipment	$EF_{BL,upstream,CH4\ is}$ calculated for power plants included in the Build Margin in line 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) would also be determined ex post. This data would be computed annually based on latest available information and would be archived in electronic/paper form. Archived data would be kept up to two years from the end of crediting period or the last issuance, whichever occurs later.
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Not Applicable
QA/QC procedures	No additional QA/QC procedures are planned.
Purpose of data/parameter	Calculation of leakage emissions
Additional comments	-

Data/Parameter	$COEF_{f,y}$
Unit	tCO_2/m^3
Description	CO_2 emission factor of Natural Gas - Quantity ($COEF_{f,y}$)
Measured/calculated/ default	Calculated
Source of data	Plant data and default value
Value(s) of monitored parameter	0.001974
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	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)
QA/QC procedures	No additional QA/QC procedures are planned.
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	PE_y
Unit	tCO_2
Description	Project emissions due to combustion of fuel
Measured/calculated/ default	Calculated
Source of data	Calculated
Value(s) of monitored parameter	685,658

Monitoring equipment	Not Applicable
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	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 for natural gas as follows: $PE_y = \sum_f FC_{f,y} \times COEF_{f,y}$
QA/QC procedures	No additional QA/QC procedures are planned.
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

D.3. Implementation of sampling plan

Not Applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

The baseline emissions are calculated as below

BEy = $EG_{PJ,y}$ * $EF_{BL,CO2,y}$
= 1882593.12 MWh *0.9284 tCO_2 /MWh
= 1,747,799 tCO_2e

E.2. Calculation of project emissions or actual net removals

As per registered PDD, the project emissions are calculated as below

$COEF_{f,y}$ = $NCV_{f,y}$ * $EF_{CO2,f,y}$ * $OXID_f$
= 0.034651 GJ/m^3 * 0.0561 tCO_2/GJ *1
=0.001943 tCO_2/ m3

PE_y = $FC_{f,y}$* $COEF_{f,y}$
= 352,718,799.16 m^3 * 0.001974 tCO_2/ m^3
=685,658 tCO_2

E.3. Calculation of leakage emissions

As per registered PDD, The 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 (LELNG,CO2,y) are calculated as below

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

As per registered PDD, Leakage emissions due to fugitive upstream CH_4 emissions are calculated as below

LECH4,y

= [$FC_{f,y}$ * $NCV_{,y}$ * $EF_{NG,upstream,CH4}$ - $EG_{PJ,y}$ * $EF_{BL,upstream,CH4}$]*$GWPCH_4$

=[352718799.16 m^3*0.034651 GJ/m^3*0.000296tCH_4/GJ – 1882593.12 MWh *0.000569830 tCH_4/MWh] *25 =63,625 tCO_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

$LE_{LNG,CO2,y} = FC_{LNG\ y} * EF_{CO2,\ upstream,LNG} = 0$ TJ* 6 t CO_2/ TJ =40,996.74 tCO_2

$LE_y = LE_{CH4,y} + LE_{LNG,CO2,y}$ =63,625 tCO_2 + 0 tCO_2 = 63,625 tCO_2

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	1,747,799	685,658	63,625	0	998,516	998,516

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)
998,516	1,624,138

E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

Emission Reduction value estimated in ex-ante calculation of registered PDD is 1,388,315 tCO_2e per annum, whereas the estimated emission reduction from this monitoring period for 427 days is 1,624,138 tCO_2e. Actual achieved emission reduction by this project during the same period is 998,516 tCO_2e. The net emission reduction for the reported period is 38.5% less than the estimated in the registered PDD. This difference has occurred due to less availability of sugar cane during monitoring period and hence the project activity couldn't generate the estimated power. Therefore, less amount of power has been exported to the grid which resulted in lower number of emission reductions from project activity.

E.6. Remarks on increase in achieved emission reductions

During this project activity, the actual emission reductions obtained is lower than the estimated value.

E.7. Remarks on scale of small-scale project activity

Not applicable as this is a large scale project activity.

Annex 1

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:

1. **Natural Gas Consumption ($FC_{f,y}$):** Based on daily meter readings and fortnightly gas tickets for the total natural gas consumption archived electronically

2. **Net Calorific Value of Natural Gas ($NCV_{f,y}$):** Based on daily arithmetic average value of net calorific value, archived electronically The parameters that would be monitored for BEy are:

3. **Net Electricity Generation (EG_y):** Based on the energy meter readings at the grid interconnection point at 400kV PGCIL Nunna substation and the individual generation of each of the generating units of LKPL phase II and candidate phase III project activities.

4. **Emission Factor based on Build Margin ($EF_{BM,y}$)** for the Southern regional grid of India: This value would be 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 $EF_{BM,y}$ will be 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. The meters at LKPL site are also of accuracy class 0.2.

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

All the related energy meters used to record energy delivered to the grid by the project activity will undergo periodical calibration as per Central Electricity Authority (CEA) regulation, 200644 on installation and operation of energy meters.

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

Metering Plan

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

1. Main meter - Measurement would be recorded at the M&R (receiving and measurement) station of RIL transporter located within the plant boundary i.e RGTIL. RIL Transporter would

subsequently issue a daily (06 to 06 hrs) gas ticket to LKPL clearly specifying total flow. The meter reading is archived by LKPL on daily basis.

2. Check meter - The similar measurement facility is available at LKPL gas conditioning skid.

Transporter will issue a joint ticket to LKPL every fortnight. The fortnight joint ticket will also be 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 transporter gas conditioning/metering skid . The main meter is installed and owned by the Gas transporter . The metering equipment shall be maintained in accordance with OEM guidelines as per relevant standards.

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 transporter 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 transporter . The metering equipment shall be maintained in accordance with OEM guidelines as per relevant standards. The measurements are obtained daily by Gas transporter 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 meter shall be 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. If on calibration, the Gas transporter‟s meter registers a variation of more/less than 1(one) 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 transporter‟s meter was registering accurately.

Calculation of ratio of RLNG and NG in the gas supplied:

LKPL will receive gas from Reliance"s KG basin. As of now, the fuel source would not have any RLNG. In the future, if LKPL has to use co-mingled gas (mixture of natural gas and regasified LNG) from its gas supplier, the ratio of NG and RLNG in the received in such gas would be calculated using the following procedure.

$$\%\ \text{of NG in the gas received} = \frac{(NCV_{RLNG} - NCV_f)}{(NCV_{RLNG} - NCV_{NG})}$$

$$\%\ \text{of RLNG in the gas received} = \frac{(NCV_f - NCV_{NG})}{(NCV_{RLNG} - NCV_{NG})}$$

% NG and RLNG will be calculated on a monthly basis using the above formulae while NCVf is the monthly arithmetic average value of NCV for the month calculated as described earlier in the monitoring plan.

Document information

Version	*Date*	*Description*
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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