APGENCO MONITORING REPORT -1ST VCS VERIFICATION

Document Prepared By (APGENCO)

Project Title	Hydro Power Project in backward district of Andhra Pradesh, India
Version	2.0
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Monitoring Period	18th August 2008 to 31st December 2013 (Including both the dates)
Prepared By	APGENCO
Contact	Khairatabad, Vidyut Soudha, Hyderabad, Andhra Pradesh, India Pin 500082 E-mail: ce-comml@apgenco.com Tel no. : +91-40-39839911

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The Project activity is hydro energy project which involves installation of 6 numbers of hydro-electric turbines each of 39 MW capacities totaling to 234 MW by Andhra Pradesh Power Generation Corporation Limited, APGENCO (Project Proponent). The hydro energy project activity is validated under Voluntary Carbon Standard (VCS 2007.1). The power units are installed across Krishna River near Revulapally village in Mahaboobnagar district of Andhra Pradesh. The project activity is on an existing reservoir where the volume and flooded area of the reservoir, built since 1992, was not increased. The project includes construction of electric sub-stations, fabrication and installation of six hydroelectric units of 39 MW capacity each. The plant has a total installed capacity of 234 MW. The power generated is exported to Andhra Pradesh State electricity grid, which is part of Southern region (SR) grid in India. The Project activity generates emission reductions by displacing electricity generation from grid connected fossil fuel-fired power plants that would otherwise be generating electricity.

This monitoring report for the first monitoring period is prepared for verification of the voluntary emission reductions generated by the project activity. Project activity is implemented as described in the registered VCS PD. There have been no major changes or damages to project activity observed during this monitoring period. The detailed information on energy meters are provided in Appendix 1.

The total GHG emission reductions generated in this monitoring period are 8,44,571 tCO_2.

1.2 Sectoral Scope and Project Type

The project activity has applied Approved Methodology ACM0002 /Version 11 (12/02/2010)

Type : Renewable energy projects

Sectoral Scope : 1

Scale : Large

This is not a Grouped project.

1.3 Project Proponent

Organization name	Andhra Pradesh Power Generation Corporation Limited (APGENCO)
Contact person	Mr. Devender Srinivasa Rao Chakravarthy

Title	Chief Engineer Assistant Divisional Engineer
Address	Khairatabad, Vidyut Soudha, Hyderabad, Andhra Pradesh, Pin 500082 India
Telephone	+91-40-39839911
Email	ce-comml@apgenco.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 18th August 2008, date on which earliest hydro turbine i.e Unit I achieved Commercial Operation Date (COD).

1.6 Project Crediting Period

Crediting Period Start Date : 18/08/2008
End Date : 17/08/2028
VCS project crediting period : 10 years of crediting period, which will be renewed twice.

1.7 Project Location

The project activity is located across Krishna River near Revulapally village of Gadwal Taluk in Mahaboobnagar district. The geological co-ordinates of the project fall between 16° 20' 15'' latitude and 70° 42' 15'' longitude.

Project boundary:

As per ACM0002 version 11, for hydroelectric projects, the project boundary includes the physical site of the hydro power plant and all power plants connected physically to the electricity system that the project power plant is connected to. The project boundary consists of turbines, generators, transformers, transmission lines, metering equipment, connected grid sub-stations and the Southern Grid.

1.8 Title and Reference of Methodology

Title: Consolidated baseline methodology for grid-connected electricity generation from renewable sources, Version 11, EB 52

Reference:
http://cdm.unfccc.int/filestorage/H/G/Y/HGY3TLRFPQVM016WA4I7XCZD92KE5S/EB52_repan07_ACM0002_ver11.pdf?t=a2l8bXhqMGU5fDA3j11BVgm4auMpQC4leAiJ

The tools applied are:-

- Tool to calculate the emission factor for an electricity system' (Version 2.0) (Annex 12, EB 35)
- Tool for the demonstration and assessment of additionality (Version 5.2)

1.9 Other Programs

Not applicable as the project activity is not registered under any other Emission trading programs or GHG programs, nor the project has sought or received another form of GHG-related environmental credit.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project activity is implemented as described in VCS PD and there have been no major changes or damages to project activity during this monitoring period.

COD of the six hydro generating units are as follows:-

Name of the Unit	COD
Unit 1	18/08/2008
Unit 2	29/11/2008
Unit 3	07/08/2009
Unit 4	08/09/2010

Unit 5	19/11/2010
Unit 6	04/08/2011

2.2 Deviations

2.2.1 Methodology Deviations

Not applicable as there are no deviations from the applied methodology

2.2.2 Project Description Deviations

No deviations observed in the project description for this monitoring period.

2.3 Grouped Project

This is not a Grouped Project.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	$\mathbf{EF_y}$
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor of the southern grid
Source of data	CO_2 baseline database for the Indian Power Sector – Central Electricity Authority (CEA), Ministry of Power, Version 5.0, dated November 2009
Value applied:	0.9027
Justification of choice of data or description of measurement methods and procedures applied	CEA has estimated the simple operating margin and build margin emission factors for the southern regional grid. For calculating the CO_2 emission factor as per combined margin method for the wind power generation project activities the weights of 0.5 for operating margin and 0.5 for build margin are considered as per 'Tool to calculate the emission factor for an electricity system (Version 02.0)
Purpose of the data	Calculation of baseline emission
Comments	

3.2 Data and Parameters Monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant to the grid for this monitoring period
Source of data	Data measured and recorded from Energy meters installed at the point of interconnection with the grid.
Description of measurement methods and procedures to be applied	Quantity of net electricity supplied to the grid measured by joint meters (main and check meters) at the point of interconnection. Data type - Measured and calculated Accuracy class – 0.2 Monitoring frequency – Continuous and monthly recording Monitoring responsibility – Shift in-charge Calibration procedures – as per PPA/CEA regulations Calibration frequency – every 5 years as Per CEA As a standardized practice followed by APGENCO the data will be archived in electronic and paper format for two years after the crediting period.
Frequency of monitoring/ recording	Continuous monitoring and monthly recording
Value monitored:	935580.60
Monitoring equipment	Electricity meters
QA/QC procedures to be applied	The value will be cross verified with the receipts/invoices raised to the power distribution company as applicable
Purpose of the data	Calculation of baseline emissions
Calculation method	Net electricity exported = Total export – total import
Comments	-

3.3 Monitoring Plan

The hydro power plant consists of 234 MW of power generation units. The data archived include the electricity generated, auxiliary consumption and electricity export/import with the grid.

Operational and Management structure:

Monitoring Team and Responsibility:

1. Chief Engineer/Commercial: Overall responsibility of compliance with the VCS monitoring plan.
2. Superintending Engineer/O&M/Jurala HES: Quality assurance of the data/report generated by Divisional Engineer.

3. Divisional Engineer/O&M/Jurala HES: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation.
4. Assistant Divisional Engineer (A.D.E) / MRT: Responsibility of daily report generation, log preparation, data recording.

The Chief Engineer/Commercial is responsible for managing the entire VCS related activities and ensures quality assurance on the final data and facts recorded. The Superintending Engineer/O&M/Jurala HES is responsible for supervising the monitoring and archiving of data required for estimating the emission reductions. The Divisional Engineer is responsible for generating daily, monthly and annual plant report. The Divisional Engineer in turn is supported by the Assistant Divisional Engineer /MRT and Assistant Engineer (A.E) /MRT they would continuously monitor the data logging at the ground level.

The Chief Engineer/Commercial has the authority to revise the monitoring plan in line with the methodology and other futuristic requirements and would be assessing the viability of the data at regular interval. The Superintending Engineer/O&M/Jurala HES in turn reports to the Chief Engineer/Commercial on monthly basis on the operational details of the project activity. APGENCO engages its existing resources to manage, monitor and ensure quality control on the monitoring and recording of the desired data for the project activity.

The proposed team in addition to their current responsibilities is responsible for the VCS related activities. The monitoring plan for the VCS project activity has been developed in order to determine the baseline emissions and project emissions over the entire credit period. The gross and the net electricity generated are determined through a robust monitoring system which comprises mainly of the energy meters.

The instrumentation and control system for the power unit is designed with adequate instruments to control and monitor the various other operating parameters for safe and efficient operation. APGENCO has employed the state of art monitoring and control equipment that will measure, record, report, monitor and control various key parameters like total power generated in the power system, auxiliary power consumption and energy exported to the grid.

The instrumentation system comprises of manual metering systems, microprocessor-based instruments of reputed make with the best accuracy available (0.2 class). All monitoring instruments are calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time. The calibration frequency too is a part of the monitoring system.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline Emissions for the amount of electricity supplied by project activity, BE_y is calculated as:

BE_y	=	$EG_{facility,y}$	X	EFgrid, $CM,_y$
(tCO_2)		(MWh)		(tCO_2/MWh)
	=	935580.60	X	0.9027
	=	844571 tCO_2		

Where,

$EG_{facility,y}$ is the quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh/Yr)

EFgrid, $CM,_y$ is the Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO2e/Yr)

Baseline emission factor

The emission factor of the southern regional grid as per combined margin approach as per registered PD is used for estimation of emission reductions of the project activity. For calculating the CO_2 emission factor as per combined margin method for the wind power generation project activities the weights of 0.5 for operating margin and 0.5 for build margin are considered as per 'Tool to calculate the emission factor for an electricity system (Version 2.0). CO_2 baseline database for the Indian Power Sector –Central Electricity Authority (CEA), Ministry of Power, Version 5.0, dated November 2009 has been adopted to determine operating margin and build margin.

The Baseline emission factor (**EF_y**) as per Combined Margin method, **0.9027 tCO_2/MWh**, is adopted for calculation of emission reductions of the project activity.

4.2 Project Emissions

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y = Project emissions in year y (tCO2e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO2e/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO2e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO2e/yr)

$PE_{FF,y}$ and $PE_{GP,y}$ are not applicable as the project activity is hydro power plant. Project emissions in the form of methane might result from the operation of a water reservoir if biomass is permanently submerged in the process.

However, the project activity is a hydropower plant project with existing reservoir where the volume of the reservoir is not increased, therefore there is no change in the size of the reservoir and no methane emissions from biomass decay. As per the applied methodology, for run of the river hydroelectric projects, project emissions are considered zero. Moreover, the power density for the project activity is 314 W/M^2 which is more than 10 W/M^2 so $PE_{HP,y}$ is zero which means project emissions is also zero.

$PE_y = 0$.

4.3 Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport). These emissions sources are neglected.

LEy = 0

4.4 Net GHG Emission Reductions and Removals

Summary of GHG Emission Reductions and Removals

As per registered PD, the emission reductions (ER_y) during a given year "y" is

$$ER_y = BE_y – PE_y$$

Where,

ERy = Emission reductions in year y (t CO2e/yr)

BEy = Baseline emissions in year y (t CO2/yr)

PEy = Project emissions in year y (t CO2e/yr)

The net GHG emission reductions of the project activity for this verification period are shown in the Table below:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2008	59191	0	0	59191
2009	169155	0	0	169155
2010	66496	0	0	66496
2011	184074	0	0	184074
2012	126338	0	0	126338
2013	239316	0	0	239316
Total	**844571**[1]	0	0	**844571**

Comparison between estimated and actual emission reduction

As per the registered VCS-PD, estimated emission reduction for the period of 18th August 2008 – 31st December 2013 is 19,58,421 tCO_2 e. whereas, the actual emission reduction achieved during this monitoring period i.e 18th August 2008 to 31st December 2013, which is 8,44,571 tCO_2e and this is lower than estimated. The reason being the actual PLF achieved by the hydro turbines during this monitoring period is lower than the expected PLF mentioned in the registered VCS-PD. Therefore, the actual generation is lower than estimated generation which has resulted in lower emission reductions.

[1] This value is rounded down

APPENDIX 1: METERING DETAILS

Monitoring meter details from Aug 2008 to Sep 2011

UNIT (COD)	Meter Make	Meter Serial No.	Accuracy class	Calibration validity Up to
Unit 1 (18th Aug 08)	CWEC ltd[2]	20051147030042	0.2S	17th Aug 13
Unit 2 (29th Nov 08)		20051147030046	0.2S	28th Nov 13
Unit 3 (7th Aug 09)		20051147030043	0.2S	6th Aug 14
Unit 4 (8th Sep 10)		20051147030040	0.2S	7th Sep 15
Unit 5 (19th Nov 10)		20051147030044	0.2S	18th Nov 15
Unit 6 (4th Aug 11)		20051147030041	0.2S	3rd Aug 16

Monitoring meter details from Oct 2011 to present

Only two feeders are in operational at any given point of time, the other two acts as backup in case of exigencies. All the energy meters are identical and exhibit similar characteristics

[2] Changsha Weisheng Electronics Co ltd

Six Units	Meter Make	Metering mechanism	Meter Serial No.	Accuracy class	Date of Installation	Calibration validity up to
Unit 1 to 6	CWEC ltd[3]	Feeder 1, 2, 3 and 4	Feeder 1: 200514703016	0.2S	Oct 2011	Oct 2016
			Feeder 2: 200514703018		Oct 2011	Oct 2016
			Feeder 3: 20051147030045		Feb 2013	Feb 2018
			Feeder 4: 20051147030047		Feb 2013	Feb 2018

[3] Changsha Weisheng Electronics Co ltd