HYDRO POWER PROJECT IN BACKWARD DISTRICT OF ANDHRA PRADESH, INDIA

Document Prepared by

Evergreen Ecotech Private Limited (EEPL)

Project Title	Hydro Power Project in backward district of Andhra Pradesh, India
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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 capacity totaling to 234 MW by Telangana State Power Generation Corporation Limited, TSGENCO (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 Telangana. 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 Telangana 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 second monitoring period is prepared for verification of the voluntary emission reductions generated by the project activity. The project activity is implemented as described in the registered VCS PD. The commissioning dates of the turbines are mentioned as below.

Units	Date of commissioning
Unit 1	18th August 2008
Unit 2	29th November 2008
Unit 3	7th August 2009
Unit 4	8th September 2010
Unit 5	19th November 2010

Unit 6	4th August 2011

The turbines were continuously operational during the monitoring period. 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 section 4.2 of this MR below. The total GHG emission reductions generated in this monitoring period are 683,638 tCO2e.

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

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Organization name	Telangana State Power Generation Corporation Limited (TSGENCO)
Contact person	Mr. T.S.N. Murthy
Title	Chief Engineer
Address	# Khairatabad, Vidyut Soudha, Hyderabad, Telangana, Pin 500082, India
Telephone	+91-40-39838911
Email	E-Mail: ce-comm@tsgenco.co.in

1.4 Other Entities Involved in the Project

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Organization name	Evergreen Ecotech Private Limited
Role in the Project	Project Consultant

Contact person	Dr. Madhukar
Title	Director – Projects & Client Engagement
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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 : 17/08/2018

VCS project crediting period : 10 years of crediting period.

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° 19' 55 8'N' latitude and 77° 42' 14.4'E' longitude. 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 Indian National 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:
https://cdm.unfccc.int/UserManagement/FileStorage/HGY3TLRFPQVM016WA4I7XCZD92KE5S

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 Participation under other GHG 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.

1.10 Other Forms of Credit

The project is not included in any emission trading program or any other mechanism that includes GHG allowance trading, and include details about any such programs or mechanisms. The project activity is not claiming any other form of credits like CERs or GS VERs. The project activity is also not registered in REC mechanism and not claiming any REC benefits.

1.11 Sustainable Development

The project activity contributes to sustainable development in the following manner.

Social well-being:

- Improves electricity availability in the region and reduces electricity deficit situation in the state
- Contribution towards the policy objectives of Government of India and State Government of incremental capacity from renewable sources;
- The Project activity has created employment opportunities for the local people during the erection and commissioning of the project.
- Project activity promotes infrastructural development like approach roads in the areas where the Project activity is located.

Economic well-being:

- The project activity results in generation of additional employment opportunities directly and indirectly which helps improving the standard of living of the people in and around the project activity location.
- VCS provides financial incentives, which encourage channelling more investment into cleaner energy projects and also result in improved returns to the project stakeholders.
- It also promotes industrial growth by catering to the energy needs arising out of the supply demand gap of electricity.
- Infrastructural development conceive from implementation of project activity shall lead to the economic development of the local people.

Environmental well-being:

- CO2 abatement through use of renewable energy.

- The project activity does not lead to any emissions like (SOx, NOx, Suspended Particulate Matters (SPM), etc). Thus the project activity would displace an equivalent quantum of electricity generated by the fossil fuel dominated grid-mix, thus resulting in reduction of the corresponding local air pollutants (NOx, SO2, Suspended Particulate Matters (SPM), etc) and environmental impacts caused by usage of fossil fuels for electricity generation.
- Use of renewable energy source for energy generation helps in conservation of natural resources like coal and petroleum fuels.

Technological well-being:

- The technology leads to utilization of environmentally safe and sound technologies in power sector. The project demonstrates harnessing only hydro power potential in the region and doesn't consume any depleting resources like coal and other fossil fuel resources. Hence the project technology contributes to the national energy and ecological security.
- The project encourages other promoters to adopt similar technology in the relevant sector and hence the project leads to technological well being.
- Increased investment in energy projects will further push R&D efforts by technology providers to develop more efficient and better machinery in future.

2 SAFEGUARDS

2.1 No Net Harm

There is no net harm arising out of the project activity since the project activity generates power by using the potential energy of water, thus resulting in zero emissions during electricity production.

No negative environmental and socio-economic impacts were created on the environment. Thus, no net harm caused.

2.2 Local Stakeholder Consultation

The stakeholders identified for the project were: the villagers around and the local communities, NGOs, state government, governmental agencies, employees, contractors and consultants/advisors, who they assumed would have an interest in the project activity. The local stakeholder review which was undertaken through an invitation of comments from all stakeholders via issuance of letter to them. A copy of issued letter is submitted to VVB's during validation. A notice was also placed in the local newspaper, informing public about the proposed VCS project and inviting comments. The meeting was conducted on 8th July 2008 at the Guest house of the project site located near to the project activity.

The meeting began with the welcome note by TSGENCO officials to all the stakeholders. The issue of global warming, climate change, its adverse effect and how to reduce those effects such

as by employing renewable energy sources of power like hydro, wind were discussed in detail. The role of local stakeholder, environmental & social impact with respect to the project was also explained and discussed in detail.

After a brief discussion regarding the consequences and impacts of this project activity the comment pertaining to project activity were received and answered in the meeting. The stakeholders viewed Project proponents as a reputed group of companies contributing to the local economy.

The stakeholders were appreciative of the project as it aides in sustainable development of the region. No negative comment was received as the project was generation of electricity through renewable energy sources. The project activity has received positive comments from local villagers, the government and non-government parties. No adverse local stakeholder comments were received during the monitoring period. There were no inputs received from the local stakeholders during the monitoring period. There was no project design change either.

2.3 AFOLU-Specific Safeguards

Not applicable.

3 IMPLEMENTATION STATUS

3.1 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

3.2 Deviations

2.3.1 Methodology Deviations

There is no methodology deviation.

2.3.2 Project Description Deviations

The asset of the APGENCO is transferred to TSGENCO on 2nd June 2014 as per the Gazette AP Reorganization Act. The applicability condition, scale/capacity, monitoring plan, additionality have not changed.

During this monitoring period, the geological coordinates of the project are updated to 16° 19' 55 8''N latitude and 77° 42' 14.4'E' longitude. The coordinates mentioned in the registered PD were not working due to some technical issues. This deviation is not having any impact on the project.

3.3 Grouped Projects

This is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

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Data / Parameter	EFy
Data unit	tCO2/MWh
Description	Combined Margin CO2 emission factor of the southern grid
Source of data	CO2 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	CEA has estimated the simple operating margin and build margin emission factors for the southern regional grid. For calculating the CO2 emission factor as per combined margin

and procedures applied	method for the hydro 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 Data	Calculation of baseline emission
Comments	-

4.2 Data and Parameters Monitored

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Data / Parameter	EGfacility,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 TSGENCO 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	757,327.97 MWh
Monitoring equipment	Electricity meters

Meters	Meter serial	Calibration dates

		number	(previous and current)
	Unit 1 (220 kV side)	2005 11470 30042	17th August 2013 22nd May 2018
	Unit 2 (220 kV side)	2005 11470 30046	28th November 2013 22nd May 2018
	Unit 3 (220 kV side)	2005 11470 30043	6th August 2014 22nd May 2018
	Unit 4 (220 kV side)	2005 11470 30040	7th September 2015 22nd May 2018
	Unit 5 (220 kV side)	2005 11470 30044	18th November 2015 22nd May 2018
	Unit 6 (220 kV side)	2005 11470 30041	3rd August 2016 22nd May 2018
QA/QC procedures to be applied	The value will be cross verified with the receipts/invoices raised to the power distribution company as applicable. PP could not retrieve the previous calibration certificates. Hence the maximum error of 0.2% is applied for the monitoring months (as a conservative measure) as below. Adjusted export = Measured export x (100%-0.2%) Adjusted import = measured import x (100%+0.2%) Net export accounted calibration delay = Adjusted export –adjusted import		
Purpose of the data	Calculation of baseline emissions		
Calculation method	Net electricity exported = Total export – total import		
Comments	-		

4.3 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. TSGENCO 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. TSGENCO 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.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Baseline emissions calculated are summarized as below.

Base Line Emissions: (BE_y)

According to the validated PD, Baseline Emission is calculated by the following formula.

$BE_y = EG_{facility,y} * EF_y$

$EG_{PJ,y}$=757,327.97 MWh

Baseline emission factor (combined margin)

$EF_{grid,CM,y}$= 0.9027 tCO_2e/MWh

BE_y = 683,638 tCO2e

5.2 Project Emissions

Project Emissions: (PEy)

Where:

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

PEFF,y = Project emissions from fossil fuel consumption in year y (tCO2e/yr)

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

PEHP,y = Project emissions from water reservoirs of hydro power plants in year y (tCO2e/yr)

PEFF,y and PEGP,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/M2 which is more than 10 W/M2 so PEHP,y is zero which means project emissions is also zero.

PEy =0 tCO2/year

5.3 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 **tCO_2/year**

5.4 Net GHG Emission Reductions and Removals

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

$ER_y = BE_y – PE_y - LE_y$

Where,

ER_y = Emission reductions in year y (t CO_2e/yr)

BE_y = Baseline emissions in year y (t CO_2e/yr)

PE_y = Project emissions in year y (t CO_2e/yr)

LE_y = Leakage emissions in year y (t CO_2e/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)
2014	198,062	0	0	198,062
2015	26,457	0	0	26,457
2016	187,239	0	0	187,239
2017	192,578	0	0	192,578
2018 (upto 17th August 2018)	79,302	0	0	79,302
Total	683,638	0	0	683,638

Comparison between estimated and actual emission reduction

As per the registered VCS-PD, estimated emission reduction for the period of 1st January 2014 to 17th August 2018 is high whereas, the actual emission reduction achieved during this monitoring period 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.