GULLUBAG 96 MW HYDRO ELECTRIC POWER PLANT PROJECT

2ND MONITORING REPORT

Project Title	GULLUBAG 96 MW HYDRO ELECTRIC POWER PLANT PROJECT, Turkey
Version	02
Report ID	-
Date of Issue	14.05.2020
Project ID	VCS 391
Monitoring Period	01/09/2013-30/04/2020
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity, Gullubag Hydroelectric Power Plant (HEPP), is located on the Coruh River in the East of Turkey, in the province of Erzurum, with total installed power of 96 MW. License application for the Hydroelectric Power Plant was made to the Energy Market Regulatory Authority and the Generation License was awarded in accordance with the Electricity Market Law (No: 4628) for a period of 49 years by the decision numbered EU/1054-1/770 on January 11th, 2007.

Proposed project is not a part of grouped project and involves a dam with reservoir, conveyance line, and power house and switchgear station. Gullubag project utilizes the elevation difference of 105 meters between 1,147 meters and 1,042 meters on the Coruh River. The dam is located at 1,090 meters riverbed elevation. It consists of a 3,246.50 meters long and 6 meters diameter tunnel and 118.31 meters, 5 meters diameter penstock connecting the powerhouse, where three turbines in the powerhouse transfers the flow rate into electrical energy. The project is designed for a flow rate of 113 cubic meters per second.

The generated electrical energy is transferred to the electrical grid by a 154 kV transmission line, through ISPIR HEP substation. The project activity generates greenhouse gas (GHG) emission reductions by avoiding CO_2 emissions from electricity generation by fossil fuel power plants connected to Turkish National Power Grid. The average annual electricity generation significantly dependents on the other HEPP projects planned to be built at the upstream of Gullubag HEPP. Since these plants are still in design and construction phase, average electricity generation is estimated as 281 GWh initially which is expected to be increase up to 313.898 GWh after commissioning of plants at the upstream. The projects which have been planned in the upstream of the project, İspir HPP and Laleli HPP.

The project milestones are provided in the table below:

Table 1. Project implementation milestones

Milestone	Date/ Explanation
Generation License (Final Amendment Date)	11/01/2007 (06/01/2012)
Loan Agreement (Investment Decision Date)	February 2008
Construction start	22/05/2009
VCS Registration date	21/04/2010
Commissioning of the Project (Project Start Date)	23/03/2012
First Monitoring Period	23/03/2012-31/08/2013
Second Monitoring Period	01/09/2013-30/04/2020

Table 2. Project generation and emission reductions in the monitoring period

Expected annual generation	281 GWh / 313.898 GWh[1]
Generated electricity during monitoring period (80 months)	1,300,224.42 MWh during monitoring period and generated electricity for per annum for this monitoring period is 195,034 MWh
Generated net emission reductions during monitoring period	800,935 tonnes CO_2 during monitoring period and emission reduction per annum is 120,140 tonnes CO_2 Sep-Dec 2013 vintage: 13,247 tonnes CO_2 Jan-Dec 2014 vintage: 68,606 tonnes CO_2 Jan-Dec 2015 vintage: 92,690 tonnes CO_2 Jan-Dec 2016 vintage: 162,035 tonnes CO_2 Jan-Dec 2017 vintage: 129,771 tonnes CO_2 Jan-Dec 2018 vintage: 148,565 tonnes CO_2 Jan-Dec 2019 vintage: 147,097 tonnes CO_2 Jan-Apr 2020 vintage: 38,924 tonnes CO_2

Table 3. Technical Properties of Gullubag HEPP

LOCATION	ÇORUH RIVER, WITHIN THE BOUNDARIES OF ERZURUM PROVINCE
DESIGN FLOW RATE	113 M3/SEC
LENGTH OF CONVEYANCE LINE	3,245 M
TOTAL INSTALLED CAPACITY	96.00 MW
NUMBER OF UNITS	3 EACH
TURBINE CAPACITY	33 MWm / 32 MWe(EACH)
TURBINE TYPE	FRANCIS TYPE – VERTICAL AXIS
TURBINE MAKE	FUJIAN NANDIAN CO LTD
ENERGY TRANSMISSION LINE	154 Kv, ISPIR SUBSTATION
LENGTH OF PENSTOCK	118.31 M
DIAMETER OF PENSTOCK	5 M
AVERAGE ANNUAL POWER GENERATION	281 GWH until the upstream HEPP is constructed. After that 313.898 is expected.

[1] The average annual electricity generation significantly dependents on the other HEPP projects planned to be built at the upstream of Gullubag HEPP. Since these plants are still in design and construction phase, average electricity generation is estimated as 281 GWh initially which is expected to be increase up to 313.898 GWh after commissioning of plants at the upstream.

1.2 Sectoral Scope and Project Type

Proposed project activity is a large-scale project activity involves electricity generation from renewable sources therefore it is categorized in the sectoral scope 1 “Energy Industry – Renewable -/Non-renewable Sources” according to the UNFCCC definition[2].

Project consists of a dam and a hydroelectric power plant. Project is not a part of grouped project.

1.3 Project Proponent

Project Participants	Role/Responsibilities	Contact Information
SENERJI Enerji Uretim AS.	Owner of the VER rights of the project. Construction and Operation of the power plant in line with regulations. Implementation of monitoring plan and collecting and archiving monitoring data	Burcu Erik Yıldırım Tower, Maslak Mahallesi, Taşyoncası Sok. B2 Blok, No:20C, Sarıyer / İSTANBUL 34485 Tel: +90 212 290 30 80 Fax: +90 212 290 30 81 E- mail: burcu.erik@yildirimenergy.com
GTE A.S.	Development of project documents. Managing validation and verification processes for the project.	M.Kemal Demirkol-Director MAIDAN - Mustafa Kemal Mah. 2118. Cad. No: 4 C Blok 42 06510 Cankaya - Ankara – TURKEY Tel:90 312 514 63 63 Fax: 90 312 514 63 63 E-mail: kemal@gtecarbon.com

1.4 Other Entities Involved in the Project

n/a

1.5 Project Start Date

23/03/2012, date of Preliminary Acceptance

[2] http://cdm.unfccc.int/DOE/scopes.html

1.6 Project Crediting Period

Crediting period will be valid for 10 years.

1.7 Project Location

Gullubag Dam and hydroelectric power plant project is located between 40^0 31" – 40^0 34" north latitudes and 41^0 02" – 41^0 04" east longitudes, on the Coruh river, between 6 to 10 kilometers east of Ispir district, in Erzurum province, in the East of Turkey.

The closest residential area to the reservoir is Gullubag District and to the power house is Yedigöze Village.

Figure 1. Location of the Project on the map

1.8 Title and Reference of Methodology

The United Nations approved consolidated baseline methodology applicable to this project is ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources”, Version 10.

ACM0002 refers to the following tools:

- “Tool for the demonstration and assessment of additionality”, Version 05.2, and

- “Tool to calculate the emission factor for an electricity system”, Version 01.1.

1.9 Participation under other GHG Programs

n/a

1.10 Other Forms of Credit

Not applicable. Project does not produce other kinds of environmental credits.

1.11 Sustainable Development

Gullubag HEPP utilize the hydroelectric potential of Turkey to meet the increasing electricity demand and contribute to the security of energy supply. The project increases the share of private sector owned hydroelectricity plants in the electricity generation mix of Turkey, reducing dependency on imported fossil fuels and thereby reducing the GHG emissions and combating climate change. Project also contributes to economic development in the region by creating direct and indirect job opportunities. In terms of local benefits, the project contributes to the reduction of local air pollutants. Considering the contribution of the project on local and national economy, environment and local community, project has positive influences on sustainable development and contributes to UN sustainable development goals (SDG) 13, 8 and 7.

2 SAFEGUARDS

2.1 No Net Harm

n/a

2.2 Local Stakeholder Consultation

Project is operational since 2012 and there is an ongoing communication with locals. Stakeholder consultation has been organized before project start date, details of which is given in PDD.

Project manager is accessible by locals all the time. Project sponsors also support local community through providing support for local organization cultural events.

After implementation of the project, no unexpected change has occurred with respect to risks, cost of locals. In terms of regulation, all staff recruited is trained as per the requirements of their assignment and regulations. Trainings include first aid, electrical

equipment operation certificates, crane operator and occupational competency trainings. Details of the trainings organized for staff has been submitted to DOE.

2.3 AFOLU-Specific Safeguards

n/a

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project has been in operation since 23/03/2012. Crediting period for the project will be 10 years. First crediting period is 23/03/2012-22/03/2022.

3.2 Deviations

3.2.1 Methodology Deviations

Project emissions from fossil fuel consumption due to diesel generator ($PE_{FF,y}$) was calculated and approved in the first monitoring period. Since it was found insignificant and it is not required to monitor this parameter according to the new version of the methodology, it was not monitored and not included in this monitoring period. With the same reason, the parameter of quantity of fuel type combusted in diesel power ($FC_{i,j,y}$) was not monitored and not included in this monitoring period.

As PMUM system is not active anymore, we have used EPIAS records and meter reading forms for ER calculations. Though there is no significant difference between, lowest figure in records have been used for conservativeness.

3.2.2 Project Description Deviations

In registered PDD, the crediting period was expected to start in 01/12/2011. However, since the facility has been commissioned later, the start date of crediting period was updated as 23/03/2012.

3.3 Grouped Projects

n/a

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	**EGy, Total**
Data unit	GWh
Description	Gross Electricity delivered to the grid by power plants in Turkey in years 2005,2006, 2007
Source of data	TEIAS web page (http://www.teias.gov.tr/ist2007/13.xls)
Value applied	191,558.1 GWh for year 2007,176,299.8 for year 2006 and, 161,956.2 for year 2005
Justification of choice of data or description of measurement methods and procedures applied	Data from Grid Operator has been used
Purpose of Data	Data used for emission reduction calculation (for calculation of OM, Netto- Gross electricity ratio and share of low-cost must-run sources)
Comments	-

Data / Parameter	**$EFCO_2$, i, y i**
Data unit	tCO_2/TJ
Description	CO2 emission factor of fossil fuel type “i” in year “y”
Source of data	For EF of fossil fuels, IPCC values at the lower limit have been used.
Value applied	

FUEL SOURCE	EF (tCO2/Tj)
Coal	94.6
Lignite	90.9
Fuel Oil	75.5
Diesel	72.6
LPG	61.6
Naphtha	69.3
Natural Gas	54.3

Justification of choice of data or description of measurement methods and procedures applied	According to ACM0002, IPCC default values at lower limit of 95% confidence interval can be used. Although, the actual emission reduction is expected to be higher due to high EF of fuels consumed in existing power plants, IPCC values have been used for conservativeness as requested by the methodology.
Purpose of Data	EF calculations
Comments	-

Data / Parameter	**FCi,y**
Data unit	Tons or 1000 m^3 for gases
Description	Amount of fuels consumed by thermal power plants for electricity generation in terms of fossil fuel type i in year y
Source of data	TEIAS web page http://www.teias.gov.tr/istatistik2005/46.xls http://www.teias.gov.tr/ist2007/43.xls
Value applied	

	2005	2006	2007	Total Fuel Consumption 2005-2007	Total Emission 2005-2007
Hard Coal	5,259,058	5,617,863	6,029,143	16,906,064	34,915,268
Lignite	48,319,143	50,583,810	61,223,821	160,126,774	96,197,334
Fuel Oil	2,005,899	1,746,370	2,250,686	6,002,955	18,165,198
Diesel Oil	28,442	61,501	50,233	140,176	436,185
LPG	12,908	33	0	12,941	36,623
Naphtha	84,481	13,453	11,441	109,375	334,828
Natural Gas	15,756,764	17,034,548	20,457,793	53,249,105	106,643,758

Justification of choice of data or description of measurement methods and procedures applied	Data from Grid Operator has been used
Purpose of Data	Data used for OM calculation
Comments	-

Data / Parameter	$\eta_{m,y}$
Data unit	%

Description	Average net energy conversion efficiency of power unit m in year y
Source of data	Environmental map of Turkey (www.cedgm.gov.tr/dosya/cevreatlasi/atlasin_metni.pdf) and EC Integrated Pollution Prevention and Control Reference Document on Best Available Techniques for Large Combustion Plants[3]
Value applied	

	Generation Efficiency %
Coal	33.6%
Lignite	32.8%
Fuel Oil	35.1%
Diesel	27.5%
LPG	45.0%
Naphtha	45.0%
Natural Gas	46.0%

Justification of choice of data or description of measurement methods and procedures applied	Default values are used as a conservative approach.
Purpose of Data	Data used for BM calculation
Comments	-

Data / Parameter	**NCV**
Data unit	Tj/kt
Description	Net Calorific Values of Fuel combusted in power plants.
Source of data	2007 Turkey National GHG Inventory, http://unfccc.int/national_reports/annex_i_ghg_inventories/items/2715.php
Value applied	

	NCV (Tj/kt) (1000m^3 for gas)	EF (tCO_2/Tj)	COEF(tCO2/kt)
Coal	21.83	94.6	2,065
Lignite	6.61	90.9	601
Fuel Oil	40.08	75.5	3,026
Diesel Oil	42.86	72.6	3,112
LPG	45.94	61.6	2,830
Naphtha	44.17	69.3	3,061
Natural Gas	36.88	54.3	2,003

[3] The validated link is not working any more.

Justification of choice of data or description of measurement methods and procedures applied	Data has been calculated from Grid Operator's (TEIAS) statistics. Consumed amount of fuel was divided by the obtained energy to determine NCV of each type.
Purpose of Data	Data used for OM and BM calculation
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	**EGfacility, y**
Data unit	GWh/year
Description	Quantity of net electricity generated and delivered to the grid by Gullubag Hydroelectric Power Plant in year y
Source of data	Metering devices installed in the power plant and EPIAS records obtained by TEAIS monthly
Description of measurement methods and procedures to be applied	Generation data were recorded by three main, three back-up metering devices continuously. These records provided the data for the monthly invoicing to TEIAS which form the basis for EPIAS data. EPIAS data is developed remotely by TEIAS and includes grid loss. According to meter reading protocols, the internal consumption of the facility was subtracted from the gross generation. EPIAS data and site records are both used for cross-check. Whichever is smaller between the site records and EPIAS, it is used for quantification of emissions due to conservative approach. Relevant documents were provided.
Frequency of monitoring/recording	Continuous measurement at the site and daily and monthly recording were applied. The plant manager and the staff extracted the records regularly every day. The monthly records recorded by TEIAS and the plant were used for monitoring emission reductions.
Value monitored	For 80 months period, total generation has been 1,300,224.42 MWh. Average annually generation corresponds to 195,034 MWh
Monitoring equipment	Six calibrated ammeters (three of them are spare). As per the regulations, it should be in compliance with the regulation on meters issued by relevant government agencies[4]. The meters are ELSTER 1500 with accuracy class of 0,5S.

[4] http://www.epdk.gov.tr/web/elektrik-piyasasi-dairesi/44

QA/QC procedures to be applied	Six calibrated ammeters (three of them are spare). Maintenance and calibration of the metering devices is made by TEIAS periodically. If there is a significant difference between the readings of the main and back-up devices, maintenance and tests of the metering devices and the associated equipment are done before waiting for the periodical maintenance.
Purpose of the data	To calculate the baseline emission value
Calculation method	Net Electricity generated and delivered to the grid by the project during the monitoring period is calculated by subtracting the internal consumption of the facility from the gross power generation.
Comments	-

Data / Parameter	**APJ**
Data unit	m^2
Description	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Description of measurement methods and procedures to be applied	Measured from topographical surveys
Frequency of monitoring/recording	Yearly
Value monitored	1,210,000 m^2
Monitoring equipment	Topographical studies
QA/QC procedures to be applied	Calibration and Maintenance of equipment are made regularly by authorized service companies.
Purpose of the data	Emission reduction calculation
Calculation method	-
Comments	-

Data / Parameter	**Minimum flow**
Data unit	m3/ sec
Description	The project releases the required flow as per the regulations.
Source of data	Gauging stations of which locations are identified by DSI. Three gauging stations are installed within the framework of the project. One is on the main river bed before the reservoir, one is after the reservoir to record life water, last one is installed on the Gullubag Creek.
Description of measurement methods and procedures to be applied	Remote gauging stations installed within the framework of Water Utilization Rights Protocol record the level of water continuously at real time. DSI extracts data remotely and checks.
Frequency of monitoring/recording	Continuous
Value monitored	8.189 m^3/s (Report date:03.06.2015) 7.306 m^3/s (Report date:21.07.2015) 8.478 m^3/s (Report date:06.10.2015) According to the report of Turkey State Hydraulic Works[5], minimum flow should be 5 m^3/s at least. Data above are higher than this value.
Monitoring equipment	Gauging stations
QA/QC procedures to be applied	-
Purpose of the data	Conservation of regional ecology
Calculation method	-
Comments	-

4.3 Monitoring Plan

Monitoring is a key procedure to verify the real and measurable emission reductions from the proposed project. To guarantee the proposed project's real, measurable and long-term GHG emission reductions, the monitoring plan has been established.

[5] Turkey State of Hydraulic Works (DSİ), Erzurum ilinde olan HES tesisleri izleme ve kontrol raporu

In order to demonstrate the emission reduction, only required data is the net electricity delivered to the grid by the project activity. TEIAS has started to extract generation data from the facilities remotely through the EPIAS (previously PMUM system) which forms the basis for the billing. In the validated PDD it was stated that "Generation data will be recorded by two metering devices continuously. These records will provide the data for the monthly invoicing to TEIAS. Each month, an officer from TEIAS and the plant manager/electricity technician of the plant will record the reading and sign. This record will form the basis for monthly invoicing."

During the monitoring period site records and EPIAS readings were used as the source of calculation of electricity generation and emission reductions. Facility meter reading protocols and EPIAS readings were compared for cross-check and whichever is smaller, it is used for quantification of emissions due to conservative approach.

Net electricity generation was measured and recorded by both TEIAS and project owners for billing purposes therefore no new additional protocol was needed for monitoring emission reduction. Power Plant Manager was responsible for the electricity generated, gathering all relevant data and keeping the records. He was informed about VER concepts and mechanisms and how to monitor and collect the data which was used for emission reduction calculations. The procedures to collect data were in line with the TEIAS requirements and rules. The project deploys software to track the generation and consumption all times. As an internal audit step, the records extracted from the software were also checked with the manual records which were extracted by the project staff. The records were reported to the plant manager who acts as the final internal auditor. Should nonconformity was identified; the plant manager was responsible for communication with TEIAS and undertaking the corrective action in line with the TEIAS procedures and rules if it fell under the authority of the plant manager. However, this might need the involvement of TEIAS as well as the project owners were not allowed to make changes or fixes on the meters. Thus, in case of non-conformity, the plant manager reported it instantly to TEIAS.

Generation data collected during crediting period was submitted to GTE who is responsible for calculating the emission reduction subject to verification. Generation data was used to prepare monitoring reports which were used to determine the vintage from the project activity. These reports were submitted to the duly authorized and appointed Designated Operational Entity 'DOE' before each verification period.

VER Team Members is expected to include the following staff of the HEPP:

Plant Manager: Responsibility for running the HEPP plant and compliance with VER monitoring plan

Accounting Manager: Responsible for keeping data about power sales, invoicing and purchasing.

GTE: Responsible for emission reduction calculations, preparing monitoring report and periodical verification process.

Installation of meter and data monitoring was carried out according to the regulations by TEIAS. 6 metering devices (3 of them used as spare) were used for monitoring the electricity generated by the

power plant. The meters are installed at the project site on 06/12/2011 as shown in the “Meters Testing Protocol”.

Readings were done using main metering devices and spare metering device was used for comparison only. Generation data were recorded by three main, three back-up metering devices continuously. These records provided the data for the monthly invoicing to TEIAS which form the basis for EPIAS data. EPIAS data is obtained remotely by TEIAS and includes grid loss. Meter reading protocols and EPIAS data are used for cross-check. Whichever is smaller between the site record and EPIAS, it is used for quantification of emissions due to conservative approach. The internal consumption of the facility was subtracted from the gross generation.

Both the site records and EPIAS records were taken into account for comparison and to identify any anomalities. TEIAS started remote reading of the generation of the facility as of June 2012.

Serial numbers of the main meters and back-up meters are tabulated below. New main meters and back-up meters were installed in 2019 December. Last index detection protocol of old meters and first index detection protocol of new meters were conducted on 03/12/2019.

Table 4. Meter Serial Numbers

Previous meters		New meters	
Main Meter Serial Numbers (ELSTER)	Back-up Meter Serial Numbers (ELSTER)	Main Meter Serial Numbers (EMH)	Back-up Meter Serial Numbers (EMH)
424835	424836	8923726	8923727
424837	424838	8923728	8923739
424839	424844	8923730	8923731

The net electricity fed to the grid was measured continuously and recorded monthly by the TEIAS and plant staff. For consistency, recorded data were compared with electricity sale receipts.

Calibration of the metering devices has been made by TEIAS and sealed before the commissioning of the power plant. The meters were calibrated by TEIAS. The installed meters are in line with the regulations.

The maximum area of the reservoir is provided in map of reservoir, the level of water was also checked from topographical surveys and maps and found that it did not exceed the limit value.

ABL value was taken as zero as the project is a new project and there was no reservoir area before the project is released, thus, as per the methodology.

All data was archived electronically and be kept at least for 2 years after the end of the last crediting period.

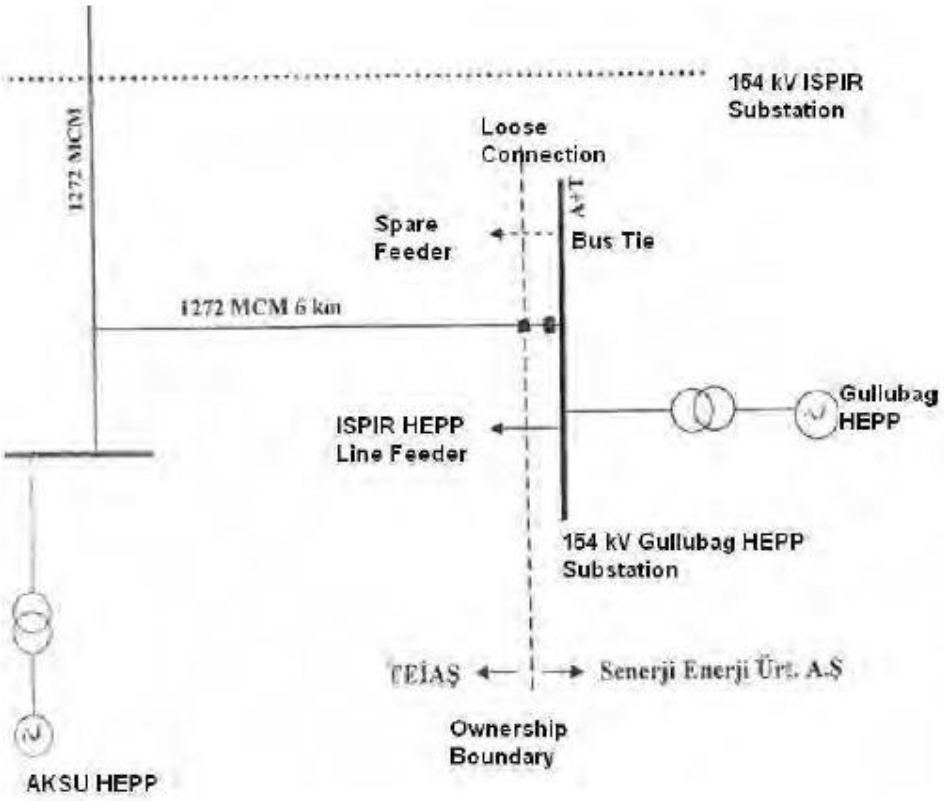

Figure 2. Gullubag HEPP single –line diagram

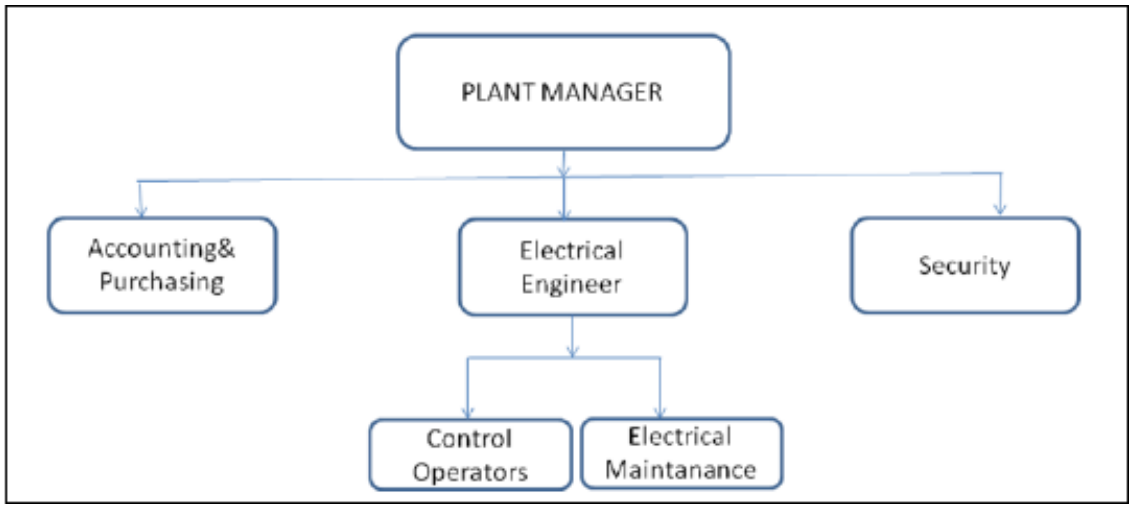

Figure 3.Organizational chart of Gullubag Hepp

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The ex-ante emission reductions (ERy) are calculated as follows:

$$ERy = BEy - PEy - LEy$$

Where:

ERy = Emission reductions in year y (tCO_2)

BEy = Baseline emissions in year y (tCO_2)

PEy = Project Emissions in year y (tCO_2)

LEy = Leakage emissions in year y (tCO_2)

Baseline emission is calculated according to the formula

BEy = EGy x EFy

Where:

EGy = Net electricity delivered to the grid by the project activity in year y excluding transmission losses of the grid.

EFy = Emission factor calculated according to selected methodology

LEy	**Leakage Emissions**	0
EGy	**Net Generation (MWh)**	1,248,239.65
EFy	**Emission Factor (tCO_2/GWh)**	616
BEy	**Gross Total Emission Reduction (tCO_2) During Monitoring Period**	768,912

PEy	**Project Emissions(tCO_2)**	0
ERy	**Net Emission Reduction (tCO_2) During Monitoring Period**	768,912
ERy Sep-Dec 2013	**Net emission reductions in 2013 (vintage)**	13,247
ERy Jan-Dec 2014	**Net emission reductions in 2014 (vintage)**	68,606
ERy Jan-Dec 2015	**Net emission reductions in 2015 (vintage)**	92,690
ERy Jan-Dec 2016	**Net emission reductions in 2016 (vintage)**	162,035
ERy Jan-Dec 2017	**Net emission reductions in 2017 (vintage)**	129,771
ERy Jan-Dec 2018	**Net emission reductions in 2018 (vintage)**	148,565
ERy Jan-Dec 2019	**Net emission reductions in 2019 (vintage)**	147,097
ERy Jan-Apr 2020	**Net emission reductions in 2020 (vintage)**	38,924

Spread sheet used for calculations have been provided. EFy has been calculated in Gullubag HEPP PDD. EGy has been calculated from monthly generation records of the plant and EPIAS records with considering the smaller one due to conservative approach.

5.2 Project Emissions

Emissions from the reservoir

The reservoir surface area is 1.21 km^2 whereas installed capacity is 96 MW. The project activity involves the generation of electricity by a hydroelectric power plant which has power density higher than $10W/m^2$ and does not include significant vegetation in the catchment area, therefore emissions from reservoir is ignored as per the applied methodology.

5.3 Leakage

The energy generating equipment is not transferred from or to another activity. Therefore leakage is also considered as "0"[6].

5.4 Net GHG Emission Reductions and Removals

Total Emission Reduction has been determined as;

ERy = BEy –Pey - LEy

Where;

ERy = Emission reductions in year y (tCO2)

BEy = Baseline emissions in year y (tCO2)

PEy = Project Emissions in year y (tCO2)

Ley = Leakage emissions in year y (tCO2)

The project emissions from reservoir is shown in section 5.2.The energy generating equipment is not transferred from or to another activity. Therefore leakage is also considered as "0".

Thus, ERy = BEy- PEy

Baseline Emissions

BEy = EGBL,y x EFCO2

Where:

BEy : Baseline emissions in year y (tCO2/year)

EGBL,y : Energy baseline in year (kWh)

EFCO2 : Combined Margin CO2 emission factor (tCO2/MWh), which is 0.616 tCO2/MWh in the validated PD.

Thus, the emission reduction (in tonnes CO2) for the years between September 2013 and April 2020 is calculated as given in table below.

[6] PDD page 30

Table 5. Summary of Emission Reductions

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)
2013 Sep-Dec	13,247	0	0	13,247
2014 Jan-Dec	68,606	0	0	68,606
2015 Jan-Dec	92,690	0	0	92,690
2016 Jan-Dec	162,035	0	0	162,035
2017 Jan-Dec	129,771	0	0	129,771
2018 Jan-Dec	148,565	0	0	148,565
2019 Jan-Dec	147,097	0	0	147,097
2020 Jan-Apr	38,924	0	0	38,924
Total (80 months)	800,935	0	0	800,935