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# GULLUBAG 96 MW HYDRO ELECTRIC POWER PLANT PROJECT, TURKEY

## 3<sup>RD</sup> MONITORING REPORT

Document Prepared by GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ

EĞİTİM DANIŞMANLIK VE TİC. A.Ş.

<b>Project Title</b>	Gullubag 96 MW Hydro Electric Power Plant Project, Turkey
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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 powerhouse 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 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 CO2 emissions from electricity generation by fossil fuel power plants connected to Turkish National Power Grid. The average annual electricity generation significantly depends 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 of Gullubag HEPP**

Milestone	Date/ Explanation
Generation License (Final Amendment Date)	11/01/2017 (06/01/2012)
Loan Agreement (Investment Decision Date)	February 2008
Construction Start Date	22/05/2009
VCS Registration Date	21/04/2010
Commissioning of the project (Project Start Date)	23/03/2012
First Index Protocol	07/03/2012
System Connection Agreement	13/06/2019

System Use Agreement	04/03/2021
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**Table 2: Project generation and emission reductions in the monitoring period**

Expected annual generation	281 GWh/ 313.898 GWh <sup>1</sup>
Generated electricity during monitoring period (23 months)	290,997 MWh during monitoring period and generated electricity for per annum for this monitoring period is 151,825 MWh
Generated net emission reductions during monitoring period	179,252 tonnes CO <sub>2</sub> during monitoring period and emission reduction per annum is 93,522.783 tonnes CO <sub>2</sub> .  May-Dec 2020 vintage: 87,229 tonnes CO <sub>2</sub> Jan-Dec 2021 vintage: 77,097 tonnes CO <sub>2</sub> Jan-Mar 2022 vintage: 14,926 tonnes CO <sub>2</sub>
First Monitoring Period	23/02/2012 – 31/08/2013
Second Monitoring Period	01/09/2013 – 30/04/2020
Third Monitoring Period	01/05/2020 – 22/03/2022

**Table 3: Characteristic of Gullubag HEPP**

LOCATION	Coruh River, within the boundaries of Erzurum Province
DESIGN FLOW RATE	113 m <sup>3</sup> /sec
LENGTH OF CONVEYANCE LINE	3,245 m
NUMBER OF UNITS	3 each
TURBINE CAPACITY	33 MWm/ 32 Mwe (each)

<sup>1</sup> The average annual electricity generation significantly depends 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 increase up to 313.898 GWh after commissioning of plants at the upstream.

<b>TURBINE TYPE</b>	Francis Type – Vertical Axis
<b>TURBINE MAKE</b>	Fujian Nandian Co Ltd
<b>ENERGY TRANSMISSION LINE</b>	154 kV, Ispir Substation
<b>LENGTH OF PENSTOCK</b>	118.31 m
<b>DIAMETER OFF PENSTOCK</b>	5 m
<b>AVARAGE ANNUAL POWER GENERATION</b>	281 GWh until the upstream HEPP is constructed. After that 313.898 GWh is expected.

## 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<sup>2</sup>.

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

## 1.3 Project Proponent

<b>Organization name</b>	SENERJI Enerji Uretim A.S.
<b>Contact person</b>	Burcu Erik
<b>Title</b>	Owner of the VER rights of the project
<b>Address</b>	Yıldırım Tower, Maslak Mahallesi, Taşyoncası Sok. B2 Blok, No:20C, Sarıyer / İSTANBUL 34485
<b>Telephone</b>	+90 212 290 30 80
<b>Email</b>	burcu.erik@yildirimenergy.com

<b>Organization name</b>	GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ EĞİTİM DANIŞMANLIK VE TİC. A.Ş.
<b>Role in the Project</b>	Carbon Consultant
<b>Contact person</b>	M.Kemal Demirkol

<sup>2</sup> <https://cdm.unfccc.int/DOE/scopes.html>

<b>Title</b>	Director
<b>Address</b>	MAIDAN - Mustafa Kemal Mah. 2118. Cad. No: 4 C Blok 42 06510 Cankaya - Ankara - TURKEY
<b>Telephone</b>	+90 312 514 63 63
<b>Email</b>	kemal@gtecarbon.com

#### 1.4 Other Entities Involved in the Project

N/A.

#### 1.5 Project Start Date

23/03/2012 which is date of preliminary acceptance, is the start date of the project.

#### 1.6 Project Crediting Period

The second crediting period of 10 years was started in 23/03/2012 and will end in 22/03/2022. The crediting period is 10 years.

#### 1.7 Project Location

Gullubag Dam and hydroelectric power plant project is located between 40° 31' – 40° 34' north latitudes and 41° 02' – 41° 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 Güllübag District and to the powerhouse 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,<sup>3</sup> and
- “Tool to calculate the emission factor for an electricity system”, Version 02<sup>4</sup>.

## 1.9 Participation under other GHG Programs

N/A

<sup>3</sup> <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-01-v5.2.pdf>

<sup>4</sup> <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v2.pdf>

## 1.10 Other Forms of Credit

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

## 1.11 Sustainable Development Contributions

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) 7, 8, and 13.

- SDG 7 on access to affordable, reliable, and sustainable energy, as the project is not relying on imported fossil fuels. In this monitoring period, 290,997 MWh renewable electricity has supplied to national grid that supports to increase the renewable energy share in the energy mix.
- SDG-8 decent work and economic growth. As the project is providing a decent and secure work environment. All personnel working at the power plant are receiving regular trainings about occupational health and safety.
- SDG-12 Responsible consumption and production as the hydroelectric power plants are producing clean source of energy. They are replacing the fossil fuel based national grid. Because of that these plants drives people to consume more sustainable type of energy.
- SDG 13 on urgent action to combat climate change, as the project is replacing the fossil fuel based national grid and it is producing emission reductions. In this particular project the power plant prevented the release of 179,252 tCO<sub>2</sub> into the atmosphere in this monitoring period.

**Table 4: Sustainable Development Contributions**

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	13.3	Tones of greenhouse gas emissions avoided	Implemented activities to increase	By generating electricity from clean sources, project has prevented 179,252 tCO2 into the atmosphere during the monitoring period	By generating electricity from clean sources, project has prevented 8,233,335 tCO2 into the atmosphere over project lifetime
2)	8.5	Job opportunities created	Implemented activities to decrease	Currently, 21 employees work at the facility.	Total 25 people were employed during over project lifetime.
3)	7.2	7.2.1 Renewable energy share in the total final energy consumption	Implemented activities to increase	The project generated 290,997 MWh electricity from hydropower which is a renewable source during the monitoring period	The project generated 12,631,000 MWh electricity from hydropower which is a renewable source over project lifetime
4)	12.4	Environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks.	Implemented activities to increase	The project is taking actions towards the safe disposal of chemicals and all wastes.	The project is taking actions towards the safe disposal of chemicals and all wastes.

## 2 SAFEGUARDS

### 2.1 No Net Harm

Since the project is a renewable energy project, it has positive impacts instead of negative impacts. The project uses hydropower to generate electricity rather than burning fossil fuels and causing pollution, hence, the project reduces emissions. The project provides employment opportunities as well. Domestic and hazardous wastes (if any), and wastewater generated at the site will be handled according to the national regulations hence will not cause harm.

### 2.2 Local Stakeholder Consultation

Project is operational since 2013 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.

No comments were received during ongoing communication.

### 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, renewable for 2 times. First crediting period will be 23/03/2012-22/03/2022; second crediting period will be 23/03/2022-22/03/2032 and 3rd period will be 23/03/2032-22/03/2042. The project activities consist of only one site. There isn't any event or any situation that occurred during the monitoring period, which can change the applicability of the methodology.

Global Tan Energy mentioned in the registered PD and initial monitoring period has changed its name to become GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ EĞİTİM DANIŞMANLIK VE TİCARET A.Ş. The company is the same with a different name.

No design changes and updates occurred in the project in this monitoring period.

## 3.2 Deviations

### 3.2.1. Methodology Deviations

Project emissions from fossil fuel consumption due to diesel generator (PEFF,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 (FCi,j,y) was not monitored and not included in this monitoring period.

The monitoring parameters wC,i,y and CapPJ would be monitored once for the crediting period according to the registered PD (dated 30/01/2010), Section B.7.1.. These parameters have been monitored once for the crediting period in the first verification. Therefore, these parameters have been removed from Section 4.2.

Water Utilization Rights Protocol was published by State Water Works (DSİ). According to this protocol, DSİ record the level of water continuously at real time and extracts data remotely. Data checks and the water level is monitored continuously by DSİ. For this reason, this parameter (minimum flow) is added to Section 4.2.

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.

According to revised agreement between TEIAS and PP, System Use Agreement was revised on 04/03/2021.

### 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.

Global Tan Energy mentioned in the registered PD and initial monitoring period has changed its name to become GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ EĞİTİM DANIŞMANLIK VE TİCARET A.Ş. The company is the same with a different name.

The deviations do not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario.

### 3.3 Grouped Projects

N/A

## 4 DATA AND PARAMETERS

### 4.1 Data and Parameters Available at Validation

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

<b>Data / Parameter</b>	<b>EFCO<sub>2</sub>, i, y i</b>																	
<b>Data unit</b>	Tco <sub>2</sub> / TJ																	
<b>Description</b>	CO <sub>2</sub> emission factor of fossil fuel type “i” in year “y”																	
<b>Source of data</b>	For EF of fossil fuels, IPCC values at the lower limit have been used.																	
<b>Value applied</b>	<table border="1"> <thead> <tr> <th>FUEL SOURCE</th> <th>EF (Tco<sub>2</sub>/ T)</th> </tr> </thead> <tbody> <tr> <td>Coal</td> <td>94.6</td> </tr> <tr> <td>Lignite</td> <td>90.9</td> </tr> <tr> <td>Fuel Oil</td> <td>75.5</td> </tr> <tr> <td>Diesel</td> <td>72.6</td> </tr> <tr> <td>LPG</td> <td>61.6</td> </tr> <tr> <td>Naphtha</td> <td>69.3</td> </tr> <tr> <td>Natural Gas</td> <td>54.3</td> </tr> </tbody> </table>		FUEL SOURCE	EF (Tco <sub>2</sub> / T)	Coal	94.6	Lignite	90.9	Fuel Oil	75.5	Diesel	72.6	LPG	61.6	Naphtha	69.3	Natural Gas	54.3
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<b>Justification of choice of data or description of</b>	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																	

measurement methods and procedures applied	in existing power plants, IPCC values have been used for conservativeness as requested by the methodology
Purpose of Data	EF calculations
Comments	-

Data / Parameter	FC <sub>i</sub> ,y																																																
Data unit	Tons or 1000 m3 for gases																																																
Description	Amount of fuels consumed by thermal power plants for electricity generation in terms of fossil fuel type i in year																																																
Source of data	TEIAS web page <a href="http://www.teias.gov.tr/istatistik2005/46.xls">http://www.teias.gov.tr/istatistik2005/46.xls</a> <a href="http://www.teias.gov.tr/ist2007/43.xls">http://www.teias.gov.tr/ist2007/43.xls</a>																																																
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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 <a href="http://www.cedgm.gov.tr/dosya/cevreatlasi/atlasin_metni.pdf">www.cedgm.gov.tr/dosya/cevreatlasi/atlasin_metni.pdf</a> ) and EC

	Integrated Pollution Prevention and Control Reference Document on Best Available Techniques for Large Combustion Plants <sup>5</sup>	
Value applied	FUEL SOURCE	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, <a href="http://unfccc.int/national_reports/annex_i_ghg_inventories/items/2_715.php">http://unfccc.int/national_reports/annex_i_ghg_inventories/items/2_715.php</a>			
Value applied		NCV (Tj/kt) (1000m <sup>3</sup> for gas)	EF (tCO <sub>2</sub> /Tj)	COEF(tCO <sub>2</sub> /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
Justification of choice of data or description of measurement methods and	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.			

<sup>5</sup> The validated link is not working any more.

procedures applied	
Purpose of Data	Data used for OM and BM calculation
Comments	-

## 4.2 Data and Parameters Monitored

Data / Parameter	EGfacility, y
Data unit	MWh
Description	Net Electricity generated and delivered to the grid by the proposed project in year y
Source of data	Metering devices installed in the power plant and EPIAS records obtained by TEIAS 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 23 months period, total generation has been 290,997 MWh. Average annually generation corresponds to 151,825 MWh
Monitoring equipment	
QA/QC procedures to be applied	Six calibrated ammeters (three of them are spare). As per the regulations, it should be following the regulation on meters issued by relevant government agencies <sup>6</sup> . The meters are EMH with accuracy class of 0.5S.
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	-

<sup>6</sup> <http://www.epdk.gov.tr/web/elektrik-piyasasi-dairesi/44>

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

<b>Data / Parameter</b>	<b>Minimum flow</b>
<b>Data unit</b>	m <sup>3</sup> / sec
<b>Description</b>	The project releases the required flow as per the regulations.
<b>Source of data</b>	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 riverbed before the reservoir, one is after the reservoir to record life water, last one is installed on the Gullubag Creek.
<b>Description of measurement methods and procedures to be applied</b>	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.
<b>Frequency of monitoring/recording</b>	Continuous

<b>Value monitored</b>	<p>According to the report of Turkey State Hydraulic Works<sup>7</sup>, minimum flow should be 5 m<sup>3</sup> /s at least. Minimum flow is provided in the monitoring period.</p> <p>The monitored minimum flow values in this monitoring period is presented with the attached documents.</p>
<b>Monitoring equipment</b>	Gauging stations
<b>QA/QC procedures to be applied</b>	-
<b>Purpose of the data</b>	Conservation of regional ecology
<b>Calculation method</b>	-
<b>Comments</b>	-

### 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.

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

<sup>7</sup> Turkey State of Hydraulic Works (DSİ), Erzurum ilinde olan HES tesisleri izleme ve kontrol raporu

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 be 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 considered for comparison and to identify any abnormalities. TEIAS started remote reading of the generation of the facility as of June 2012.

TEIAS is the governmental energy transmission institution in Turkey. However, it gives authorization to several local distribution companies in specific regions to manage local energy distribution works. According to the communique given in file 7 in attached documents, calibration of the meters is done by TEIAS every ten years.

According to the revised agreement between TEIAS & PP i.e., Annex 3, Article 3.3 of "The Transmission System Usage Agreement dated 04/03/2021", it has been found that the testing of energy meters will be carried out every 2 years. The installed meters are in line with the regulations. 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.

Serial numbers of the main meters and back-up meters are tabulated below. New main meters and back-up meters were installed in 03/12/2019. For this reason, main and back-up meters will be replaced with new ones in 2029.

**Table 5: 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

Also, back-up meter with serial number as 8923729 were replaced the meter with serial number 8923739 in 03/01/2020 due to breakdown. For this reason, Table 5 has been revised to this update. Also, the detailed information of the replaced meter was given in Table 6.

**Table 6: Summary of Replaced Meter**

	Back-up Meter (Removed on 03/01/2020)	Back-up -Meter
Serial no.	8923729	8923739
Brand (Type)	EMH- LZQJ-XC	EMH- LZQJ-XC
First Index Date (First Calibration Date)	03/12/2019	03/01/2020
Calibration Due	02/12/2029	02/01/2030
Calibration Frequency	10 years	10 years
Test Date	03/12/2019	03/01/2020
Test Frequency	2 years <sup>8</sup>	2 years
Class	0.5S	0.5S
Entity responsible for calibration	TEIAS	TEIAS

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.

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.

<sup>8</sup> Gullubag HEPP- System Use Agreement, page 13, section 3.3., item d

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.

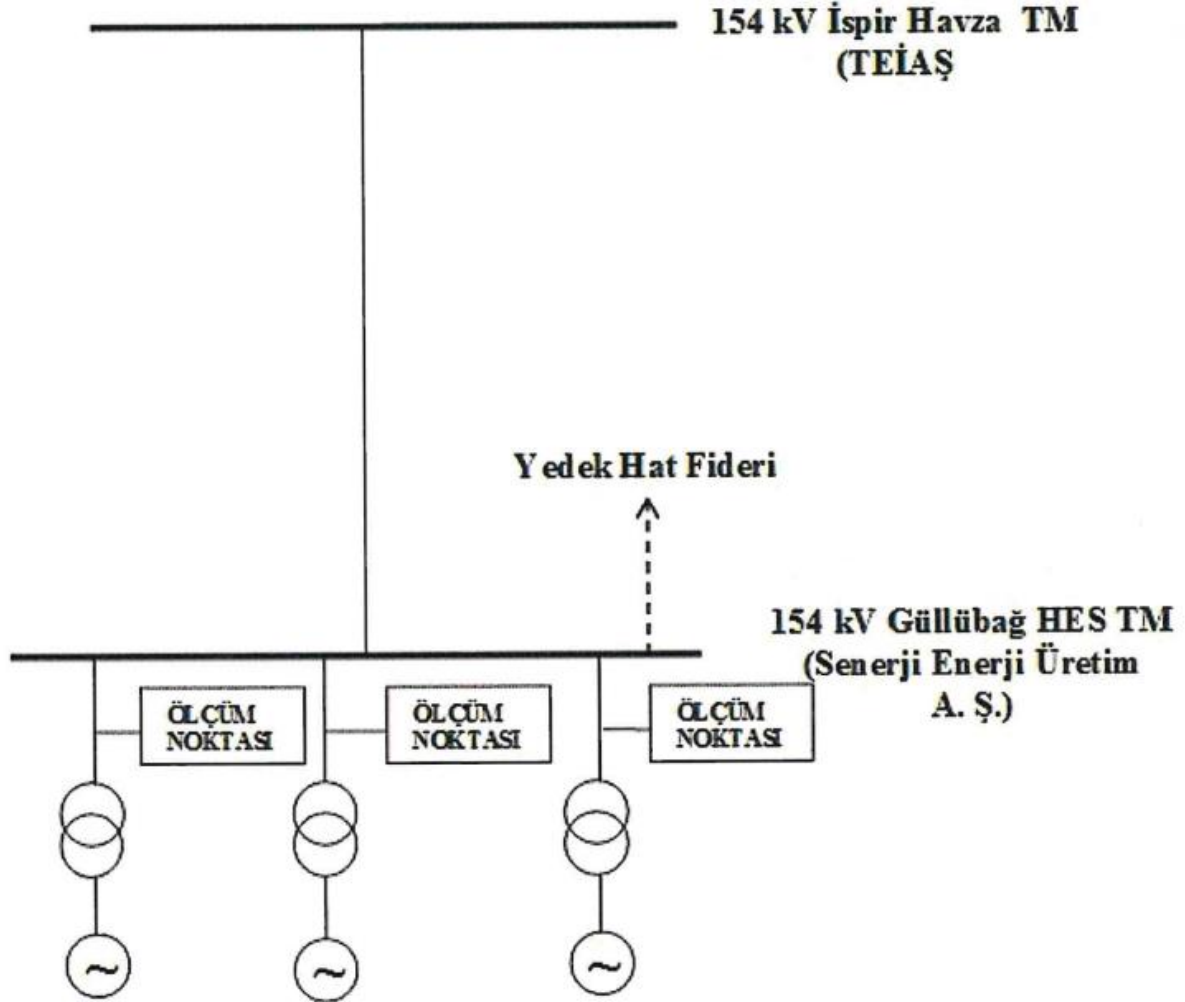
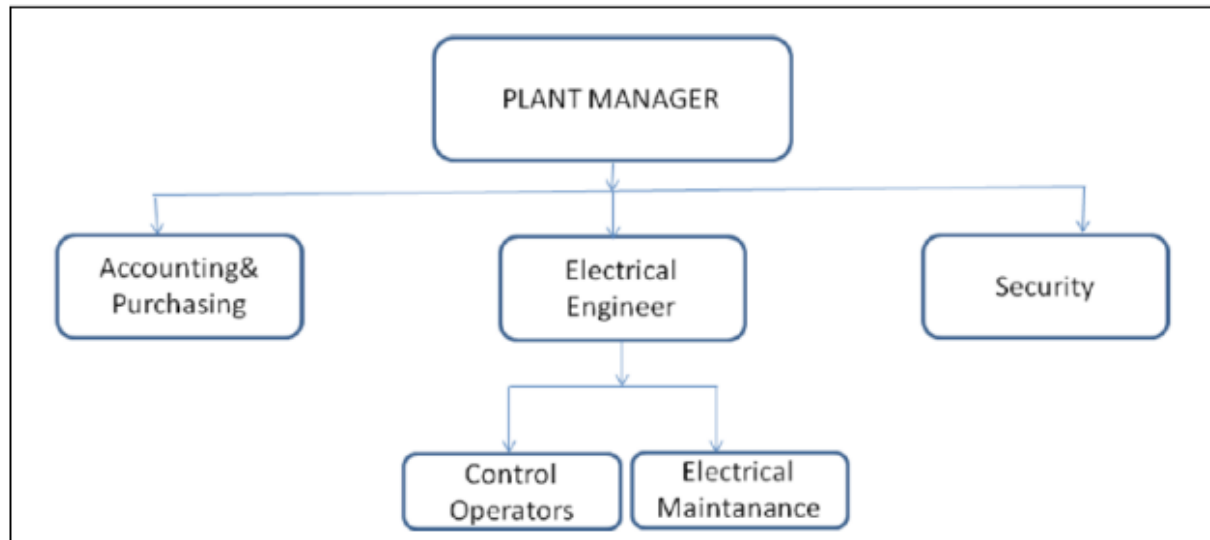


Figure 2 Gullubag HEPP single- line diagram



**Figure 3 Organizational chart of Gullubag HEPP**

## 5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

### 5.1 Baseline Emissions

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

Where:

$ER_y$  = Emission reductions in year y (tCO<sub>2</sub>)

$BE_y$  = Baseline emissions in year y (tCO<sub>2</sub>)

$PE_y$  = Project Emissions in year y (tCO<sub>2</sub>)

$LE_y$  = Leakage emissions in year y (tCO<sub>2</sub>)

$ER_y = 179,252 \text{ tCO}_2$

Baseline emission is calculated according to the formula

$ER_y = EG_y \times EF_y$

Where:

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

EF<sub>y</sub> = Emission factor calculated according to selected methodology

$$179,252 \text{ tCO}_2 = 290,997 \text{ MWh} \times 0.616 \text{ tCO}_2/\text{MWh}$$

## 5.2 Project Emissions

Emissions from the reservoir

The reservoir surface area is 1.21 km<sup>2</sup> 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<sup>2</sup> and does not include significant vegetation in the catchment area, therefore emissions from reservoir is ignored as per the applied methodology.

**Table 1: Calculations for net total values**

LE <sub>y</sub>	Leakage Emissions	0
EG <sub>y</sub>	Net Generation (MWh)	290,997
EF <sub>y</sub>	Emission Factor (tCO <sub>2</sub> / MWh)	0.616
BE <sub>y</sub>	Gross Total Emission Reduction (tCO <sub>2</sub> ) During Monitoring Period	179,252
PE <sub>y</sub>	Project Emissions (tCO <sub>2</sub> )	0
ER <sub>y</sub>	Net Emission Reduction (tCO <sub>2</sub> ) During Monitoring Period	179,252
ER <sub>y</sub> May- Dec 2020	Net Emission Reductions in 2020 (vintage)	87,229
ER <sub>y</sub> Jan- Dec 2021	Net Emission Reductions in 2021 (vintage)	77,097
ER <sub>y</sub> Jan- Mar 2022	Net Emission Reductions in 2022 (vintage)	14,926

## 5.3 Leakage

The energy generating equipment is not transferred from or to another activity. Therefore, leakage is also considered as “0”<sup>9</sup>.

## 5.4 Net GHG Emission Reductions and Removals

Total Emission Reduction has been determined as;

$$ER_y = BE_y - PE_y - LE_y$$

<sup>9</sup> PPD page 30

Where;

ER<sub>y</sub> = Emission reductions in year y (tCO<sub>2</sub>)

BE<sub>y</sub> = Baseline emissions in year y (tCO<sub>2</sub>)

PE<sub>y</sub> = Project Emissions in year y (tCO<sub>2</sub>)

LE<sub>y</sub> = Leakage emissions in year y (tCO<sub>2</sub>)

The project emissions from reservoir are 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, ER<sub>y</sub> = BE<sub>y</sub>- PE<sub>y</sub>

Baseline Emissions

BE<sub>y</sub> = EGBL<sub>y</sub> x EFCO<sub>2</sub>

Where:

BE<sub>y</sub>: Baseline emissions in year y (tCO<sub>2</sub>/year)

EGBL<sub>y</sub> : Energy baseline in year (kWh)

EFCO<sub>2</sub>: Combined Margin CO<sub>2</sub> emission factor (tCO<sub>2</sub>/MWh), which is 0.616 tCO<sub>2</sub>/MWh in the validated PD.

290,997 MWh x 0,616 tCO<sub>2</sub>/ MWh = 179,252 tCO<sub>2</sub>

Thus, the emission reduction (in tonnes CO<sub>2</sub>) for the years between May 2020 and March 2022 is calculated as given in table below.

**Table 2: Summary of emission reductions**

Year	Baseline emissions or removals (tCO <sub>2e</sub> )	Project emissions or removals (tCO <sub>2e</sub> )	Leakage emissions (tCO <sub>2e</sub> )	Net GHG emission reductions or removals (tCO <sub>2e</sub> )
2020 May- Dec	87,229	0	0	87,229
2021 Jan- Dec	77,097	0	0	77,097
2022 Jan-Mar	14,926	0	0	14,926

Total	179,252	0	0	179,252
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