KOYULHISAR HYDRO ELECTRICITY POWER PLANT

Document Prepared by GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ EĞİTİM DANIŞMANLIK VE TİC. A.Ş.

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

AYDEM Yenilenebilir Enerji A.S. constructed KOYULHİSAR Hydro Electric Power Plant (HPP) on the Kelkit Stream, within the jurisdiction of Koyulhisar Town of Sivas Province. The purpose of the project is electricity production using the potential energy of Kelkit Stream as a renewable resource. The purpose of the project is to supply electricity to the Turkish power grid, from a renewable source.

Therefore, the electricity is produced without causing airborne pollutants or Green House Gas (GHG) emissions. The Project Activity (PA) utilizes the Kelkit Stream to generate electricity with zero carbon emissions for the Turkish Power Grid. The PA is displacing electricity that would otherwise be generated by the existing grid of the host country. The set capacity of Koyulhisar HPP is 63 MW, with 3 turbines of 21 MW each. One of these three turbines is installed as a standby unit, intended to operate only whenever one of the other two turbines does not operate for the purpose of maintenance and repair. Hence, the total installed capacity is considered as 42 MWe (2x21 MWe). The gross electricity production by the PA was calculated as 278,184 MWh while the net electricity production was found to be 277,784 MWh during the monitoring period of 17-November-2019 to 31-December-2021. Therefore, the Project Activity led to an emission reduction of 127,975 tons CO2e annually in the 2nd crediting period for the monitoring period of 17-November-2019 to 31-December-2021.

Table 1. Milestones

Date	Milestone
10/02/2005	Project License Granted by EMRA
18/01/2005	Water Use Agreement
27/07/2020	Water Use Agreement (Renewed)
23/06/2020	System Use Agreement
21/12/2005	Connection Agreement
20/03/2020	Connection Agreement (Renewed)
01/06/2005	Project was granted EIA not needed certification
25/04/2014	Commissioning date of Turbine 1 and Turbine 2

The Koyulhisar HPP is a runoff river reservoir type plant that was constructed at the downstream of two state owned dams, namely: Kılıçkaya Dam (124 MW) and Çamlıgöze Dam (33MW). The project is collecting the water that leaves the spillway of Çamlıgöze Dam. The water is collected and kept up to 5 hours behind the spill weir regulator of the Koyulhisar HPP. The water then be transferred to a set of open canals and tunnels that brings the water to a head pond from which it is loaded to the penstock that brings pass the water to the powerhouse where it reaches the 3 vertical axis Francis turbines with 21 MW capacity each. The electricity is produced by the two of these three turbines as one of the turbines is a stand-by unit. The spill weir regulator is located at an altitude of 724m and the tail water of Koyulhisar

is at an altitude of 623 m. This brings a head difference of approximately 101 m. How the project activity is operating is shown schematically below in Figure 1. Koyulhisar HPP with 63 MWe installed capacity is connected to the Turkish National Power Grid via one of the Transformer Substations by 80 km long 154 kV transmission line at the Suşehri Transfer Station and Reşadiye Transfer Station.

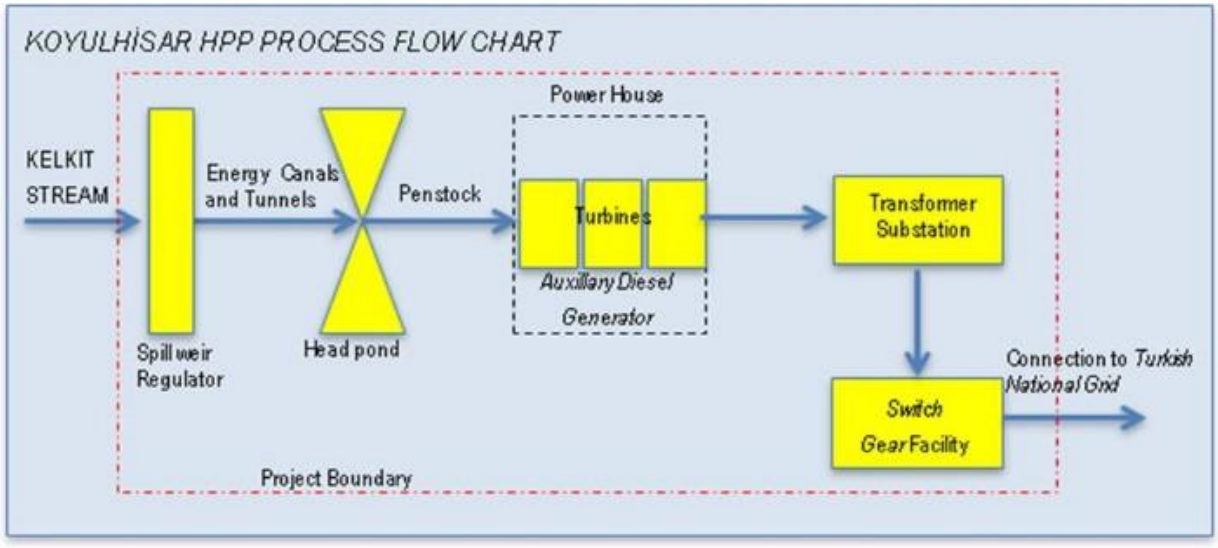

Figure 1: Flow chart showing the basic operational principles of the project activity.

1.2 Sectoral Scope and Project Type

The project category is Sectoral Scope 1: Energy industries (renewable-/non-renewable sources). The project is a non-grouped, stand-alone project.

1.3 Project Proponent

Organization name	Aydem Yenilenebilir Enerji A.S. 2
Contact person	Özgün Gül Koparan
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1.4 Other Entities Involved in the Project

Organization name	GTE Karbon Sürdürülebilir Enerji Eğitim Danişmanlik Ve Ticaret A.Ş

Contact person	M. Kemal DEMİRKOL
Title	Director
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1.5 Project Start Date

17/11/2009 is the date when the project started to supply electricity to the Turkish grid as substantiated by the provisional acceptance letter sent.

1.6 Project Crediting Period

The second crediting period of the project is 10 years: 17/11/2019 to 16/11/2029 (both days included.

1.7 Project Location

The project is located at the Central Anatolian geographical region of Turkey at the Sivas Province. The coordinate of the powerhouse is as follows and as indicated on the location Map below (Figure 2). The following are the exact coordinates of the main project structures, as shown in the following Table (Table 2):

Table 2: The geographical coordinates indicating the location of the major components of the project activity:

Component's name	Latitude	Longitude
Powerhouse	40°16'13.48"N	37°46'54.58"E
Switch Gear	40°17'28.28"N	38°26'27.58"E

Figure 2. Project location

1.8 Title and Reference of Methodology

The following UNFFCC methodology and its related tools are utilized:

Approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources." Version 20.0.

The Approved Methodology refers to the following tools:

- "Tool for the demonstration and assessment of additionality" (Version 05.2.1)
- "Tool to calculate the emission factor for an electricity system". (Version 07.0)
- Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1)

1.9 Participation under other GHG Programs

Not applicable

Emission Trading Programs and Other Binding Limits: The project reduces GHG emissions from activities that are not included in an emissions trading program or any other mechanism that includes GHG allowance trading, therefore the net GHG emission reductions or removals generated during this monitoring period are not to be used for compliance under such programs or mechanisms. The host country does not have binding emissions limits and the project is not eligible to produce any compliance emissions reductions.

Participation under Other GHG Programs: The project is not registered under any other GHG programs and, the project activity does not have any GHG credits claimed under such programs.

1.10 Other Forms of Credit

Not applicable

Host country does not have an emissions trading scheme and the project activity is not taking place in any other form of environmental credit.

Other Forms of Environmental Credit: The project has not sought or has not received another form of GHG-related environmental credit, including renewable energy certificates, during this monitoring period. Additionally, the project activity is not eligible to create another form of GHG-related environment credit

1.11 Sustainable Development Contributions

The purpose of the project is electricity production using the potential energy of Aksu River as a renewable resource. Therefore, the electricity is going to be produced without causing airborne pollutants or Green House Gas (GHG) emissions. The construction and operation of the Koyulhisar Hydro Electric Power Plant (HEPP) is delaying theaddition of conventional thermal power plants to the Turkish National Electricity Grid.

The project produces an average of 130,323 MWh of electricity per year and the total of 277,784 MWh net electricity for the whole monitoring period. The project is a green field project and in the absence of the project activity an equivalent amount of electricity would have been generated in the fossil fuel based national grid.

The following is a list of the project's contribution to the UN SDG:

- SDG 7 on access to affordable, reliable, and sustainable energy, as the project is not relying on imported fossil fuels.
- SDG-8 decent work and economic growth. As the project is providing a decent and secure work environment.
- 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.

Table 3: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	13.3	Tons of greenhouse gas emissions avoided	Implemented activities to increase	By generating electricity from clean sources, project has prevented 127,975 tCO2 into the atmosphere during the monitoring period	By generating electricity from clean sources, project has prevented 891,790 tCO2 into the atmosphere Over Project Lifetime
2)	8.5	Job opportunities created	Implemented activities to increase	During the monitoring period 4 employees were recruited.	- Total 34 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 277,784 MWh electricity from hydropower which is a renewable source during the monitoring period	The project generated 1,935,740 MWh electricity from hydropower which is a renewable source over project lifetime

2 SAFEGUARDS

2.1 No Net Harm

During the project design phase, the following measures are undertaken in order to minimize the impacts during operational periods:

Figure 3. Waste Collection Site

Water & Wastewater Management

Water for domestic use is supplied by tankers to the site and wastewater is collected in septic tanks which is emptied regularly. The wastewater is discharged in accordance with Water Pollution Control regulations of the host country.

Collection records are provided dated 13/10/20, 12/06/20, 24/09/21, 16/12/21, 07/06/21, 24/03/21.

Waste Oil

The waste oil is collected in impermeable containers and transferred to recycling centers in accordance with Hazardous Waste Control Regulations and Waste Oil Control Regulations. A photograph of the hazardous waste storage area is provided.

Collection records are provided dated 23/11/21, 11/08/20.

Solid Waste

Solid waste is collected, and recyclables are separated to be sent to recycling centers. The rest is disposed to the nearest landfill site in coordination with Koyulhisar District Municipality. The solid waste here also covers the E-Waste. Hence the disposal is realized in accordance with Regulation

on Waste Management, Regulation on Electrical and Electronic Waste Control, and Regulation on Battery and Accumulator Wastes.

Collection records are provided dated 15/07/20, 05/02/20, 10/12/20, 14/06/20, 14/01/20, 03/05/21, 13/12/21, 13/03/21, 11/08/21, These records include collection of hazardous wastes, electric waste and battery waste generated at the site.

Biodiversity

Necessary precautions are taken for the species under conservation by international conventions, The field is regularly observed in terms of any change and irregularity of the biodiversity.

2.2 Local Stakeholder Consultation

The relationship with the local stakeholders deemed to be very important and before the project implemented a stakeholder's consultation meeting on 13 November 2006 at Kılıçpınar Village.a detailed summary of this meeting is provided in the validated PD. In addition to this there is a "communication box" in Koyulhisar District Municipality Building within the vicinity of the project and a continuous grievance policy is implemented by the project owner. The project owner is open to dialogue with stakeholders. They communicate regularly with the village heads, and the district governorship and welcome the visitors. During the monitoring period there were no complaints about or demands from the project.

2.3 AFOLU-Specific Safeguards

The Project is a non-AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project start date is 17.11.2009. Since that date, there is no special event that may have impact on monitoring of GHG emission reductions other than the water transmission channel maintenance activities. Water transmission channel maintenance works were carried out in November 2014, April 2017, November 2018 and September, October, November of 2019. For that reason, no electricity has been produced in these months, which results with no GHG emission reductions or removals. As was mentioned in the validated PD the project site is located within the North Anatolian Fault Zone that is active and in motion all the times. For this reason, the project had to stop and do some major repairs in the canals carrying water to the project. This was to ensure and stop water leakage via the canals and to improve the stability of the canals.

3.2 Deviations

3.2.1 Methodology Deviations

The UNFCCC methodology of ACM0002 (version 20.0) and its related tools are applied as they are without any deviation from methodology.

3.2.2 Project Description Deviations

For the Project Proponent part, Bereket Energy was the major shareholder of Koyulhisar Üretim A.S and as the Bereket changed tittle as a company policy they have dissolved all the individual sister companies that hold licenses of facilities and changed the ownership as Aydem Yenilenebilir A.Ş on 24/12/2019 as stated in official gazette with registration number of 13798[1].

The project activity is in compliance with the scenario described at the Project Design Document. After EPİAŞ received Market Operating License on 01/09/2015, market operations were transferred from PMUM to EPİAŞ.

According to the revised agreement between TEIAS & PP i.e., Annex-3, Article 3.3 of "The Transmission System Usage Agreement dated 23/06/2020", it has been found that the testing of energy meters is carried out every 2 years[2].

For the periods of 11/2019, 12/2019, 01/2020 and 02/2020 there was no electricity generation due to a breakage happened in transmission line that was rehabilitated after with the maintenance agreement signed on 12/2019[3].

3.3 Grouped Projects

The project is not a grouped project activity.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO2/MWh

[1] Official Gazette ..\Official Gazette\Aydem Yenilebilir Enerji A.Ş. Official Gazette.pdf
[2] System Use Agreement
[3] Maintenance Agreement for Breakage ..\6. Restoration Docs for Breakdown event\43_BEREKET_AŞ-NTA_MÜH_KOYULHISAR_REHB_PROJ_HAZIRL_HES_SOZLESMESİ-11.12.2... (2).pdf

Description	Operating margin CO2 emission factor for grid connected power generation in year y calculated using the "Tool to calculate the emission factor for an electricity system"
Source of data	Data published by Turkish Ministry of Energy and Natural Resources on 03/09/2020
Value applied	0.6993
Justification of choice of data or description of measurement methods and procedures applied	The $EF_{grid,OM,y}$ was calculated and published by Turkish Ministry of Energy and Natural Resources on 03/09/2020 using Version 06.042 of TOOL 7:"Tool to calculate the emission factor for an electricity system",
Purpose of Data	For calculation of $EF_{grid,CM,y}$
Comments	$EF_{grid,OM,y}$

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO2/MWh
Description	Building margin CO2 emission factor for grid connected power generation in year y calculated using the "Tool to calculate the emission factor for an electricity system"
Source of data	Data published by Turkish Ministry of Energy and Natural Resources on 03/09/2020
Value applied	0.3812
Justification of choice of data or description of measurement methods and procedures applied	$EF_{grid,BM,y}$ was calculated and published by Turkish Ministry of Energy and Natural Resources on 03/09/2020 using Version 06.0 of TOOL 7:"Tool to calculate the emission factor for an electricity system".
Purpose of Data	For calculation of $EF_{grid,CM,y}$
Comments	-

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO2/MWh
Description	Combined margin Emission Factor of Turkey
Source of data	Data published by Turkish Ministry of Energy and Natural Resources on 03/09/2020
Value applied	0.4607
Justification of choice of data or description of measurement methods and procedures applied	$EF_{grid,CM,y}$ was calculated using the published data by Turkish Ministry of Energy and Natural Resources on 03/09/2020. Calculated data of $EF_{grid,OM,y}$ and $EF_{grid,OM,y}$ were used.

Purpose of Data	Calculation of baseline emission (BE_y).
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{PP\text{-}Import,\ y}$
Data unit	MWh
Description	Quantity of electricity imported by the power plant from the Grid, in year y
Source of data	The Primary source of data will be the Main TEIAS meter recorded at the monthly reading protocols, the column related to electricity imported from the Grid.
Description of measurement methods and procedures to be applied	Measurements are to be made by electricity meters. That belong to the grid operator TEIAŞ. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid.
Frequency of monitoring/recording	Recorded continuously, reported monthly on TEIAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.
Value monitored	The value is determined as 399 MWh at the monitoring period of 17/11/2019-31/12/2021
Monitoring equipment	Main Electricity Meter: EMH, Serial Number: 8923761/8923763 Back-up Electricity Meter: EMH-Serial Number:8923762/8923764
QA/QC procedures to be applied	Measurements are carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market. The class of the meters is 0.2s Class. The monthly reported meter readings by the main meter with serial number 8923761/8923763 (transformer A/transformer B), will be cross-checked against the back up meter that has the serial number 8923762/8923764 (transformer A/transformer B) The monthly reported readings will also be cross checked against the monthly EPİAŞ screen shots. The EPİAŞ data of electricity sales will also be a proof for quality and reliability of data. The details related to energy meters, calibration dates and their validity is given in Section 4.3, Table 4.
Purpose of the data	Data will be used to calculate net electricity supplied to the grid.
Calculation method	Direct continuous measurement
Comments	The collected data is kept by Koyulhisar Elektrik Üretim A.Ş. During the crediting period and until two years after the last issuance of VERs for the “Koyulhisar Hydro Electricity Power Plant” project activity for that crediting period.

Data / Parameter	$EG_{PP\text{-}export,\ y}$
Data unit	MWh
Description	Quantity of electricity exported by the power plant to the grid, in year y
Source of data	The Primary source of data will be the Main TEIAS meter recorded at the monthly reading protocols, the column related to electricity exported to the Grid.
Description of measurement methods and procedures to be applied	Measurements are to be made by electricity meters. That belong to the grid operator TEIAŞ. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid.
Frequency of monitoring/recording	Recorded continuously, reported monthly on TEIAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.
Value monitored	The value is determined as 278,184 MWh at the monitoring period of 17/11/2019-31/12/2021 [4]
Monitoring equipment	Main Electricity Meter: EMH,Serial Number: 8923761/8923763 Back-up Electricity Meter: EMH-Serial Number:8923762/8923764 Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market. They have an accuracy class of 0.2s Class
QA/QC procedures to be applied	Measurements are carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market. The class of the meters is 0.2s Class. The monthly reported meter readings by the main meter with serial number 8923761/8923763 (transformer A/transformer B), will be cross-checked against the back up meter that has the serial number 8923762/8923764 (transformer A/transformer B). The monthly reported readings will also be cross checked against the monthly EPİAŞ screen shots. The EPİAŞ data of electricity sales will also be a proof for quality and reliability of data. The Calibration dates of the meters and their validity is as follows: The details related to energy meters, calibration dates and their validity is given in Section 4.3, Table 4.
Purpose of the data	Data to be used to calculate the net electricity supplied to the grid
Calculation method	Direct Continuous Measurement
Comments	The collected data is kept by Koyulhisar Elektrik Üretim A.Ş. During the crediting period and until two years after the last issuance of

[4] for the periods of 11/2019, 12/2019, 01/2020 and 02/2020 there was no electricity generation due to a breakage happened in transmission line that was rehabilitated after with the maintenance agreement signed on 12/2019 Maintenance Agreement for Breakage ..\6. Restoration Docs for Breakdown event\43_BEREKET_AŞ-NTA_MÜH_KOYULHISAR_REHB_PROJ_HAZIRL_HES_SOZLESMESİ-11.12.2... (2).pdf

	VERs for the “Koyulhisar Hydro Electricity Power Plant” project activity for that crediting period.

Data / Parameter	$EG_{pp-net,y}$
Data unit	MWh
Description	Quantity of the net electricity supplied to the grid by the power plant, in year y
Source of data	The Primary source of data will be the Main TEIAS meter recorded at the monthly reading protocols, the column related to electricity exported to the Grid.
Description of measurement methods and procedures to be applied	Measurements are to be made by electricity meters. That belong to the grid operator TEIAŞ. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid.
Frequency of monitoring/recording	Recorded continuously, reported monthly on TEIAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.
Value monitored	The value is determined as 277,784 MWh at the monitoring period of 17/11/2019-31/12/2021
Monitoring equipment	Main Electricity Meter: EMH,Serial Number: 8923761/8923763 Back-up Electricity Meter: EMH-Serial Number:8923762/8923764 Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market. They have an accuracy class of 0.2s Class
QA/QC procedures to be applied	Measurements are carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market. The class of the meters is 0.2s Class The monthly reported meter readings by the main meter with serial number 8923761/8923763 (transformer A/transformer B), will be cross-checked against the back up meter that has the serial number 8923762/8923764 (transformer A/transformer B) The monthly reported readings will also be cross checked against the monthly EPİAŞ screen shots. The EPİAŞ data of electricity sales will also be a proof for quality and reliability of data. There are two meters that backup each other for each transformer. Generated electricity is also monitored via the operator by the help of EPİAŞ trading software for internal monitoring. The details related to energy meters, calibration dates and their validity is given in Section 4.3, Table 4.
Purpose of the data	Data will be used to calculate emission reduction calculations.
Calculation method	EGPP-net, y= EGPP-export, y- EGPP-import, y

Comments	The collected data is kept by Koyulhisar Elektrik Üretim A.Ş. During the crediting period and until two years after the last issuance of VERs for the "Koyulhisar Hydro Electricity Power Plant" project activity for that crediting period.

Data / Parameter	Cap_{PJ}
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data	Project Site
Description of measurement methods and procedures to be applied	Turbine Supplier information on the equipment
Frequency of monitoring/recording	Yearly
Value monitored	42,000,000 W
Monitoring equipment	N/A
QA/QC procedures to be applied	Supplier information on the related equipment and existence of the equipment will be checked
Purpose of the data	To monitor capacity of the project and used to calculate the power density
Calculation method	N/A
Comments	-

Data / Parameter	A_{PJ}
Data unit	m2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full. Project site
Source of data	Project Site
Description of measurement methods and procedures to be applied	The reservoir area corresponding to maximum operational level has been determined via the topographic map showing the lake area.
Frequency of monitoring/recording	Once at the beginning of each crediting period

Value monitored	1,204,040 m2
Monitoring equipment	-
QA/QC procedures to be applied	Can be checked and compared to satellite imagery available by Google Earth.
Purpose of the data	To use for calculating the power density.
Calculation method	N/A
Comments	-

4.3 Monitoring Plan

The Monitoring Plan for the project consists mainly of the net electricity generation by the project activity. Based on the baseline scenario presented above, this amount of electricity would have been produced by the Turkish National Grid.

The electricity produced is sold to TEİAŞ. Therefore, TEİAŞ measures the electricity produced by four meters (two main meter and two control meters). These four meters that backup each other. Generated electricity is also monitored via the operator by the help of EPİAŞ trading software for internal monitoring. Metering points can be observed in single line diagram (Appendix 1)

Table 4: Energy Meters

	Transformer A		Transformer A		Transformer A		Transformer B	
	Main Meter (Removed on 24/11/2009)	Spare Meter (Removed on 24/11/2009)	Main Meter (Removed on 14/12/2019)	Spare Meter (Removed on 14/12/2019)	Main Meter	Spare Meter	Main Meter	Spare Meter
Serial no.	342822104	342822103	53030781	53030782	8923761	8923762	8923763	8923764
Brand-(Type)	CIRWATT	CIRWATT	ACTARIS	ACTARIS	EMH / LZQJ-XC	EMH / LZQJ-XC	EMH / LZQJ-XC	EMH / LZQJ-XC
First Index Date (First Calibration Date)	07/05/2009	07/05/2009	24/11/2009*	24/11/2009	14/12/2019	14/12/2019	24/12/2019	24/12/2009
Calibration Due	Removed on 24/11/2009	Removed on 24/11/2009	-Removed on 14/12/2019*	- Removed on 14/12/2019	14/12/2029[5]	14/12/2029[6]	24/12/2029[7]	24/12/2029[8]
Calibration frequency	10 years	10 years	10 years	10 years	10 years	10 years	10 years	10 years
Test Date	-	-	-	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Test Due	-	-			09/12/2023	09/12/2023	09/12/2023	09/12/2023

[5] https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5
[6] https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5
[7] https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5
[8] https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5

Test frequency	-	-			2 years	2 years	2 years	2 years
Class	-	-	0.2S	0.2S	0.2S	0.2S	0.2S	0.2S

*Transformer A, the ACTARIS brand meters were installed on 24/11/2009 and replaced with EMH Brand Meters on 14/12/2019. In order to meet the 10-year calibration frequency, the meters should have been recalibrated/replaced within 24/11/2019 but done only on 14/12/2019.There is 20 days delay in calibration. Error factor should have been applied for the month of Nov and Dec 2019. since there was already no electricity generation in the months 11/2019, 12/2019, 01/2020 and 02/2020 i.e., their readings were not accounted hence there was no requirement to apply the error factor. Also, internal consumption for these months has been deducted from next months as being a conservative approach

These meters are placed on the switchgear station where the power plant gets connected to the Turkish national grid. Those meters will provide official data which will be read and recorded monthly by TEİAŞ officers for invoicing. TEİAŞ also conducts the calibration and maintenance of these meters and thus, ensures the accuracy and quality of the measurements. The quality standards that the meters need to comply is "The ICE/TSE 62053-22: Electricity metering equipment (a.c) – Particular requirements - Part 22: Static meters for active energy (Classes 0.2 S and 0.5 S)" The calibration of the meters is done and the meters will be checked continuously if there is a difference of 0.2 % in the readings of the main and the auxiliary meters, the calibration is repeated.

The net electricity produced (EGPP-net, y) in year y is calculated by subtracting the total electricity consumed by the hydroelectric power plant (EGPP-self consumption,y) , from the gross electricity generation (EGPP-gross,y) . After obtaining the net electricity production value, the emission reductions will be calculated by multiplying the net electricity with the Combined Margin calculated above.

The monitoring is conducted by the Verified Emission Reduction (VER) Monitoring Team. The VER Team Members, and their position and duties for the monitoring is outlined in the following table (Table 5):

Table 5: Positions and responsibilities of the VER monitoring team members.

Position	Responsibility
Koyulhisar HEPP Manager	**Day to day operation of the Koyulhisar HEPP, Compliance of the project activity with the host country rules and regulations Coordination of the data collection and recording for the VCS monitoring report.**
Chief Electrical Engineer	**Day to day follow up of electrical equipment** **Recording and monitoring of the electricity generation data**
Accounts Manager	**Data keeping for power sales** **Data entry to EPİAŞ system**
Chief Mechanical Engineer	**Day to day operation of the power plant** **Keeping records of malfunctions and repairs**
Carbon Consultant	**Emission reduction calculations** **Scripting of the periodic monitoring report** **Follow up of the verification process**

The power generation meter readings are performed by using the main metering devices and the auxiliary metering devices for accuracy checks only. Data from metering devices is recorded by TEİAŞ and form the basis for the electricity production data. In addition to the readings of the main and auxiliary (back-up) metering devices, generation data of the KOYULHISAR HEPP can be cross checked, via the TEİAŞ – EPİAŞ web site (https://seffaflik.epias.com.tr/transparency/) which is accessible by a password available to the electricity generation companies (in the case of project activity the project owner has this capacity). The electricity generation data at the Market Financial

Reconciliation Centre (MFRC/EPİAŞ) web page exhibits the net electricity generated less transmission loss, to be able to produce comparable numbers, the figures taken from EPİAŞ web site needs to be multiplied by the transmission loss factor of the grid. This data is the main QA/QC data for the project activity.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Baseline emission is calculated according to the formula

$$BE_y = EG_y \times EF_y$$

Where:

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

EF_y = Emission factor calculated according to selected methodology

5.2 Project Emissions

The proposed project activity involves the generation of electricity by hydroelectric power plant therefore project activity does not result in greenhouse gas emissions. Power density of the projects higher than 10 W-m^2 for 42,000,000 MWe installed capacity and 1,204,040 m^2 maximum lake area.

The power density of the project activity (PD) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD = Power density of the project activity (W-m^2)

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W)

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

For proposed project HEPP,

Cap_{PJ} = 42,000,000 We

Cap_{BL} = 0.0 W

A_{PJ} = 1,204,040 (m^2)[9]

A_{BL} = 0.0 (m^2)

Therefore, PD is calculated as.

$$PD = \frac{42{,}000{,}000 - 0}{1{,}204{,}040 - 0}$$

$$PD = 34{,}88\ W - m^2$$

5.3 Leakage

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

$$LE_y = 0$$

5.4 Net GHG Emission Reductions and Removals

Total Emission Reduction has been determined as;

$ERy = BE_y - PE_y - LE_y$

Where;

ER_y = Emission reductions in year y (tCO_2)

BE_y = Baseline emissions in year y (tCO_2)

PE_y = Project Emissions in year y (tCO_2)

LE_y = Leakage emissions in year y (tCO_2)

The project emissions and leakage are considered as "0". Thus, $ER_y = BE_y$

Table 4. Calculations for net total values

EGy	Net Generation (MWh) During Monitoring Period	277,784
EFy	Emission Factor (tCO_2-MWh)	0.4607[10]

[9] Reservoir area, Annex 2

[10] Fixed ex-ante CM as per Section 4.3. og registered PD

BEy	Baseline emissions in year y (tCO2) During Monitoring Period	0
PEy	Project Emissions (tCO_2)	0
LEy	Leakage Emissions (tCO_2)	0
ERy	Net Emission Reduction (tCO_2) During Monitoring Period	127,975

Thus, the net emission reduction (in tons CO_2) in this monitoring period (17-November-2019 to 31-December-2021) is calculated as given in table below.

Table 5. Summary of Emission Reductions

Year	Baseline Emissions (tCO_2e)	Project Emissions (tCO_2e)	Leakage Emissions (tCO_2e)	Net GHG Emission Reductions or Removals (tCO_2e)
2019 (17/11/2019-31/12/2019)	**0**			**-25**
2020 (01/01/2020 – 31/12/2020)	**81,644**	0	0	**81,644**
2021 (01/01/2021 – 31/12/2021)	**46,356**	0	0	**46,356**
Total	**127,975**	0	0	**127,975**

Total emission reductions were realized as 127,975 tCO_2 for this monitoring period (Table 7). When the estimated electricity generation figure of the power plant for each year in the validated VCS PD (193,574 MWh-year) is considered, the total emission reductions should be approximately 178,359 tCO_2 for the monitoring period (26 months). Percent difference is calculated as -28,2%, which means the project reduced 28.2% less CO_2 than the estimated amount. Since the project is a HEPP, seasonal variations in the amount of precipitation and temperature affect the monthly generation rates and may create deviations from the estimated values. According to the values revealed in "Evaluation of Areal Precipitation in 2021" published by Directorate General of Meteorology of Turkey, Sivas Province received around 350 mm precipitation during 2021[11] which is 30% less precipitation compared to regular levels

[11] https://www.mgm.gov.tr/FILES/arastirma/yagis-degerlendirme/2021AlansalYagisDegerlendirmesi.pdf

of precipitation for central Anatolia (500 mm), This fact reflects on the electricity generation obtained in 2021. These fluctuations cause significant decrease in electricity generation by the plant. On the other hand, the electricity generation is dependent on water flow estimation, which is a natural phenomenon and cannot be estimated with 100% accuracy.

Table 6. Summary of net electricity supply to the grid versus emissions reductions (estimate and actual values for this monitoring period)

	Project Baseline Estimate		Actual Values Achieved in the Monitoring Period	
Year	Net Electricity Supplied to the Grid (MWh)	Emission Reductions (tCO_2e)	Net Electricity Supplied to the Grid (MWh)	Emission Reductions (tCO_2e)
2019	**25,456**	**11,728**	**-54**	**-25**
2020	**193,574**	**89,180**	**177,218**	**81,644**
2021	**193,574**	**89,180**	**100,620**	**46,356**
Total	**387,148**	**178,359**	**277,784**	**127,975**

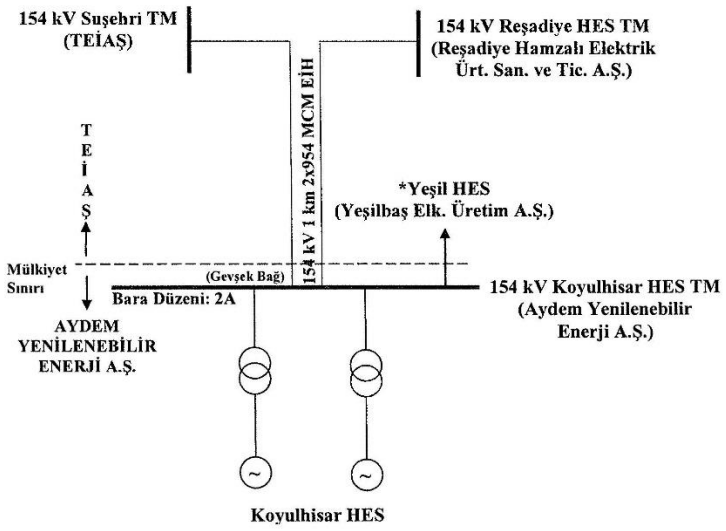
APPENDIX 1: SINGLE LINE DIAGRAM

BAĞLANTI ANLAŞMASI

EK-3
MÜLKİYET SINIRLARI

a) Mülkiyet sınırının yazılı ifadesi: Üretim tesisi şalt sahasından sonraki nihayet direği ile üretim tesisi şalt sahası arasındaki gevşek bağlantı hariç, enerji iletim hatları TEİAŞ'ın mülkiyetindedir.

b) Mülkiyet sınırının Prensip Tek Hat Şeması üzerinde gösterimi:



***: Yeşil HES'in Bağlı Olduğu Fiderin Mülkiyeti TEİAŞ'a Aittir.**