DUZCE AKSU HYDRO ELECTRICITY POWER PLANT

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CONTENTS

DÜZCE-AKSU HYDRO ELECTRICITY POWER PLANT 1

1 PROJECT DETAILS 4

1.1 Summary Description of the Implementation Status of the Project 4

1.2 Sectoral Scope and Project Type 7

1.3 Project Proponent 7

1.4 Other Entities Involved in the Project 7

1.5 Project Start Date 8

1.6 Project Crediting Period 8

1.7 Project Location 8

1.8 Title and Reference of Methodology 10

1.9 Participation under other GHG Programs 11

1.10 Other Forms of Credit and Supply Chain (Scope 3) Emissions 11

1.11 Sustainable Development Contributions 12

2 SAFEGUARDS 14

2.1 No Net Harm 14

2.2 Local Stakeholder Consultation 15

2.3 AFOLU-Specific Safeguards 15

3 IMPLEMENTATION STATUS 15

3.1 Implementation Status of the Project Activity 15

3.2 Deviations 17

3.2.1 Methodology Deviations 17

3.2.2 Project Description Deviations 17

3.3 Grouped Projects 18

4 DATA AND PARAMETERS 18

4.1 Data and Parameters Available at Validation 18

4.2 Data and Parameters Monitored 21

4.3 Monitoring Plan 24

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS 27

5.1 Baseline Emissions 27

5.2 Project Emissions 28
5.3 Leakage 29
5.4 Net GHG Emission Reductions and Removals 29

APPENDIX 1: SINGLE LINE DIAGRAM 32

APPENDIX 2: RESERVOIR AREA 33

APPENDIX 3: RESERVOIR AREA USED IN PD VER 2.03 34

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Düzce-Aksu Elektrik Üretim A.Ş. which is owned by AYDEM Yenilenebilir Enerji A.Ş. constructed Düzce-Aksu Regulator and Hydro Electricity Power Plant (HEPP) on the Aksu River, that is a branch of the Büyük Melen River, within the jurisdiction of Gölyaka Town of Düzce Province. The host country is Turkey. The purpose of the project is electricity production using the potential energy of Aksu River as a renewable resource.

Therefore, the electricity is produced without causing airborne pollutants or Green House Gas (GHG) emissions. The construction and operation of the Düzce-Aksu Hydro Electric Power Plant (HEPP) delays the addition of conventional thermal power plants to the Turkish National Electricity Grid.

According to the methodology[1], baseline scenario was identified as “the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources”.

The project start date is 25/04/2014, which is the date when the project started to supply electricity to the Turkish grid. The Project Activity (PA) utilizes the Aksu River to generate electricity with zero carbon emissions for the Turkish Power Grid. Düzce-Aksu HEPP is a run-off river reservoir as per EPDK license with a number of EÜ/8909-3/04348 and a date of 24/10/2019, which has a total installed capacity of 46.2 MWe (48,304 MWm) with two pelton type turbines each having a capacity of 23,10 MWe. The PA is displacing electricity that would otherwise be generated by the existing grid of the host country. The estimated electricity generation is 141,370 MWh per year, and the estimated emission reduction is 75,382 tCO_2e per year for this crediting period.

The net electricity production by the PA is calculated as 187,432 MWh, and the Project Activity led to an emission reduction of 99,931 tons CO_2e for this monitoring period (01-January-2022 to 31-August-2023).

Table 1. Milestones of the project

Milestone	Date

[1] https://cdm.unfccc.int/UserManagement/FileStorage/A04BWNRKLUEP6O1QX75YVTH28JDICZ

Turn Key contract signed between Düzce-Aksu and Bereket Enerji	03/12/2009
Name Change from Bereket Enerji to AYDEM Enerji	29/12/2019
Project License (granted by EMRA for AYDEM Yenilebilir Enerji Anonim Şirketi)	24/10/2019
Connection Agreement	20/03/2020
System Usage Agreement	23/03/2020
Water usage agreement	27/07/2020
EIA Exemption	16/07/2007
Commissioning date of Turbine 1 and Turbine 2	25/04/2014
The first crediting period	25/04/2014 – 24/04/2024
The first monitoring period	25/04/2014 – 30/09/2020
The second monitoring period	01/11/2020 – 31/12/2021
The third monitoring period	01/01/2022 – 31/08/2023

The Düzce-Aksu HEPP is going to be made up of one regulating body, a sedimentation pond, a water conveyance tunnel, a head pond, a valve chamber, penstock, power plant, tail water canal and the switchgear area. The produced electricity is fed to the Turkish National grid via an 8 km transmission line.

The water is entering the weir body and the water collecting area over the Aksu River at the 790.50 m elevation level. The water is then settled in the sedimentation pond before being transferred to the conveyance tunnel. The water that passes through this tunnel is then transferred to the head pond where it is fed to the penstock and is passed to the hydro power plant building where the electricity is produced via turbines. The water then is left back in the Aksu River at the 138.2 m elevation level. How the project activity operates is shown below in Figure 1.

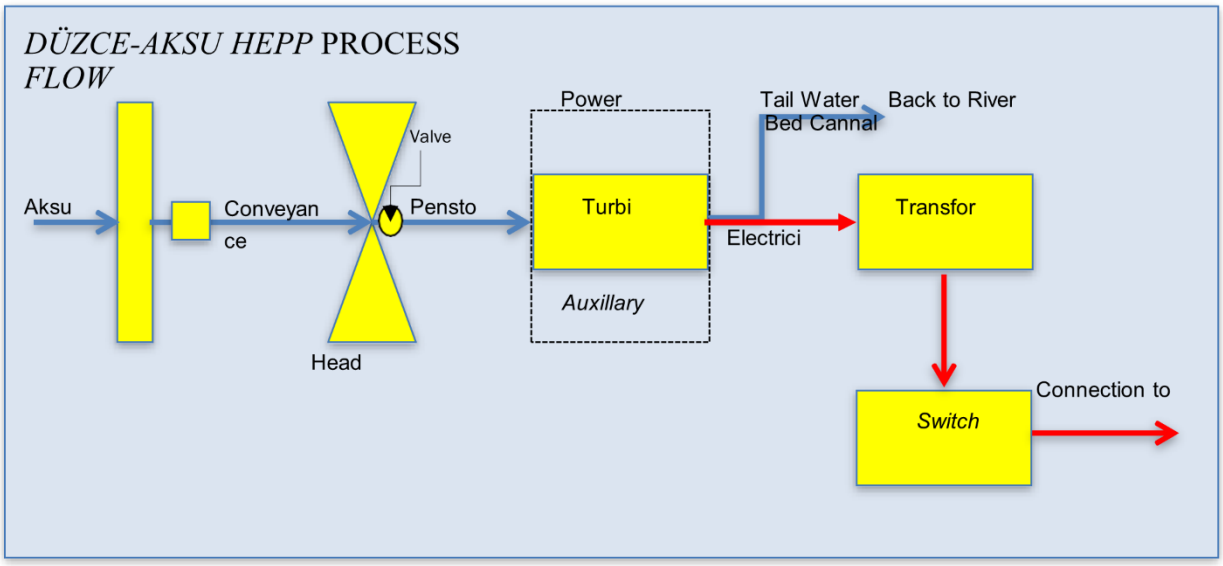

Figure 1. Flow chart showing the basic operational principles of the project activity

The project activity is connected to the grid via the 154 KV Osmanca Transformation Center, as indicated in the connection agreement provided. The project start period is 25/04/2014 and the project has been operational since that day including the monitoring period of 01-January-2022 to 31-August-2023. How the project activity operates is as shown in Figure 1.

There are three diesel generator units in the plant which are AKSA brand and APD 40 A, APD 125 A and APD 200 C types. The APD 40 A type generator has 40 kVA voltage, and the standby power is 32 kW. The APD 125 A type generator has 125 kVA voltage, and the standby power is 100 kW. The APD 200 C type generator has 200 kVA voltage, and the standby power is 160 kW.

Audit Type	Period	Program	VVB Name	Number of years
Validation/ Verification	25-April-2014 – 24-April-2024 (1st crediting period)	VCS	RINA S.p.A (RINA)	10
Verification	25-April-2014 – 30-September-2020 (1st monitoring period)	VCS	KBS Certification Services Pvt. Ltd.	6

Verification	01-October-2020 – 31-December-2021 (2nd monitoring period)	VCS	Carbon Check	~1.5 (14 months)
Verification	01-January-2022 – 31-August-2023 (3rd monitoring period)	VCS	Re-carbon	~2 (20 months)
Total	-	-	-	-

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.Ş.3
Contact person	Özgün Gül Koparan
Title	Environmental Affairs Manager
Address	Gazi Mustafa Kemal Bulvarı 15 Mayıs Mah. 832 Sok. No:2 75.Yıl Esnaf Sarayı K:2 Denizli-Turkey
Telephone	+90 258 242 27 76
Email	ozgun.gulkoparan@aydemenerji.com.tr

1.4 Other Entities Involved in the Project

Organization name	GTE Karbon Sürdürülebilir Enerji Eğt. Dan. ve Tic. A.Ş.
Role in the Project	Project consultant

Contact person	M. Kemal Demirkol
Title	Director
Address	Mustafa Kemal Mah. 2111. Sok. No: 5 06530 Cankaya - Ankara – TURKEY
Telephone	+90 312 514 63 63
Email	kemal.demirkol@gte.com.tr

1.5 Project Start Date

The project start date is 25/04/2014, which is the date when the project started to supply electricity to the Turkish grid as substantiated by the partial acceptance letter sent to the Governance of Düzce Province, Düzce-Turkey.

1.6 Project Crediting Period

The project crediting period is 10 years, 25-April-2014 to 24-April-2024 (both days inclusive). Renewable twice.

1.7 Project Location

The project is located at the Western Part of the Northern Black Sea geographical district of Turkey at the Düzce Province as shown in the location Map below (Figure 1). The nearest settlement to the project site is Taşlı village which is 1 km away from the project location. The coordinates of the weir and the powerhouse are indicated in the below table (Table 2).

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

Component's name	Latitude	Longitude
Weir	40°42'8.07"N	30°57'49.93"E
Powerhouse	40°45'39.31"N	30°59'20.59"E

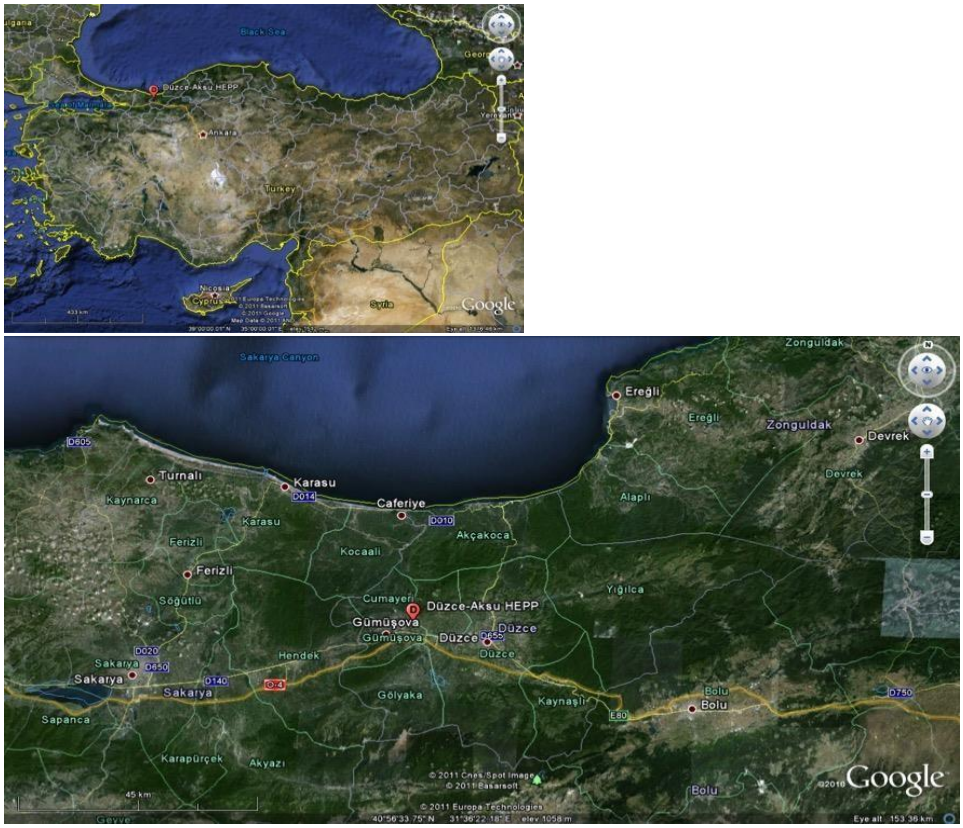

Figure 1. Project location

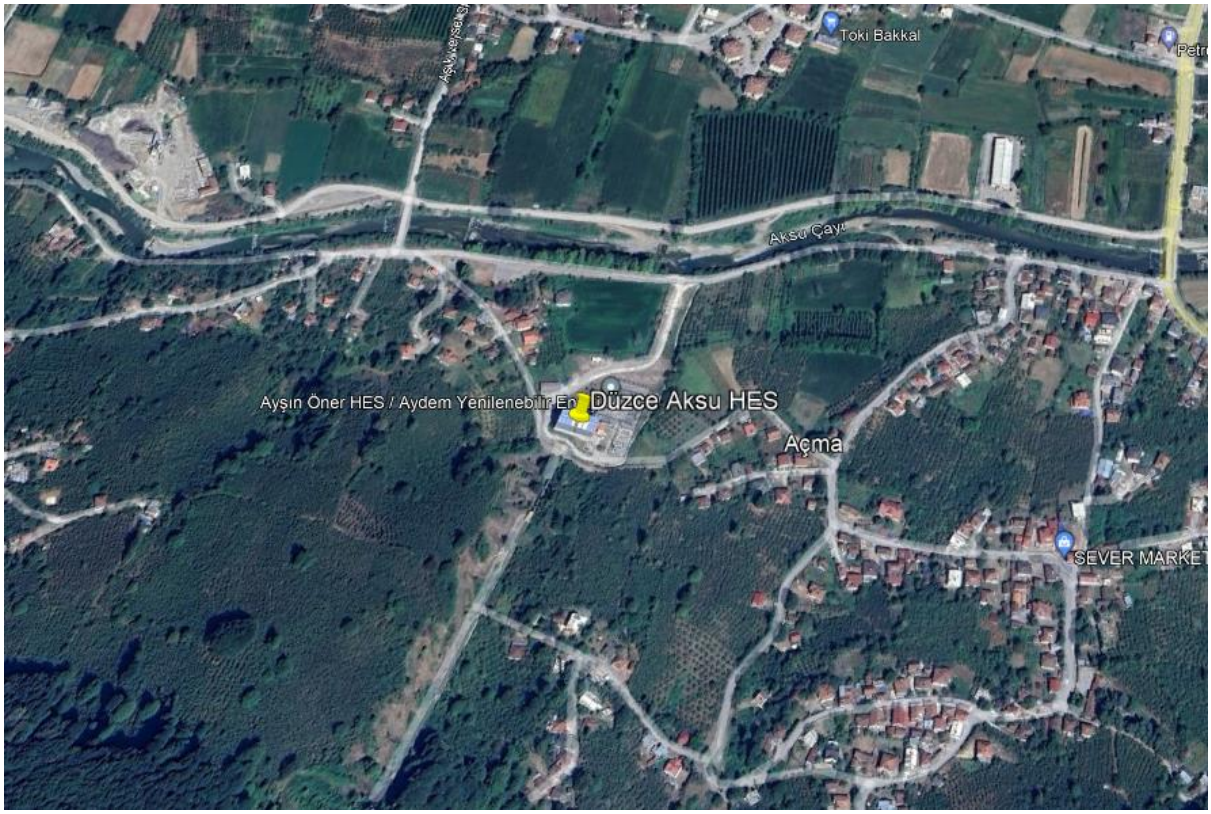

Figure 2. Location of the project activity

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.”[2] Version 16.0.0.

The Approved Methodology refers to the following tools:

- “Tool for the demonstration and assessment of additionality”[3] (Version 07.0)
- “Tool to calculate the emission factor for an electricity system”[4] (Version 07.0)
- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"[5] (Version 03)

[2] https://cdm.unfccc.int/UserManagement/FileStorage/0X6IERWMG92J7V3B8OTKFSL1QZH5PA

[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[5] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

- "Combined tool to identify the baseline scenario and demonstrate additionality"[6] (Version 7.0.0).

Only the following tools are utilized:

- "Tool for the demonstration and assessment of additionality" [7] (Version 07.0.0)
- "Tool to calculate the emission factor for an electricity system"[8] (Version 07.0.0)
- "Tool to determine the remaining lifetime of equipment"[9] (Version 01.0.0)

1.9 Participation under other GHG Programs

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.

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.

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 and Supply Chain (Scope 3) Emissions

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 received any other form of GHG-related environmental credit, including renewable energy certificates, during this monitoring period.

[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf

[7] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[8] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[9] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

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 Düzce- Aksu Hydro Electric Power Plant (HEPP) is delaying the addition of conventional thermal power plants to the Turkish National Electricity Grid.

The project produces total of 187,432 MWh of electricity for this 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.

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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 99,931 tCO_2 into the atmosphere during the monitoring period	By generating electricity from clean sources, project has prevented 482,812 tCO_2 into the atmosphere Over Project Lifetime.
2)	8.5	Job opportunities created	Implemented activities to increase	During the monitoring period 16 employees were recruited.	Total 16 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 187,432 MWh electricity from hydropower which is a renewable source during the monitoring period	The project generated 984,970.3 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:

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 16/03/2022, 27/07/2022, 26/12/2022, 25/05/2023, and 29/05/2023.

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 31/03/2022, 07/09/2022, 20/10/2022, and 11/05/2023. These records include collection of hazardous wastes generated at the site.

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 Dereli 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 11/10/2022.

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. Regular

ecosystem reporting mechanism is applied for the field. A fish passage is constructed to ease up and down stream movements of the fish living in Aksu river.

2.2 Local Stakeholder Consultation

The project owner identified the stakeholders and got into communication with them at the start of the project, on 2010. Among the government authorities, EMRA is a significant stakeholder as they issue the electricity production licence and monitor the realization stages of the project.

The relationship with the local stakeholders deemed to be very important and before the project was implemented a stakeholder's consultation meeting was held at the project site. In addition to this there is a "grievance logbook" in the mosque and mukhtar's office within the vicinity of the project (Taşlık Village) for a continuous grievance policy that is implemented by the project owner.

Every month the PP consults with local stakeholders at the book locations and discuss their grievances as well as positive comments. The demands of the local stakeholders from the project owners has been collected and the necessary actions are conducted. A complaint box has been placed in the mosque of the Taşlık Village, and it has been checked continuously.

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 construction of Düzce Aksu HPP has started in 16.11.2009. Düzce Aksu HPP consists of 2 units with an installed capacity of 46.2 MWe (48.304 MWm) with two pelton type turbines each having a capacity of 23.10 MWe. Both units were commissioned in 25.04.2014, which is also the start date of the project.

Düzce-Aksu HEPP, that is built on Aksu River. The tyrolean type weir is approximately at the elevation of 790.50 m. Düzce-Aksu HEPP utilizes approximately (net) 645 m of potential energy difference to produce electricity. Düzce-Aksu HEPP with 46.20 MW installed capacity, is connected to the Turkish National Power Grid via one of Transformer Substations by 23 km long 154 kV Hendek-Osmanca transmission line. The project involves collecting of water, at the 645.50 m level, by the help of a weir and a water intake body. After that the water is kept at the sedimentation pond and passes to a conveyance tunnel of approximately 5 km long, then is transferred to the penstock via a head pond, the water that enters to the penstock then be transferred to two turbine units, each with 23.1 MW capacity. The two turbines are housed within the Hydro Electricity Power Plant (HEPP) building. The water that hit these two turbines, then leave the turbines via the tail water canal and a spillway which is located at a level of approximately 138 m.

No major shutdown was observed during the monitoring period. Some minor failures in electricity generation have occurred due to drought and maintenance activities. Meters are checked and controlled everyday by the Operational Team (Table 5). Also, the data from these metering devices are recorded by TEIAS on monthly agreed protocols. Necessary tests were carried out regularly in the metering devices during the monitoring period and no problems were encountered.

Since the start date of the project, there is no special event that may have impact on monitoring of GHG emission reductions.

Details of the current meters have been given in table below.

Table 4. Meter details

Meter Details	Main Meter (current)	Spare Meter (current)
Serial Number	10172379	10172380
Brand	EMH	EMH
Calibration Year	2021	2021
Valid Until	2031	2031
Accuracy Class	0.2-0.5S (Active-Reactive)	0.2-0.5S (Active-Reactive)
Test Dates	29/09/2023	29/09/2023

First Index Date	13/06/2021	13/06/2021

The single line diagram of the project activity is shown in the figure below.

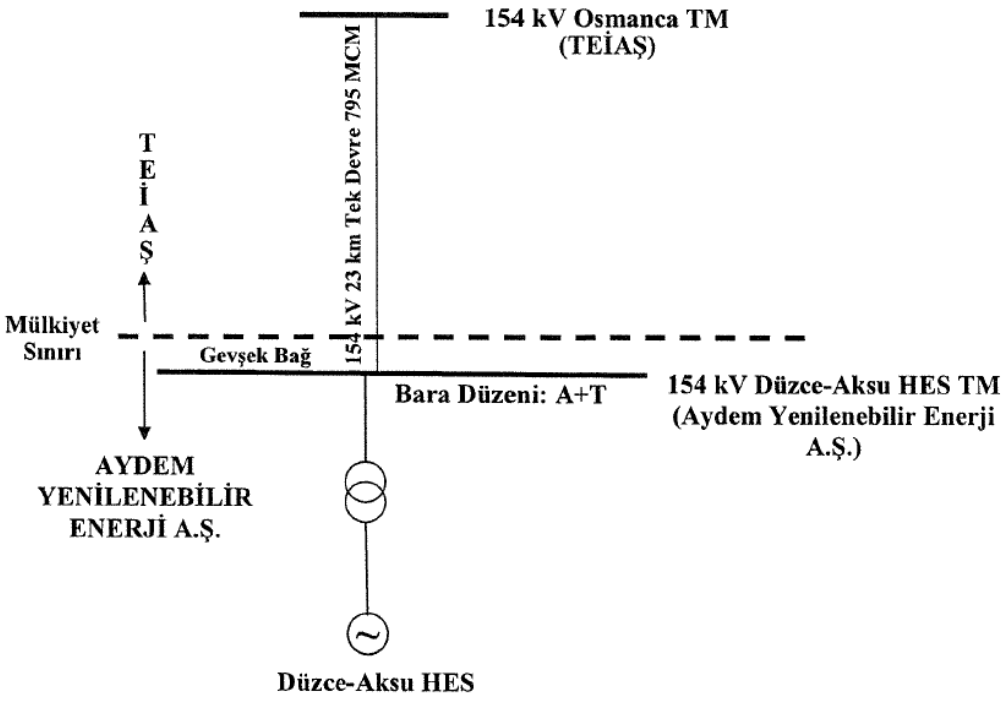


Figure 3. Single line diagram of Düzce-Aksu HEPP

3.2 Deviations

3.2.1 Methodology Deviations

The UNFCCC methodology of ACM0002 (version 16.0.0) 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 Düzce Aksu 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 (like the Düzce Aksu HPP)[10] and changed the ownership as Aydem Yenilenebilir A.Ş on 24/12/2019 as stated in official gazette with registration number of 13798[11].

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 23/03/2020", it has been found that the testing of energy meters will be carried out every 2 years. This will be applicable from the date of replacement of new meters i.e. from 13/06/2021.

The reservoir surface area (A_{PJ}) was indicated as 708,202 m^2 in both PD version 2.03 and MR version 1.03. However, this value was an error due to the character language i.e. "," and ".". The real value was 708.282 m^2 (i.e. 708.3 m^2) as per the technical drawing provided in Appendix-3. The error was corrected by the project proponent in this monitoring period and new A_{PJ} was determined to be 707 m^2 for the current monitoring period (01-January-2022 to 31-August-2023) as per the lake surface area map provided in Appendix-2.

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	$FC_{i,y}$
Data unit	Mass or Volume Unit (Tons or cubic meter)
Description	Amount of fuel i consumed by relevant power plants in Turkey in years, 2009, 2010, 2011
Source of data	Turkish Electricity Transmission Company (TEIAŞ) Web Site [12]

[10] EPDK License
[11] Official Gazette with registration number of 13798

[12] https://www.teias.gov.tr/tr-TR/turkiye-elektrik-uretim-iletim-istatistikleri

Value applied	Please see Appendix 2 (Table 1) in the validated PD (version 2.03)
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to date and reliable data available for the Turkish grid.
Purpose of Data	Data used for the calculation of $EF_{grid,OM,Simple,y}$
Comments	

Data / Parameter	NCV
Data unit	GJ/Mass or Volume Unit
Description	Net Calorific Values for fossil fuels in years 2009, 2010 and 2011
Source of data	Turkish Electricity Transmission Company Web Site[13]
Value applied	Please see Appendix-2 –Table 5 in the validated PD (version 2.03).
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to date and reliable data available for the Turkish grid.
Purpose of Data	Data used for the calculation of $EF_{grid, OM,Simple,y}$. As data on the NCV is not published directly on the TEİAŞ website, this data is calculated using the heating values of fuels and the volume or mass of fuels consumed for each year.
Comments	

Data / Parameter	$EF_{CO_2,i,y}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied	Please see Appendix 2-Table 2 in the validated PD (version 2.03)

[13] https://www.teias.gov.tr/tr-TR/turkiye-elektrik-uretim-iletim-istatistikleri

Justification of choice of data or description of measurement methods and procedures applied	According to the "Tool to calculate the emission factor for an electricity system" version 2, if values provided by the fuel supplier of the power plants in invoices or regional or national average defaults values are not available the IPCC default values at the lower limit of uncertainty must be used.
Purpose of Data	Data used both for the calculation of $EF_{grid},OM_{,Simple,y}$ and $EF_{EL,m,y}$
Comments	

Data / Parameter	EGy
Data unit	MWh
Description	Net electricity generated in the project electricity system in other words, net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost - must-run power plants - units, in year y
Source of data	Turkish Electricity Transmission Company Web Site
Value applied	Please see Appendix 2, Table 3, and Table 4 in the validated PD (version 2.03).
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to-date and reliable data available for the Turkish grid.
Purpose of Data	Data used for the calculation of EFgrid, OM,Simple,y
Comments	

Data / Parameter	EGm,y
Data unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit m in year y
Source of data	Turkish Electricity Transmission Company Web Site[14]. Data is extracted from the relevant annexes of the capacity projection reports for the years 2010, 2011, and 2012[15].
Value applied	Please see Appendix-2-Table 8 in the validated PD version 2.03
Justification of choice of data or description of	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published

[14] https://www.teias.gov.tr/tr-TR/turkiye-elektrik-uretim-iletim-istatistikleri

[15] https://www.elektrikport.com/uploads/content/TEIAS%20Uretim%20Kapasite%20Projeksiyonu%202011-2020.pdf

measurement methods and procedures applied	on the TEİAŞ website is the most up-to-date and reliable data available for the Turkish grid.
Purpose of Data	Data used for the calculation of $EF_{grid,BM,y}$
Comments	

Data / Parameter	$\eta_{m,y}$
Data unit	-
Description	Average net energy conversion efficiency of power unit m in year y
Source of data	The default values provided at the Annex 1 of the "Tool to calculate emission factor for an electricity system (Version 5.0, EB87Annex 9)" are used
Value applied	Please see Annex 2 in the validated PD version 2.03.
Justification of choice of data or description of measurement methods and procedures applied	According to the "tool to calculate emission factor for an electricity specifications or data from the utility, the dispatch center or official records are not available then the default values given in Annex 1 of the shall be used. The first two options are not available for the power plants supplying the Turkish grid; therefore, the default values are used.
Purpose of Data	Data used for the calculation of $EF_{grid,BM,y}$
Comments	

4.2 Data and Parameters Monitored

Data / Parameter	EG_y
Data unit	MWh
Description	Electricity
Source of data	Net Amount of Electricity supplied to the "Turkish National Grid" by the proposed project
Description of measurement methods and procedures to be applied	Data is measured directly from meters and records on TEIAS readings protocol papers.

<table>
<tr><td>Frequency of monitoring/recording</td><td>Annually</td></tr>
<tr><td>Value monitored</td><td>187,432 MWh</td></tr>
<tr><td>Monitoring equipment</td><td>Data is monitored continuously by redundant metering devices. The recording meter is in compliance with the communiqué for Metering Devices to be used in the Electricity Market. By regulation, the accuracy class is 0.2%.
Main Electricity Meter: ITRON, Serial Number: 65000766
Back-up Electricity Meter: ITRON, Serial Number: 65000767

Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market[8]. They have an accuracy class of Class 002 indicating an accuracy range of 0.2%.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>There are two meters that backup each other. Generated electricity is also monitored via the operator by the help of EPİAŞ trading software for internal monitoring.
The Calibration dates of the meters and their validity is as follows:
<table>
<tr><th></th><th>Main Meter (current)</th><th>Spare Meter (current)</th><th>Old Main Meter (Replaced on 13/06/2021)</th><th>Old Spare Meter (Replaced on 13/06/2021)</th></tr>
<tr><td>Serial no.</td><td>10172379</td><td>10172380</td><td>65000766</td><td>65000767</td></tr>
<tr><td>Brand-(Type)</td><td>EMH</td><td>EMH</td><td>ITRON (SL761B071)</td><td>ITRON (SL761B071)</td></tr>
<tr><td>First Index Date</td><td>13/06/2021</td><td>13/06/2021</td><td>26/04/2014</td><td>26/04/2014</td></tr>
<tr><td>Calibration due date</td><td>13/06/2031[16]</td><td>13/06/2031[17]</td><td>NA</td><td>NA</td></tr>
<tr><td>Calibration frequency</td><td>10 years</td><td>10 years</td><td>10 years</td><td>10 years</td></tr>
<tr><td>Test Due Date</td><td>13/06/2023</td><td>13/06/2023</td><td>NA</td><td>NA</td></tr>
<tr><td>Test frequency</td><td>2 years</td><td>2 years</td><td>NA</td><td>NA</td></tr>
</table></td></tr>
</table>

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

	Class	0.2-0.5S (Active-Reactive)	0.2-0.5S (Active-Reactive)	0.5-2.0S (Active-Reactive)	0.2-0.5S (Active-Reactive)
Purpose of the data	Data to be used for the calculation of Baseline Emissions.				
Calculation method	Direct Continuous Measurement				
Comments	The collected data is kept by Düzce Aksu Elektrik Üretim A.Ş. During the crediting period and until two years after the last issuance of VERs for the "Düzce-Aksu Hydro Electricity Power Plant" project activity for that crediting period.				

Data / Parameter	Cap_{PJ}
Data unit	W
Description	Installed capacity of the hydropower plants after the implementation of the Project Activity.
Source of data	Measured
Description of measurement methods and procedures to be applied	Project site computers with SCADA system and the turbine name plates.
Frequency of monitoring/recording	Observed via the SCADA system of the Project Activity
Value monitored	Once for each monitoring period
Monitoring equipment	46,200,000
QA/QC procedures to be applied	SCADA system of the Project Activity
Purpose of the data	Can be confirmed also by the parameter readings on the design plates of each turbine and by summing the two units.
Calculation method	N/A
Comments	-

Data / Parameter:	A_{PJ}
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 at its maximum fullness.

Measured /Calculated /Default:	Indirectly measured based on the reservoir area map provided in Appendix-2.
Source of data:	Surface area determined using the lake surface area map provided in Appendix-2.
Description of measurement methods and procedures to be applied:	The reservoir area corresponding to maximum operational level has been determined via the topographic satellite images showing the lake area, presented in Appendix-2.
Frequency of monitoring/recording:	Once during each monitoring period
Value applied:	707 m^2
Monitoring equipment:	-
QA/QC procedures to be applied:	The value checked and compared to satellite imagery available by Google Earth.
Purpose of the data:	Data to be used for the calculation of Baseline Emissions.
Calculation method:	N/A
Any comment:	-

4.3 Monitoring Plan

Objectives of the monitoring program

The Monitoring plan is developed to ensure that the Project Activity is well organized from the start in terms of the collection and archiving of complete and reliable data that is needed to ensure reliable and accurate measurements of actual emission reductions.

Data to be monitored

Given that the emission factor is calculated on an ex-ante basis, the first data to be monitored is the net electricity supplied to the grid.

The second data to be monitored is the installed capacity of the Project Activity. Using the SCADA system installed capacity is measured automatically.

The third data to be monitored is the reservoir area of the Project Activity. The reservoir area corresponding to maximum operational level has been determined as a certain value according to the topographical maps. In order to make verification of the reservoir area, the reservoir lake is compared to the reservoir area map, presented in Appendix 2.

The electricity produced is sold to TEİAŞ. Therefore, TEİAŞ measures the electricity produced by two meters placed on the switchgear station where the power plant gets connected to the Turkish national grid. Those meters provide official data which is 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 are checked continuously if there is a difference of 0.5 % in the readings of the main and the auxiliary meters, the calibration is repeated.

The net electricity produced is calculated by subtracting the total electricity consumed by the hydroelectric power plant, from the gross electricity generation and a certain percentage is lost during the transmission. After obtaining the net electricity production value, the emission reductions are 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. Positions and responsibilities of the VER monitoring team members

Position	Responsibility
Düzce-Aksu HEPP Manager	Day to day operation of the Düzce-Aksu 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 DÜZCE AKSU HEPP can be cross checked, via the TEİAŞ – EPİAŞ web site[18] 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.

The two electricity metering devices were replaced with new ones on 13/06/2021 as the previous ones reached their end of validity period of 10 years.

Meter Details	**Main Meter (current)**	**Spare Meter (current)**	**Main Meter (old)**	**Spare Meter (old)**
Serial Number	10172379	10172380	65000766	65000767
Brand	EMH	EMH	ITRON	ITRON
Calibration Year	2021	2021	2011	2011
Valid Until	2031	2031	2021	2021
Accuracy Class	0.2-0.5S (Active-Reactive)	0.2-0.5S (Active-Reactive)	0.5-2.0S (Active-Reactive)	0.2-0.5S (Active-Reactive)
Test Dates	29/09/2023	29/09/2023	25/11/2013	25/11/2013
First Index Date	13/06/2021	13/06/2021	26/04/2014	26/04/2014

The collected data is kept by Düzce Aksu Elektrik Üretim A.Ş. During the crediting period and until two years after the last issuance of VERs for the “Düzce-Aksu Hydro Electricity Power Plant” project activity for that monitoring period.

The single line diagram of the project activity is shown in the figure below.

[18] https://seffaflik.epias.com.tr/transparency

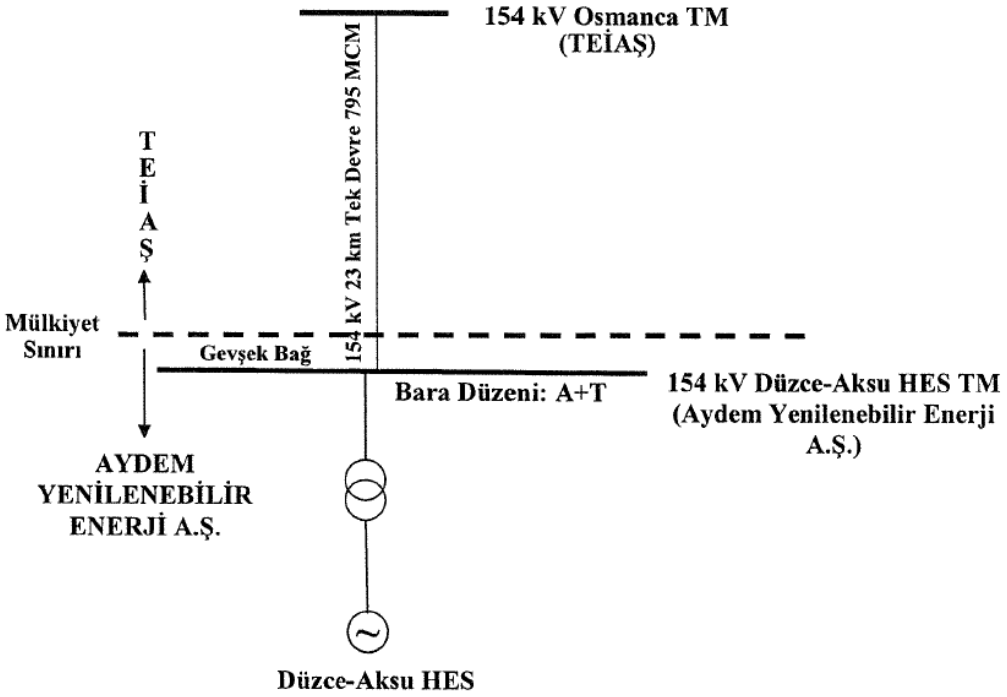


Figure 4. Single line diagram of Düzce-Aksu HEPP

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

$$187{,}432\ MWh \times 0.5332\ tCO_2/MWh = 99{,}931\ tCO_2$$

$$BE_y = 99{,}931\ \ tCO_2$$

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 46.200 MWe installed capacity and 707 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} = 46,200,000 We

Cap_{BL} = 0.0 W

A_{PJ} = 707 (m^2)[19]

A_{BL} = 0.0 (m^2)

Therefore, PD is calculated as follows;

[19] Reservoir area, Appendix 2

$$PD = \frac{46{,}200{,}000 - 0}{707 - 0}$$

$$PD = 65346.53\ W - m^2$$

Since the power density (PD) of the project activities is greater than 10 W/m^2, Project Emissions (PE) are considered 0.[20]

5.3 Leakage

The energy generating equipment is not transferred from or to another activity. Therefore, leakage is also considered as "0", according to the ACM0002 "Grid-connected electricity generation from renewable sources" methodology, version 16.0.

$$LE_y = 0$$

5.4 Net GHG Emission Reductions and Removals

Total Emission Reduction has been determined as;

$$ER_y = BE_y - PE_y - LE_y$$

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)

The project emissions and leakage are considered as "0". Thus, ERy = BEy

Table 6. Calculations for net total values

EGy	**Net Generation (MWh) During Monitoring Period**	**187,432**
EFy	**Emission Factor (tCO_2-MWh)**	**0.5332**[21]

[20] ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources." Ver 16
[21] Fixed ex-ante CM as per Section 4.3. og registered PD

BEy	Baseline emissions in year y (tCO2) During Monitoring Period	99,931
PEy	Project Emissions (tCO_2)	0
LEy	Leakage Emissions (tCO_2)	0
ERy	Net Emission Reduction (tCO_2) During Monitoring Period	99,931

Thus, the net emission reduction (in tons CO_2) in this monitoring period (01/01/2022 to 31/08/2023) is calculated as given in table below.

Table 7. 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)
2022	55,152	0	0	55,152
2023 (01/01/2023 – 31/08/2023)	44,779	0	0	44,779
Total	**99,931**	**0**	**0**	**99,931**

Total emission reductions were realized as 99,931 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 (141,370 MWh-year) is considered, the total emission reductions should be approximately 125,637 tCO_2 for the monitoring period (20 months). Percent difference is calculated as 20.5%, which means the project reduced 20.5% less CO_2 than the estimated amount. Since the project is a HEPP, seasonal effects are significant on the monthly generation rates and deviations from the calculated values are acceptable. 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 8. 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)
2022	141,370	75,382	103,443	55,152
2023	94,247	50,255	83,988	44,779
Total	**235,617**	**125,637**	**187,432**	**99,931**

Ex-ante emissions reductions /removals	Achieved emissions reductions /removals	Percent difference	Justification for the difference
125,637	**99,931**	20.5%	Since the project is a HEPP, seasonal effects are significant on the monthly generation rates and deviations from the calculated values are acceptable.

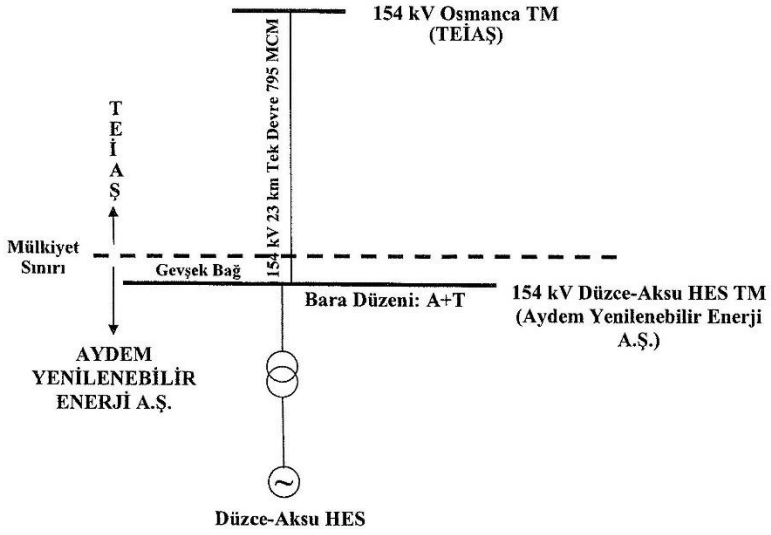
APPENDIX 1: SINGLE LINE DIAGRAM

BAĞLANTI ANLAŞMASI

EK-3
MÜLKİYET SINIRLARI

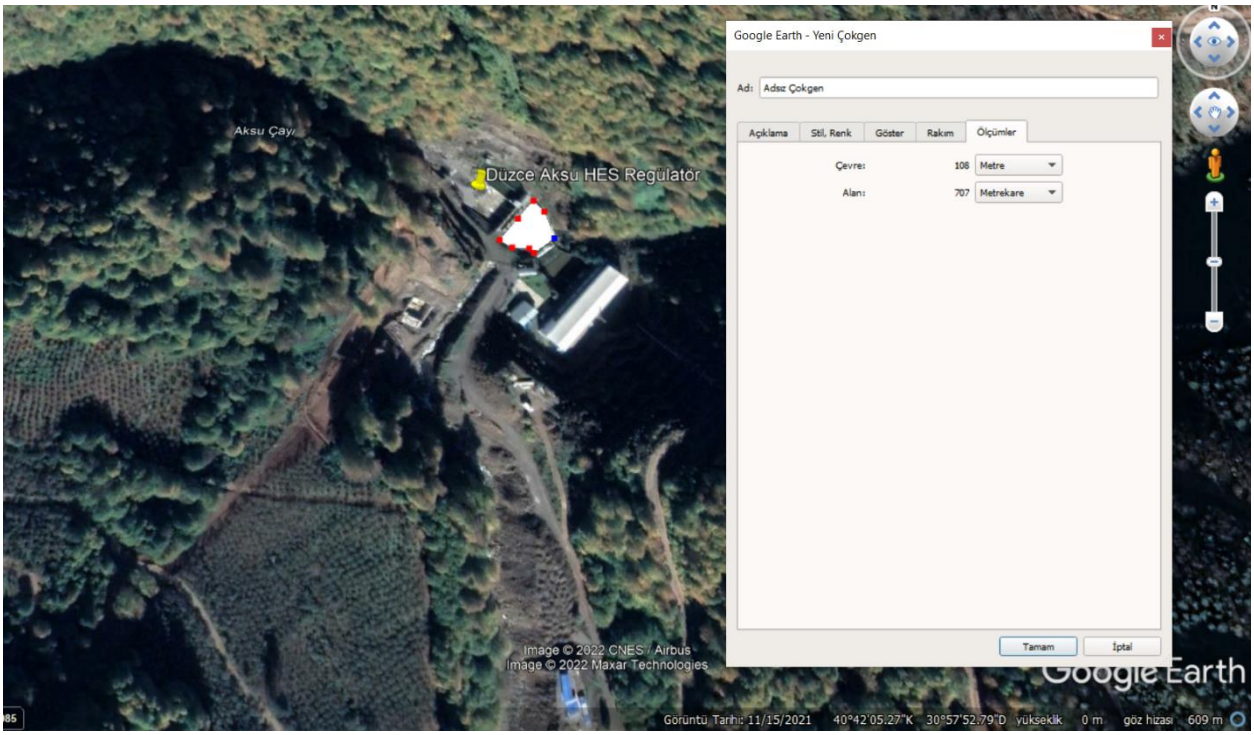
a) **Mülkiyet sınırının yazılı ifadesi: :** Üretim Tesisi Şalt Sahasından sonraki nihayet direği ile Üretim Tesisi Şalt Sahası arasındaki gevşek bağlantı hariç, tesis edilecek enerji iletim hatları TEİAŞ'ın mülkiyetindedir.

b) **Mülkiyet sınırının Prensip Tek Hat Şeması üzerinde gösterimi:**



14

APPENDIX 2: RESERVOIR AREA



APPENDIX 3: RESERVOIR AREA USED IN PD VER 2.03