DUZCE AKSU HYDRO ELECTRICITY POWER PLANT

Document Prepared by GTE Karbon Sürdürülebilir Enerji Eğt. Dan. ve Tic. A.Ş.

Project title	Duzce Aksu Hydro Electricity Power Plant
Project ID	2095
Monitoring period	01-September-2023 to 24-April-2024
Original date of issue	17-September-2025
Most recent date of issue	22-October-2025
Version	06
***VCS Standard* Version**	4.7
Prepared by	Mustafa Kemal Mah. 2111. Sok. No: 5 06530 Cankaya - Ankara – TURKEY +90 312 514 63 63 kemal.demirkol@gte.com.tr www.gte.com.tr

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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 141,370.00 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 70,539.15 MWh, and the Project Activity led to an emission reduction of 37,609 tons CO_2e for this monitoring period (01-September-2023 to 24-April-2024). The project is already implemented and has been generating electricity continuously since commissioning.

The purpose of the project is to supply electricity to the Turkish power grid, from a renewable source.

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

According to the applied methodology ACM0002[2], 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 following table summarizes the project milestones.

Table 1. Milestones of Duzce Aksu Hydro Electricity Power Plant

Event	Date
Turn Key contract signed between Düzce-Aksu and Bereket Enerji	03-December-2009
Name Change from Bereket Enerji to AYDEM Enerji	29-December-2019
Generation License (granted by EMRA for AYDEM Yenilebilir Enerji Anonim Şirketi)	24-October-2019
Connection Agreement	20-March-2020
System Usage Agreement	23-March-2020
Water usage agreement	27-July-2020
EIA Exemption	16-July-2007
Commissioning date of Turbine 1 and Turbine 2	25-April-2014
The first crediting period	25-April-2014 – 24-April-2024
The first monitoring period	25-April-2014 – 30-September-2020
The second monitoring period	01-November-2020 – 31-December-2021
The third monitoring period	01-January-2022 – 31-August-2023
The fourth monitoring period	01-September-2023 – 24-April-2024

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

[2] https://cdm.unfccc.int/UserManagement/FileStorage/D5YFS9I3VKBT18MQNGX0LPZ6U7AWCO

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.

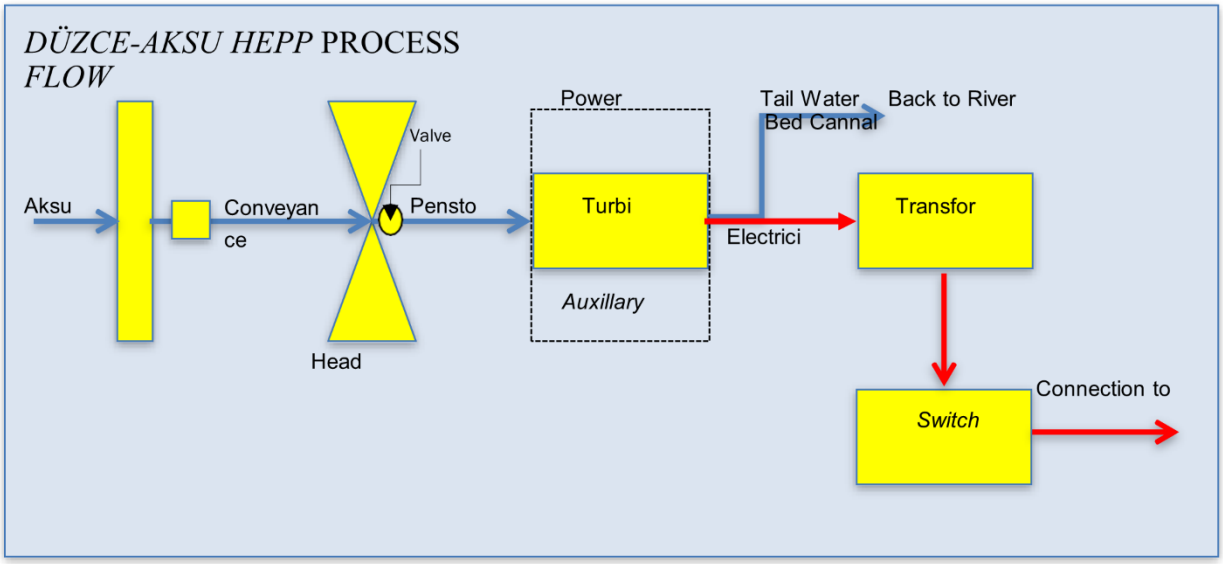

Figure 1. Flow chart showing the basic operational principles of the project activity

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 this monitoring period of 01-September-2023 to 24-April-2024.

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.

1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation	25-April-2014 – 24-April-2024 (1st crediting period)	*VCS*	*RINA Services S.p.A (RINA)*	*Ten years*
Verification	25-April-2014 – 30-September-2020 (1st monitoring period)	*VCS*	*KBS Certification Services Pvt. Ltd.*	*Six years*

Verification	01-October-2020 – 31-December-2021 (2nd monitoring period)	*VCS*	*Carbon Check*	*~1.5 years (14 months)*
Verification	01-January-2022 – 31-August-2023 (3rd monitoring period)	*VCS*	*Re-carbon*	*~2 years (20 months)*
Verification	01-September-2023 – 24-April-2024 (4th monitoring period)	*VCS*	*RINA Services S.p.A (RINA)*	*~1 year (8 months)*

1.3 Sectoral Scope and Project Type

Sectoral scope[3]	Sectoral Scope 1: Energy Industries
Project activity type	Renewable — Non-renewable Sources

1.4 Project Proponent

Organization name	Aydem Yenilenebilir Enerji A.Ş.
Contact person	Özgün Gül Koparan
Title	Environmental Affairs Manager
Address	Gazi Mustafa Kemal Bulvarı 15 Mayıs Mah. 832 Sok. No:275.Yıl Esnaf Sarayı K:2 Denizli-Turkey
Telephone	+90 258 242 27 76
Email	ozgun.gulkoparan@aydemenerji.com.tr

[3] *Projects, activities, or methodologies may be developed under any of the 16 VCS sectoral scopes: https://verra.org/programs/verified-carbon-standard/vcs-program-details/#sectoral-scopes*

1.5 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

1.6 Project Start Date

Project start date	25-April-2014
Justification	This is the date of the provisional acceptance of the units.

1.7 Project Crediting Period

Crediting period	☐ *Seven years, twice renewable* ☐ *Ten years, fixed* ☒ *Other (state the selected crediting period and justify how it conforms with the VCS Program requirements)*
Start and end date of first or fixed crediting period	25-April-2014 to 24-April-2024 (1st Crediting Period, both days included) The project has been registered under previous versions of the Project Standard, v3.7[4], which states that the 10 year crediting period of the project activity can be renewed twice. The duration of the crediting period of the project activity cannot be changed during revalidation.

[4] https://verra.org/wp-content/uploads/2022/12/PREVIOUS-VERSION-VCS-Standard-v3.7.pdf

1.8 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. The nearest settlement to the project site is Taşlık village which is 1 km away from the project location. The coordinates of the weir and the powerhouse are indicated in the table below.

Table 2. Geographical coordinates 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

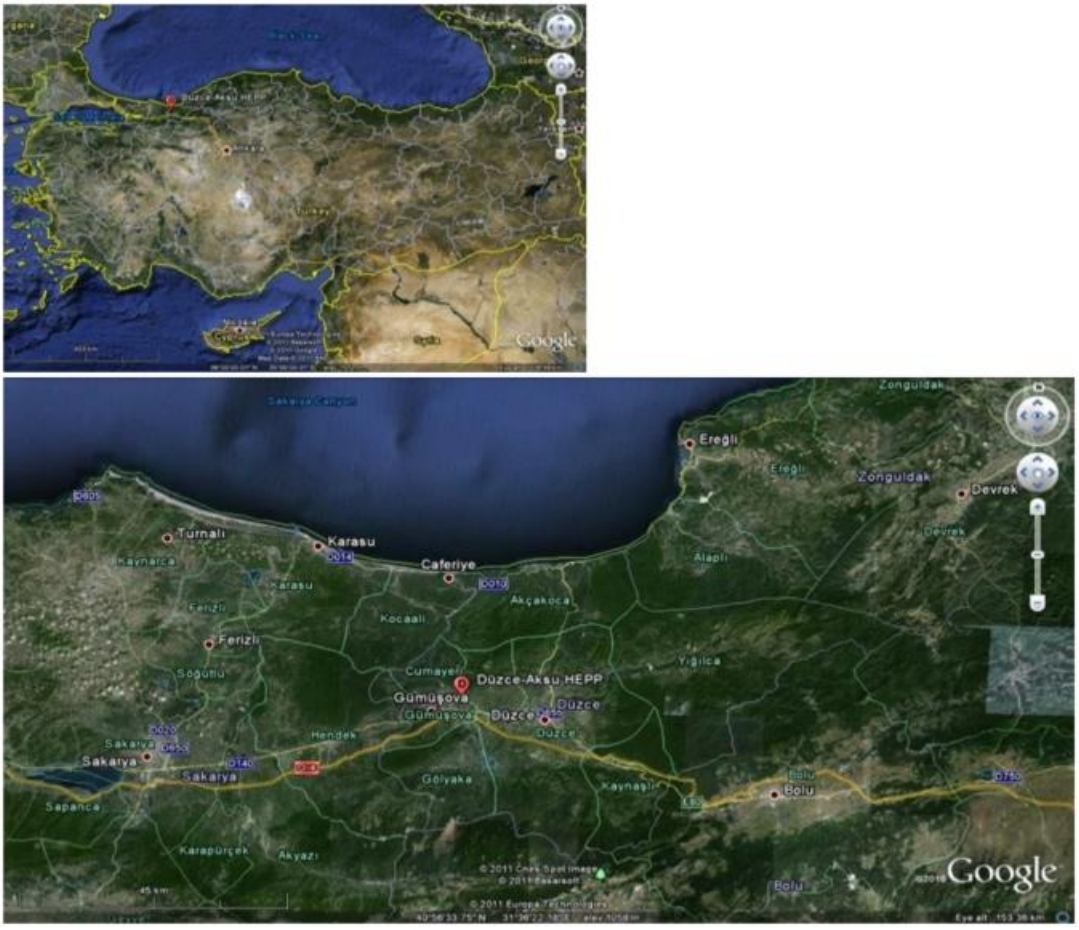

Figure 2. Project location

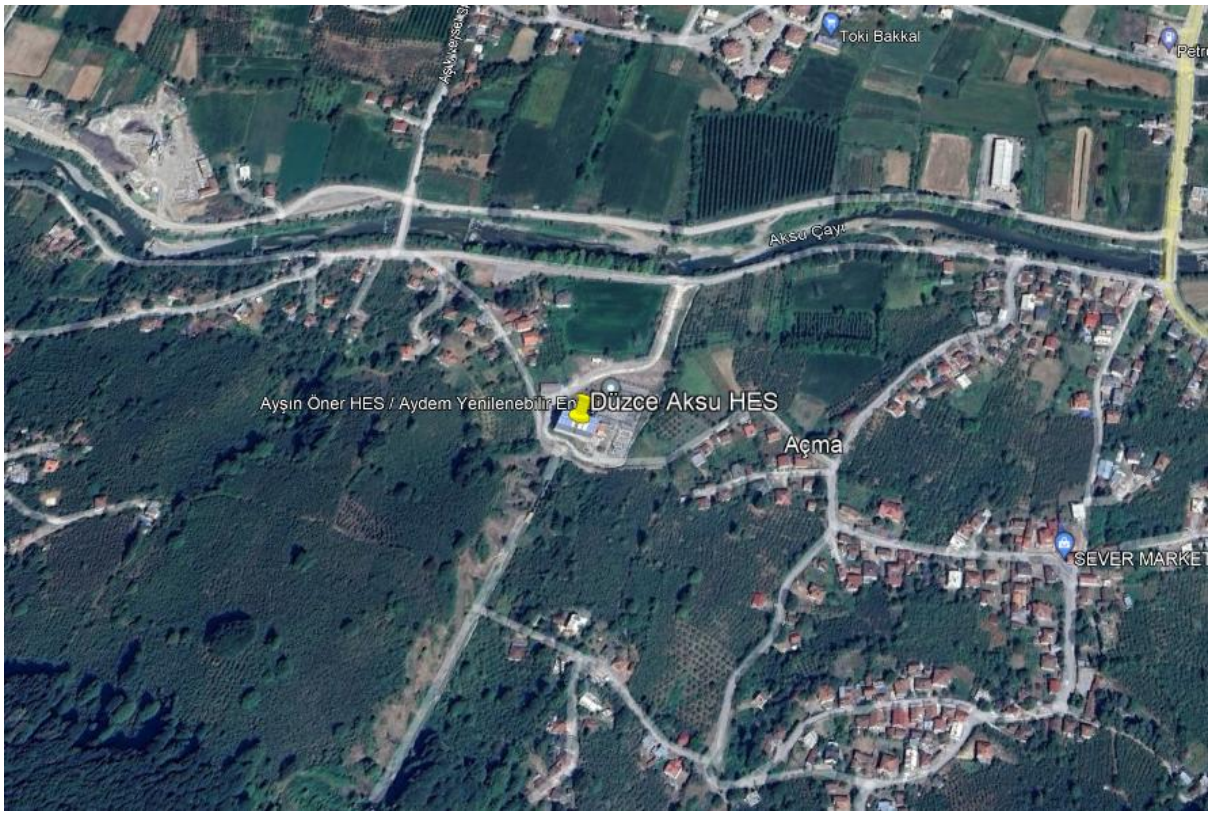

Figure 3. The screenshot of the satellite image of the project location

1.9 Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	*ACM*0002	Large-scale Consolidated Methodology: Grid-connected electricity generation from renewable sources	16.0[5]
Tool	TOOL07	*Tool to calculate the emission factor for an electricity system*	07.0.0[6]

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

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

1.10 Double Counting and Participation under Other GHG Programs

1.10.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

1.10.2 Registration in Other GHG Programs

Was the project registered or seeking registration under any other GHG programs?

☐ Yes ☒ No

1.11 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

1.11.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the *VCS Program Definitions* for definitions of emissions trading program and binding emission limit.

☐ Yes ☒ No

1.11.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the *VCS Program Definitions* for definition of GHG-related environmental credit system.

☐ Yes ☒ No

1.11.3 Supply Chain (Scope 3) Emissions

Do the project activities affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

☐ Yes ☒ No

1.12 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 70,539.15 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.

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	Tonnes of greenhouse gas emissions avoided	Implemented activities to increase	By generating electricity from clean sources, project has prevented 37,609 tCO_2 into the atmosphere during the monitoring period	By generating electricity from clean sources, project has prevented 520,421 tCO_2 into the atmosphere Over Project Lifetime.
2)	8.5	Job opportunities created	Implemented activities to increase	During the monitoring period 15 employees were recruited.	Total 15 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 70,539.15 MWh electricity from hydropower which is a renewable source during the monitoring period	The project generated 1,055,509.8 MWh electricity from hydropower which is a renewable source over project lifetime

1.13 Commercially Sensitive Information

N/A

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

2.1.1 Stakeholder Identification

Stakeholder Identification	Through consultation meetings, stakeholders are identified.
Legal or customary tenure/access rights	No expropriation was required during the implementation period. There are no lands which was occupied by IPs.
Stakeholder diversity and changes over time	There were no changes in the stakeholder diversity. The locals of the nearby villages are the stakeholders.
Expected changes in well-being	The project does not have any negative impacts.
Location of stakeholders	Near places to the plant, Taşlık Village.
Location of resources	Taşlık village which is a close settlement at the project site.

2.1.2 Stakeholder Consultation and Ongoing Communication

Ongoing consultation	The ongoing communication with stakeholders is achieved with a “grievance logbook” in easily reachable places to the stakeholders.
Date(s) of stakeholder consultation	2010 (during the start of project)
Communication of monitored results	Local stakeholders were able to communicate with the project site personnel verbally to share their grievances and inputs in a Continuous Input / Grievance Expression Process

	Book. A book was provided by PP is available with Chief of HPP to note down Input / Grievance Expression if any local stakeholder would like to share. The grievance might be negative as well as positive could be provided by local stakeholders related to operation of the project activity.
Consultation records	There was a "grievance book" in the mukhtars' office in the vicinity of the project for a continuous grievance policy that is implemented by the project owner.
Stakeholder input	Stakeholders did not report any critical issues regarding the Project activity. Therefore, there is no need to revise the Project.

2.1.3 Free, Prior, and Informed Consent

Consent	In these meetings general information about the construction site, duration of the construction and cost of the project, technical information about the equipment's to be used at the project, the potential environmental impacts and the measures to be taken are presented to the stakeholders.
Outcome of FPIC	There is no outcome for FPIC.

2.1.4 Grievance Redress Procedure

No grievance has been raised during the monitoring period of this project.

Grievances received	Resolution and outcome
No grievance received from the stakeholders.	-
	…

2.1.5 Public Comments

There were not any positive or negative comments coming from public itself.

Summary of comments received	Actions taken

No positive or negative comments received from the stakeholders.	-
…	….

2.2 Risks to Stakeholders and the Environment

2.2.1 Management Experience

The project owner periodically provides necessary trainings to employees. The records of the trainings have been provided to VVB.

2.2.2 Risk assessment

There is no risk identified for the project activity.

Risk identified		Mitigation or preventative measure(s) taken
Natural and human-induced risks to stakeholders' wellbeing	There is no risk identified for the stakeholder's wellbeing.	-
Risks to stakeholder participation	There is no risk identified for the stakeholder participation.	-
Working conditions	There is no risk identified for the working conditions.	-
Safety of women and girls	There is no risk identified for the safety of women and girls.	-
Safety of minority and marginalized groups, including children	There is no risk identified for the safety of minority and marginalized groups, including children.	-
Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)	There is no risk identified for any environment (air, water, soil, etc…)	-

2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

No discrimination or sexual harassment has occurred.

	Risks identified[7]	Mitigation or preventative measure(s) taken
Discrimination	No risk identified	Türkiye has ratified ILO convention 100, 111, 122 and 142. All the workers are socially secured by the PO and protected by employment agreements.
Sexual harassment	No risk identified	Türkiye has ratified ILO convention 100, 111, 122 and 142. All the workers are socially secured by the PO and protected by employment agreements.
Gender equity in labor and work	No risk identified	Türkiye has ratified ILO convention 100, 111, 122 and 142. All the workers are socially secured by the PO and protected by employment agreements.
Forced labor	No risk identified	Türkiye has ratified ILO convention 100, 111, 122 and 142. All the workers are socially secured by the PO and protected by employment agreements.
Child labor	No risk identified	Türkiye has ratified ILO convention 100, 111, 122 and 142. All the workers are socially secured by the PO and protected by employment agreements.
Human trafficking	No risk identified	Türkiye has ratified ILO convention 100, 111, 122 and 142. All the workers are socially secured by the PO and protected by employment agreements.

[7] The identified risks and commensurate mitigation or preventative measure(s) for forced labor, child labor, and human trafficking, must be inclusive of staff and contracted workers employed by third parties.

2.3.2 Human Rights

The PO recognizes, respects, and promotes the protection of the rights of LCs, and customary rights holders in line with applicable international human rights law. Türkiye has ratified ILO convention[8]. PO will never be complicit in violence or human rights abuses. If any complaint is received by the PO, they will act on the issue right away throughout the lifetime of project activity.

Risks identified	Mitigation or preventative measure(s) taken
No risks identified	-

2.3.3 Indigenous Peoples and Cultural Heritage

There are no lands which was occupied by IPs. This section is not applicable.

Risks identified	Mitigation(s) or preventative measure taken
No risks identified	-

2.3.4 Property Rights

No expropriation was required during the implementation period. There are no lands which was occupied by IPs. The project site is not a private land. On the contrary it is a government land that classified as forestry area. The property is leased to the project owner by the government until the end of the generation license.

Risks identified	Mitigation or preventative measure(s) taken
No risks identified	-

2.3.5 Benefit Sharing

The project does not impact property rights. So this section is N/A.

Summary of the benefit sharing plan	N/A
Benefit sharing during the monitoring period	N/A

[8] https://www.ilo.org/wcmsp5/groups/public/---europe/---ro-geneva/---ilo-ankara/documents/genericdocument/wcms_645630.pdf

2.4 Ecosystem Health

There is no risk identified for the project activity.

	Risk identified	Mitigation or preventative measure(s) taken during the monitoring period
Impacts on biodiversity and ecosystems	No risk identified	-
Soil degradation and soil erosion	No risk identified	-
Water consumption and stress	No risk identified	-

2.4.1 Rare, Threatened, and Endangered species

Species or habitat	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.
Areas needed for habitat connectivity	...
...	

2.4.2 Introduction of species

No adverse effects from the introduction of species identified at validation are specified.

There is no invasive species in the project location. This section is N/A.

There are no invasive species exist in the project area.

2.4.3 Ecosystem conversion

The project is not an ARR, ALM, WRC or ACoGS project. Hence, this section is N/A.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The construction of Duzce Aksu HPP has started in 16.11.2009. Duzce 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.

Duzce-Aksu HEPP, that is built on Aksu River. The tyrolean type weir is approximately at the elevation of 790.50 m. Duzce-Aksu HEPP utilizes approximately (net) 645 m of potential energy difference to produce electricity. Duzce-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 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 (**Hata! Başvuru kaynağı bulunamadı.**). 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.

Technical details of the current units have been given in tables below.

Table 4. Properties of the Weir

Properties of the Weir	
Place	The Weir is located on the Aksu River, at the close proximity of the Gölyaka Town of Düzce Province.
Purpose	Temporarily storing and diverting the Aksu River's water to the water intake structure.
Elevation of the river bed	788.5 m
Elevation of the foundation	790.5 m
Weir Crest Level	793.75 m
Upstream water level	793.55 m

Type	Reinforced Concrete Body without gates
Height from the foundation of the weir	3.25 m (approximately)
Height of the weir from the River Bed	3.0 m
Full Body Crest Length	16 m (including the middle feet)

Table 5. Sedimentation Ponds

Sedimentation Ponds	
First Level	
Length	41.0 m
Width	4.50 m
Number of Sections	2
Second Level	
Length	80.0 m
Width	5.50 m
Number of Sections	3

Table 6. Conveying Tunnel

Properties of the Tunnel	
Type	Horse shoe type
Number of units	2
Length	2x130 = 260.0 m
Height	6.0 m
Width	20.0 m

Table 7. Sedimentation Pool Access Tunnels

Sedimentation Pool Access Tunnels

Type	Prent Profile
Slope	0.001
Length	4,895 m
Digging Radius	3.5 m
Inner Radius	3 m
Head Pond	
Maximum Water Level	786.55 m
Volume	2000 m^3
Penstock	
Radius	1420-1730 mm
Pipe wall thickness	40 to 12 mm
Length	2,200 m
Number of Branching	2
Radius of Branching	866 mm
Pipe wall thickness of Branching	10 mm
Power Plant Building	
Power plant type	Over the surface
Dimensions	2x15x17 m
Height	1x6x10.5 m
Gross fall	652.30 m
Net fall	645.51 m
Total Installed Capacity (Bar)	46.2 MW
Project Flow Rate	8 m^3/s

Table 8. Turbines

Turbines

Number of turbines	2
Unit capacity	23.1 MW
Type	Horizontal Axis Pelton Type
Unit Flow Rate	4 m^3/s

Table 9. Generators

Generators	
Type	SF23.5 – 10 / 3250
Nominal frequency	50 Hz
Nominal Capacity	23.100 MW
Power Factor	0.85 END

The commissioning date of both units is 25/04/2014 which is accepted as project start date. Since that date, there is no special event that may have impact on monitoring of GHG emission reductions.

Table 10. Current meter details

	Main Meter	Spare Meter
Serial Number	10172379	10172380
Brand-Type	EMH LZQJ-XC	EMH LZQJ-XC
First Index Date	13/06/2021	13/06/2021
Next Calibration Date	2031	2031
Calibration Frequency[9]	10 years	10 years
Test Date	29/09/2023	29/09/2023
Test Frequency	2 years	2 years

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

Class	0.2S-0.5S (Active-Reactive)	0.2S-0.5S (Active-Reactive)

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

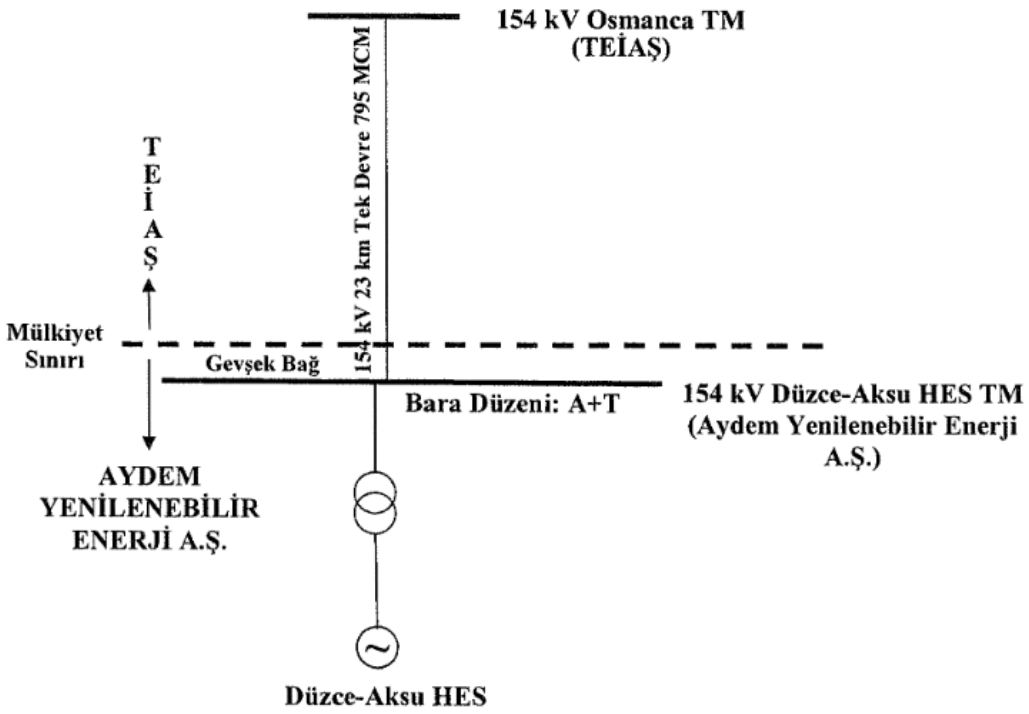

Figure 4. Single line diagram of the project activity

3.2 Deviations

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

3.2.1 Methodology Deviations

The UNFCCC methodology of ACM0002 and its related tools are applied as they are without any deviation from the methodology and the registered PDD.

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 title as a company policy they have dissolved all the individual sister companies that hold licenses of facilities (like the Duzce Aksu HPP) and changed the ownership as Aydem Yenilenebilir A.Ş on 24/12/2019 as stated in official gazette with registration number of 13798.

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 (APJ) 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 APJ was determined to be 707 m^2 for the current monitoring period (01-September-2023 to 24-April-2024) as per the lake surface area map provided in Appendix-2.

3.3 Grouped Projects

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

3.4 Baseline Reassessment

Did the project undergo baseline reassessment during the monitoring period?

☐ Yes ☒ No

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	FCi,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 [10]
Value applied	Please see Appendix 2 (Table 1) in the validated PD (version 2.03)

[10] 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	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[11]
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	$EFCO_2,i,y$
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)
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	

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

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[12]. Data is extracted from the relevant annexes of the capacity projection reports for the years 2010, 2011, and 2012[13].
Value applied	Please see Appendix-2-Table 8 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 $EF_{grid,BM,y}$
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

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

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

<table>
<tr><td>Data unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>Electricity</td></tr>
<tr><td>Source of data</td><td>Net Amount of Electricity supplied to the “Turkish National Grid” by the proposed project</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>Data is measured directly from meters and records on TEIAS readings protocol papers.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Annually</td></tr>
<tr><td>Value monitored</td><td>70,539.15 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: 10172379
Back-up Electricity Meter: ITRON, Serial Number: 10172380

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[14]</td><td>13/06/2031[15]</td><td>NA</td><td>NA</td></tr>
</table></td></tr>
</table>

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

	Calibration frequency	10 years	10 years	10 years	10 years
	Test Date	29/09/2023	29/09/2023	NA	NA
	Test frequency	2 years	2 years	NA	NA
	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 "Duzce-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	Project site computers with SCADA system and the turbine name plates.
Description of measurement methods and procedures to be applied	Observed via the SCADA system of the Project Activity
Frequency of monitoring/recording	Once for each monitoring period
Value monitored	46,200,000
Monitoring equipment	SCADA system of the Project Activity
QA/QC procedures to be applied	Can be confirmed also by the parameter readings on the design plates of each turbine and by summing the two units.
Purpose of the data	Data to be used for the calculation of Baseline Emissions.
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 can be 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. After obtaining the net electricity production value, the emission reductions are calculated by multiplying the net electricity with the Combined Margin calculated in the registered PDD at validation.

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 11. Positions and responsibilities of the VER monitoring team members

Position	Responsibility
Duzce Aksu HEPP Manager	Day to day operation of the Duzce Aksu HPP, 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 Duzce Aksu HEPP can be cross checked, via the TEİAŞ – EPİAŞ web site[16] 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 EPIAS records are the main source for the electricity generation. The site visit records are used for crosschecking. 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.

Table 12. Properties of the electricity meters

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 "Duzce-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.

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

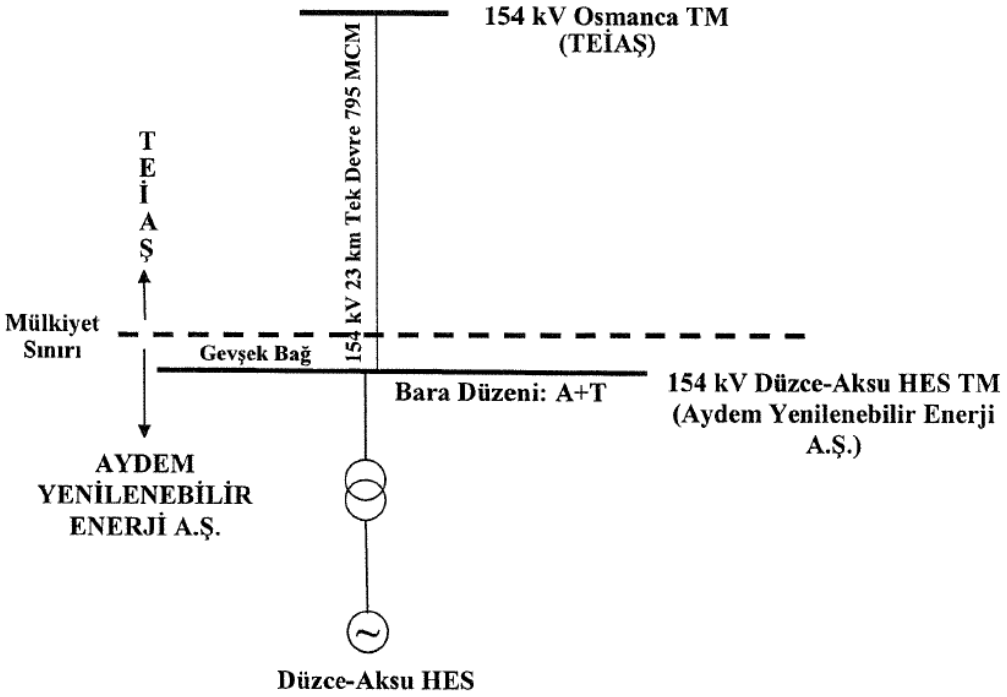

Figure 5. Single line diagram of Duzce Aksu HEPP

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

$$70{,}539.15\ MWh \times 0.5332\ tCO_2/MWh = 37{,}609\ tCO_2$$

$$BE_y = 37{,}609\ \ tCO_2$$

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)[17]

A_{BL} = 0.0 (m^2)

Therefore, PD is calculated as follows;

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

[17] Reservoir area, Appendix 2

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

Since the power density (PD) of the project activities is greater than 10 W/m^2, Project Emissions (PE) are considered 0.[18]

5.3 Leakage Emissions

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 GHG Emission Reductions and Carbon Dioxide Removals

Total Emission Reduction has been determined as;

$$ER_y = BE_y - PE_y - LE_y$$

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 5. Calculations for net total values

EG_y	Net Generation (MWh) During Monitoring Period	70,539.15
EF_y	Emission Factor (tCO_2/MWh)	0.5332
BE_y	Baseline emissions in year y (tCO_2) During Monitoring Period	37,609
PE_y	Project Emissions (tCO_2)	0
LE_y	Leakage Emissions (tCO_2)	0
ER_y	Net Emission Reduction (tCO_2) During Monitoring Period	37,609
	Estimated Emission Reduction for this Monitoring Period (tCO_2)	48,947

[18] ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources." Ver 16

Thus, the net emission reduction (in tonnes CO_2) in this monitoring period (01-September-2023 to 24-April-2024) is calculated as given in table below.

Total emission reductions were realized as 37,609 tCO_2 for this monitoring period. When the estimated electricity generation figure of the power plant for each year 141,370.00 MWh/year (in the validated VCS PD, 03/07/2020) is considered, the total emission reductions should be approximately 48,947 tCO_2 for the monitoring period (8 months). Percent difference is calculated as -23.2%, which means the project reduced 23.2% less CO_2 than the estimated amount. The annual emission reduction for the current monitoring period was 22,565 tCO_2, which is found to be less in comparison with expected emission reduction in registered PD i.e., 75.382 tCO_2. Since the project utilizes hydro power and hydro is a natural phenomenon, slight differences in estimated and actual values may occur.

Vintage period	Baseline emissions (tCO_2e)	Project emissions (tCO_2e)	Leakage emissions (tCO_2e)	Reduction VCUs (tCO_2e)	Removal VCUs (tCO_2e)	Total VCUs (tCO_2e)
01-September-2023 to 31-December-2023	15,106	0	0	15,106	15,106	15,106
01-January-2024 to 24-April-2024	22,503	0	0	22,503	22,503	22,503
Total	**37,609**	**0**	0	**37,609**	**37,609**	**37,609**

In the following table, the estimated ex-ante GHG emission reductions and carbon dioxide removals and the achieved reductions and removals for the monitoring period have been stated for Duzce Aksu HEPP. The percentage differences have been reported, and differences have been explained. The quantities of reductions and removals are the total quantities before any deductions for buffer credits.

Vintage period	Ex-ante estimated reductions/ removals	Achieved reductions/ removals	Percent difference	Explanation for the difference
01-September-	25,196	15,106	-40.0%	Since the project is a HEPP, seasonal variations in the

2023 to 31-December-2023				amount of precipitation and temperature affect the monthly generation rates and may create deviations from the estimated values.
01-January-2024 to 24-April-2024	23,751	22,503	-5.3%	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.
Total	**48,947**	**37,609**	**-23.2%**	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.

APPENDIX 1: COMMERCIALLY SENSITIVE INFORMATION

There is no commercially sensitive information about the project. So this appendix section is N/A.

APPENDIX 2: RESERVOIR AREA