



Verified Carbon Standard

A VERRA STANDARD

DUZCE AKSU HYDROELECTRICITY POWER PLANT



Project title	DUZCE AKSU HYDRO ELECTRICITY POWER PLANT
Project ID	2095
Crediting period	25-April-2024 to 24-April-2034
Original date of issue	29-September-2025
Most recent date of issue	29-September-2025
Version	05
VCS Standard Version	4.7
Prepared by	GTE Karbon Sürdürülebilir Enerji Eğitim Danışmanlık Ve Ticaret A.Ş Mustafa Kemal Mah. Barış Sitesi 2111. Sok. No: 5 Çankaya, Ankara - Turkey +90 312 514 63 63 kemal.demirkol@gte.com.tr https://www.gte.com.tr/

CONTENTS

- CONTENTS 2**

- 1 PROJECT DETAILS..... 5**

 - 1.1 Summary Description of the Project 5
 - 1.2 Audit History 7
 - 1.3 Sectoral Scope and Project Type 8
 - 1.4 Project Eligibility 8

 - 1.4.1 General eligibility 8
 - 1.4.2 AFOLU project eligibility 9
 - 1.4.3 Transfer project eligibility 9

 - 1.5 Project Design 9

 - 1.5.1 Grouped project design 9

 - 1.6 Project Proponent 9
 - 1.7 Other Entities Involved in the Project 9
 - 1.8 Ownership 10
 - 1.9 Project Start Date 10
 - 1.10 Project Crediting Period 10
 - 1.11 Project Scale and Estimated GHG Emission Reductions or Removals 11
 - 1.12 Description of the Project Activity 12
 - 1.13 Project Location 15
 - 1.14 Conditions Prior to Project Initiation 17
 - 1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks 17
 - 1.16 Double Counting and Participation under Other GHG Programs 17

 - 1.16.1 No Double Issuance 18
 - 1.16.2 Registration in Other GHG Programs 18
 - 1.16.3 Projects Rejected by Other GHG Programs 18

 - 1.17 Double Claiming, Other Forms of Credit, and Scope 3 Emissions 18

 - 1.17.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits 18
 - 1.17.2 No Double Claiming with Other Forms of Environmental Credit 18
 - 1.17.3 Supply Chain (Scope 3) Emissions 19

 - 1.18 Sustainable Development Contributions 19

1.19	Additional Information Relevant to the Project	20
1.19.1	Leakage Management	20
1.19.2	Commercially Sensitive Information	20
1.19.3	Further Information	20
2	SAFEGUARDS AND STAKEHOLDER ENGAGEMENT	20
2.1	Stakeholder Engagement and Consultation	20
2.1.1	Stakeholder Identification	20
2.1.2	Stakeholder Consultation and Ongoing Communication	21
2.1.3	Free Prior and Informed Consent	21
2.1.4	Grievance Redress Procedure	21
2.1.5	Public Comments	22
2.2	Risks to Stakeholders and the Environment	22
2.2.1	Management Experience	22
2.2.2	Risk Assessment	22
2.3	Respect for Human Rights and Equity	23
2.3.1	Labor and Work	23
2.3.2	Human Rights	24
2.3.3	Indigenous Peoples and Cultural Heritage	24
2.3.4	Property Rights	25
2.3.5	Benefit Sharing	25
2.4	Ecosystem Health	25
2.4.1	Rare, Threatened, and Endangered Species	25
2.4.2	Introduction of Species	26
2.4.3	Ecosystem Conversion	26
3	APPLICATION OF METHODOLOGY	26
3.1	Title and Reference of Methodology	26
3.2	Applicability of Methodology	27
3.3	Project Boundary	42
3.4	Baseline Scenario	43
3.5	Additionality	43
3.5.1	Regulatory Surplus	44

3.5.2	Additionality Methods	44
3.6	Methodology Deviations	44
4	QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS.....	44
4.1	Baseline Emissions	44
4.2	Project Emissions	45
4.3	Leakage Emissions	47
4.4	Estimated GHG Emission Reductions and Carbon Dioxide Removals	47
5	MONITORING	49
5.1	Data and Parameters Available at Validation	49
5.2	Data and Parameters Monitored.....	51
5.3	Monitoring Plan	55
	APPENDIX 1: COMMERCIALY SENSITIVE INFORMATION.....	58
	APPENDIX 2: THE LEGAL FRAMEWORK OF THE HOST COUNTRY	59
	APPENDIX 3: PROJECT'S RESERVOIR AREA.....	61
	APPENDIX 4: BASELINE INFORMATION	62

1 PROJECT DETAILS

1.1 Summary Description of the Project

Duzce-Aksu Elektrik Üretim A.Ş. which is owned by AYDEM Yenilenebilir Enerji A.Ş. constructed Duzce-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 Duzce-Aksu Hydro Electric Power Plant (HEPP) delays the addition of conventional thermal power plants to the Turkish National Electricity Grid.

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. Duzce-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 (originally given by EPDK on 21/09/2006 to Düzce Aksu Elektrik Üretim Anonim Şirketi), which has a total installed capacity of 46.2 MWe (48.304 MWm) with two hydraulic Pelton type turbines each having a capacity of 23.10 MWe. The project activity 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 64,574 tCO_{2e} per year for this crediting period.

According to the applied methodology ACM0002¹, “the baseline scenario is electricity delivered to the grid by the project activity that would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in TOOL07.”.

As per the applied methodology, “the spatial extent of the project boundary includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to”.

The Environmental impacts of the project is kept to a minimum and all the regulations that are in act in Türkiye is obeyed during the operation stages of the Duzce Aksu Hydroelectricity Power Plant project.

¹ <https://cdm.unfccc.int/UserManagement/FileStorage/R0IJ1X9LQ7W2GOYHSMBFCPE3VKZ685>

The milestones of the project activity are provided in the table below.

Table 1. Milestones of Duzce Aksu HEPP

Milestone	Date
Generation License (granted for Düzce Aksu Elektrik Üretim Anonim Şirketi)	21-September-2006
Generation License (granted for Aydem Yenilenebilir Enerji Anonim Şirketi)	24-October-2019
Provisional Acceptance (Project Start Date)	25-April-2014
Water Usage Agreement	27-July-2020
EIA Exemption	16-July-2007
System Usage Agreement	23-March-2020
Connection Agreement	20-March-2020
The first crediting period	25-April-2014 – 24-April-2024
The second crediting period (current)	25-April-2024 – 24-April-2034

The Duzce-Aksu HEPP is 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 to the weir body and the water collecting area over the Aksu River at the 790.50 m elevation level. Then the water is settled at the sedimentation pond and is transferred to the conveyance tunnel. The water that passes this tunnel will then be transferred to the head pond where it is fed to the penstock, and is passed to the hydro power plant building where the electricity will be produced via turbines. The water is then being left back to the Aksu River at the 138.2 m elevation level. “How the project activity operates” is shown in figure below.

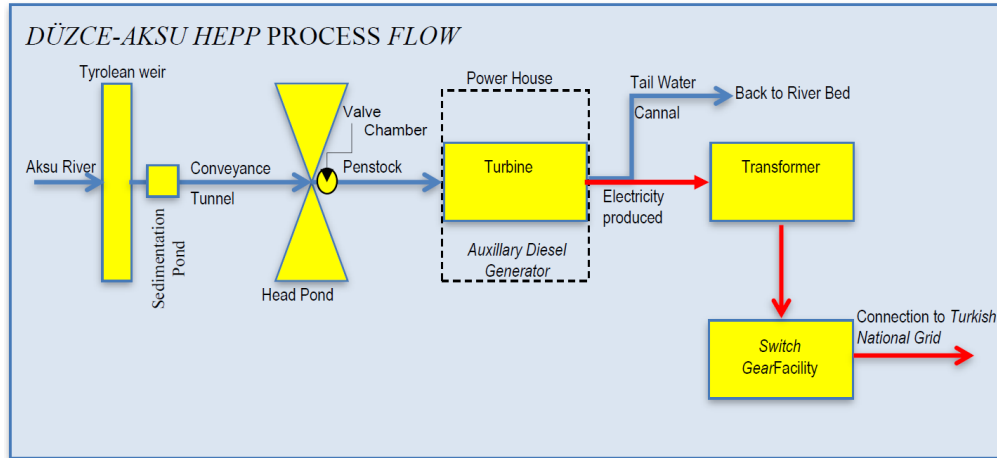


Figure 1. Flow chart of the project activity

1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation	25-April-2014 – 24-April-2024 (1 st crediting period)	VCS	RINA Services S.p.A (RINA)	Ten years
Verification	25-April-2014 – 30-September-2020 (1 st monitoring period)	VCS	KBS Certification Services Pvt. Ltd.	Six years
Verification	01-October-2020 – 31-December-2021 (2 nd monitoring period)	VCS	Carbon Check	~1.5 years (14 months)
Verification	01-January-2022 – 31-August-2023 (3 rd monitoring period)	VCS	Re-carbon	~2 years (20 months)

Validation	25-April-2024 – 24-April-2034 (2 nd crediting period)	VCS	RINA Services S.p.A (RINA)	Ten years
-------------------	---	-----	----------------------------	-----------

1.3 Sectoral Scope and Project Type

Sectoral scope²	1
Project activity type	Energy Industries (Renewable/Non-Renewable Sources)

1.4 Project Eligibility

1.4.1 General eligibility

The project activity is included under the scope of the VCS Program and not excluded under Table 2.1 of the VCS Standard. This is the renewal of crediting period, and it is the second crediting period.

The project is eligible under the scope of VCS therefore the project meets the requirements below.

- Duzce Aksu HEPP project is grid-connected renewable power generation project that applies a methodology (ACM0002) eligible under VCS program.
- The implementation of the project activities does not cause the violation of any applicable law.
- The project is a hydro project.

The project meets requirements related to the pipeline listing deadline, the opening meeting with the validation/verification body, and the validation deadline.

The applied methodology (ACM0002) is eligible under the VCS Program. The project is not a fragmented part of a larger project or activity that would otherwise exceed such limits.

The project helps Turkey to stimulate the commercial application of grid connected renewable energy technologies and markets. The specific benefits of the project are:

- Reduce greenhouse gas emissions in Turkey compared to the business-as-usual scenario,
- Help to stimulate private sector participation in hydro power industry in Turkey,

² 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>

- Relatively reduce some other pollutants from power generation industry in Turkey, compared to a business-as-usual scenario,
- Help to diminish Turkey's increasing energy deficit,
- Diversify the electricity generation portfolio and reduce dependency on import of other energy sources.

1.4.2 AFOLU project eligibility

This project is not an AFOLU project.

1.4.3 Transfer project eligibility

This project is not a transfer project and CPA seeking registration.

1.5 Project Design

- Single location or installation
- Multiple locations or project activity instances (but not a grouped project)
- Grouped project

1.5.1 Grouped project design

This is not a grouped project.

1.6 Project Proponent

Organization name	Aydem Yenilenebilir Enerji A.Ş
Contact person	Özgün Gül Koparan
Title	Sustainability manager
Address	Gazi Mustafa Kemal Bulvarı 15 Mayıs Mah. 832 Sok. No:2 75.Yıl Esnaf Sarayı K:2 Denizli-Türkiye
Telephone	+90 258 242 27 76
Email	ozgun.gulkoparan@aydemenerji.com.tr

1.7 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 - TÜRKİYE
Telephone	+90 312 514 63 63
Email	kemal.demirkol@gte.com.tr

1.8 Ownership

The Project is owned by the Project owner, AYDEM Yenilenebilir Enerji A.Ş. The generation license issued by the EMRA (Energy Market Regulatory Authority) names the Project owner as the holder of title for this Project activity.

1.9 Project Start Date

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

1.10 Project Crediting Period

Crediting period	<input type="checkbox"/> <i>Seven years, twice renewable</i> <input checked="" type="checkbox"/> <i>Ten years, fixed</i> <input type="checkbox"/> <i>Other (state the selected crediting period and justify how it conforms with the VCS Program requirements)</i>
Start and end date of first or fixed crediting period	<p>25-April-2014 to 24-April-2024 (1st Crediting Period, both days included)</p> <p>25-April-2024 to 24-April-2034 (2nd Crediting Period, both days included)</p> <p>The project has been registered under previous versions of the Project Standard, v3.2, which states that the 10 year crediting period</p>

of the project activity can be renewed twice. The duration of the crediting period of the project activity cannot be changed during revalidation.

1.11 Project Scale and Estimated GHG Emission Reductions or Removals

- < 300,000 tCO₂e/year (project)
- ≥ 300,000 tCO₂e/year (large project)

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO ₂ e)
25-April-2024 to 31-December-2024	44,405
01-January-2025 to 31-December-2025	64,574
01-January-2026 to 31-December-2026	64,574
01-January-2027 to 31-December-2027	64,574
01-January-2028 to 31-December-2028	64,574
01-January-2029 to 31-December-2029	64,574
01-January-2030 to 31-December-2030	64,574
01-January-2031 to 31-December-2031	64,574
01-January-2032 to 31-December-2032	64,574
01-January-2033 to 31-December-2033	64,574
01-January-2034 to 24-April-2034	20,168
Total estimated ERRs during the first or fixed crediting period	645,739
Total number of years	10 years
Average annual ERRs	64,574

1.12 Description 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. The following information has been obtained from the registered PD of the project activity, dated 19-April-2016.

Table 2. 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 3. 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 4. 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 5. 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 6. Turbines

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

Table 7. 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 8. 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 ³	10 years	10 years
Test Date	29/09/2023	29/09/2023
Test Frequency	2 years	2 years
Class	0.2S-0.5S (Active-Reactive)	0.2S-0.5S (Active-Reactive)

1.13 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 9. 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

³ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5>

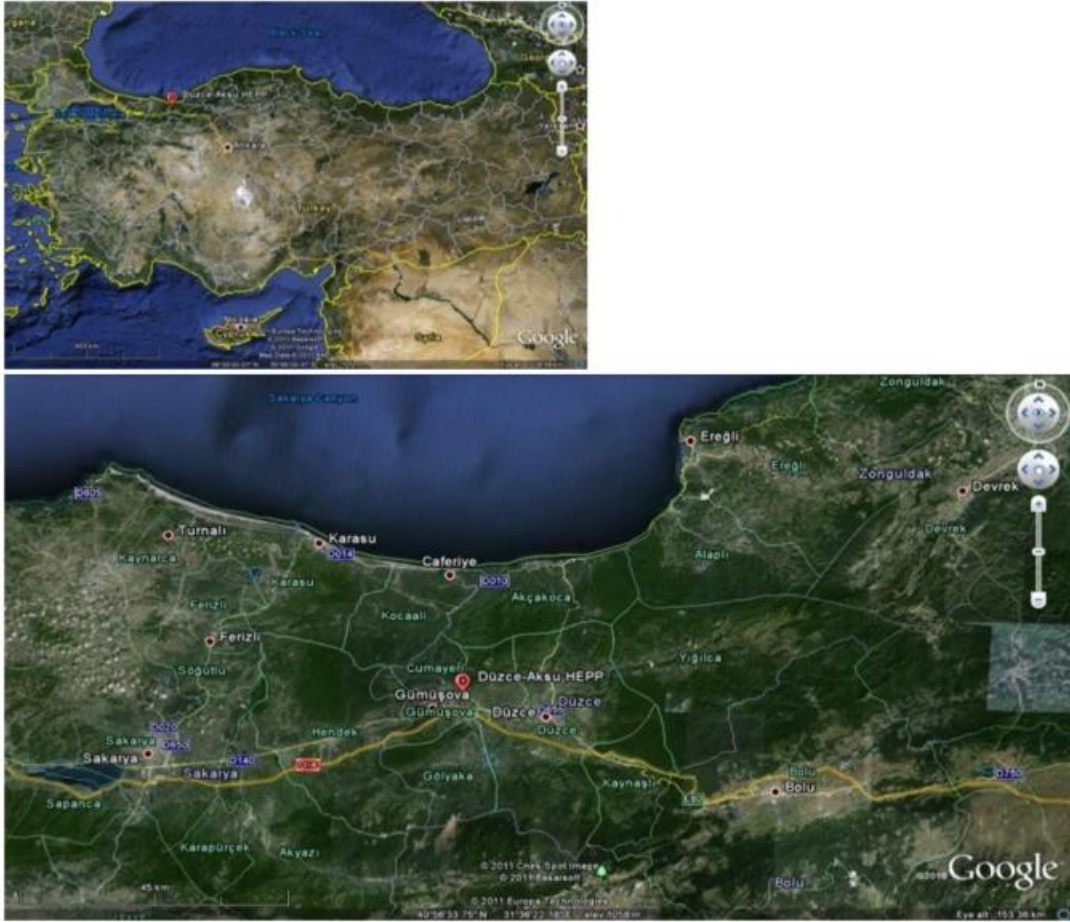


Figure 2. Project location

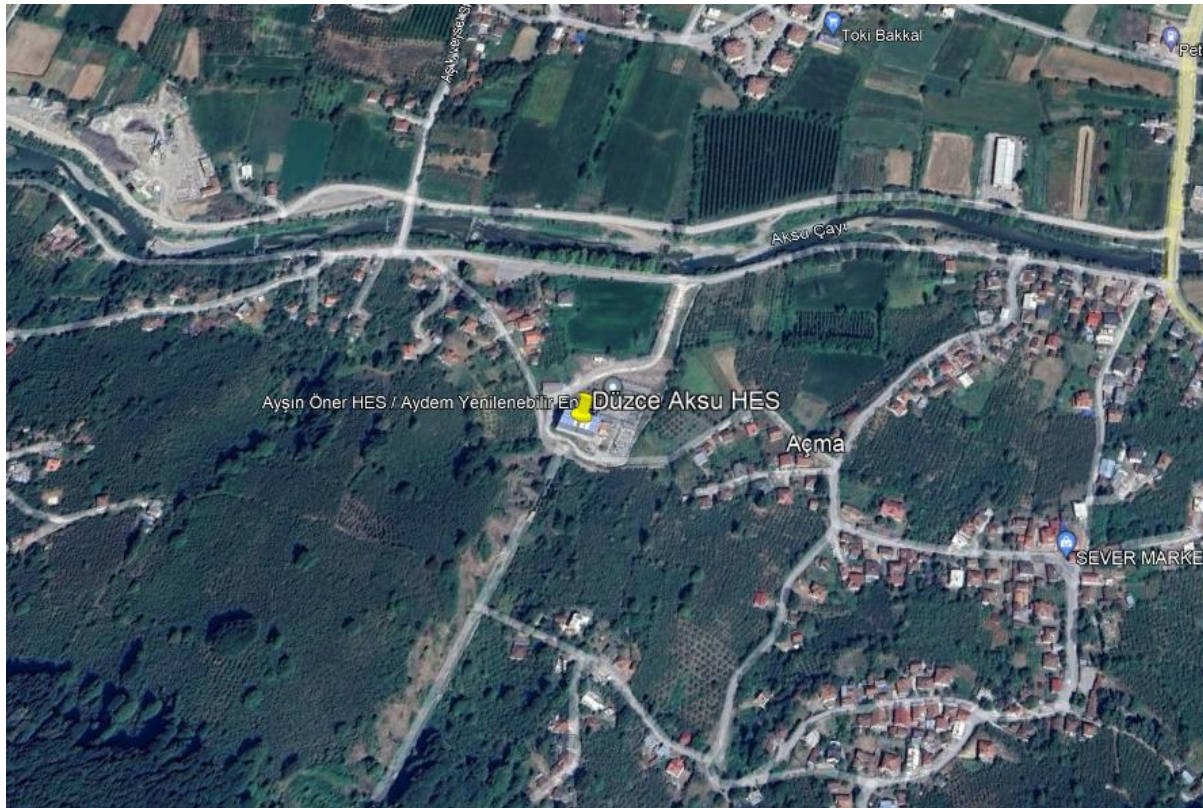


Figure 3. The screenshot of the satellite image of the project location

1.14 Conditions Prior to Project Initiation

The project is a renewable energy project, prior the project initiation, there was no other electric power plant installation at the project site.

1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks

Addition of a new power generation capacity to the grid is regulated by Energy Market Regulatory Authority (EMRA) who issues the licenses for electricity generation and is responsible for ensuring that new capacity applies with its rules and regulations. The list of the rules and regulations of the host country that a new electricity generation project has to comply are given in Appendix 2.

1.16 Double Counting and Participation under Other GHG Programs

1.16.1 No Double Issuance

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

Yes No

1.16.2 Registration in Other GHG Programs

Has the project registered under any other GHG programs?

Yes No

Is the project active under the other program?

Yes No

1.16.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

Yes No

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

1.17.1 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

1.17.2 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

1.17.3 Supply Chain (Scope 3) Emissions

Do the project activities specified in Section 1.12 affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

Yes No

Is the project proponent(s) or authorized representative a buyer or seller of the product(s) (goods or services) that are part of a supply chain?

Yes No

Has the project proponent(s) or authorized representative posted a public statement on their website saying, “Carbon credits may be issued through Verified Carbon Standard project [project ID] for the greenhouse gas emission reductions or removals associated with [project proponent or authorized representative organization name(s)] [name of product(s) whose emissions footprint is changed by the project activities].”

Yes No

1.18 Sustainable Development Contributions

The project aims to generate electricity by using hydroelectric power to supply the increasing national electricity demand in a cleaner and sustainable manner. It reduces the air pollution caused by the grid-connected power plants which are mostly fossil fuel fired.

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. In this crediting period, the total of 1,413,700 MWh renewable electricity is estimated to be supplied to national grid that supports to increase the renewable energy share in the energy mix.
- SDG-8 decent work and economic growth. As the project is providing a decent and secure work environment for 16 people. All personnel working at the power plant are receiving regular trainings about occupational health and safety.
- SDG-13 on urgent action to combat climate change, as the project is replacing the fossil fuel based national grid and it is producing emission reductions. In this particular project the power plant is estimated to prevent the total release of 645,739 tCO_{2e} into the atmosphere in this crediting period.

1.19 Additional Information Relevant to the Project

1.19.1 Leakage Management

Leakage is neglected according to the UNFCCC tools and methodologies that are used.

1.19.2 Commercially Sensitive Information

There is no commercially sensitive information. Hence, this section is not applicable.

1.19.3 Further Information

There is no further information about project activity. Hence, this section is not applicable.

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. The project site is not a private land.
Stakeholder diversity and changes over time	No changes over time about the stakeholder diversity.
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

Date of stakeholder consultation	2010 (during the start of project)
Stakeholder engagement process	There is a “grievance logbook” in Taşlık Village Mosque within the vicinity of the project 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.
Consultation outcome	There were no negative comments received. During the last crediting period there were no complaints about or demands from the project.
Ongoing communication	The ongoing communication with stakeholders is achieved with a “grievance logbook” in easily reachable places to the stakeholders.
Stakeholder input	There were no negative comments received.

2.1.3 Free Prior and Informed Consent

Obtaining 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

Development process	No grievance has been raised during the last crediting period of this project. The grievance, negative or positive, can be provided by local stakeholders related to operation of the project activity.
Grievance redress procedure	PP will resolve all the grievances during whole crediting period. Project manager is accessible by locals all the time. There is no problem encountered about the project/way of communication so far. There is a grievance box.

2.1.5 Public Comments

Comments received	Actions taken
No comment received from the stakeholders.	Since there is no comment received from the stakeholders, no actions have been taken.

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

	Risks 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	There is no risk identified for the safety of minority and	-

groups, including children	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

	Risks identified ⁴	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.
Equal pay for equal 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.
Gender equity in labor and work	No risk identified	Türkiye has ratified ILO convention 100, 111, 122 and 142. All the workers are socially

⁴ 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.

		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.

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 convention⁵. 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	-

⁵https://www.ilo.org/wcmsp5/groups/public/---europe/---ro-geneva/---ilo-ankara/documents/genericdocument/wcms_645630.pdf

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

As explained in Section 2.3.4, the project does not impact property rights. Therefore, this section is not applicable.

2.4 Ecosystem Health

	Risks identified	Mitigation or preventative measure(s) taken
Impacts on biodiversity and ecosystems	No risk identified	Since there are no risk identified, there are no mitigation or preventative measure(s) taken.
Soil degradation and soil erosion	No risk identified	Since there are no risk identified, there are no mitigation or preventative measure(s) taken.
Water consumption and stress	No risk identified	Since there are no risk identified, there are no mitigation or preventative measure(s) taken.

2.4.1 Rare, Threatened, and Endangered Species

Is the project located in or adjacent to habitats for rare, threatened, or endangered species?

Yes No

Since the project is not located in or adjacent to habitats for rare, threatened, or endangered species, this section is not applicable.

	Risks identified	Mitigation or preventative measure(s) taken
Habitats for rare, threatened, and endangered species	No risk identified	The project is not located in or adjacent to habitats for rare, threatened, or endangered species.
Areas for habitat connectivity	No risk identified	The project is not located in or adjacent to habitats for rare, threatened, or endangered species.

2.4.2 Introduction of Species

There are no species introduced. Hence, this section is not applicable

2.4.3 Ecosystem Conversion

The project is not an ARR, ALM, WRC or ACoGS project. Hence, this section is not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	ACM0002	Consolidated baseline methodology for grid-connected electricity generation from renewable sources	22.0
Tool	TOOL01	Tool for the demonstration and assessment of additionality	07.0.0
Tool	TOOL07	Tool to calculate the emission factor for an electricity system	07.0
Tool	TOOL11	Assessment of the validity of the original/current baseline and update of	03.0.1

		the baseline at the renewal of the crediting period	
--	--	---	--

3.2 Applicability of Methodology

The ACM0002 (version 22.0) methodology is applicable to grid-connected renewable power generation project activities that:

- (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant);
- (b) involve a capacity addition;
- (c) involve a retrofit of (an) existing plant(s); or
- (d) involve areplacement of (an) existing plant(s).

The project activity is suitable for the application of the ACM0002 version 22.0 because it is the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant).

The choice of methodology ACM0002, Version 22.0, is justified as the project activity meets the following applicability criteria:

Methodology ID	Applicability condition	Justification of compliance
ACM0002, v22.0.0		
5	<p>This methodology is applicable to grid-connected renewable energy power generation project activities that:</p> <ul style="list-style-type: none"> (a) Install a Greenfield power plant; (b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plant(s)/unit(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); <p>or</p>	<p>The Duzce Aksu HEPP project activity is the installation of a new hydro power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant). Hence, condition (a) is met.</p>

	<p>(e) Involve a replacement of (an) existing plant(s)/unit(s); or</p> <p>(f) Install a Greenfield power plant together with a grid-connected Greenfield pumped storage power plant. The greenfield power plant may be directly connected to the PSP or connected to the PSP through the grid.</p>	
<p>6</p>	<p>In case the project activity involves the integration of a BESS, the methodology is applicable to grid-connected renewable energy power generation project activities that:</p> <p>(a) Integrate BESS with a Greenfield power plant;</p> <p>(b) Integrate a BESS together with implementing a capacity addition to (an) existing solar photovoltaic¹ or wind power plant(s)/unit(s);</p> <p>(c) Integrate a BESS to (an) existing solar photovoltaic or wind power plant(s)/unit(s) without implementing any other changes to the existing plant(s);</p> <p>(d) Integrate a BESS together with implementing a retrofit of (an) existing solar</p>	<p>This project does not include an integration of a BESS. Hence, this condition is N/A.</p> <p>a) This project does not include an integration of a BESS. Hence, this condition is N/A.</p> <p>b) This project does not include integration a BESS together with implementing a capacity addition to (an) existing solar photovoltaic or wind power plant(s)/unit(s). Hence, this condition is N/A.</p> <p>c) This project does not include integration of a BESS to (an) existing solar photovoltaic or wind power plant(s)/unit(s) without implementing any other changes to the existing plant(s).</p>

	<p>photovoltaic or wind power plant(s)/unit(s).</p> <p>(e) Integrate a BESS together with a Greenfield power plant that is operating in coordination with a PSP. The BESS is located at site of the greenfield renewable power plant.</p>	<p>Hence, this condition is N/A.</p> <p>d) This project does not include integration of a BESS together with implementing a retrofit of (an) existing solar photovoltaic or wind power plant(s)/unit(s). Hence, this condition is N/A.</p> <p>e) This project does not include integration of a BESS together with a Greenfield power plant that is operating in coordination with a PSP. Hence, this condition is N/A.</p>
7	<p>The methodology is applicable under the following conditions:</p> <p>(a) Hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;</p> <p>(b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for</p>	<p>(a) Duzce Aksu HEPP is a hydro power plant. Hence, this condition is met.</p> <p>(b) Since there is no capacity additions, this condition is N/A.</p> <p>(c) This project does not include an integration of a BESS. Hence, this condition is N/A.</p> <p>(d) This project does not include an integration</p>

	<p>wind, solar, wave or tidal power capacity addition projects) the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;</p> <p>(c) In case of Greenfield project activities applicable under paragraph 5 (a) above, the project participants shall demonstrate that the BESS was an integral part of the design of the renewable energy project activity (e.g. by referring to feasibility studies or investment decision documents);</p> <p>(d) The BESS should be charged with electricity generated from the associated renewable energy power plant(s). Only during exigencies may the BESS be</p>	<p>of a BESS. Hence, this condition is N/A.</p> <p>(e) The project activity does not involve PSP. Hence, this condition is N/A.</p>
--	--	---

	<p>charged with electricity from the grid or a fossil fuel electricity generator. In such cases, the corresponding GHG emissions shall be accounted for as project emissions following the requirements under section 5.4.4 below. The charging using the grid or using fossil fuel electricity generator should not amount to more than 2 per cent of the electricity generated by the project renewable energy plant during a monitoring period. During the time periods (e.g. week(s), months(s)) when the BESS consumes more than 2 per cent of the electricity for charging, the project participant shall not be entitled to issuance of the certified emission reductions for the concerned periods of the monitoring period.</p> <p><i>(e) In case the project activity involves PSP, the PSP shall utilize the electricity generated from the renewable energy power plant(s) that is operating in coordination with the PSP during pumping mode.</i></p>	
8	<p>In case of hydro power plants, one of the following conditions shall apply:</p>	<p>The project is a hydro power plant. The project activity satisfies condition (c), as it</p>

	<p>(a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or</p> <p>(b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density, calculated using equation (7), is greater than 4 W/m²; or</p> <p>(c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m²; or</p> <p>(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m², all of the following conditions shall apply:</p> <p>(i) The power density calculated using the total installed capacity of the integrated project, as per</p>	<p>results in a new reservoir and the power density of the project activity is 65,346.53 W/m² which is greater than 4 W/m².</p>
--	---	---

	<p>equation (8), is greater than 4 W/m²;</p> <p>(ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;</p> <p>(iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m² shall be:</p> <p>a. Lower than or equal to 15 MW; and</p> <p>b. Less than 10 per cent of the total installed capacity of integrated hydro power project.</p>	
<p>9</p>	<p>In the case of integrated hydro power projects, project participants shall:</p> <p>(a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or</p> <p>(b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the</p>	<p>The project is not an integrated hydro power project. Hence, this condition is N/A.</p>

	<p>construction of reservoirs.</p> <p>The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum of five years prior to the implementation of the CDM project activity.</p>	
<p>10</p>	<p>In the case of PSP, the project participants shall demonstrate in the PDD that the project is not using water which would have been used to generate electricity in the baseline.</p>	<p>The project does not include a PSP. Hence, this condition is N/A.</p>
<p>11</p>	<p>The methodology is not applicable to:</p> <p>(a) Project activities that involve switching from fossil fuels to renewable energy</p>	<p>a) The project does not involve switching from fossil fuel use to renewable energy at the site of the project activity.</p>

	<p>sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;</p> <p>(b) Biomass fired power plants/units.</p>	<p>b) The project is not a biomass fired power plant.</p>
12	<p>In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.</p>	<p>The project activity does not include retrofits, rehabilitations, replacements, or capacity additions. Hence, this condition is N/A.</p>
13	<p>In addition, the applicability conditions included in the tools referred to below apply.⁶</p>	<p>Given below.</p>

Methodology ID	Applicability condition	Justification of compliance
----------------	-------------------------	-----------------------------

⁶ The condition in “TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality” that all potential alternative scenarios to the proposed project activity must be available options to project participants; does not apply to this methodology, as this methodology only refers to some steps of this tool.

<p>TOOL07</p>	<p>This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g., demand-side energy efficiency projects).</p>	<p>The project activity supplies electricity to a grid. Hence, this condition is met.</p>
	<p>Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e., option IIa and option IIb. If option IIa is chosen, the conditions specified in “Appendix 1: Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10</p>	<p>CO₂ emission factor for the displacement of electricity generated by power plants in an electricity system is determined by calculating the “combined margin” emission factor (CM) of the electricity system⁷.</p>

⁷ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v7.0.pdf>

	per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	
	In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project electricity system is not located partially or totally in an Annex I country. Hence, this condition is N/A.
	Under this tool, the value applied to the CO ₂ emission factor of biofuels is zero.	The project does not involve biofuels in any way.

Methodology ID	Applicability condition	Justification of compliance
TOOL01	The use of the “Tool for the demonstration and assessment of additionality” is not mandatory for project participants when proposing new methodologies. Project participants may propose alternative methods to demonstrate additionality for consideration by the Executive Board. They may also submit revisions to approved methodologies using the additionality tool.	Tool for the demonstration and assessment of additionality is applied in this project since there is no new methodologies proposed. Hence, this condition is N/A.
	Once the additionally tool is included in an approved methodology, its application by project participants using	The additionality tool is applied using this methodology.

	this methodology is mandatory.	
--	--------------------------------	--

Methodology ID	Applicability condition	Justification of compliance
TOOL11		
Step 1.1	<p>If the current baseline complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation or the submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period, go to Step 1.2.</p> <p>If the current baseline does not comply with relevant mandatory national and/or sectoral policies, then assess based on the examination of current practice in the country or region in which the policies apply, whether those policies are systematically not enforced and that non-compliance with those requirements is widespread in the country or region.</p>	<p>There is no change in national/sectoral policies affecting project implementation. Hence Step 1.2 can be evaluated.</p>
Step 1.2	<p>Assess the impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions, without reassessing the</p>	<p>The combined margin is updated as per OM & BM calculations by Ministry of Energy and Resources.</p>

	<p>baseline scenario. In the situation where the baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment, an assessment of the changes in market characteristics is required for the renewal of the crediting period. Evaluate whether the conditions used to determine the baseline emissions in the previous crediting period are still valid. Assess the availability of new fuels or raw materials and the impact of electricity or fuel prices in the identification of the current practice for the baseline emissions.</p>	
<p>Step 1.3</p>	<p>This sub-step should only be applied if the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology. Assess whether the remaining technical lifetime of the equipment that would have continued to be</p>	<p>The project is a greenfield activity. Since it includes a new investment and the use of new equipment, this step is not applicable.</p>

	<p>used in the absence of the project activity, as determined in the CDM-PDD or CDM-PDD-REN, exceeds the crediting period for which renewal is requested. Take into consideration the market penetration of different technologies. Evaluate the penetration rate of different technologies that are available in the market and evaluate how they could affect the baseline.</p>	
<p>Step 1.4</p>	<p>Assess whether data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are still valid or whether they should be updated. Updates should be undertaken in the following cases:</p> <p>Where IPCC default values are used, the values should be updated if any new default values have been adopted and published by the IPCC, for example, in guidelines for national GHG inventories, IPCC assessment report or special reports by the IPCC;</p> <p>Where emission factors, values or emission benchmarks are used and determined only once for the</p>	<p>The combined margin is updated as per OM & BM calculations by Ministry of Energy and Resources. Hence the assessment should proceed to Step 2.</p>

	<p>crediting period, they should be updated, except if the emission factors, values, or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity.</p> <p>If the application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the current baseline as well as data and parameters are still valid for the subsequent crediting period, then this baseline, data and parameters can be used for the renewed crediting period. Otherwise, proceed to Step 2.</p>	
<p>Step 2.1</p>	<p>Update the current baseline emissions for the subsequent crediting period, without reassessing the baseline scenario, based on the latest approved version of the methodology applicable to the project activity. The procedure should be applied in the context of the sectoral policies and circumstances that are applicable at the time of request for renewal of the crediting period.</p>	<p>The latest version of the applicable methodology and current circumstances have been used for the second crediting period.</p>

Step 2.2	If the application of Step 1.4 showed that the data and/or parameter(s) that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, project participants should update all applicable data and parameters, following the guidance in Step 1.4.	The data and the parameters are updated for the second crediting period.
-----------------	--	--

3.3 Project Boundary

CO₂ emission is included in the baseline but the project activity does not emit any of the gases listed, in the table below.

The project boundary is considered as the National Electricity Grid of Turkey according to applied tool. The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the power plant is connected to.

Source		Gas	Included?	Justification/Explanation
Baseline	Electricity generation in baseline (Turkey's Grid)	CO ₂	Yes	Main emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	Minor emission source
		Other	No	N/A
Project	Emission from the reservoir of the proposed project	CO ₂	No	Minor emission source
		CH ₄	No	Minor emission source (Power density greater than 10 W/m ²)
		N ₂ O	No	Minor emission source
		Other	No	N/A

Source	Gas	Included?	Justification/Explanation
Auxiliary Diesel Generator	CO ₂	Yes	Neglected ⁸
	CH ₄	No	Minor emission source
	N ₂ O	No	Minor emission source
	Other	No	N/A

3.4 Baseline Scenario

Since the proposed project activity is the installation of a new grid-connected wind power plant, that is renewable power plant and therefore, the baseline scenario is defined as the following based on ACM0002 (Version 22.0.0):

“If the project activity is the installation of a Greenfield power plant with or without a BESS as described under paragraph 5(a) or paragraph 7(a) or paragraph 7(e) above (in ACM0002, v22.0), the baseline scenario is electricity delivered to the grid by the project activity that would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in TOOL07.”

Since the proposed project activity is going to be connected to the Turkish national grid, the baseline scenario of the proposed project is the supply of the equivalent amount of annual power output by the existing Turkish national grid which is the continued operation of existing power plants that are mainly natural gas and coal and the addition of new sources to meet electricity demand. In 2013, power plants containing a total of 6.985 MW additional capacity were added to the system, and our capacity has risen to around 64.044 MW. 43.8% of our electricity output in 2013 came from natural gas, 24.5% from coal, 24.8% from hydraulic energy, %2 from liquid fuels, and 4% from other renewable sources”.⁹

3.5 Additionality

The proposed project activity reduces GHG emissions by substituting fossil fuel based electricity generation by renewable resources (hydro) based electricity generation. This is the second crediting

⁸ ACM0002 Version 22.0.0 indicates that “...For all renewable energy power generation project activities, emissions due to the use of fossil fuels for the backup generator can be neglected.” (Page 15 paragraph 42).

⁹ <http://www.enerji.gov.tr/en-US/Pages/Electricity>

period. In the first crediting period, additionality of the project was presented. There has been no capacity change in the project between the first and the second crediting period. The Project is in compliance with all required relevant regulations but is not a mandatory Project. There is no change in the relevant national and/or sectoral regulations with respect to project activity or its technology till date through which the project activity is not found mandated by regulations. There is no breach of any legislation, and all required permits are obtained.

3.5.1 Regulatory Surplus

Is the project located in an UNFCCC Annex 1 or Non-Annex 1 country?

- Annex 1 country Non-Annex 1 country

Are the project activities mandated by any law, statute, or other regulatory framework?

- Yes No

If the project is located inside a Non-Annex 1 country and the project activities are mandated by a law, statute, or other regulatory framework, are such laws, statutes, or regulatory frameworks systematically enforced?

- Yes No

3.5.2 Additionality Methods

In the first crediting period, additionality of the project was presented. There has been no capacity change in the project between the first and the second crediting period.

3.6 Methodology Deviations

There are no methodological deviations in the project.

4 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Accordingly, the baseline emissions BE_y are calculated as following:

$$BE_y = (EG_{PJ,y}) \times EF_{grid,CM,y}$$

where,

BE_y	Baseline emissions (tCO ₂ e)
$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{grid,CM,y}$	Combined margin CO ₂ emission factor for grid connected power generation in year y calculated using the latest version of TOOL07 (v 07.0) “Tool to calculate the emission factor for an electricity system” (tCO ₂ e/MWh)

Emission factor calculated according to selected methodology. In the Turkey’s National Electricity Network Emission Factor Factsheet¹⁰, OM is calculated as 0.7108 tCO₂/MWh whereas BM is 0.3721 tCO₂/MWh). Therefore, CM is calculated as 0.75 and 0.25 weightage factor given to OM and BM, respectively (since this is the second crediting period).

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times 0.25 + EF_{grid,BM,y} \times 0.75$$

$$EF_{grid,CM,y} = 0.7108 \times 0.25 + 0.3721 \times 0.75 = 0.4568 \text{ tCO}_2/\text{MWh}$$

Accordingly, BE_y is calculated as follows:

$$BE_y = 141,370 \text{ MWh}/y \times 0.4568 \text{ tCO}_2/\text{MWh} = 64,574 \text{ MWh}$$

4.2 Project Emissions

As per ACM0002 "Grid-connected electricity generation from renewable sources", v22,

“For most renewable power generation project activities, $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

where:

PE_y = Project emissions in year y (tCO₂e/yr)

¹⁰

https://enerji.gov.tr//Media/Dizin/EVCED/tr/ÇevreVeİklim/İklimDeğişikliği/TUESEmisyonFktr/Belgeler/Sebeke_EF_Bilgi_Formu_2022.pdf

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO₂/yr)

$PE_{GP,y}$ = Project emissions from the operation of dry, flash steam or binary geothermal power plants in year y (t CO_{2e}/yr)¹¹

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO_{2e}/yr)

- Since this project uses hydroelectric power, $PE_{GP,y}$ is “0” (tCO₂/yr)
- The only emission source in the plant is the diesel generator which is used as auxiliary power source when there is no electricity generation in the plant or supply by the grid. In urgent cases, a diesel-powered generator will be operated for the daily consumption of personnel and the building, which is negligible. Project emissions are taken as zero. The same is also stated in paragraph 33 of “ACM0002: Grid-connected electricity generation from renewable sources, v22.0”. Hence it is neglected. Therefore, $PE_{FF,y} = 0$ (tCO₂/yr)

Beside of the diesel generator, other potential project emission for this proposed project is $PE_{HP,y}$.

However, if the power density of the project activity is greater than 10 W/m² than $PE_{HP,y} = 0$

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

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

Where:

PD = Power density of the project activity (W/m²)

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 (m²)

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 (m²). For new reservoirs, this value is zero.

For proposed project HEPP,

Cap_{PJ} = 46,200,000 We

Cap_{BL} = 0.0 W

¹¹

<https://enerji.gov.tr//Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/TUES>

$$A_{PJ} = 707 \text{ (m}^2\text{)}^{12}$$

$$A_{BL} = 0.0 \text{ (m}^2\text{)}$$

Therefore, PD is calculated as;

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

$$PD = 65,346.53 \text{ W/m}^2$$

Since the power density of the project activity is greater than 10 W/m², $PE_{HP,y} = 0$. Therefore;

$$PE_y = 0$$

4.3 Leakage Emissions

The energy generating equipment is not transferred from or to another activity. Therefore, leakage is also considered as “0”.¹³

$$LE_y = 0$$

As a result, Total Emission Reduction is:

$$ER_y = BE_y$$

4.4 Estimated GHG Emission Reductions and Carbon Dioxide Removals

Vintage period	Estimated baseline emissions (tCO _{2e})	Estimated project emissions (tCO _{2e})	Estimated leakage emissions (tCO _{2e})	Estimated reduction VCUs (tCO _{2e})	Estimated removal VCUs (tCO _{2e})	Estimated total VCUs (tCO _{2e})
25-Apr-2024 to 31-Dec-2024	44,405	0	0	44,405	44,405	44,405

¹² Reservoir area, Annex 6 of registered PD

¹³ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf>

01-Jan-2025 to 31-Dec-2025	64,574	0	0	64,574	64,574	64,574
01-Jan-2026 to 31-Dec-2026	64,574	0	0	64,574	64,574	64,574
01-Jan-2027 to 31-Dec-2027	64,574	0	0	64,574	64,574	64,574
01-Jan-2028 to 31-Dec-2028	64,574	0	0	64,574	64,574	64,574
01-Jan-2029 to 31-Dec-2029	64,574	0	0	64,574	64,574	64,574
01-Jan-2030 to 31-Dec-2030	64,574	0	0	64,574	64,574	64,574
01-Jan-2031 to 31-Dec-2031	64,574	0	0	64,574	64,574	64,574
01-Jan-2032 to 31-Dec-2032	64,574	0	0	64,574	64,574	64,574
01-Jan-2033 to 31-Dec-2033	64,574	0	0	64,574	64,574	64,574
01-Jan-2034 to 24-Apr-2034	20,168	0	0	20,168	20,168	20,168
Total	645,739	0	0	645,739	645,739	645,739

5 MONITORING

5.1 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 Türkiye in years 2009, 2010, 2011
Source of data	Turkish Electricity Transmission Company (TEİAŞ) Web Site ¹⁴
Value applied	Please see Appendix 4-Figure 6 (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 ¹⁵
Value applied	Please see Appendix 4-Figure 7 (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 $EF_{grid,OM,Simple,y}$

¹⁴ <https://www.teias.gov.tr/turkiye-elektrik-uretim-iletim-istatistikleri>

¹⁵ <https://www.teias.gov.tr/turkiye-elektrik-uretim-iletim-istatistikleri>

Comments	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.
-----------------	--

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 Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value applied	Please see Appendix 4-Figure 8 (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 4 ¹⁶ , 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	$EG_{m,y}$
Data unit	MWh
Description	Net electricity generated and delivered to the grid by power unit m in year y
Source of data	Turkish Electricity Transmission Company Web Site ¹⁷ . Data is extracted from the relevant annexes of the capacity projection reports for the years 2010, 2011, and 2012 ¹⁸ .
Value applied	Please see Appendix-2-Table 10 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 $EF_{grid,BM,y}$

¹⁶ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf>

¹⁷ <https://www.teias.gov.tr/turkiye-elektrik-uretim-iletim-istatistikleri>

¹⁸ <https://www.elektrikport.com/uploads/content/TEIAS%20Uretim%20Kapasite%20Projeksiyonu%202011-2020.pdf>

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 4.0, EB87Annex 9)” are used.
Value applied	Please see Appendix 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 system”, version 4 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	-

5.2 Data and Parameters Monitored

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	EPIAS data as main source (TEIAS meter readings as back-up data)
Description of measurement methods and procedures to be applied	Data is measured directly from meters and records on TEIAS readings protocol papers.

Frequency of monitoring/recording	Annually			
Value applied	Will be determined at the monitoring stage of this crediting period			
Monitoring equipment	<p>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%.</p> <p>Main Electricity Meter: EMH, Serial Number: 10172379</p> <p>Back-up Electricity Meter: EMH, Serial Number: 10172380</p> <p>Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market⁸. They have an accuracy class of Class 002 indicating an accuracy range of 0.2%.</p>			
	Main Meter (current)	Spare Meter (current)	Old Main Meter (Replaced on 13/06/2021)	Old Spare Meter (Replaced on 13/06/2021)
Serial no.	10172379	10172380	65000766	65000767
Brand-(Type)	EMH	EMH	ITRON (SL761B071)	ITRON (SL761B071)
First Index Date	13/06/2021	13/06/2021	26/04/2014	26/04/2014
Calibration due date	13/06/2031 ¹⁹	13/06/2031 ²⁰	NA	NA
Calibration frequency	10 years	10 years	10 years	10 years
Latest Test Date	13/06/2023	13/06/2023	NA	NA
Test frequency	2 years	2 years	NA	NA

¹⁹ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5>
²⁰ <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)
	Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market.				
QA/QC procedures to be applied	There are two meters that backup each other. Generated electricity is also monitored via the operator by the help of EPIAŞ trading software for internal monitoring.				
Purpose of data	Data to be used for the calculation of Baseline Emissions.				
Calculation method	Direct Continuous Measurement				
Comments	The collected data is kept by Duzce 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 hydro power plant 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 applied	46,200,000 W
Monitoring equipment	SCADA System of the Project activity

QA/QC procedures to be applied	Turbine labels checked with SCADA System reading.
Purpose of data	To monitor capacity of the project
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.
Source of data	Indirectly measured based on the reservoir area map provided in Appendix-3.
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-3.
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 data	Data to be used for the calculation of Baseline Emissions.
Calculation method	N/A
Comments	-

5.3 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-3.

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 10. 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 EPIAŞ 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 – EPIAŞ web site²¹ 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 EPIAŞ 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/EPIAŞ) web page exhibits the net electricity generated less transmission loss, to be able to produce comparable numbers, the figures taken from EPIAŞ 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 11. 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

²¹ <https://seffaflik.epias.com.tr/transparency>

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.

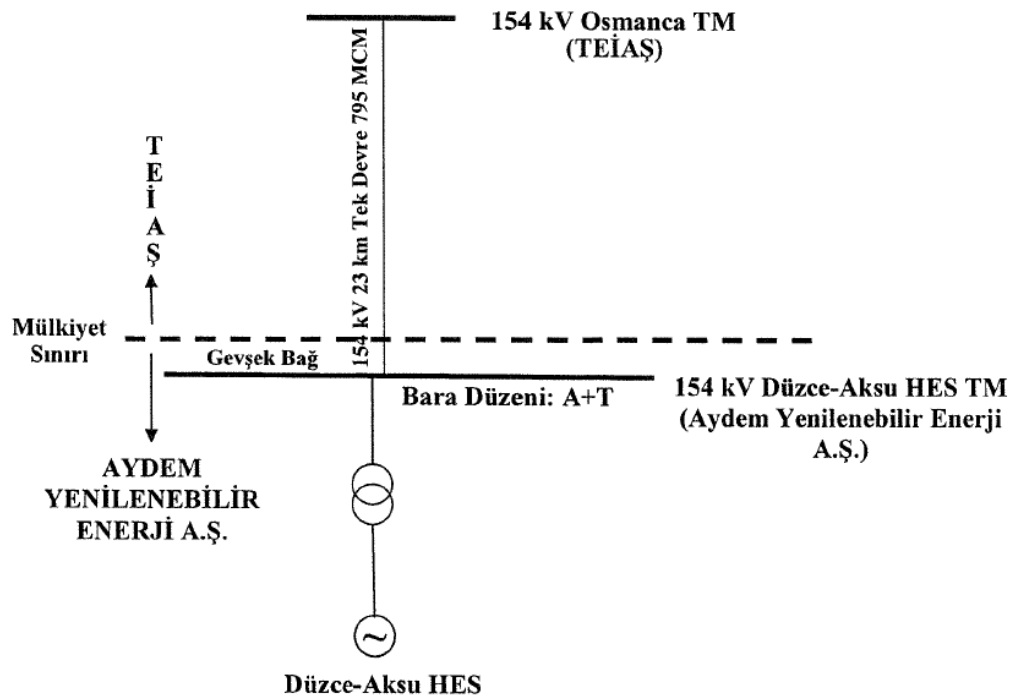


Figure 4. Single line diagram of Duzce-Aksu HEPP

APPENDIX 1: COMMERCIALLY SENSITIVE INFORMATION

There is no commercially sensitive information about the project activity. Hence, this section is not applicable.

APPENDIX 2: THE LEGAL FRAMEWORK OF THE HOST COUNTRY

Turkish Environmental Legislation

The Environmental Law (No. 2872), which was published in Turkish Official Gazette No. 18132 dated August 11, 1983 and revised in Turkish Official Gazette No. 26167 dated May 13, 2006 (Law No. 5491) provides the legislative framework for the regulation of industries and their potential impact on the environment. Industrial projects are subject to varying levels of review that begin while projects are in the development and pre-operation phases. Additional regulations apply to facilities once they are in operation.

The Environmental Law authorized the promulgation of a number of regulations. Those that pertain to development and operation of renewable energy projects are the following:

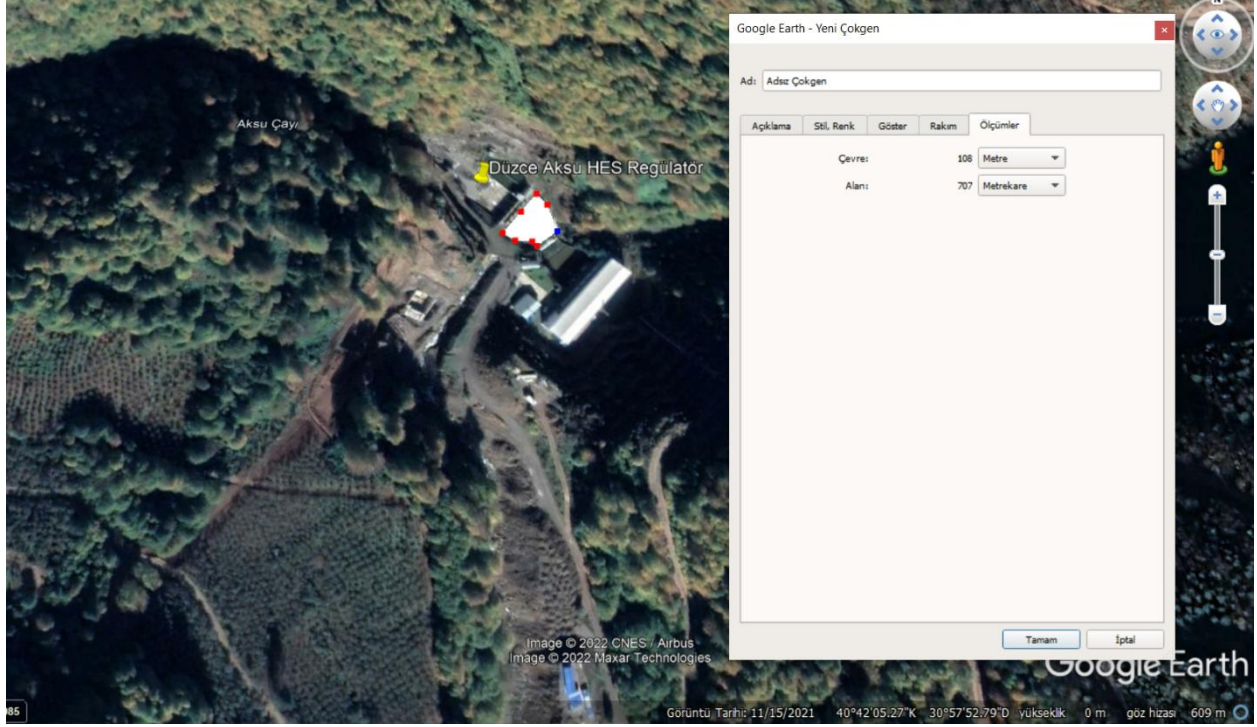
- Environmental Impact Assessment Regulation, Official Gazette No. 26939 dated July 17, 2008.
- Water Pollution Control Regulation, Official Gazette No. 25687 dated December 31, 2004 and revised in Official Gazette No. 26786 dated February 13, 2008;
- Regulation on Construction of Cesspits where there is no Wastewater Collection System, Official Gazette No. 13783 dated March 13, 1971;
- Hazardous Chemicals Regulation, Official Gazette No. 21634 dated July 11, 1993 and revised in Official Gazette No. 27092 dated December 26, 2008;
- Regulation on General Principles of Waste Management, Official Gazette No. 26927 dated July 5, 2008;
- Hazardous Wastes Control Regulation, Official Gazette No. 25755 dated March 14, 2005;
- Waste Oil Control Regulation, Official Gazette No. 26952 dated July 30, 2008 and revised Official Gazette No. 27304 dated July 31, 2009;
- Vegetative Waste Oil Control Regulation, Official Gazette No. 25791 dated April 19, 2005; and revised Official Gazette No. 27305 dated July 31, 2009
- Solid Waste Control Regulation, Official Gazette No. 20814 dated March 14, 1991 and revised in Official Gazette No. 25777 dated April 5, 2005;
- Medical Waste Control Regulation, Official Gazette No. 25883 dated July 22, 2005;
- Environmental Audit Regulation, Official Gazette No. 27061 dated November 21, 2008;
- Packaging Waste Control Regulation, Official Gazette No. 26562 dated June 24, 2007 and revised in Official Gazette No. 27046 dated November 6, 2008; and
- Waste Batteries and Accumulators Control Regulation, Official Gazette No. 25569 dated August 31, 2004 and revised in Official Gazette No. 25744 dated March 03, 2005;
- The Excavation, Construction and Demolition Waste Control Regulation, Official Gazette No. 25406 dated March 18, 2004;
- Soil Pollution Control Regulation, Official Gazette No. 25831 dated May 31, 2005;
- Regulation Related to Workplace Opening and Operation Permits, Official Gazette No. 25902 dated August 10, 2005 and revised in Official Gazette No. 26492 dated April 13, 2007;
- Industrial Air Pollution Control Regulation, Official Gazette No. 27277 dated July 3, 2009
- Air Quality Assessment and Management Regulation, Official Gazette No. 26898 dated June 6, 2008 and revised in Official Gazette No. 27219 and dated May 5, 2009;
- Air Pollution Control Regulation For Heating Sources, Official Gazette No. 25699 dated January 13, 2005 and revised in Official Gazette No. 27134 dated February 07, 2009;
- Exhaust Gases Emission Control Regulation, Official Gazette No. 27190 dated April 04, 2009; and

- Regulation on Protection of Wetlands, Official Gazette No. 25818 dated May 17, 2005.
- In addition to the Environmental Law and its associated regulations, there are several other laws that directly or indirectly include environmental review, and thus, are applicable to the proposed project. The project will comply with the 4857 numbered Labour Law and its regulations stated below:
- Occupational Health and Safety Statute, Official Gazette No. 14765 dated April 11, 1974;
- Health and Safety Regulation for Construction Works, Official Gazette No. 25325 dated December 23, 2003;
- Regulation on Health and Safety Regarding Temporary Works, Official Gazette No. 25463 dated May 15, 2004.

Other regulations that the project will comply with can be listed as follows:

- 5346 numbered Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy;
- Regulation on Protection and Usage of Agricultural Lands, Official Gazette No. 25766 dated March 25, 2005;
- 2863 numbered Law on Protection of Cultural and Natural Heritage (revised by 5226 numbered Law)
- 4342 numbered Pasture Law;
- 6831 numbered Forestry Law (amended by 5192 numbered Revision in Forestry Law)
- Regulation on Buildings located on the Disaster Areas, Official Gazette No. 26582 dated July 14, 2007;
- Law No. 4628: Electricity Market Law Ratification Date: 20.02.2001 Enactment Date: 03.03.2001
- Law No. 5627: Energy Efficiency Law Enactment Date: 18/4/2007.

APPENDIX 3: PROJECT'S RESERVOIR AREA



APPENDIX 4: BASELINE INFORMATION

TÜRKİYE TERMİK SANTRALLARINDA TÜKETİLEN YAKIT MİKTARLARININ ÜRETİCİ KURULUŞLARA DAĞILIMININ YILLAR İTİBARIYLA GELİŞİMİ (BİRLEŞİK ISI-ELEKTRİK SANTRALLARINDA ISI ÜRETİMİ İÇİN KULLANILAN YAKITLAR DAHİL) ANNUAL DEVELOPMENT OF FUELS CONSUMED IN THERMAL POWER PLANTS IN TURKEY BY THE ELECTRIC UTILITIES (FUELS USED FOR HEAT PRODUCTION IN CHP PLANTS INCLUDED)						
		Birim(Unit):Ton/Gaz(gas) 10 ³ m ³				
		2009	2010	2011		
EÜAŞ VE BAĞLI ORTAKLIKLARI EÜAŞ AND AFFILIATED PARTNERSHIPS OF EÜAŞ	Taşkömürü	<i>Hard Coal</i>	1,664,859	1,563,792	1,700,458	
	Linyit	<i>Lignite</i>	57,850,129	50,123,941	54,558,282	
	TOPLAM	TOTAL	59,514,988	51,687,733	56,258,740	
	Fuel-Oil	<i>Fuel Oil</i>	239,410	16,864	27,098	
		Yrd. Yakıt	<i>Auxiliary Fuel</i>	134,007	105,073	118,439
	TOPLAM	TOTAL	373,417	121,937	145,537	
	Motorin	<i>Diesel Oil</i>	45,364	4	0	
		Yrd. Yakıt	<i>Auxiliary Fuel</i>	72,956	18,901	13,984
	TOPLAM	TOTAL	118,320	18,905	13,984	
	TOPLAM	TOTAL	491,737	140,842	159,521	
Doğal Gaz	<i>Natural Gas</i>	5,091,011	4,493,275	4,173,420		
MOBİL SANTRALLAR MOBILE POWER PLANTS	Fuel-Oil	<i>Fuel Oil</i>	0	0	0	
	Motorin	<i>Diesel Oil</i>	0	0	0	
TOPLAM	TOTAL	0	0	0		
OTOPRODÜKTÖRLER ÜRETİM ŞİRKETLERİ İŞLETME HAKKI DEVİR ADÜAŞ* AUTOPRODUCERS PRODUCTION COMP. TOOR ADÜAŞ	Taşkömürü+İthal kömür	<i>Hard Coal+Imported Coal</i>	4,956,318	5,855,911	8,873,976	
	Linyit	<i>Lignite</i>	5,770,389	6,565,451	6,949,028	
	TOPLAM	TOTAL	10,726,707	12,421,362	15,823,004	
	Fuel-Oil	<i>Fuel Oil</i>	1,220,904	769,845	386,071	
	Motorin	<i>Diesel Oil</i>	62,537	1,449	1,063	
	LPG	<i>LPG</i>	111	0	0	
	Nafta	<i>Naphta</i>	8,077	13,140	0	
	TOPLAM	TOTAL	1,291,629	784,434	387,134	
	Doğal Gaz	<i>Natural Gas</i>	15,887,029	17,290,139	18,631,167	
	TÜRKİYE TURKEY	Taşkömürü+İthal kömür	<i>Hard Coal+Imported Coal</i>	6,621,177	7,419,703	10,574,434
Linyit		<i>Lignite</i>	63,620,518	56,689,392	61,507,310	
TOPLAM		TOTAL	70,241,695	64,109,095	72,081,744	
Fuel-Oil		<i>Fuel Oil</i>	1,594,321	891,782	531,608	
Motorin		<i>Diesel Oil</i>	180,857	20,354	15,047	
LPG		<i>LPG</i>	111	0	0	
Nafta		<i>Naphta</i>	8,077	13,140	0	
TOPLAM		TOTAL	1,783,366	925,276	546,655	
Doğal Gaz		<i>Natural Gas</i>	20,976,040	21,783,414	22,804,587	

Figure 5. Consumption of fuel in thermal power plants in Türkiye

NET CALORIFIC VALUES OF FUELS CONSUMED IN THE THERMAL POWER PLANTS

			Unit: TJ/KT			
			2009	2010	2011	
EÜAŞ VE BAĞLI ORTAKLIKLARI <i>EÜAŞ AND AFFILIATED PARTNERSHIPS OF EÜAŞ</i>	Taşkömürü	<i>Hard Coal</i>	13.71	13.36	13.57	
	Linyit	<i>Lignite</i>	6.03	6.76	7.01	
	TOPLAM	TOTAL	6.25	6.96	7.21	
	Fuel-Öil	<i>Fuel Oil</i>	40.24	40.30	40.27	
		<i>Asıl Yakıt Main Fuel</i>	40.19	40.19	40.19	
		<i>Yrd. Yakıt Auxiliary Fuel</i>	40.22	40.21	40.21	
		TOPLAM TOTAL				
	Motorin	<i>Diesel Oil</i>	0.00	1.00	0.00	
		<i>Asıl Yakıt Main Fuel</i>	43.12	43.12	43.17	
		<i>Yrd. Yakıt Auxiliary Fuel</i>	43.12	43.12	43.17	
	TOPLAM TOTAL	40.92	40.60	40.47		
	Doğal Gaz	<i>Natural Gas</i>	34.82	34.81	34.73	
MOBİL SANTRALLAR <i>MOBILE POWER PLANTS</i>	Fuel-Öil	<i>Fuel Oil</i>	0.00	0.00	0.00	
	Motorin	<i>Diesel Oil</i>	0.00	0.00	0.00	
	TOPLAM	TOTAL	0.00	0.00	0.00	
OTOPRODÜKTÖRLER ÜRETİM ŞİRKETLERİ İŞLETME HAKKI DEVİR ADÜAŞ* <i>AUTOPRODUCERS PRODUCTION COMP. TOOR ADÜAŞ</i>	Taşkömür+İthal kömür	<i>Hard Coal+imported Coal</i>	25.07	24.71	24.56	
	Linyit	<i>Lignite</i>	10.37	9.94	9.55	
	TOPLAM	TOTAL	17.16	16.90	17.97	
	Fuel-Öil	<i>Fuel Oil</i>	39.69	40.23	42.10	
	Motorin	<i>Diesel Oil</i>	40.94	42.66	42.85	
	LPG	<i>LPG</i>	0.00	1.00	0.00	
	Nafta	<i>Naphta</i>	43.65	33.50	0.00	
	TOPLAM	TOTAL	39.77	40.13	42.10	
		Doğal Gaz	<i>Natural Gas</i>	37.93	38.05	37.63
TÜRKİYE <i>TURKEY</i>	Taşkömür+İthal kömür	<i>Hard Coal+imported Coal</i>	22.21	22.32	22.79	
	Linyit	<i>Lignite</i>	6.43	7.13	7.30	
	TOPLAM	TOTAL	7.91	8.89	9.57	
	Fuel-Öil	<i>Fuel Oil</i>	39.81	40.23	41.58	
	Motorin	<i>Diesel Oil</i>	42.37	43.09	43.15	
	LPG	<i>LPG</i>	46.47	0.00	0.00	
	Nafta	<i>Naphta</i>	43.65	33.50	0.00	
	TOPLAM	TOTAL	40.09	40.20	41.63	
		Doğal Gaz	<i>Natural Gas</i>	37.17	37.38	37.10

Figure 6. Net calorific values of fuels consumed in the thermal power plants

Fuel Type:	EF (tCO ₂ /TJ)
Coal	92.80
Lignite	90.90
Fuel Oil	75.50
Diesel	72.60
LPG	61.60
Naphtha	69.30
Natural Gas	54.30
Bitumen	73.00

Figure 7. IPCC Default CO₂ emission factors

<http://www.teias.gov.tr/TurkiyeElektrikIsiSantralleri/istatistik2011/ykn06-48/49.xls>

TÜRKİYE TERMİK SANTRALLARINDA TÜKETİLEN YAKITLARIN KURULUŞLARA GÖRE İSİ DEĞERLERİ
(BİRLEŞİK İSİ-ELEKTRİK SANTRALLARINDA İSİ ÜRETİMİ İÇİN KULLANILAN YAKITLAR DAHİL)
HEATING VALUES OF FUELS CONSUMED IN THERMAL POWER PLANTS IN TURKEY BY THE ELECTRIC UTILITIES
(FUELS USED FOR HEAT PRODUCTION IN CHP PLANTS INCLUDED)

Birim(Unit): Tcal

		2009	2010	2011		
EÜAŞ VE BAĞLI ORTAKLIKLARI	Taşkömürü	Hard Coal	5,452	4,990	5,511	
	Linyit	Lignite	83,356	80,967	91,352	
	TOPLAM	Total	88,809	85,957	96,863	
	Fuel-Oil	Fuel Oil	Asıl Yakıt Main Fuel	2,301	162	261
			Yrd. Yakıt Auxiliary Fuel	1,286	1,009	1,137
		TOPLAM TOTAL	TOPLAM TOTAL	3,587	1,171	1,398
	Motorin	Diesel Oil	Asıl Yakıt Main Fuel	467	0	0
			Yrd. Yakıt Auxiliary Fuel	751	195	144
		TOPLAM TOTAL	TOPLAM TOTAL	1,219	195	144
	TOPLAM	TOTAL	4,806	1,366	1,542	
Doğal Gaz	Natural Gas		42,335	37,354	34,621	
	TOPLAM	TOTAL	135,949	124,676	133,026	
MOBİL SANTRALLAR MOBIL POWER PLANTS	Fuel-Oil	Fuel Oil	0	0	0	
	Motorin	Diesel Oil				
	TOPLAM	TOTAL	0	0	0	
OTOPRODÜKTÖRLER ÜRETİM ŞİRKETLERİ İŞLETME HAKKI DEVİR ADÜAŞ AUTOPRODUCERS PRODUCTION COMP. TOOR ADÜAŞ	Taşkömürü	Hard Coal+Imported Coal	29,677	34,556	52,056	
	Linyit	Lignite	14,295	15,584	15,857	
	TOPLAM	Total	43,973	50,141	67,914	
	Fuel-Oil	Fuel Oil	11,573	7,398	3,882	
	Motorin	Diesel Oil	612	15	11	
	Lpg	Lpg	1	0	0	
	Nafta	Naphta	84	105	0	
	TOPLAM	TOTAL	12,270	7,518	3,893	
	Doğal Gaz	Natural Gas	143,931	157,134	167,443	
	TOPLAM	TOTAL	187,904	207,275	235,357	
TÜRKİYE TURKEY	Taşkömürü	Hard Coal+Imported Coal	35,130	39,546	57,567	
	Linyit	Lignite	97,652	96,551	107,210	
	TOPLAM	Total	132,782	136,097	164,777	
	Fuel-Oil	Fuel Oil	15,163	8,569	5,280	
	Motorin	Diesel Oil	1,830	209	155	
	Lpg	Lpg	1	0	0	
	Nafta	Naphta	84	105	0	
	TOPLAM	TOTAL	17,076	8,884	5,435	
	Doğal Gaz	Natural Gas	186,266	194,487	202,064	
	TOPLAM	TOTAL	336,123	339,468	372,276	

Figure 8. Heat values of fuels consumed in thermal power plants in Türkiye according to their establishments (Tcal)

TÜRKİYE TERMİK SANTRALLARINDA TÜKETİLEN YAKITLARIN KURULUŞLARA GÖRE ISI DEĞERLERİ
(BİRLEŞİK ISI-ELEKTRİK SANTRALLARINDA ISI ÜRETİMİ İÇİN KULLANILAN YAKITLAR DAHİL)
HEATING VALUES OF FUELS CONSUMED IN THERMAL POWER PLANTS IN TURKEY BY THE ELECTRIC UTILITIES
(FUELS USED FOR HEAT PRODUCTION IN CHP PLANTS INCLUDED)

1cal = 4,1868 Joule

			Birim(Unit): Gjoule		
			2009	2010	2011
EÜAŞ VE BAĞLI ORTAKLIKLARI	Taşkömürü	Hard Coal	22,828,163	20,892,383	23,074,208
	Linyit	Lignite	348,995,433	338,990,622	382,472,805
	TOPLAM	Total	371,823,595	359,883,005	405,547,013
	Fuel-Oil	Fuel Oil			
	Asıl Yakıt Main Fuel		9,632,696	679,656	1,091,289
Yrd. Yakıt Auxiliary Fuel		5,386,180	4,223,229	4,760,433	
TOPLAM TOTAL		15,018,876	4,902,885	5,851,723	
EÜAŞ AND AFFILIATED PARTNERSHIPS OF EÜAŞ	Motorin Diesel Oil				
	Asıl Yakıt Main Fuel		1,956,278	159	0
	Yrd. Yakıt Auxiliary Fuel		3,146,162	815,082	603,737
	TOPLAM TOTAL		5,102,441	815,241	603,737
	TOPLAM	TOTAL	20,121,317	5,718,126	6,455,459
	Doğal Gaz	Natural Gas	177,247,713	156,392,061	144,950,365
TOPLAM	TOTAL	569,192,626	521,993,192	556,952,838	
MOBİL SANTRALLAR MOBIL POWER PLANTS	Fuel-Oil	Fuel Oil	0	0	0
	Motorin	Diesel Oil	0	0	0
	TOPLAM	TOTAL	0	0	0
OTOPRODÜKTÖRLER ÜRETİM ŞİRKETLERİ İŞLETME HAKKI DEVİR ADÜAŞ AUTOPRODUCERS PRODUCTION COMP. TOOR ADÜAŞ	Taşkömür+İthal kömür	Hard Coal+Imported Coal	124,253,075	144,680,890	217,948,438
	Linyit	Lignite	59,852,102	65,249,084	66,392,055
	TOPLAM	Total	184,105,177	209,929,975	284,340,493
	Fuel-Oil	Fuel Oil	48,452,601	30,974,336	16,254,037
	Motorin	Diesel Oil	2,560,350	61,818	45,552
	Lpg	Lpg	5,158	0	0
	Nafta	Naphta	352,524	440,154	0
	TOPLAM	TOTAL	51,370,633	31,476,308	16,299,589
	Doğal Gaz	Natural Gas	602,609,967	657,887,178	701,051,608
	TOPLAM	TOTAL	786,715,144	867,817,153	985,392,101
TÜRKİYE TURKEY	Taşkömür+İthal kömür	Hard Coal+Imported Coal	147,081,237	165,573,274	241,022,646
	Linyit	Lignite	408,847,535	404,239,706	448,864,860
	TOPLAM	Total	555,928,772	569,812,980	689,887,506
	Fuel-Oil	Fuel Oil	63,471,478	35,877,221	22,105,760
	Motorin	Diesel Oil	7,662,790	877,059	649,289
	Lpg	Lpg	5,158	0	0
	Nafta	Naphta	352,524	440,154	0
	TOPLAM	TOTAL	71,491,950	37,194,434	22,755,049
	Doğal Gaz	Natural Gas	779,857,681	814,279,239	846,001,974
	TOPLAM	TOTAL	1,407,278,403	1,421,286,653	1,558,644,529

Figure 9. Heat values of fuels consumed in thermal power plants in Türkiye according to their establishments (Gjoule)