CIRAKDAMI HYDRO ELECTRICITY POWER PLANT

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

Project Title	Cirakdami Hydro Electricity Power Plant
Version	04
Report ID	03
Date of Issue	07-February-2024
Project ID	1506
Monitoring Period	01-January-2022 to 27-June-2022
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Karadeniz Hidroelektrik Enerjiden Elektrik Üretim Santrali Ltd (KARHES) which is owned by Aydem Yenilenebilir Enerji A.S. constructed Cirakdami Regulator and Hydro Electric Power Plant (HEPP) on the Aksu River, within the jurisdiction of Çırakdamı Town of Giresun Province, Turkey. The purpose of the project is electricity production using the potential energy of Aksu River as a renewable resource. The purpose of the project is to supply electricity to the Turkish power grid, from a renewable source.

The Project Activity (PA) utilizes the Aksu River to generate electricity with zero carbon emissions for the Turkish Power Grid. The PA is displacing electricity that would otherwise be generated by the existing grid of the host country. The project was designed as a runoff river reservoir type power plant as per EPDK license states (EÜ/365-2/478). The installed capacity of the project is 49.1 MWe with two turbines each having installed capacity of 24.55 MWe (29.33 MWm) according to the generation license which is dated 14/09/2004. The project has started on 28/06/2012, which is the commissioning date for Unit 2. The generation and emission reduction for this monitoring period is estimated as 81,171 MWh and 43,283 tCO_2e as per registered PD, respectively. The net electricity generation achieved is reported as 87,975.17 MWh and emission reductions of 46,908 tCO_2e during this monitoring period (01-January-2022 to 27-June-2022).

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 Environmental impacts of the project is kept to a minimum and all the regulations that are in act in Turkey is obeyed during the operation stages of the Cirakdami HEPP project.

Table 1. Milestones of ÇIRAKDAMI HYDROELECTRIC POWER PLANT

Milestone	Date
The Electricity Production License is granted	14/09/2004
EIA Exemptions certification issued	27/04/2006

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

Milestone	Date
Amendment to the Water Usage Agreement Signed	30/09/2010
Connection Agreement	24/06/2019
Revised TEİAŞ Agreement	21/06/2019
Commissioning Date for Unit 2	28/06/2012
Commissioning Date for Unit 1	26/04/2013
First Crediting Period	28/06/2012 – 27/06/2022
Third Monitoring Period (current)	01/01/2022 – 27/06/2022

The Cirakdami HPP is made up of one hydro power plant. There is one regulating body that is taking up the water from the 492 m elevation level and the tail water level is 475 m. The potential energy of water at approximate gross head level of 23 m is utilized and the electricity is produced by the power plant. The project start period is 28/06/2012 and the project has been operational since that day including the monitoring period of 01-January-2022 to 27-June-2022.

The water is entering to the regulatory body and the water collecting area over the Aksu River at the 492 m elevation level. Then the water is settled at the sedimentation pool and is transferred to a tunnel. The water that passes this tunnel is transferred to a canal and transferred to the loading pool via penstock and passed to the hydro power plant building where the electricity is produced. The water is than be left back to the Aksu River at the 475 m elevation level.

The project boundary can be seen in Figure 1.

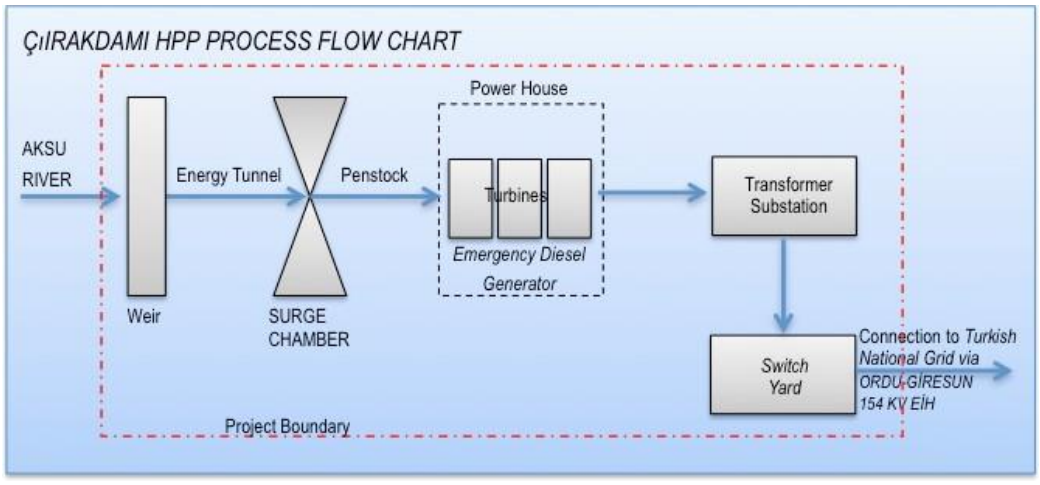

Figure 1. Project boundary

Flow chart showing the basic operational principles of the project activity. The project activity is connected to the grid via the 154 KV Ordu-Giresun Transmission Line, as indicated in the connection agreement provided to the validating DOE.

Audit Type	**Period**	**Program**	**VVB Name**	**Number of years**
Validation/ Verification	28-June-2012 – 27-June-2022	VCS	RINA S.p.A (RINA)	10
Verification	28-June-2012 – 30-September-2020 (1st monitoring period)	VCS	Carbon Check	~8
Verification	01-October-2020 – 31-December-2021 (2nd monitoring period)	VCS	Carbon Check	15 months
Verification	01-January-2022 to 27-June-2022 (3rd monitoring period)	VCS	Re-carbon	6 months
Total	-	-	-	-

1.2 Sectoral Scope and Project Type

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

1.3 Project Proponent

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

1.4 Other Entities Involved in the Project

Organization name	GTE Karbon Sürdürülebilir Enerji Eğt. Dan. ve Tic. A.Ş.
Role in the Project	Project consultant
Contact person	M. Kemal Demirkol
Title	Director
Address	Mustafa Kemal Mah. 2111. Sok. No: 5 06530 Cankaya - Ankara – TURKEY
Telephone	+90 312 514 63 63
Email	kemal.demirkol@gte.com.tr

1.5 Project Start Date

Project start date is 28/06/2012[2], which is the date when the project started to supply electricity to the Turkish grid as substantiated by the partial acceptance letter sent to the Governance of Giresun Province, Giresun-Turkey.

[2] Provisional acceptance

1.6 Project Crediting Period

The project crediting period is 10 years (twice renewable). The period includes the dates of 28/06/2012 to 27/06/2022 (both days included).

1.7 Project Location

The project is located at the Northern Black Sea region of Turkey at the Giresun Province as shown in the location Map below (Figure 2). The coordinates of the weir and the powerhouse are indicated in the below table (Table 2). The nearest settlement to the Project Activity is Çırakdamı village.

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

Component's name	Latitude	Longitude
Weir	40°41'24.29"N	38°26'22.67"E
Powerhouse	40°43'58.23"N	38°26'33.02"E

Figure 2. Project location

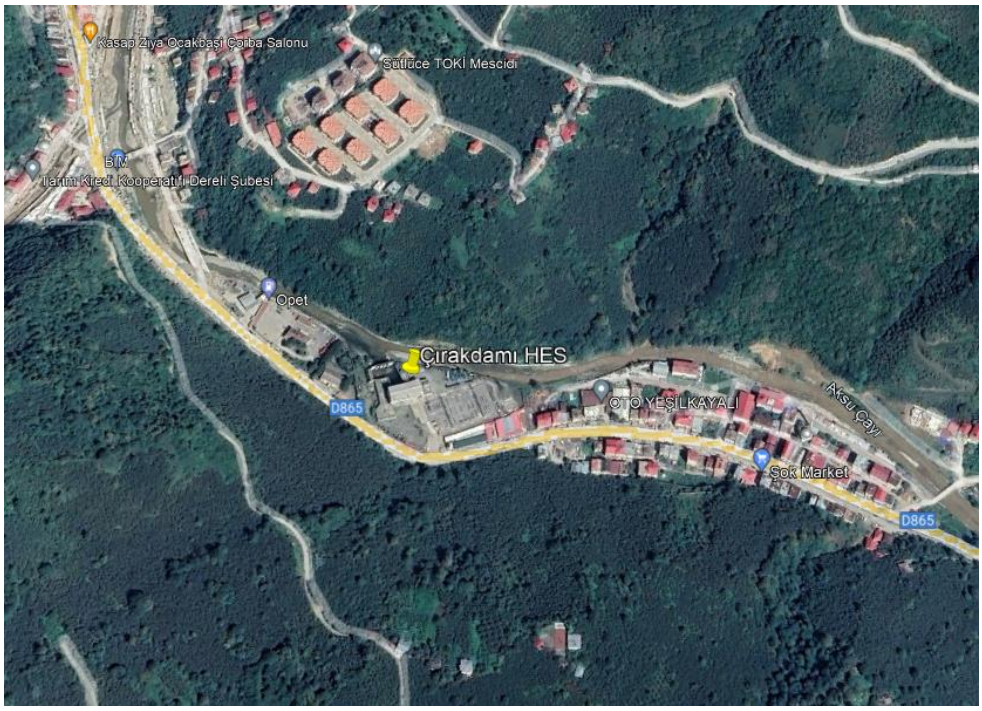

Figure 3. Satellite image of the project activity

1.8 Title and Reference of Methodology

The following UNFFCC methodology and its related tools are utilized:

Approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources." Version 14.0.0.

The following tools are utilized:

- "Tool for the demonstration and assessment of additionality" (Version 07.0.0)[3]
- "Tool to calculate the emission factor for an electricity system". (Version 07.0.0)[4]

1.9 Participation under other GHG Programs

The project is a voluntary project and the host country, Turkey cannot host CDM or JI projects.

The project has not been registered under any other voluntary GHG program.

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

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

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

Emission Trading Programs and Other Binding Limits: There is no other form of environmental credit generated by the project because there is no such system within the host country. The projects originate from Turkey do not comply for renewable energy certificates of EU because there is no energy trade between EU and Turkey because of different grid structures.

Other Forms of Environmental Credit: There is no other form of environmental credit generated by the project because there is no such system within the host country. The project does not generate other form of environmental credits such as Green Power Certificates. The projects originate from Turkey do not comply for renewable energy certificates of EU because there is no energy trade between EU and Turkey because of different grid structures.

1.11 Sustainable Development Contributions

The project aims to generate energy source by reducing the dependence on fossil fuels without producing air pollution or toxic by-products. Hydroelectric Power Plant supplies the increasing national electricity demand in a cleaner and sustainable manner.

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. For this monitoring period, 87,975.17 MWh of clean electricity has been produced.

SDG-8 is to promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for 12 people. In this project, occupational trainings and occupational health trainings were given regularly. The project providing decent and secure work environment.

SDG-12 Responsible consumption and production as the hydroelectric power plants are producing clean source of energy. They are replacing the fossil fuel based national grid. Because of that these plants drive people to consume more sustainable type of energy.

SDG-13 On urgent action to combat climate change, as the project is replacing the fossil fuel based national grid and it is producing emission reductions, 46,908 tCO_2 reduction for this monitoring period.

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Table 3. Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	13.3	Tonnes of greenhouse gas emissions avoided	Implemented activities to increase	By generating electricity from clean sources, project has prevented 46,908 tCO_2 into the atmosphere during the monitoring period	By generating electricity from clean sources, project has prevented 885,100 tCO_2 into the atmosphere Over Project Lifetime
2)	8.5	Job opportunities created	Implemented activities to increase	Total 12[5] people were employed during this monitoring period.	Total 12 people were employed over project lifetime. This number will be maintained during the first crediting period.
3)	7.2	7.2.1 Renewable energy share in the total final energy consumption	Implemented activities to increase	The project generated 87,975.17 MWh electricity from hydropower which is a renewable source during the monitoring period	The project is expected to generate 165,990 MWh/year electricity from hydropower which is a renewable source over project lifetime
4)	12.4	Environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks.	Implemented activities to increase	The project is taking actions towards the safe disposal of chemicals and all wastes.	The project is taking actions towards the safe disposal of chemicals and all wastes.

[5]It was indicated during the site-visit.

2 SAFEGUARDS

2.1 No Net Harm

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

Water & Wastewater Management

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

Sewage truck records are provided dated 24/03/2022, 26/04/2022, and 21/06/2022.

Waste Oil

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

Collection records are provided dated 10/01/2022. These records include collection of hazardous wastes generated at the site.

Solid Waste

Solid waste is collected, and recyclables are separated to be sent to recycling centers. The rest is disposed to the nearest landfill site in coordination with Dereli District Municipality. The solid waste here also covers the E-Waste. Hence the disposal is realized in accordance with Regulation on Waste Management, Regulation on Electrical and Electronic Waste Control, and Regulation on Battery and Accumulator Wastes.

Biodiversity

Necessary precautions are taken for the species under conservation by international conventions, the field is regularly observed in terms of any change and irregularity of the biodiversity (a report has been prepared on March 2006). Regular ecosystem reporting mechanism is applied for the field.

Çırakdamı Regulator and HEPP Project is located between 500 m elevations of Aksu Stream and 310 m elevations of Dereli Stream. The valley floor of the Aksu Creek valley has a high slope and there is almost no land suitable for agriculture. The surrounding areas mostly consist of neighborhoods, and these neighborhoods generally supply their drinking and utility water from deterioration springs and wastewater. A part of the lower area remains on the old bed of the Aksu stream, whose bed has been changed. This section will be filled with excavation material that will come during the leveling of the sub-area. If this material is not sufficient, the material from the other excavation of the power plant will also be used in the filling work. There is no risk of explosion, for the switchgear area. Çırakdamı HEPP Project is a river type facility and the regulator to be built on the stream bed is 4 m. Since the volume of water accumulated in the regulatory structure is very small, the water coming from the number of streams is transferred to the downstream without being accumulated. Therefore, there is no negative impact on water quality. During the construction of the facility, the excavations obtained from the transmission tunnel and other structures is placed in a suitable place so that they will not be damaged.

2.2 Local Stakeholder Consultation

A stakeholder meeting has been organized on 09/04/2006 in the Mukhtarship room of the Kuşluhan Sub district which is a close settlement at the project site. The meeting was announced by announcements placed at the Mukhtarship board and several places at the nearby settlements. These announcements were given to the Mukhtar on 20/03/2006 and announced the meeting time and place. The meeting was held in the afternoon at 14:00, and the Mukhtar coordinated the meeting. There were no negative comments received.

The relationship with the local stakeholders deemed to be very important and before the project was implemented a stakeholder's consultation meeting was held at the project site. In addition to this there is a "grievance box" in a gas station within the vicinity of the project (Kuşluhan Neighborhood) for a continuous grievance policy that is implemented by the project owner. Every month the PP consults with local stakeholders at the box locations and discuss their grievances as well as positive comments. During the monitoring period there were no complaints about or demands from the project.

2.3 AFOLU-Specific Safeguards

The project is not an AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

Çırakdamı HEPP is built on Aksu River. The regulator is approximately at the elevation of 485 m. The PA utilizes approximately (gross) 177 m of potential energy difference to produce electricity. Çırakdamı HEPP is connected to Turkish National Power Grid via one of Transformer Substations y 28 km long 154 kV Giresun transmission line.

There are two Vertical Francis type turbines that have an installed capacity of 49.1 MWe, each having installed capacity of 24.55 MWe (29.33 MWm) according to the generation license which is dated 14/09/2004.

Table 4. Properties of the installed turbines

Turbine Properties	
Type	Vertical Francis
Number of Turbines	2
Installed Capacity	49.1 MWe (2 x 24.55 MWe)

The commissioning date the unit 2 was 28/06/2012 which is accepted as project start date. The unit 1, on the other hand, was commissioned on 26/04/2013. There is no special event that may have impact on monitoring of GHG emission reductions.

Table 5. Current meter details

	Main Meter	**Spare Meter**
Serial no.	9798711	9798712
Brand-Type	EMH LZQJ-XC	EMH LZQJ-XC
First Index Date	19/11/2020	19/11/2020
Next Calibration date	19/11/2030[6]	19/11/2030[7]
Calibration frequency	10 years	10 years
Test Date	22/06/2020	22/06/2020

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

	Main Meter	Spare Meter
Test frequency	2 years	2 years
Class	0.2S - 0.5S	0.2S - 0.5S

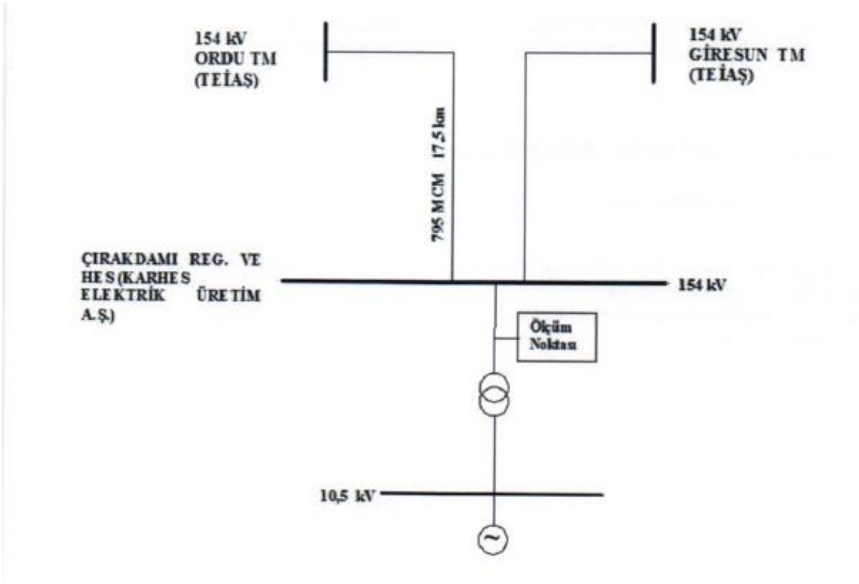


Figure 4. The single line diagram of the project activity

3.2 Deviations

3.2.1 Methodology Deviations

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

3.2.2 Project Description Deviations

Title of the company changed from Bereket Enerji Üretim San. ve Tic. A. Ş. to Aydem Yenilenebilir Enerji A.Ş which is the current project proponent as stated in Turkey Trade Registry Gazette on 24/12/2019.[8]

[8] Turkey Trade Registry Gazette, No:9982, page 219

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 25/01/2019", it has been found that the testing of energy meters will be carried out every 2 The total capacity of Cirakdami HEPP was recorded as 49,11 MWe, having three turbine units, two with 20 MW capacity and one with 9.11 MW capacity, in validated PD (version 2.00) (EPDK license on 14/09/2004). However, an amendment EPDK license was approved on 29/12/2005, in which the total capacity of project remained the same as PD, however, the number of turbines and their capacity changed to 2x24.55 MWe, for a total of 49,11 MWe.

3.3 Grouped Projects

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

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$FC_{i,y}$
Data unit	Mass or Volume Unit (Tonnes 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 [9]
Value applied	Please see Appendix 3 (Figure 6) (from the validated PD (version 2.00))
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.

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

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[10]
Value applied	Please see Appendix 3 (Figure 7) (from the validated PD (version 2.00))
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to date and reliable data available for the Turkish grid.
Purpose of Data	Data used for the calculation of $EF_{grid,OM,Simple,y}$. As data on the NCV is not published directly on the TEİAŞ website, this data is calculated using the heating values of fuels and the volume or mass of fuels consumed for each year.
Comments	-

Data / Parameter	$EF_{CO2,i,y}$
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 3 (Figure 8) (from the validated PD (version 2.00))
Justification of choice of data or description of measurement	According to the "Tool to calculate the emission factor for an electricity system" version 7, if values provided by the fuel supplier of the power plants in invoices or regional or national

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

methods and procedures applied	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_y
Data unit	MWh
Description	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y
Source of data	Turkish Electricity Transmission Company Web Site[11]
Value applied	Please see Appendix 3 (Figure 9 and Figure 10) (from the validated PD (version 2.00))
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	$EG_{m,y}$
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 2.00
Justification of choice of data or description of measurement	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The

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

[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

methods and procedures applied	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, EB87 Annex 9)" are used
Value applied	Please see Annex 2 in the validated PD version 2.01.
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	-

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	CO_2 emission factor of the grid electricity in year y
Source of data	Combined margin emission factor calculated in the registered PDD $EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$ Where: $EF_{grid,CM,y}$: Combined margin CO_2 emissions factor in year y (tCO_2/MWh) $EF_{grid,BM,y}$: Build margin CO_2 emission factor in year y (tCO_2/MWh)

	w_{OM} : weight of operating margin emissions factor (0.5 by default) w_{BM} : weight of build margin emissions factor (0.5 by default) $EF_{grid,CM,y}$ = 0.5 * 0.65716 tCO_2/MWh + 0.5 * 0.40930 tCO_2/MWh = 0.53323 tCO_2/MWh
Value applied	0.53323
Justification of choice of data or description of measurement methods and procedures applied	”Tool to calculate the emission factor for an electricity system” v.04.0.0
Purpose of Data	Baseline emission calculation
Comments	$EF_{grid,CM,y}$ value (0.53323 tCO_2/MWh) is valid for the duration of the crediting period.

4.2 Data and Parameters Monitored

Data / Parameter	EG_y
Data unit	MWh
Description	Electricity
Source of data	Net Amount of Electricity supplied to the “Turkish National Grid” by the proposed project EPIAS screenshots are the main source, and TEIAS readings are used in cross-check.
Description of measurement methods and procedures to be applied	Data is measured directly from meters and records on TEİAŞ readings protocol papers (back-up source). EPIAS screenshots are used (main source).

<table>
<tr><td>Frequency of monitoring/recording</td><td>Annually</td></tr>
<tr><td>Value monitored</td><td>87,975.17 MWh (for this monitoring period)</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 0.5%. The two electricity metering devices were replaced with new ones on 19/11/2020 as the previous ones reached their end of validity period of 10 years.

Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market[8].</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 current meters and their validity is as follows:

<table>
<tr><th></th><th>Main Meter</th><th>Spare Meter</th></tr>
<tr><td>Serial no.</td><td>9798711</td><td>9798712</td></tr>
<tr><td>Brand- (Type)</td><td>EMH-(LZQJ-XC)</td><td>EMH-(LZQJ-XC)</td></tr>
<tr><td>Next Calibration date</td><td>19/11/2030[14]</td><td>19/11/2030[15]</td></tr>
<tr><td>Calibration frequency</td><td>10 years</td><td>10 years</td></tr>
<tr><td>Test Date</td><td>22/06/2020</td><td>22/06/2020</td></tr>
<tr><td>Test frequency</td><td>2 years</td><td>2 years</td></tr>
<tr><td>Class</td><td>0.2S - 0.5S</td><td>0.2S - 0.5S</td></tr>
</table></td></tr>
<tr><td>Purpose of the data</td><td>Data to be used for the calculation of Baseline Emissions.</td></tr>
<tr><td>Calculation method</td><td>Direct continuous measurement
$EG_{Facility,y}=EG_{export,y}-EG_{import,y}$
(Annual electricity generation of the plant is calculated as the sum of the monthly generations obtained from EPIAS records. After deducting the amount of imported electricity from the generated electricity, the net electricity supplied to the grid is evaluated.)
During verification, “net generation value” will replace “total generation value”. Where, (Net Generation) = (Gross Generation) – (Electricity consumed from grid)
Total generation value from the generation license is only considered here for estimation purpose only.</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

Comments	The collected data is kept by Aydem Yenilenebilir Enerji AS. During the crediting period and until two years after the last issuance of VERs for the "Çırakdamı Hydroelectricity 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 monitored	49,110,000 W
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	To monitor capacity of the project
Calculation method	N/A
Comments	

Data / Parameter:	AP_J
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:	2,827.116 m^2
Monitoring equipment:	-
QA/QC procedures to be applied:	Can be 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

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.

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 was 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 was 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 every ten years and the test of electricity meters are performed every two years. If the meters exhibit any error or fault during the test, the electricity meters would be calibrated or replaced with the new ones. The meters are checked continuously if there is a difference of 0.2 % in the readings of the main and the auxiliary meters, the calibration is repeated. For Cirakdami HEPP, the next calibration date of electricity meters is recorded as 19/11/2030.

The net electricity produced is calculated by subtracting the total electricity consumed by the hydroelectric power plant, from the gross electricity generation and a certain percentage is lost during the transmission. After obtaining the net electricity production value, the emission reductions are calculated by multiplying the net electricity with the Combined Margin calculated above.

The monitoring is conducted by the Verified Emission Reduction (VER) Monitoring Team. The VER Team Members, and their position and duties for the monitoring is outlined in the following table (Table 6).

Table 6. Positions and responsibilities of the VER monitoring team members

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

The power generation meter readings were performed by using the main metering devices and the auxiliary metering devices for accuracy checks only. Data from metering devices is recorded by TEİAŞ on monthly agreed protocols and form the basis for invoicing. In addition to the readings of the two metering devices, generation data of the Cirakdami HEPP can be cross checked, via the TEİAŞ – EPİAŞ web site (https://seffaflik.epias.com.tr/transparency/) which is accessible by a password available to the electricity generation companies. 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.

Each period, the monitoring report is submitted to DOE for the verification. The report covers the monitoring of grid-connected power generation, check report, report on calculation of the emission reductions and records of monitoring instrument repair and calibration, etc. All data collected as part of monitoring is archived electronically and kept at least for 2 years after the end of the last crediting period. The company establishes a dedicated maintenance system to ensure the data availability for the required period.

TEİAŞ is the responsible body for the meters and ensures the quality and accuracy of the measurements. Calibration of the meters are handled by TEİAŞ; hence no internal audit is performed by the power plant employees. Calibrations are done according to the national regulations by the distribution company. Calibrations are done according to the Measuring Instruments Directive[16]. Calibration of the meters are valid for 10 years based on Regulation on Metering and Metering Devices[17].The generation is zero for the period where the meters are being replaced. Meter replacements are done on the same day. Meters are tested every two years, according to the System Use Agreement between the PP and the distribution company TEİAŞ. Testing is done by TEİAŞ.

The two electricity metering devices were replaced with new ones on 19/11/2020 as the previous ones reached their end of validity period of 10 years.

Meter	Serial Number	Brand	Calibration Year	Valid Until	Accuracy Class
Main Meter	9798711	EMH	2020	2030	0.2S - 0.5S (+-%1)

[16] Regulation on Measuring And Measuring Instruments (Official Gazette Date & No : 25/07/1994 & 22000) https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=7&MevzuatNo=6381&MevzuatTertip=5

[17] Regulation on Measuring And Measuring Instruments (Official Gazette Date & No : 25/07/1994 & 22000) https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=7&MevzuatNo=6381&MevzuatTertip=5

Control Meter	9798712	EMH	2020	2030	0.2S - 0.5S (+-%1)

The single line diagram can be seen in the figure below.

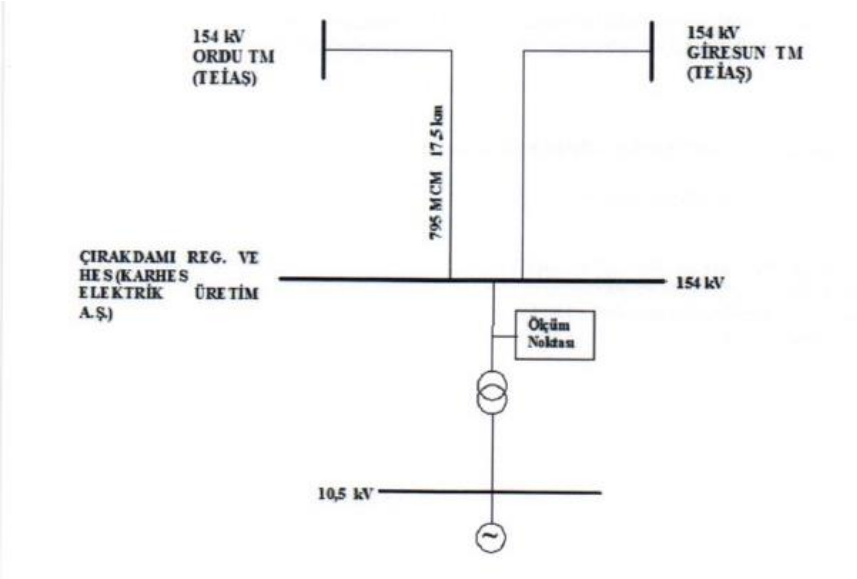


Figure 5. The single line diagram of the project activity

Local stakeholders are 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 is 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 can be provided by local stakeholders related to operation of the project activity. PP will resolve all the grievances during whole crediting period.

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

$$87{,}975.17\ MWh \times 0{,}5332\ tCO_2/MWh = 46{,}908\ tCO_2$$

$$BE_y = 46{,}908\ tCO_2$$

5.2 Project Emissions

As per ACM0002 "Grid-connected electricity generation from renewable sources", v14.0, page 10,

"For most renewable power generation project activities, PEy = 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 (t CO_2e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (t CO_2/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (t CO_2e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (t CO_2e/yr)

- Since this project uses hydroelectric power, $PE_{GP,y}$ is "0" (t CO_2/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 para 30 of "ACM0002: Grid-connected electricity generation from renewable sources" ver 14. Hence it is neglected. Therefore; $PE_{FF,y}$ = 0 (t CO_2/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/m^2 than $PE_{HP,y}$ = 0.

Therefore, as per ACM0002: Grid-connected electricity generation from renewable sources, v14.0:

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 49.110 MWe installed capacity and 2,827m^2 maximum lake area.

The power density of the project activity (PD) is calculated as follows (Equation 1 in the applied methodology):

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

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} = 49,110,000 We

Cap_{BL} = 0.0 W

A_{PJ} = 2,827 (m^2)[18]

A_{BL} = 0.0 (m^2)

Therefore, PD is calculated as;

$$PD = \frac{49{,}110{,}000 - 0}{2{,}827 - 0}$$

[18] Çırakdamı HEPP reservoir area, Annex 6 of registered PD

$$PD = 17{,}371.77\ W - m^2$$

Since the power density of the project activity is greater than 10 W/m^2, $PE_{HP,y}$ = 0. Therefore;

$$PE_y = 0$$

5.3 Leakage

The energy generating equipment is not transferred from or to another activity. Therefore, leakage is also considered as "0", according to the ACM0002 "Grid-connected electricity generation from renewable sources" methodology, version 14.0.

$$LE_y = 0$$

5.4 Net GHG Emission Reductions and Removals

Total Emission Reduction has been determined as;

$$ERy = BE_y - PE_y - LE_y$$

Where;

ER_y = Emission reductions in year y (tCO_2)

BE_y = Baseline emissions in year y (tCO_2)

PE_y = Project Emissions in year y (tCO_2)

LE_y = Leakage emissions in year y (tCO_2)

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

$$ER_y = BE_y$$

Table 7. Calculations for net total values

EG_y	**Net Generation (MWh) During Monitoring Period**	**87,975.17**
EF_y	**Emission Factor (tCO_2-MWh)**	**0.5332**[19]

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

BE_y	Baseline emissions in year y (tCO_2) During Monitoring Period	46,908
PE_y	Project Emissions (tCO_2)	0
LE_y	Leakage Emissions (tCO_2)	0
ERy	Net Emission Reduction (tCO_2) During Monitoring Period	46,908

Thus, the net emission reduction (in tonnes CO_2) in this monitoring period (01-January-2022 to 27-June-2022) is calculated as given in table below.

Table 8. Summary of Emission Reductions

Year	Baseline Emissions (tCO_2e)	Project Emissions (tCO_2e)	Leakage Emissions (tCO_2e)	Net GHG Emission Reductions or Removals (tCO_2e)
2022 (01/01/2022 – 27/06/2022)	46,908	0	0	46,908
Total	46,908	**0**	**0**	46,908

The electricity production and the emission reduction values have been apportioned since the monitoring period does not cover the whole month of June 2022. The monthly electricity generation has been apportioned for 27 days in the 30 days in month June (i.e. (electricity generation x (27/39)).

Total emission reductions were realized as 46,908 tCO_2 for this monitoring period (Table 8). When the estimated electricity generation figure of the power plant for each year in the validated VCS PD (165,990 MWh-year) is considered, the total emission reductions should be approximately 43,283 tCO_2 (Table 9) for this monitoring period (6 months). Percent difference is calculated as -8.4%, which means the project reduced 8.4% more CO_2 than the estimated amount. Since the project is a HEPP, seasonal effects are significant on the monthly generation rates and deviations from the calculated values are acceptable. On the other hand, the electricity generation is dependent on water flow estimation, which is a natural phenomenon and cannot be estimated with 100% accuracy.

Table 9. Summary of net electricity supply to the grid versus emissions reductions (estimate and actual values for this monitoring period)

	Project Baseline Estimate		Actual Values Achieved in the Monitoring Period	
Year	Net Electricity Supplied to the Grid (MWh)	Emission Reductions (tCO_2e)	Net Electricity Supplied to the Grid (MWh)	Emission Reductions (tCO_2e)
(01/01/2022 – 27/06/2022)	81,171	43,283	87,975.17	46,908
Total	**81,171**	**43,283**	**87,975.17**	**46,908**

Ex-ante emissions reductions/removals	**Achieved emissions reductions/removals**	**Percent difference**	**Justification for the difference**
43,283	46,908	8.4%	Since the project is a HEPP, seasonal effects are significant on the monthly generation rates and deviations from the calculated values are acceptable.

APPENDIX 1: SINGLE LINE DIAGRAM

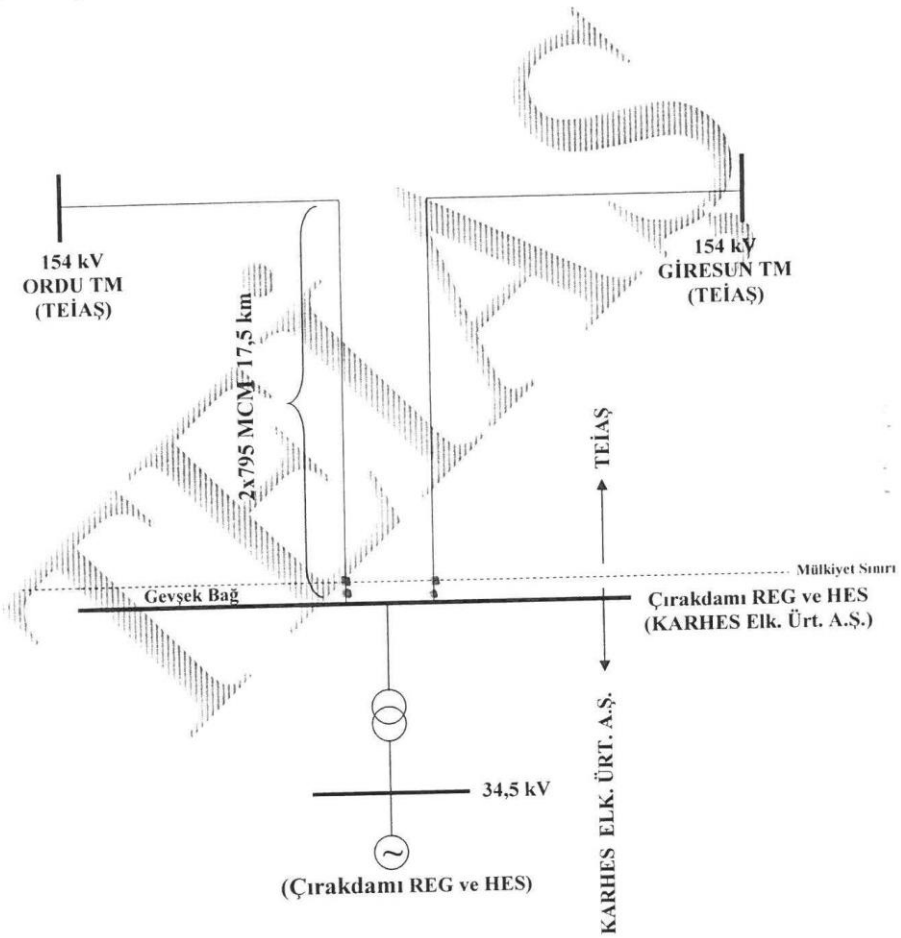
BAĞLANTI ANLAŞMASI

EK-3

MÜLKİYET SINIRLARI

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

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



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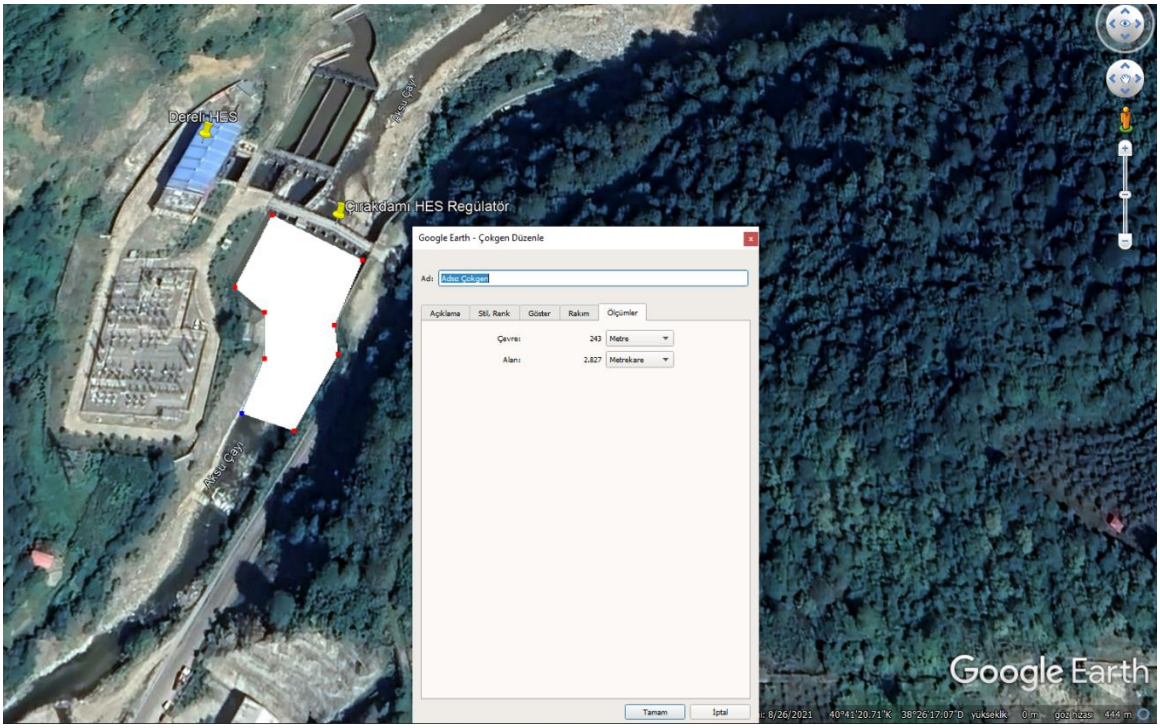
APPENDIX 2: RESERVOIR AREA



APPENDIX 3

TÜRKİYE TERMİK SANTRALLARINDA TÜKETİLEN YAKIT MİKTARLARININ ÜRETİCİ KURULUŞLARA DAĞILIMININ YILLAR İTİBARİYLE 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	*Hard Coal*	1,664,859	1,563,792	1,700,458
	Linyit	*Lignite*	57,850,129	50,123,941	54,558,282
	TOPLAM	*TOTAL*	**59,514,988**	**51,687,733**	**56,258,740**
	Fuel-Oil *Fuel Oil*	Asıl Yakıt *Main Fuel*	239,410	16,864	27,098
		Yrd. Yakıt *Auxiliary Fuel*	134,007	105,073	118,439
		TOPLAM *TOTAL*	**373,417**	**121,937**	**145,537**
	Motorin *Diesel Oil*	Asıl Yakıt *Main Fuel*	45,364	4	0
		Yrd. Yakıt *Auxiliary Fuel*	72,956	18,901	13,984
		TOPLAM *TOTAL*	**118,320**	**18,905**	**13,984**
	TOPLAM	*TOTAL*	**491,737**	**140,842**	**159,521**
	Doğal Gaz	*Natural Gas*	5,091,011	4,493,275	4,173,420
MOBİL SANTRALLAR / *MOBILE 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*	4,956,318	5,855,911	8,873,976
	Linyit	*Lignite*	5,770,389	6,565,451	6,949,028
	TOPLAM	*TOTAL*	**10,726,707**	**12,421,362**	**15,823,004**
	Fuel-Oil	*Fuel Oil*	1,220,904	769,845	386,071
	Motorin	*Diesel Oil*	62,537	1,449	1,063
	LPG	*LPG*	111	0	0
	Nafta	*Nephta*	8,077	13,140	0
	TOPLAM	*TOTAL*	**1,291,629**	**784,434**	387,134
	Doğal Gaz	*Natural Gas*	15,887,029	17,290,139	18,631,167
TÜRKİYE / *TURKEY*	Taşkömür+İthal kömür	*Hard Coal+Imported Coal*	6,621,177	7,419,703	10,574,434
	Linyit	*Lignite*	63,620,518	56,689,392	61,507,310
	TOPLAM	*TOTAL*	**70,241,695**	**64,109,095**	**72,081,744**
	Fuel-Oil	*Fuel Oil*	1,594,321	891,782	531,608
	Motorin	*Diesel Oil*	180,857	20,354	15,047
	LPG	*LPG*	111	0	0
	Nafta	*Nephta*	8,077	13,140	0
	TOPLAM	*TOTAL*	**1,783,366**	**925,276**	**546,655**
	Doğal Gaz	*Natural Gas*	20,978,040	21,783,414	22,804,587

Figure 6. Consumption of fuel in thermal power plants in Turkey

NET CALORIFIC VALUES OF FUELS CONSUMED IN THE THERMAL POWER PLANTS

Unit: TJ/KT

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

Figure 7. Net calorific values of fuels consumed in the thermal power plants

Fuel Type:	EF (tCO2/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 8. IPCC Default CO2 emission factors

http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/statistik2011/yakit46-48/49.xls

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 TÜRKEY BY THE ELECTRIC UTILITIES
(FUELS USED FOR HEAT PRODUCTION IN CHP PLANTS INCLUDED)

Birim(Unit): Tcal

			2009	2010	2011
EÜAŞ VE BAĞLI ORTAKLIKLARI EÜAŞ AND AFFILIATED PARTNERSHIPS OF EÜAŞ	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*	**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*	**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+İthal kömür	*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+İthal kömür	*Hard Coal+Imported Coal*	55,130	39,546	57,367
	Linyit	*Lignite*	97,652	96,551	107,210
	TOPLAM	*Total*	**152,781**	**136,097**	**164,777**
	Fuel-Oil	*Fuel Oil*	15,160	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 9

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 *EÜAŞ AND AFFILIATED PARTNERSHIPS OF EÜAŞ*	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
	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 10