Verified Carbon Standard

Yazi 1.13 MW HEPP

Document Prepared by GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ

EĞİTİM DANIŞMANLIK VE TİC. A.Ş.

Project Title	Yazi 1.13 MW HEPP
Version	1.03
Report ID	YAZI VCSMR-01
Date of Issue	08-December-2022
Project ID	583
Monitoring Period	02 October 2009 to 30 September 2019.
Prepared By	GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ EĞİTİM DANIŞMANLIK VE TİC. AŞ (Project Developer)

CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Yazi Hydro-Electric Power Plant is designed by Elestas Elektrik Uretim A.S. which is private company contributes Hydro-Electric and Wind Power projects within Turkish Renewable Energy sector. Yazi HEPP is located right at the downstream of the Güldürcek Dam built on the Devres stream, which is one of the branches of the Kizilirmak River inside the boundaries of the province of Cankiri. The project aims to generate electricity by utilizing the downstream flow from Güldürcek Dam which is designed for irrigation and water supply to the region.

The Güldürcek Dam's construction has been completed in 1988 by DSI. As the main purpose of the Dam is actually irrigation and supplying portable water, only excess water arriving at the Dam could be utilized for power generation. Yazi Hydro- Electric Power Plant is a runoff river dam type project that targets to supply about 1.062 MWe/1.135 MWm of renewable electricity to the rapidly grow Turkish electricity market. The project has one turbine with an installed capacity of 1.062 MWe/1.135 MWm as per EPDK license with License No: EÜ/902-3/709 and date of 31/08/2006.

The project has no adverse environmental impacts and reduces greenhouse gas emissions. Renewable resources are utilized to generate electricity and therefore fossil fuel resources can be avoided in power generation. After the construction of the Güldürcek Dam in 1988, fauna and flora enhanced in a positive way as a result of environmental impact of the dam. Since Yazi HEPP has built to the downstream of the Güldürcek Dam, it uses the capacity of the dam without affecting the environment.

The project is used only for energy generation purpose and has an Energy Generation License for 49 years obtained from Electricity Market Regulation Authority in 31/08/2006. Since the project is a small-scale project activity, the Environmental Impact Assessment Exemption letter has been given on 09/11/2006. The HEPP is a run-off dam type plant as per EPDK license in 31/08/2006 with a license number of EÜ/902-3/709. The project has one unit and an installed capacity of 1.062 MWe. The net electricity generation of the project was recorded as 35,198 MWh and 19,113 tons CO2 for the monitoring period of 02 October 2009 to 30 September 2019. The monitoring period is ended on 30-September-2019 instead of 01-October-2019 for simplification purpose. The HEPP is a run-off dam type power plant.

Table 1. Milestones of YAZI HYDROELECTRIC POWER PLANT

Date	Milestone
09/05/2007	System Use Agreement
09/05/2008	Connection Agreement
11/08/2006	Water Use Agreement

Date	Milestone
02/10/2009	Commissioning date
02 October 2009 to 30 September 2019	Continued Operations

Power to be generated by Yazi HEPP by 18 kms length transmission line is fed to national grid (Çankırı ve Kurşunlu TM) with 33 kV voltage. Project boundary is shown in the figure below.

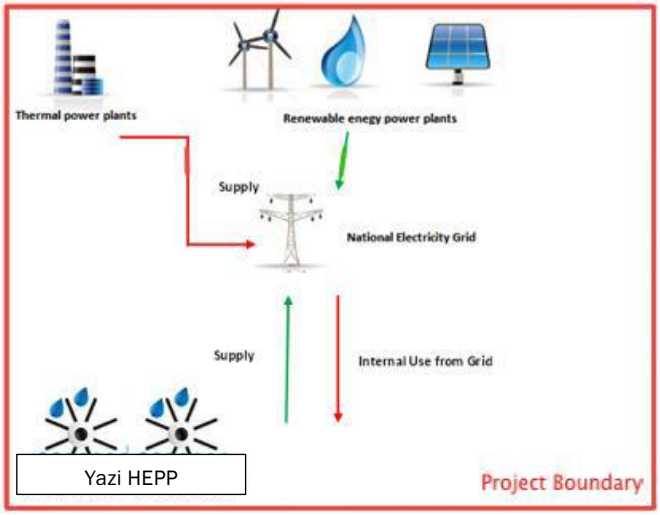


Figure 1. Project boundary

1.2 Sectoral Scope and Project Type

VCS approves the classification by UNFCCC. According to the sectoral scopes defined by CDM Executive Board, the project is classified as follows:

Type (i). Renewable Energy Projects

Category: AMS-I.D. "Grid connected renewable electricity generation" Version 15

The project is a single greenfield investment and is not part of a project group or bundle.

1.3 Project Proponent

Organization name	Elestas Elektrik Uretim A.S.
Contact person	Ali Çiçek
Title	Manager

Address	Merkez Mah. Dereboyu Cad. No: 68 Halkalı-İstanbul-Turkey
Telephone	+90 212 697 67 75
Email	acicek@elestas.com.tr

1.4 Other Entities Involved in the Project

Organization name	GTE Karbon Sürdürülebilir Enerji Eğitim Danişmanlik Ve Ticaret A.Ş
Contact person	M. Kemal DEMİRKOL
Title	Director
Address	MAIDAN - Mustafa Kemal Mah. 2118. Cad. No: 4 C Blok 42 06510 Çankaya - Ankara – TURKEY
Telephone	+90 312 514 63 63
Email	kemal.demirkol@gte.com.tr

1.5 Project Start Date

Project start date is 02/10/2009[1].

1.6 Project Crediting Period

The project crediting period is 10 years: 02/10/2009 to 01/10/2019 (both dates included).

1.7 Project Location

The power plant is located at the downstream of the Devres River in Orta district and 44km west to Cankiri Province close to Orta district.

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

Component's name	Yazi HEPP
Güldürcek Dam	40 34 54.85" N; 32 56 08.35" E
Powerhouse	40 33 22.68" N; 32 57 34.23" E

[1] Provisional Acceptance

Figure 2. Project location

Figure 3. The location of the plant.

1.8 Title and Reference of Methodology

The latest version of Official methodology AMS-I.D. "Grid connected renewable electricity generation" Version 15 (hereafter AMS-I.D. v15) is used to develop the proposed project activity under VCS. Additionally, methodology related tools and relevant guidelines are applied, namely

- TOOL07 "Methodological tool: Tool to calculate the emission factor for an electricity system" Version 02.0

- TOOL01 "Methodological tool: Tool for the demonstration and assessment of additionality" Version 05.2

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.

1.10 Other Forms of Credit

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 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 monitoring period, 35,198 MWh renewable electricity has 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. 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 prevented the release of 19,113 tCO2 into the atmosphere in this monitoring period.

Table 3: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	13.3	Tons of greenhouse gas emissions avoided	Implemented activities to increase	By generating electricity from clean sources, project has prevented 19,113 tCO2 into the atmosphere during the monitoring period	By generating electricity from clean sources, project has prevented 19,113 tCO2 into the atmosphere Over Project Lifetime
2)	8.5	Job opportunities created	Implemented activities to increase	During the monitoring period 5 employees were recruited.	5 employees will be maintained for throughout the crediting period
3)	7.2	7.2.1 Renewable energy share in the total final energy consumption	Implemented activities to increase	The project generated 35,198 MWh electricity from hydropower which is a renewable source during the monitoring period	The project generated 35,198 MWh electricity from hydropower which is a renewable source over project lifetime

2 SAFEGUARDS

2.1 No Net Harm

During the project activity phase, to minimize the environmental impacts rising from the project activity, certain precautions are followed by the project proponent. Waste oils and solid wastes are separately collected and disposed properly as it is demonstrated in the picture below.

Figure 4. The collection cage of waste oil/solid waste

2.2 Local Stakeholder Consultation

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 board" and logbook kept in the mosque of the vicinity of village of the project (Tutmacı Bayındır Village) for a continuous grievance policy, that is implemented by the project owner. The PP consults with local stakeholders via this mechanism including direct phone calls and face-to-face meetings to 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

The project start date is 02/10/2009[2]..

Special events occurred that had impacted on monitoring of GHG emission reductions:

- 01/07/2010-25/09/2010 Plant was not running due to preventive maintenance that causes very low electricity generation in July and September 2010, while it causes zero electricity generation in August 2010.
- 11/10/2010-6/12/2010 Plant was not running due to preventive maintenance that causes zero electricity generation in November 2010.
- 24/01/2014-26/05/2014 plant was not running due to no water availability from dam that zero electricity generation in February, March and April and low electricity generation in May 2014.
- 20/08/2015-29/09/2015 less no water availability from dam due to seasonal conditions that causes low electricity generation in September 2015.

3.2 Deviations

3.2.1 Methodology Deviations

The UNFCCC methodology of AMS-I.D. Ver 15.0 and its related tools are applied as they are without any deviation from methodology.

3.2.2 Project Description Deviations

In registered PD ver. 03, mechanical capacity was defined as two turbines each with a capacity of 0.600 MWm, making the total mechanical capacity of 1.13 MWm. However, as per the registered EPDK license (License No: EÜ/902-3/709 and date: 31/08/2006), there is only one unit with 1.13 MWm/1.062 MWe capacity[3].

As this project is a runoff river dam type project, "Cap_{PJ}" and "ApJ" parameters are included in YAZI VCSMR-01.

[2] Provisional Acceptance
[3] EPDK License

As per internal protocol of BAŞKENT EDAŞ, testing frequency of energy meters is 2 years. This protocol was transitioned to in 2020. As the new replaced meters were tested at 2 years of frequency after their installation (29/11/2018) i.e., last test date of the testing of meters was realized in 12/11/2020 by BEDAS.

BEDAS declares that for spare meters there is no subscription number formed by their system and those meters (spare meters) that have no subscription number are not included in the calibration protocol unless there is a problem with the meters. Since this is the case, the spare meter installed on 19/12/2008 was not calibrated or replaced with a new one as there was no problem found with the meter. However, the invoicing and calculations are performed over the main one, and the spare meter was never utilized in emission reduction calculations.

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

<table>
<tr><td>Data – Parameter</td><td>Electricity Generation</td></tr>
<tr><td>Data unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>Total electricity generated by all power plants connected to the national grid between years 2006-2008</td></tr>
<tr><td>Source of data</td><td>TEIAS (Turkish Electricity Transmission Company) annual data</td></tr>
<tr><td>Value applied</td><td>
<table>
<tr><th>Year</th><th>Gross Generation</th><th>Import</th><th>Total</th></tr>
<tr><td>2006</td><td>176299.8</td><td>573.2</td><td>176873</td></tr>
<tr><td>2007</td><td>191558.1</td><td>864.3</td><td>192452.4</td></tr>
<tr><td>2008</td><td>198418.0</td><td>789.4</td><td>199207.4</td></tr>
</table>
</td></tr>
<tr><td>Justification of choice of data or description of measurement methods and procedures applied</td><td>Official data used for CM calculations.</td></tr>
<tr><td>Purpose of Data</td><td>Data used for the calculation of $EF_{grid,CM,Simple,y}$</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data – Parameter	FC_i
Data unit	Tons or m^3
Description	Fossil fuel consumed by thermal power plants between years 2006-2008
Source of data	Turkish Electricity Transmission Company (TEIAŞ) annual data

Value applied

Fuel Type	2006	2007	2008
Hard Coal + Imported Coal	5,617,863	6,029,143	6,270,008
Lignite	50,583,810	61,223,821	66,374,120
TOTAL	56,201,673	67,252,964	72,644,128
Fuel Oil	1,746,370	2,250,686	2,173,371
Diesel Oil	61,501	50,233	131,206
Lpg	33	0	0
Naphtha	13,453	11,441	10,606
TOTAL	**1,821,357**	**2,312,360**	**2,315,183**
Natural Gas	17,034,548	20,457,793	21,607,635

Justification of choice of data or description of measurement methods and procedures applied	Official data
Purpose of Data	Data used for the calculation of $EF_{grid,OM,Simple,y}$
Comments	-

Data - Parameter	NCV
Data unit	TJ/mass or volume
Description	Net calorific value of each fossil fuel type between 2006-2008
Source of data	Turkish Electricity Transmission Company Annual Data

Value applied

Fuel Type	2006	2007	2008
Hard Coal + Imported Coal	21.99	22.30	22.24
Lignite	6.95	6.86	6.83
Fuel Oil	40.20	39.87	39.70
Diesel Oil	42.68	43.09	42.38
Naphtha	43.88	43.18	44.61
Natural Gas	37.01	36.76	36.63

Justification of choice of data or description of measurement methods and procedures applied	Official Data
Purpose of Data	Data used for the calculation of $EF_{grid,OM,Simple,y}$
Comments	

Data – Parameter	$EF_{CO2,}$
Data unit	tCO2/TJ
Description	Emission factor for each fuel type.
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

Fuel	CO_2		
	Default Emission Factor	Lower	Upper
Residual Fuel Oil	77,400	75,500	78,800
Gas/Diesel Oil	74,100	72,600	74,800
Residual Fuel Oil	77,400	75,500	78,800
Liquefied Petroleum Gases	63,100	61,600	65,600
Naptha	73,300	69,300	76,300
Anthracite	98,300	94,600	101,000
Lignite	101,000	90,900	115,000
Natural Gas	56,100	54,300	58,300

Justification of choice of data or description of measurement methods and procedures applied	IPCC data
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 by all power plants connected to the national grid excluding low-cost must run power plants between years 2006-2008

Source of data	Turkish Electricity Transmission Company Annual Data
Value applied	**Year** / **Net Generation** / **Import** / **Total (EG_y)** **2006** 169543.1 573.2 **170116.3** **2007** 183339.7 864.3 **184204** **2008** 189761.9 789.4 **190551.3**
Justification of choice of data or description of measurement methods and procedures applied	Official data used for CM calculations.
Purpose of Data	Data used for the calculation of $EF_{grid,OM,Simple,y}$
Comments	-

Data – Parameter	Electricity Imported
Data unit	MWh
Description	Electricity imported to the national grid between 2006-2008.
Source of data	Turkish Electricity Transmission Company Web Site
Value applied	**Year** / **Import** **2006** 573.2 **2007** 864.3 **2008** 789.4
Justification of choice of data or description of measurement methods and procedures applied	Official data used for CM calculations.
Purpose of Data	-
Comments	-

Data – Parameter	Capacity Addition
Data unit	MWh
Description	Capacity addition to the national grid between 2004-2008
Source of data	Turkish Electricity Transmission Company Web Site
Value applied	Summing up all the plants (Detailed in Appendix 3) build in 2008, 2007, 2006, 2005 and some of the capacity addition in 2004 the total generation is 42,035.7 GWh.

Justification of choice of data or description of measurement methods and procedures applied	Official data used for CM calculations.
Purpose of Data	-
Comments	-

Data - Parameter	$\eta_{m,y}$	
Data unit	%	
Description	Average net energy conversion efficiency of power unit m in year y	
Source of data	Annex.1. of registered PD, "Tool to calculate emission factor for an electricity system"	
Value applied	**Fossil fuel type**	**Efficiency (%)**
	Hard Coal + Imported Coal	39
	Lignite	39
	Fuel-oil	39
	Diesel-oil	39
	Naphtha	39
	Natural gas	60
Justification of choice of data or description of measurement methods and procedures applied	The default values in CDM tool referred by the selected methodology. No official record available.	
Purpose of Data	Data used for the calculation of $EF_{grid,BM,y}$	
Comments	-	

4.2 Data and Parameters Monitored

Data – Parameter	$EG_{,y}$
Data unit	MWh
Description	Net Electricity generated and delivered to the grid by the Yazi HEPP in year "y"
Source of data	Power meters in located in Yazi HEPP Powerhouse in the project site. The produced electricity was read from BEDAŞ (Başkent EDAŞ) protocol papers.

Description of measurement methods and procedures to be applied	The net electricity is measured continuously by main power meter at the grid interface and recorded monthly. The power meters are bi-directional and measures both the supplied and used electricity by the power plant. The measured electricity generation is cross – checked by the records of sold electricity and the value reported by the project owner to the website of "Market Financial Settlement Center" or EPİAŞ. The power meters are calibrated and sealed by the transmission company, Başkent Elektrik Dağıtım A.Ş.
Frequency of monitoring-recording	Continuous monitoring and hourly reading. The monthly recorded for invoicing purposes.
Value monitored	The annual electricity fed to the grid is estimated as 35,199 MWh
Monitoring equipment	Power meters should be in line with Measure and Metering Devices Regulation and with IEC-EN 60687 Standards with the accuracy class 0.5S. Both electricity meter was calibrated in 19/12/2008 (Main meter: Elster (A-1500) Serial No:00376477 and Spare Meter: Elster (A-1500) Serial No:00376476) [4]. The main electricity metering device were replaced with new one on 29/11/2018 as it was malfunctioned and 10 years of calibration over[5]. The malfunction is due to a cross connection in the main meter; however, the generation readings were correctly recorded despite the cross connection. When the ten-year calibration cycle is completed, the main meter is replaced with a new one, and a cross-connection is repaired. In case of any implication, the readings from the spare meter were used instead of the readings from the main meter for 11/2018. According to the data provided to VVB, the main meter reads

[4] Manufacturer's calibration
[5] Signed Petition between Elestas Elektrik Uretim A.S. and Başkent EDAŞ.

	211.2 MWh, and the spare meter reads 226.13 MWh in November. Even though the difference is less than 10%, the spare meter was used for this month's calculation to be safe. . Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market[8]. They have an accuracy class of Class 005 indicating an accuracy range of 0.5%. The main electricity meter used after 29/11/2018 is: Main Electricity Meter: Landis, Serial Number: 40673867 Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market[8]. They have an accuracy class of Class 005 indicating an accuracy range of 0.5%.
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 EPİAŞ trading software for internal monitoring. The Calibration dates of the meters and their validity is as follows:

	Main Meter (Previous Meter)	Spare Meter
Serial no.	00376477	00376476
Brand-(Type)	Elster (A-1500)	Elster (A-1500)
First Calibration Date	19/12/2008	19/12/2008
Current Calibration date	Replaced on 29/11/2018	-[6]
Calibration frequency	10 years	-

[6] BEDAŞ does not perform calibration for Spare Meters: Official Email from BEDAŞ

	Due Date of Calibration	-	-	29/11/2028[7]
	Test Date		29/11/2020	29/11/2020
	Test frequency	2 years	2 years	2 years
	Due Date of Test		29/11/2022	29/11/2022
	Class	0.5S	0.5S	0.5S
Purpose of the data	Data to be used for the calculation of Baseline Emissions.			
Calculation method	The net electricity export/supplied to a grid is the difference between the measured quantities of the grid electricity export and the import.			
Comments				

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	1,062,000 W
Monitoring equipment	SCADA System of the Project activity
QA-QC procedures to be applied	Turbine labels checked with SCADA System reading.
Purpose of the data	To monitor capacity of the project
Calculation method	N-A
Comments	

Data / Parameter:	A_{PJ}

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

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:	10,016 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 used for determining the emission reduction by the Project is based on the approved methodology AMS-I.D. The aim of the plan is to maintain credible and transparent measurement and collection of data for precise calculation of emission reduction during the crediting period.

In order to demonstrate the emission reduction, the only required data is the amount of electricity generated by the project activity. The Monitoring Plan used for determining the emission reduction by the Project is based on the approved methodology AMS-I.D. Monitoring Plan is implemented by the Project Owner who keeps track of gross electricity production by an automated system. Başkent EDAŞ officers do monthly readings for the sale of net electricity fed into the grid and issue reports. Two data sets are used for cross-checking. The sources are from EPİAŞ Records and Başkent EDAŞ protocol reading papers.

Hourly readings are done and noted to protocol reading papers by the personnel. At the same time OSF forms are formed by the Başkent EDAŞ through online system and send to the powerplant. These readings are automatically transferred to the website of “Market Financial Settlement Center” or EPİAŞ by the Manager of the power plant. The Manager has access to the readings by using a secured ID and password identified for each user. EPİAŞ serves as an official unit to balance real time electricity demand with production. Each electricity producer has to report their daily generation forecasts and realized

generation to the database run by EPİAŞ. The invoicing of the generated electricity is also realized by EPİAŞ.

The emission reduction calculations are based on the Başkent EDAŞ reports as the power meters are placed where net electricity fed into the grid. The internal energy consumption is supplied from the plant generation and is deducted from the total generation. When there is no electricity production in the plants, the internal consumption is supplied from grid. The amount of supplied has been reported in monthly Başkent EDAŞ monitoring reports. In case of emergency, a generator has been provided. However, the emissions from the generator have been neglected as it is estimated to be less than 1% of the total emission reductions achieved.

The electricity meters were detailed in Table 4:

Table 4. Electricity Meters

	Main Meter (Previous Meter)	Spare Meter	Main Meter (Current Meter)
Serial no.	00376477	00376476	40673867
Brand- (Type)	Elster (A-1500)	Elster (A-1500)	Landis-(Gyr-E550)
First Calibration Date	19/12/2008	19/12/2008	29/11/2018
Current Calibration date	Replaced on 29/11/2018	-[8]	-
Calibration frequency	10 years	-	10 years
Due Date of Calibration	-	-	29/11/2028[9]
Test Date		29/11/2020	29/11/2020
Test frequency		2 years	2 years
Due Date of Test		29/11/2022	29/11/2022
Class	0.5S	0.5S	0.5S

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Baseline emission is calculated according to the formula

$$BE_y = EG_y \times EF_y$$

[8] BEDAŞ does not perform calibration for Spare Meters: Official Email from BEDAŞ
[9] https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5

Where:

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

EF_y = Emission factor calculated according to selected methodology

5.2 Project Emissions

The proposed project activity involves the generation of electricity by hydroelectric power plant therefore project activity does not result in greenhouse gas emissions. Power density of the projects higher than 10 W-m^2 for 11,089 MWe installed capacity and 10,016 m^2 maximum lake area.

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

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

Where:

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

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

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

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

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

For proposed project HEPP,

Cap_{PJ} = 1,062,000 We

Cap_{BL} = 0.0 W

A_{PJ} = 10,016 (m^2)[10]

A_{BL} = 0.0 (m^2)

Therefore, PD is calculated as;

$$PD = \frac{1{,}062{,}000 - 0}{10{,}016 - 0}$$

[10] Reservoir area, Appendix 2

$$PD = 106.03\ W - m^2$$

PE (project emission) is not applicable due to power density is (PE) 106.03 W-m^2 which is greater than 10 W/m^2 and not less than 4 W/m^2[11]

5.3 Leakage

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

$$LE_y = 0$$

5.4 Net GHG Emission Reductions and Removals

Total Emission Reduction has been determined as;

$ER_y = BE_y - PE_y - LE_y$

Where;

ER_y = Emission reductions in year y (tCO_2)

BE_y = Baseline emissions in year y (tCO_2)

PE_y = Project Emissions in year y (tCO_2)

LE_y = Leakage emissions in year y (tCO_2)

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

Table 5. Calculations for net total values

EG_y	Net Generation (MWh) During Monitoring Period	35,198
EF_y	Emission Factor (tCO_2-MWh)	0.543[12]
BE_y	Baseline emissions in year y (tCO2) During Monitoring Period	0
PE_y	Project Emissions (tCO_2)	0
LE_y	Leakage Emissions (tCO_2)	0
ER_y	Net Emission Reduction (tCO_2) During Monitoring Period	19,113

[11] AMS-I.D Ver 18 "Grid connected renewable electricity generation"
[12] Fixed ex-ante CM as per Section 4.3. og registered PD

Thus, the net emission reduction (in tons CO2) in this monitoring period (02-October-2009 to 30-September-2019) is calculated as given in table below.

Table 6. 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)
2009 (02/10/2009-31/12/2009)	**475.7**	0	0	**475.7**
2010 (01/01/2010-31/12/2010)	**1,834.3**	0	0	**1,834.3**
2011 (01/01/2011-31/12/2011)	**2,819.8**	0	0	**2,819.8**
2012 (01/012012-31/12/2012)	**2,179.1**	0	0	**2,179.1**
2013 (01/012013-31/12/2013)	**1,692**	0	0	**1,692**
2014 (01/012014-31/12/2014)	**777**	0	0	**777**
2015 (01/01/2015 – 31/12/2015)	**2,082.9**	0	0	**2,082.9**
2016 (01/012016– 31/12/2016	**2,233.9**	0	0	**2,233.9**
2017 (01/01/2017 – 31/12/2017)	**1,915.2**	0	0	**1,915.2**
2018 (01/01/2018– 31/12/2018)	**1,716.4**	0	0	**1,716.4**
2019 (01/01/2019 – 30/09/2019)	**1,386**	0	0	**1,386**
Total	**19,113**	**0**	**0**	**19,113**

Total emission reductions were realized as 19,113 tCO_2 for this monitoring period (Table 5). When the estimated electricity generation figure of the power plant for each year in the validated VCS PD (5,203 MWh-year) is considered, the total emission reductions should be approximately 28,252tCO_2 (Table 6)

for the monitoring period (120 months). Percent difference is calculated as -32,3%, which means the project reduced 32,3% less CO_2 than the estimated amount. Since the project is a HEPP, seasonal effects are significant on the monthly generation rates and deviations from the calculated values are acceptable. On the other hand, the electricity generation is dependent on water flow estimation, which is a natural phenomenon and cannot be estimated with 100% accuracy.

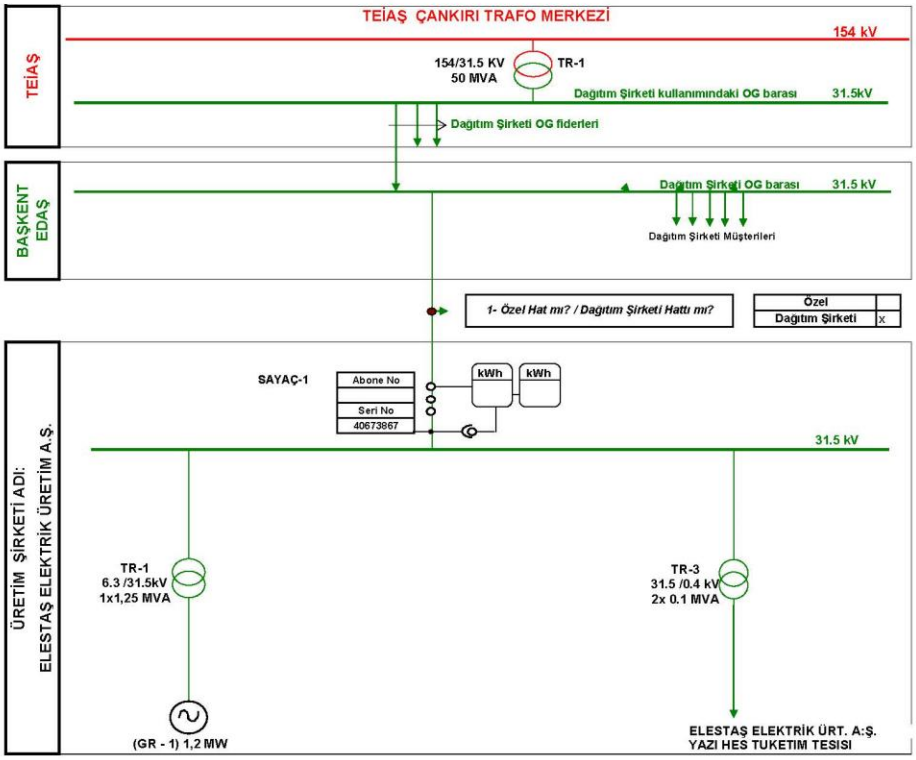
Table 7. Summary of net electricity supply to the grid versus emissions reductions (estimate and actual values for this monitoring period)

	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)
2009 (02/10/2009-31/12/2009)	1,300.8	706.3	876	**475.7**
2010 (01/12/2010-31/12/2010)	5,203	2,825.2	3,378	**1,834.8**
2011 (01/12/2011-31/12/2011)	5,203	2,825.2	5,193	**2,819.8**
2012 (01/12/2012-31/12/2012)	5,203	2,825.2	4,013	**2,179.1**
2013 (01/12/2013-31/12/2013)	5,203	2,825.2	3,116	**1,692**
2014 (01/12/2014-31/12/2014)	5,203	2,825.2	1,431	**777**
2015 (01/01/2015 – 31/12/2015)	5,203	2,825.2	3,836	**2,082.9**
2016 (01/012016–31/12/2016	5,203	2,825.2	4,114	**2,233.9**
2017 (01/01/2017 – 31/12/2017)	5,203	2,825.2	3,527	**1,915.2**
2018 (01/01/2018–31/12/2018)	5,203	2,825.2	3,161	**1,716.4**
2019 (01/01/2019 – 30/09/2019)	3,902.3	2,118.9	2,553	**1,386**
Total	**52,030**	**28,252.3**	**35,198**	**19,113**

APPENDIX 1: PROJECT'S SINGLE LINE DIAGRAM

FORM NO: K.03.03

DAĞITIM SİSTEMİNE OG GERİLİM SEVİYESİNDEN BAĞLI ÜRETİM TESİSLERİNİN SAYAÇLARININ BAĞLANTI NOKTALARINI GÖSTEREN TEK HAT ŞEMASI



SAYAÇ KODU *	SAYAÇ SERİ NO	TK EVET/HAYIR	Pb	Pcu	HK EVET/HAYIR	Devre Sayısı	İletken Tipi Al/Cu	Uzunluk	Kesit	İletim Sistemi Kaybı *	Dağıtım Sistemi Kaybı OG*	Dağıtım Sistemi Kaybı AG*
	40673867(ANA SAYAÇ)	HAYIR			EVET	1	Al	20 km	3/0			

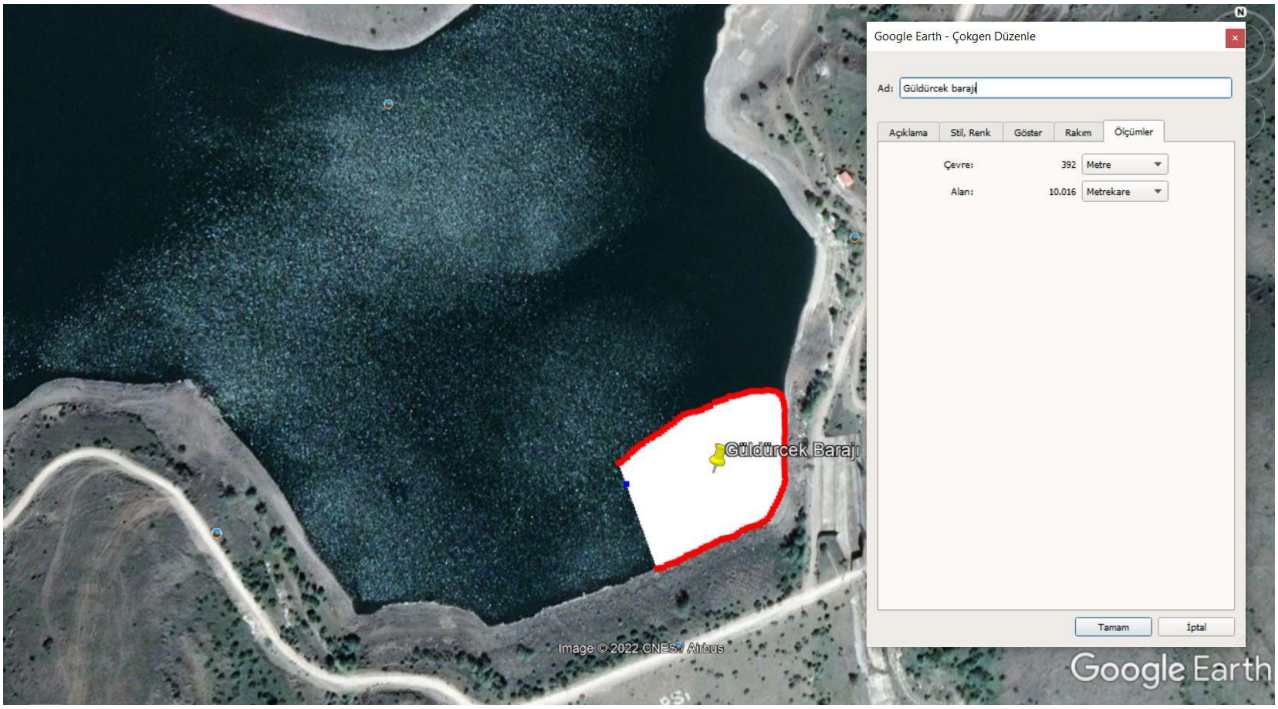
TK=Trafo Kaybı, **HK**=Hat Kaybı
TK ve HK "Evet" olarak işaretlenmişse ilgili bölümler doldurulmalıdır.
* Bu bölümler, PMUM tarafından doldurulacaktır.

NOT 1.Üretim tesisine ait bilgiler, sayaç sayısı, trafo ve bara gerilim seviyeleri örnek olarak gösterilmiştir. Format bozulmadan tesisin durumuna göre sadece mevcut olan satışa esas sayaçlar çizilmelidir.
2. Tek hat şemasında belirtilen 1 nolu soru alanı doldurulmalıdır.
3.Yukarıdaki tablolardaki satır sayısı, sayaç sayısına göre artırılacaktır.

	** DAĞITIM ŞİRKETİ YETKİLİ KİŞİLER	TARİH	İMZA	DAĞITIM ŞİRKETİ MÜHÜRÜ
1.				
2.				

** Dağıtım Şirketi mührü ve iki yetkili kişi imzası olmayan form geçersizdir.
Formdaki eksik ve yanlış bilgi nedeniyle doğabilecek maddi hatalardan Dağıtım Şirketi yetkilileri sorumludur.

APPENDIX 2: RESERVOIR AREA



APPENDIX 3: CAPACITY ADDITION

Generation Units put into Operation in 2004 used for BM calculations[13]

POWER PLANTS	INSTALL ED CAPACITY (MW)	ELECTRICITY UTILITIES	FUEL TYPE	GENERATION CAPACITY (GWh)		COMMISSIONARY DATE
				Average	Firm	
STANDART PROFĠL 3GM	6.7		*N.GAS*	49.,2	49.2	22.10.2004
KARKEY-II 3+3 DGM	54.3	IPP	*FUEL-OIL*	369.7	369.7	12.11.2004
ALTINMARKA GIDA GR I-II-III	3.6	UCERS	*N.GAS*	28.8	28.8	17.12.2004
TOTAL	**64.6**			**447.7**	**447.7**	

Generation Units put into Operation in 2005[14]

	INSTALLED CAPACITY (MW)	ELECTRICITY UTILITIES	FUEL TYPE	GENERATION CAPACITY (GWh)		COMMISSIONARY DATE
				Average	Firm	
ÇAN GR I	160.0	EÜAŞ	LIGNITE	1,040.0	1,040.0	14/02/2001
ÇAN GR II	160.0	EÜAŞ	LIGNITE	1,040.0	1,040.0	14/03/2001
ELBĠSTAN-B GR I	360.0	EÜAŞ	LIGNITE	2,340.0	2,340.0	14/02/2001
AKBAĞLAR GR- II (İZOLE)	8.830	AUTOPRODUCER	N.GAS	73.0	73.0	23/06/2001
AKÇA ENERJİ GR- III	8.730	AUTOPRODUCER	NAPHTHA	65.4	65.4	13/12/2001
AYKA TEKSTİL GR-I	5.500	AUTOPRODUCER	N.GAS	40.0	40.0	23/09/2001
BAYDEMİRLER GR IV-V-VI	6.210	AUTOPRODUCER	N.GAS	51.4	51.4	03/02/2001
BOSEN GR-III	50.000	AUTOPRODUCER	N.GAS	350.0	350.0	29/12/2001
BOSEN (DÜZELTME)	6.500	AUTOPRODUCER	N.GAS	-45.5	-45.5	29/12/2001
ÇUMRA ŞEKER	16.000	AUTOPRODUCER	LIGNITE	40.0	40.0	31/12/2000
MAD. (BAN.ASİT)(SÖKÜLDÜ	3.800	AUTOPRODUCER	RENEW.+WASTES	-28.5	-28.5	14/07/2001
MAD. (BAN.ASİT)(GR-I)	11.500	AUTOPRODUCER	RENEW.+WASTES	85.0	85.0	14/07/2001
EVYAP GR I-II	5.120	AUTOPRODUCER	N.GAS	30.0	30.0	26/08/2001
GRANİT GR-I	5.500	AUTOPRODUCER	N.GAS	42.0	42.0	13/11/2001
HABAŞ ALİAĞA GR III	47.694	AUTOPRODUCER	N.GAS	381.6	381.6	01/06/2001
HABAŞ ALİAĞA GR IV	47.694	AUTOPRODUCER	N.GAS	381.6	381.6	20/09/2001
HAYAT KAĞIT GR-I	7.531	AUTOPRODUCER	N.GAS	56.0	56.0	26/05/2001
İÇDAŞ ÇELİK GR-I	135.000	AUTOPRODUCER	IMPORTED COAL	1080	1080	29/11/2001
KAHRAMANMARAŞ KAĞIT GR-I	6.000	AUTOPRODUCER	IMPORTED COAL	45	45	07/12/2001
KORUMA KLOR GR I-II-III	9.600	AUTOPRODUCER	N.GAS	77	77	02/12/2001
KÜÇÜKÇALIK TEKSTİL GR-I-II-III-IV	8.000	AUTOPRODUCER	N.GAS	64	64	26/11/2001
MERCEDES BENZ-I-II-III-IV	8.280	AUTOPRODUCER	N.GAS	68	68	03/02/2001
MODERN ENERJİ-III	8.830	AUTOPRODUCER	N.GAS	62.9	62.9	13/06/2001
MODERN ENERJİ (Düzeltme)	10.000	AUTOPRODUCER	N.GAS	-75	-75	13/06/2001
MODERN ENERJİ GR-II	6.720	AUTOPRODUCER	LPG	50.4	50.4	13/06/2001
MOSB GR-I-II-III (SÖKÜLDÜ)	54.300	AUTOPRODUCER	F.OIL	-407.3	-407.3	30/04/2001
MOSB GR-I-II-III-IV-V-VI-VII	84.834	AUTOPRODUCER	N.GAS	434	434	01/08/2005
ORS RULMAN	12.420	AUTOPRODUCER	N.GAS	99.4	99.4	24/08/2001
PAK GIDA GR-I	5.670	AUTOPRODUCER	N.GAS	45.0	45.0	06/12/2001
TEZCAN GALVANİZ GR-I-II	3.664	AUTOPRODUCER	N.GAS	29.0	29.0	26/05/2001
YONGAPAN (KAST.ENTG) GR-	5.200	AUTOPRODUCER	N.GAS	32.7	32.7	24/05/2001

[13] http://www.teias.gov.tr/istat2004/7.xls
[14] http://www.teias.gov.tr/istatistik2005/7.xls

II						
ZEYNEP GİYİM SAN. GR-I	1.165	AUTOPRODUCER	N.GAS	9.0	9.0	06/07/2001
OTOP DÜZELTME	0.024	AUTOPRODUCER	RENEW.+WASTES	0.0	0.0	
OTOP DÜZELTME	0.187	AUTOPRODUCER	N.GAS	0.0	0.0	
OTOP DÜZELTME	7.202	AUTOPRODUCER	LIQUID	-55.2	-55.2	
OTOP DÜZELTME	1.016	AUTOPRODUCER	F.OIL	-6.0	-6.0	
OTOP DÜZELTME	2.109	AUTOPRODUCER	SOLID	5.2	5.2	
OTOP DÜZELTME	0.060	AUTOPRODUCER	LIGNITE	0.0	0.0	
OTOP DÜZELTME	0.300	AUTOPRODUCER	NAPHTHA	0.0	0.0	
OTOP DÜZELTME	0.612	AUTOPRODUCER	D.OIL	1.8	1.8	
AK ENERJİ (K. PAŞA) GR-III	40.000	IPP	N.GAS	256.9	256.9	08/11/2001
AK ENERJİ (K. PAŞA) GR-I-II	87.200	IPP	N.GAS	560.1	560.1	29/04/2001
ALTEK ALARKO) GR-I-II	60.100	IPP	N.GAS	420.0	420.0	13/10/2001
BİS ENERJİ GR-VII	43.700	IPP	N.GAS	360.8	360.8	17/03/2001
CAN ENERJİ GR-I	3.900	IPP	N.GAS	28.0	28.0	24/08/2001
ÇEBİ ENERJİ BT	21.000	IPP	N.GAS	164.9	164.9	26/08/2001
ÇEBİ ENERJİ GT	43.366	IPP	N.GAS	340.1	340.1	22/08/2001
ENTEK ELK A.Ş KOÇ ÜNİ GR-I-II	2.332	IPP	N.GAS	19.0	19.0	06/02/2001
KAREGE GR IV-V	18.060	IPP	N.GAS	141.9	141.9	06/04/2001
KARKEY (SİLOPİ -4) GR-IV	6.150	IPP	F.OIL	47.2	47.2	29/06/2001
METEM ENERJİ GR-I-II	7.832	IPP	N.GAS	58.0	58.0	28/01/2001
METEM ENERJİ GR-I-II-III	11.748	IPP	N.GAS	89.0	89.0	28/01/2001
NOREN ENRJİ GR-I	8.730	IPP	N.GAS	70.0	70.0	23/08/2001
NUH ENERJİ 2 GR-I	46.950	IPP	N.GAS	319.7	319.7	23/05/2001
ZORLU ENERJİ KAYSERİ GR-I-II-III	149.871	IPP	N.GAS	1144.1	1144.1	21/07/2001
ZORLU ENERJİ KAYSERİ GR-IV	38.630	IPP	N.GAS	294.9	294.9	25/10/2001
ZORLU ENERJİ YALOVA GR-I-II	15.930	IPP	N.GAS	122.0	122.0	25/11/2001
THERMAL TOTAL	**1,757.749**			**12,236.3**	**12,236.3**	
TEKTUĞ (Kargılık) GR-I-II	23.900		Run-off	83.0	19.0	24/04/2001
İÇTAŞ ENERJİ (GR-I-II	14.190			44.0	20.0	21/05/2001
MURATLI GR-I-II	115.0	EÜAŞ	Dam	444.0	444.0	02/06/2001
BEREKET ENERJİ DALAMAN GR-XIII-XIV-XV	7.500	IPP	Run-off	35.8	0	15/07/2001
YAMULA GR-I-II-	100.000	YİD	Dam	422.0	345.0	30/07/2001
HYDROLIC TOTAL	**260.590**			**1,028.8**	**784.0**	
SUNJÜT RES GR-I-II	1.200	AUTOPRODUCER	WIND	2.4	2.4	22/04/2001
WIND TOTAL	**1.200**			**2.4**	**2.0**	
TOTAL	**2,019.539**			**13,267.5**	**13,022.3**	

Generation Units put into Operation in 2006[15]

POWER PLANTS	INSTALL ED CAPACITY (MW)	GENERATION CAPACITY (GWh)	
		Average	Firm
AUTOPRODUCER	143.5	1,086.2	1,086.2
EÜAŞ	1,080.0	7,020.0	7,020.0
IPP	389.8	3,048.8	3,048.8
THERMAL TOTAL	**1,613.3**	**11,155.0**	**11,155.0**
IPP	46.8	188.0	164.5
GEOTHERMAL+WIND TOTAL	***46.8***	***188.0***	***164.5***
IPP	52.1	124.0	0.0
IPP	105,4	358.1	211.0

[15] http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202007.pdf

HYDRO TOTAL	*157.5*	*482.1*	*211.0*
GENERAL TOTAL	*1,817.6*	*11,825.1*	*11,530.5*

Generation Units put into Operation in 2007[16]

POWER PLANTS	INSTALL ED CAPACITY (MW)	GENERATION CAPACITY (GWh)	
		Average	Firm
AUTOPRODUCER	144.6	864.4	864.4
IPP	490.9	3,390.1	3,390.1
THERMAL TOTAL	**635.6**	**4,254.5**	**4,254.5**
IPP	87.3	273.9	131.0
GEOTHERMAL+WIND TOTAL	**87.3**	**273.9**	**131.0**
IPP	300.6	1,039.0	600.0
IPP	36.1	183.8	82.7
HYDRO TOTAL	**336.7**	**1,222.8**	**682.7**
GENERAL TOTAL	**1,059.6**	**5,751.1**	**5,068.2**

Generation Units put into Operation in 2008[17]

NAME OF THE PLANT	FUEL TYPE	KURULU GÜCÜ (MW)	ÜRETİMLERİ (MWh)
MB ŞEKER NİŞASTA SAN. A.Ş. (Sultanhanı)	NATURAL GAS	8.800	0
AKSA ENERJİ (Antalya)	NATURAL GAS	183.800	133,736
AKSA ENERJİ (Manisa)	NATURAL GAS	52.380	79,183
ANTALYA ENERJİ (İlave)	NATURAL GAS	17.460	256,120
ATAÇ İNŞAAT SAN. A.S.B.(ANTALYA)	NATURAL GAS	5.400	10
BAHÇIVAN GIDA (LÜLEBURGAZ)	NATURAL GAS	1.165	0
CAN ENERJİ (Çorlu- TEKİRDAĞ) (İlave)	NATURAL GAS	52.380	274,260
FOUR SEASONS OTEL (ATIK PASHA TUR.A.Ş)	NATURAL GAS	1.165	0
FRĠTOLAY GIDA SAN.VE TİC. A.Ş.(İlave)	NATURAL GAS	0.060	0
ITC-KA Enerji Üretim A.Ş. (Mamak)(İlave)	WASTE	14.130	95,832
KARKEY(SİLOPİ-5) (154 kV) (İlave)	FUEL OIL	14.780	16,362
MELĠKE TEKSTĠL (GAZĠANTEP)	NATURAL GAS	1.584	0
MĠSĠS APRE TEKSTİL BOYA EN. SAN.	NATURAL GAS	2.000	5,324
MODERN ENERJİ (LÜLEBURGAZ)	NATURAL GAS	13.400	508,942
ORTADOĞU ENERJİ (ODA YERĠ) (Eyüp/ĠST.)	WASTE	2.830	0
POLAT TURZ. (POLAT RENAISSANCE ĠST.OT.)	NATURAL GAS	1.600	490
SARAYKÖY JEOTERMAL (Denizli)	GEOTHERMAL	6.850	14,099
YILDIZ SUNTA (Uzunçiftlik- Köseköy)(Düzeltme)	NATURAL GAS	22.630	136,018
SÖNMEZ Elektrik (İlave)	NATURAL GAS	8.730	61
AKKÖY ENERJĠ (AKKÖY I HES)	HYDRO	101.940	21,608
ALP ELEKTRĠK (TINAZTEPE) ANTALYA	HYDRO	7.689	9,245
CANSU ELEKTRİK (Murgul/ARTVĠN)	HYDRO	9.180	12,518
ÇALDERE ELK.(ÇALDERE HES)Dalaman-MUĞLA	HYDRO	8.740	11,153
DAREN HES ELKT. (SEYRANTEPE BARAJI VE HES)	HYDRO	49.700	14,370
DEĞĠRMENÜSTÜ EN. (KAHRAMANMARAŞ)	HYDRO	25.700	0
GÖZEDE HES (TEMSA ELEKTRĠK) BURSA	HYDRO	2.400	6,107
H.G.M. ENERJİ (KEKLİCEK HES) (Yeşilyurt)	HYDRO	8.674	120
HAMZALI HES (TURKON MNG ELEKTRĠK)	HYDRO	16.700	2,934
HİDRO KNT.(YUKARI MANAHOZ REG.VE HES)	HYDRO	22.400	13,772

[16] http://www.teias.gov.tr/ist2007/8.xls

[17] http://www.teias.gov.tr/istatistik2008/8.xls

NAME OF THE PLANT	FUEL TYPE	KURULU GÜCÜ (MW)	ÜRETİMLERİ (MWh)
İÇ-EN ELK.(ÇALKIŞLA REGÜLATÖRÜ VE HES)	HYDRO	7.660	3,364
KALEN ENERJİ (KALEN II REGÜLAT. VE HES)	HYDRO	15.650	10,281
MARAŞ ENERJİ (FIRNIS REGÜLATÖRÜ VE HES)	HYDRO	7.220	0
SARMAŞIK I HES (FETAŞFETHİYE ENERJİ)	HYDRO	21.040	1,472
SARMAŞIK II HES (FETAŞ FETHİYE ENERJİ)	HYDRO	21.580	1,221
TORUL	HYDRO	105.600	18,551
YEŞİL ENERJİ ELEKTRİK (TAYFUN HES)	HYDRO	0.820	0
ZORLU ENERJİ (MERCAN) (Düzeltme)	HYDRO	1.275	22,828
BAKİ ELEKTRİK ÇAMLI RÜZGAR	WIND	21.000	60,943
DATÇA RES (Datça)	WIND	8.100	3,778
ERTÜRK ELEKTRİK Çatalca RES	WIND	60.000	65,961
İNNORES ELK YUNTDAĞ RÜZG. (Aliağa)	WIND	42.500	98,058
LODOS RES (Taşoluk)(G.O.P./İSTANBUL)	WIND	24.000	25,714
SAYALAR RÜZGAR (Doğal Enerji)	WIND	30.600	53,925