



**Verified Carbon
Standard**

ULUABAT HYDROELECTRIC POWER PLANT

Document Prepared by GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ EĞİTİM
DANIŞMANLIK VE TİCARET A.Ş

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Uluabat HEPP and Cinarcik Dam Project is an integrated project located on the lower basin of Orhaneli Creek, one of the major branches of Mustafa Kemalpasas River. It is built within the scope of Emet Orhaneli Project developed by General Directorate of DSI (State Hydraulic Works) for utilizing the water potential in Marmara Region and has two components. First component, Cinarcik Dam is built by DSI mainly for providing agricultural, industrial and drinking water for Bursa city whereas second component, Uluabat HEPP project has been awarded to Akenerji Elektrik Uretim A.S. for 48 years 6 months period after the bidding by the Turkish Energy Market Regulatory Authority (EMRA) as stated in the license dated 27/06/2007.

Scope of the project is using the hydraulic sources of the Orhaneli Creek for securing long term potable water supply for Bursa city and industrial zone, providing irrigation water for agricultural land and generating electricity to meet the increasing energy demand. The first component of the project, Çınarcık Dam, is built and owned by DSI whereas the Uluabat HEPP was built and operated by Akenerji for electricity generation using excess water (after securing potable and irrigation water) stored at Çınarcık Dam.

Proposed project is located in Marmara Region of Western Turkey, within the borders of Bursa province and about 55 km southwest of the city center. It is surrounded by Nilufer Creek in the East, Emet Creek in the west and Orhaneli District and Buyuk Orhan town in the South.

The project consists of a rock filled embankment dam at 210 meters riverbed elevation, 556 m long horseshoe shaped derivation tunnel, 11,820 m long transmission tunnel, source and downstream cofferdams, spillway, 838 m long penstock pipe and a power plant with 2 vertical axis Francis turbines. Electricity generated by the power plant will be delivered to the grid by an 11.2 km long 154 kV double circuit overhead transmission line.

Technical properties of the technologies used are given in tables below.

Table 1. Technical properties of turbines

Parameter	Turbine 1	Turbine 2
Model	Vertical Francis	Vertical Francis
Serial no.	19397	19398
Size	18.9 dm	18.9 dm
Velocity	600 rpm	600 rpm
Design discharge	19 m ³ /s	19 m ³ /s

Table 2. Technical properties of generators

Parameter	Generator 1	Generator 2
Model	IM8425 (W41)	IM8425 (W41)
Type	1DH5945-3WE05-Z	1DH5945-3WE05-Z
Serial no.	SP06.002123.01	SP06.002123.02
Rated output	55000 kVA	55000 kVA
Rated Voltage	13800 V	13800 V
Rated current	2301 A	2301 A

Uluabat HEPP had an initial capacity of 110.3 MWm/100 MWe and expected to generate 422.6 GWh as per the license dated 25/08/2005. The licence represented 2 units with a capacity configuration of (2 x 55.15) MWm / (2 x 50.00) MWe. However, the capacity has been changed as (2 x 51.04) MWm / (2 x 50.00) MWe and a total installed capacity of 102.08 MWm / 100 MWe as per license dated 27/06/2007 and approved by notary on 18/03/2013. Expected generation is stated as 335.3 GWh as per license. The project has generated 1,988,633.20 MWh electricity in the whole monitoring period corresponding 1,101,947 tCO₂ emission reduction (regarding project emissions, too). These values were estimated as 1,983,858 MWh electricity generation and the Project aims to;

- contribute to the Host Country's sustainable development, and specifically the region surrounding it.
- utilize the hydroelectric potential of Turkey to meet the increasing electricity demand and contribute improving regional energy security.
- increase share of HEPPs in electricity generation mix of Turkey and reduce GHG emissions.

- contribute to economic development by creating direct and indirect job opportunities during construction and operation phases.
- increase income of fishermen in the region, increase the agricultural income of the local community and support the development of the industrial zone of Bursa.
- reduce import dependency on fossil fuel weighed electricity sector and diversifies generation mix through use of local resources.

Table below shows the milestones of the project.

Table 3. Milestones table

Milestone	Date
First License Issue	25/08/2005
Second License Issue	27/06/2007
Revised Feasibility Study	01/06/2006
Water Usage Agreement	25/09/2006
EIA- Exemption Letter	15/08/2006
Electro-mechanic Equipment Agreement	07/04/2006
Start of Construction	01/08/2007
Energy Transmission Line Agreement	27/02/2008
Provisional Acceptance&Commissioning for Unit 1	27/10/2010
Provisional Acceptance&Commissioning for Unit 2	25/11/2010
Validation Report Date	19/11/2010
First Monitoring Period	27/10/2010 – 30/04/2012
Second Monitoring Period	01/05/2012 – 31/03/2018

The expected electricity generation for this monitoring period was 2,500,866 MWh, considering expected annual electricity generation given in PD. However, net electricity generation in this monitoring was monitored as 1,988,633.20 MWh. Thus, estimated emission reduction was 1,180,406 tCO₂ for this monitoring but the actual achieved reduction is calculated as 1,101,947.

The electricity generation in hydropower plants are quite dependable to the natural and climatic conditions. As can be seen from the calculations, the project has generated 25.76% less electricity than expected. Therefore, the project owner needs the revenue obtained from this VCS project.

1.2 Sectoral Scope and Project Type

Proposed project activity is a large-scale project activity involves electricity generation from renewable sources therefore it is categorized in the sectoral scope 1 "Energy Industry – Renewable -/Non-renewable Sources" according to the UNFCCC definition.

Project consists of a dam and a hydroelectric power plant. Project is not a part of grouped project.

1.3 Project Proponent

Organization name	AKENERJİ Elektrik Üretim A.Ş.
Contact person	Özlem Sefer Palabıyık
Title	Strategic Planning and Risk Manager
Address	Miralay Sefik Cad. No:15 Zip Code:34437 Taksim/Istanbul
Telephone	+90 212 249 8282
Email	info@akenerji.com.tr

1.4 Other Entities Involved in the Project

Organization name	GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ EĞİTİM DANIŞMANLIK VE TİCARET A.Ş.
Role in the Project	Consultant
Contact person	M. Kemal Demirkol
Title	Director
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1.5 Project Start Date

The project has started to feed energy to the grid as of 27/10/2010.

1.6 Project Crediting Period

Crediting period for the project is 10 years between 27/10/2010 and 26/10/2020.

Crediting period type is renewable and will be renewed 2 times.

1.7 Project Location

The project site lies between 28° 46' - 28 ° 43' E longitudes and 40° 03' - 40° 09' N latitudes. The closest settlement is the Akçalar Village, about 20 km to the project site. Other settlements close to the project site are the towns of Orhaneli and Büyük Orhan in the south, within the province of Bursa. The project lies between the Emet Creek in the west and Nilüfer Creek at the east. Also the project location represented on Map of Turkey is shown below.



Figure 1. Project Location

Table below provides GPS coordinates of the project site which is shown in Figure 1 below. The visual is also provided along with the supporting documents.

Table 4. Project location coordinates

Point No	Y	X
1	651387.778	4434697.267
2	651342.545	4434703.745
3	646944.437	444688.422
4	646915.271	4445230.452
5	646856.450	4446323.491
6	646845.481	4446354.827
7	646827.668	4446395.584
8	646820.742	4446414.333
9	646744.234	4446621.429
10	646693.091	4446720.120
11	646657.748	4446828.656
12	646496.721	4446885.577
13	646355.948	4446987.683
14	646063.367	4447149.876
15	646831.525	4446439.195
16	646931.943	4446484.528
17	646991.766	4446362.026
18	646887.499	4446315.207

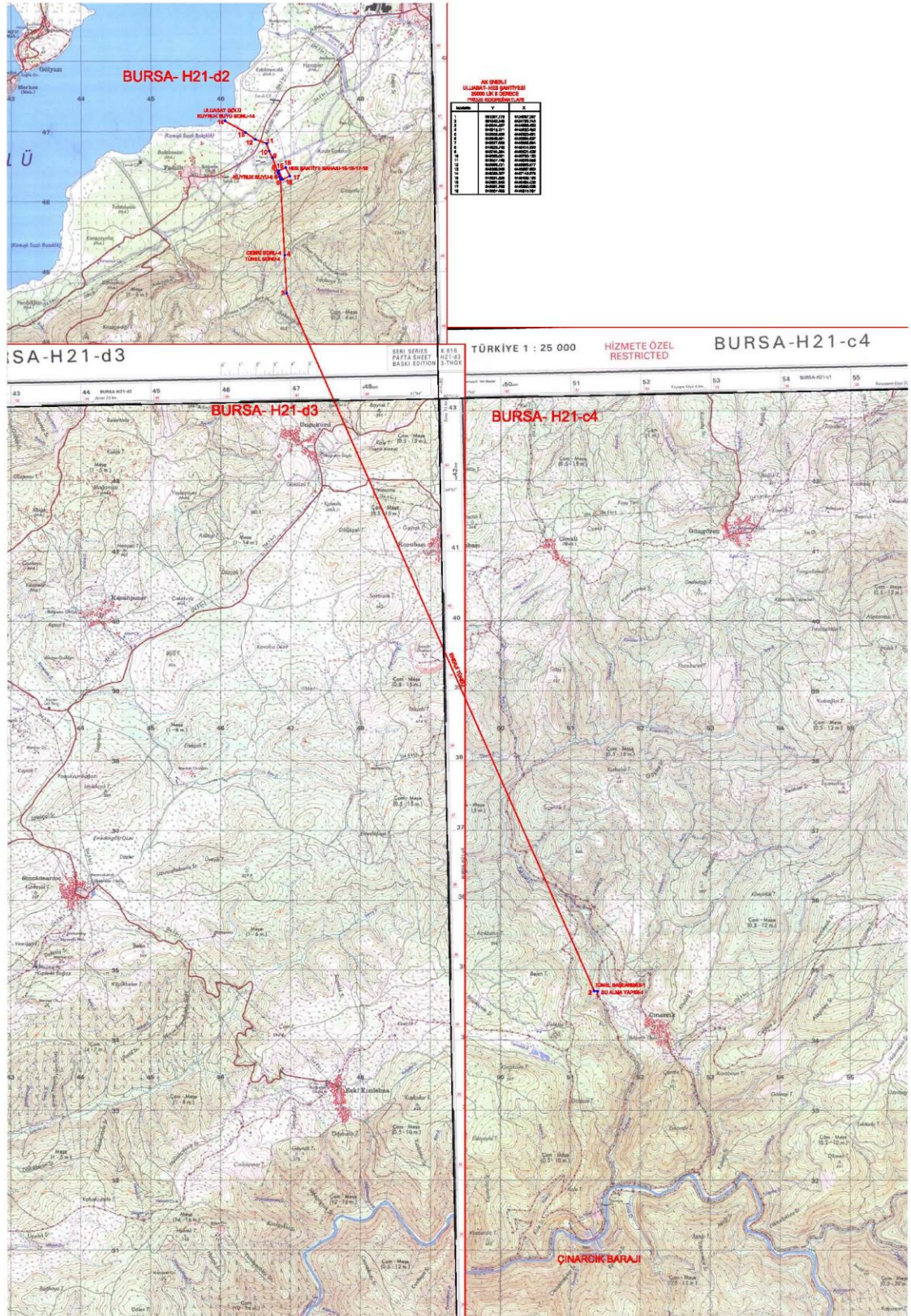


Figure 1. Project location

1.8 Title and Reference of Methodology

The starting date of the project is 27/10/2010. For monitoring of the project, United Nations approved consolidated baseline methodology applicable to this project is ACM0002 "Consolidated methodology for grid-connected electricity generation from renewable sources", Version 10.

ACM0002 refers to the following tools:

- "Tool for the demonstration and assessment of additionality", Version 05.2
- "Tool to calculate the emission factor for an electricity system", Version 01.1.

1.9 Participation under other GHG Programs

The project is not registered or seeking registration under other GHG programmes.

1.10 Other Forms of Credit

Project does not produce other kinds of environmental credits.

1.11 Sustainable Development

The project helps Turkey to stimulate the commercial application of grid connected renewable energy technologies and markets. It is also a crucial sample of establishing the feasibility of HEPPs as a tool to support energy security, improved air quality, alternative sustainable energy, improved local source of income and sustainable renewable energy industry development. The project highly supports the sustainable economic development in the region. It has significant contribution in diminishing carbon emissions and protecting the climate compared to the business-as-usual scenario. It created employment during the construction and the operation phase of the plant. Therefore, the project has positive influences on sustainable development and contributes to UN sustainable development goals (SDG) 13, 8 and 7.

- Climate Action (SDG 13): Renewable energy power plants contributes to "Emission Reductions or Removals and/or Adaptation to Climate Change" by reducing CO₂ emissions caused by fossil fuel-fired power plants that are displaced due to the project activity. The project has reduced CO₂ emissions in an amount of 1,101,947 tonnes in the whole monitoring period.
- Decent Work and Economic Growth (SDG 8): The project generates employment and income. The project has created permanent job opportunity for 16 people.

- Affordable and Clean Energy (SDG 7): Increasing the number and percentage of renewable energy power plants provides substantial increase in the share of renewable energy in the global energy mix and ensure universal access to affordable, reliable and modern energy services. The project has generated 1,988,633.20 in the whole monitoring period.

2 SAFEGUARDS

2.1 No Net Harm

Uluabat HEPP and Cinarcik Dam Project have been exempted from the procedure of preparation of an Environmental Impact Assessment Report in 2002, since the project approval date is before 1993. However, an Environmental Assessment Report was prepared by PRD Planlama, Arastirma, and Gelistirme ve Danismanlik Sti. In March 2006, in order to evaluate the possible impacts of the project on the environment and take the necessary steps to mitigate the possible negative impacts.

EIA report prepared for the project covers all aspects of the project including capacity, interaction with other plants in the vicinity, natural resources used, waste management, social and economic impacts, technology and materials used, current land use in the region, any historical or protected site within the project boundaries, geological assessment of the project site and any communities affected with the project. 54The project does not have significant environmental effects and environmental assessment is positive for the project activities.

It shall not have any negative effects on the environment because it shall be operated based on national and international regulations. The HEPP does not change any water volume or cause any water pollution. Water is released to the river bed for the Mustafa Kemal Pasa creek. There are some existing small and big creeks feeding the Mustafa Kemal Pasa Creek so that any big changes in irrigation and the structure of natural life does not occur. The environmental impacts of the proposed project are not considered to be significant. All necessary permissions including, environmental, health and safety, have been acquired from relevant agencies and all precautions have been applied strictly by Investor Company. Many trainings including HSE trainings were given to the employees. The related documents containing different type of training records are provided to VVB.

A possibility of harm caused by the project may be named as wastes generated due to project activity. Wastes generated at the project site are handled according to Turkish law and regulations. Invoices, pictures etc. are provided by the project owner as proofs of management activities of these wastes. Sewage truck forms, septic tank photograph, waste management and handling area photographs are among proof documents provided. Also, occupational hygiene report is provided which includes noise measurements at different locations in the project area.

Çınarcık DAM is managed by State Hydraulic Works (DSİ) and related flow controls are done by DSİ. Both operation and management works are conducted by DSİ. There is no fish passage.

Another point might be the fish species which live in the river that the project is installed. However, the project does not include regulator etc. within its structure. It is located at the end of the 11.461 km long canal through which water is directed from the Çınarcık Dam under DSİ control. Fish passes are a system applied in regulator structures, not in power plants. Therefore, there is no fish passage within the context of the project.

For the reason explained above, life water control is made by DSİ from Çınarcık DAM. All of the water that is discharged to the canal by DSİ and delivered to Ulubat HEPP is already left to the bed. There is no water in the canal that can be left in periods when there is no water came from the Çınarcık Dam.

2.2 Local Stakeholder Consultation

Initial Stakeholder meeting of the project was held on 4th of December, 2008 in Akcalar village, in Bursa. Stakeholders were invited through invitation letters sent by mail, newspaper announcements and thorough village heads.

Since Turkey had not then ratified Kyoto Protocol there was no official DNA in the country. However, as the most relevant government agencies, Ministry of Environment and Forestry and Ministry of Energy and Natural Resources were invited. In addition to local and national authorities, local and national NGOs and were also invited and informed about the meeting by mail.

The meeting was held between 14:00 and 16:00 hours and some 60 minutes were dedicated to the presentation about the project, climate change and carbon markets.

Initial Stakeholder consultation meeting has been recorded to video and minutes have been noted. Comments have also been requested from government agencies and invitees by letters sent by mail. The comments from stakeholder have been positive in general. The concerns raised by the participants were reduction of the oxygen content and the heating of the water outlet of the HEPP, the probable damage of the transmission tunnel to drinking water, closure of the water flowing in the riverbed, probable landslides filling the dam.

Due to COVID-19 interim, site visit for this verification was held remotely on 11/08/2021. Locals were notified by the mukhtar about the LSC meeting. For the meeting, they gathered on the plant area. The mukhtar, two local people, site chief and two people from the headquarter of the project owner's company attended to the meeting as well as project consultant and DOE. Locals were asked if they had any input or grievances to submit. No grievance was received related to the project implementation. Locals stated that the water in the river is reachable for them, and they can access to the water for irrigation purpose when they need. They also stated the communication between them, and project owner is quite good. No grievances were received during this monitoring period.

Local stakeholders can communicate face-to-face with the mukhtar. Also, they can use the logbook at mukhtar's office to submit their grievances.

No design changes and updates occurred in the project in this monitoring period.

2.3 AFOLU-Specific Safeguards

N/A

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project has been in operation since 27/10/2010. Crediting period for the project will be 10 years. First crediting period is 27/10/2010 - 26/10/2020.

There isn't any event or any situation that occurred during the monitoring period, which can change the applicability of the methodology.

There are not any changes with the entities involved in the project compared with the registered project.

Global Tan Energy mentioned in the registered PD and initial monitoring period has changed its name to become GTE KARBON SÜRDÜRÜLEBİLİR ENERJİ EĞİTİM DANIŞMANLIK VE TİCARET A.Ş. The company is the same with a different name.

3.2 Deviations

3.2.1 Methodology Deviations

N/A

3.2.2 Project Description Deviations

Section A.2 of the approved PD indicates the duration of award as 49 years. However, Uluabat HEPP project has been awarded to Akenerji Elektrik Üretim A.S. for 48 years 6 months period after the bidding by the Turkish Energy Market Regulatory Authority (EMRA) as stated in the license dated 27/06/2007. Therefore, it is also stated as 48 years 6 months in the monitoring period.

As per the licence on 27/06/2007, total installed capacity was stated as 110.3 MWm/100 MWe with configuration of (2x55.15 MWm / 2x50.00 MWe). However, the capacity has been changed as (2 x 51.04 MWm / 2 x 50.00 MWe) and a total installed capacity of 102.08 MWm / 100 MWe as per the amendment dated 17/09/2011.

As per approved VCS PD, the other entity involved in the project is named as "Global Tan Energy Limited". However, after the name change of the other entity, current name of the company is "GTE Karbon Sürdürülebilir Enerji Eğitim Danışmanlık Ve Ticaret A.Ş".

In the PD, the project emissions from the reservoir were indicated to be between 4 W/m² and 10 W/m² and the power density was calculated as 9.86 W/m². However, the surface area of the river (0.47 km²) prior to the project is documented and deducted from the reservoir area. This has resulted in the power density increasing to 10.34 W/m². Hence, the project emissions are ignored in the monitoring report as in the initial verification period.

3.3 Grouped Projects

The project is not a part of group project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	EG_y, Total
Data unit	MWh
Description	Net Electricity generated by power plants in Turkey in year 2007, 2006 and 2005.
Source of data	TEIAS web page ¹
Value applied	183,339.7 GWh
Justification of choice of data or description of measurement methods and procedures applied	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, providing the most up-to-date and accurate information available.
Purpose of Data	Baseline emission calculation
Comments	-

Data / Parameter	EF_{CO2, i, y i}	
Data unit	tCO ₂ /TJ	
Description	CO ₂ emission factor of fossil fuel type "i" in year "y"	
Source of data	For EF of fossil fuels, IPCC values at the lower limit has been used. (Validated PD page 22)	
Value applied	Fuel Source	EF (tCO₂/Tj)
	Coal	89.50
	Lignite	90.9
	Fuel Oil	75.5
	Diesel	72.6
	LPG	61.6

¹

<https://webapi.teias.gov.tr/file/512cbf1d-0ca3-4492-b901-3722c7b682f7?download>

	Naphta	69.3
	Natural Gas	54.3
Justification of choice of data or description of measurement methods and procedures applied	There is no information on the fuel specific default emission factor in Turkey. Hence, IPCC values have been used as per the "Tool to calculate the emission factor for an electricity system"	
Purpose of Data	Baseline emission calculation	
Comments	-	

Data / Parameter	FC i, y					
Data unit	Tons or 1000 m ³ for gases					
Description	Amount of fuels consumed by thermal power plants for electricity generation in terms of fossil fuel type i in year y					
Source of data	TEIAS web page ² (Validated PD page 22)					
Value applied		2005	2006	2007	Total Fuel Consumption 2005-2007	Total Emission 2005-2007
	Hard Coal	5,259,058	5,617,863	6,029,143	16,906,064	34,915,268
	Lignite	48,319,143	50,583,810	61,223,821	160,126,774	96,197,334
	Fuel Oil	2,005,899	1,746,370	2,250,686	6,002,955	18,165,198
	Diesel Oil	28,442	61,501	50,233	140,176	436,185
	LPG	12,908	33	0	12,941	36,623
	Naphtha	84,481	13,453	11,441	109,375	334,828
	Natural Gas	15,756,764	17,034,548	20,457,793	53,249,105	106,643,758
Justification of choice of data or description of measurement	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, providing the most up-to-date and accurate information available.					

² <https://webapi.teias.gov.tr/file/037a54ff-0964-46b5-84ff-375ab6c285dc?download>

methods and procedures applied	
Purpose of Data	Baseline emission calculation
Comments	-

Data / Parameter	GE	
Data unit	%	
Description	Generation efficiency of thermal power plants	
Source of data	Annex I of the tool applied (Validated PD page 46)	
Value applied	Fuel Source	Generation Eff (%)
	Coal	39.0
	Lignite	39.0
	Fuel Oil	39.5
	Diesel	39.5
	LPG	39.5
	Naphta	39.5
	Natural Gas	60.0
Justification of choice of data or description of measurement methods and procedures applied	-	
Purpose of Data	Baseline emission calculation	
Comments	-	

Data / Parameter	NCV
Data unit	Tj/kt
Description	Net Calorific Values of Fuel combusted in power plants.
Source of data	TEIAS web page (Validated PD page 46)

Value applied	Fuel Source	NCV (Tj/kt)
	Coal	21.83
	Lignite	6.61
	Fuel Oil	40.08
	Diesel	42.86
	LPG	45.94
	Naphta	44.17
	Natural Gas	36.88
Justification of choice of data or description of measurement methods and procedures applied	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, providing the most up-to-date and accurate information available.	
Purpose of Data	Baseline emission calculation	
Comments	-	

Data / Parameter	CapBL
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data	Project site
Value applied	For new hydro power plants, this value is zero.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Leakage emission calculation
Comments	-

Data / Parameter	ABL
Data unit	m ²

Description	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).
Source of data	Project site
Value applied	470,000 (m ²)
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Leakage emission calculation
Comments	-

Data / Parameter	EF _{grid,CM y}
Data unit	tCO ₂ /MWh
Description	Combined margin CO ₂ emission factor for the project electricity system in year y
Source of data	
Value applied	0.562 tCO ₂ /MWh
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Baseline emission calculations
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	EG_{facility, y}
Data unit	MWh
Description	Net Electricity generated and delivered to the grid by Uluabat HEPP in year y

Source of data	Metering devices installed in the power plant form the basis for TEIAS records. These records were obtained by TEIAS monthly.																		
Description of measurement methods and procedures to be applied	Generation data were recorded by two metering devices continuously. These records provided the data for the monthly invoicing to TEIAS. Each month, an officer from TEIAS and the plant manager/electricity technician of the plant recorded the reading.																		
Frequency of monitoring/recording	Continuous measurement at the site and daily and monthly recording were applied. The plant manager and the staff extracted the records regularly every day. The monthly records recorded by TEIAS, and the plant manager were used for monitoring emission reductions.																		
Value monitored	1,988,633.20 MWh in the whole monitoring period 336,107.02 MWh per annum in this monitoring period <table> <tr> <th>Year</th><th>Net Electricity Supplied to the Grid (MWh)</th></tr> <tr> <td>2012 (01/05/2012 - 31/12/2012)</td><td>311,504.11</td></tr> <tr> <td>2013</td><td>320,468.74</td></tr> <tr> <td>2014</td><td>134,221.64</td></tr> <tr> <td>2015</td><td>526,025.77</td></tr> <tr> <td>2016</td><td>420,254.53</td></tr> <tr> <td>2017</td><td>194,570.33</td></tr> <tr> <td>2018 (01/01/2018 - 31/03/2018)</td><td>81,588.08</td></tr> <tr> <td>Total</td><td>1,988,633.20</td></tr> </table>	Year	Net Electricity Supplied to the Grid (MWh)	2012 (01/05/2012 - 31/12/2012)	311,504.11	2013	320,468.74	2014	134,221.64	2015	526,025.77	2016	420,254.53	2017	194,570.33	2018 (01/01/2018 - 31/03/2018)	81,588.08	Total	1,988,633.20
Year	Net Electricity Supplied to the Grid (MWh)																		
2012 (01/05/2012 - 31/12/2012)	311,504.11																		
2013	320,468.74																		
2014	134,221.64																		
2015	526,025.77																		
2016	420,254.53																		
2017	194,570.33																		
2018 (01/01/2018 - 31/03/2018)	81,588.08																		
Total	1,988,633.20																		

Monitoring equipment

Four calibrated ammeters (two of them are spare). The devices are in compliance with the regulation on meters issued by relevant government agencies. Technical properties of meter that had been used in this monitoring period are given below.

	Main Meter 1	Main Meter 2	Spare Meter 1	Spare Meter 2
Brand	ACTARIS	ACTARIS	ACTARIS	ACTARIS
Type	SL761A071	SL761A071	SL761A071	SL761A071
Class	0.2S	0.2S	0.2S	0.2S
Serial No.	530352242	53035241	53035240	53035243

Meters were replaced in April 2019 however; it is not in the length of this monitoring period.

TEİAŞ is responsible for the meters and their calibrations, thus project owner does not apply an additional internal audit. Calibration is done according to Measuring Instruments Directive.³

The spare meters were changed in 12/08/2021, as the photographs from the project site and the replacement documents show. Both meters were tested as well on the same day of replacement, which is on 12/08/2021. Technical information are as follows:

	Spare Meter 1	Spare Meter 2
Brand	EMH	EMH
Type	LZQJ-XC	LZQJ-XC
Class	0.5S	0.5S
Serial No.	10305689	10305690

All test dates of the meters are presented below:

Year	Calibration Date
2010	27/10/2010
2012	18/07/2012
2013	17-18/07/2013
2014	23/07/2014
2015	14/07/2015
2017	11/07/2017
2018	27/07/2018
2019	03/04/2019

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

	2021	21/01/2021
QA/QC procedures to be applied	Four calibrated ammeters (two of them are spare. Maintenance and calibration of the metering devices is made by TEİAŞ periodically. If there is a significant difference between the readings of two devices, maintenance and tests of the metering devices and the associated equipment are done before waiting for the periodical maintenance. TEİAŞ is responsible for the meters and their calibrations, thus project owner does not apply an additional internal audit. The calibration frequency is determined by that institution. However, according to the national laws, the meters have be changed/calibrated at least once in 10 years.⁴	
Purpose of the data	Baseline emission calculations	
Calculation method	The internal consumption of the facility was subtracted from the gross generation. The internal consumption was also taken from the facility's records and cross-checked with the EPAİŞ data. Calibration of the metering devices should be done once every ten years as according to Measuring Instruments Directive.⁵	
Comments	-	

Data / Parameter	Cap _{PJ}
Data unit	W

⁴ <https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=7&MevzuatNo=6381&MevzuatTertip=5>

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

Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site.
Description of measurement methods and procedures to be applied	The parameter were determined from the labels on the equipment and letter for approval of commissioning issued by Ministry of energy and Natural Resources
Frequency of monitoring/recording	Yearly
Value monitored	100 MW
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Project emission calculation
Calculation method	-
Comments	-

Data / Parameter	APJ
Data unit	m ²
Description	Area of the reservoir measured on the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Description of measurement methods and procedures to be applied	Measured from topographical surveys or maps
Frequency of monitoring/recording	Yearly
Value monitored	9,670,000 (m ²)

Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Project emission calculation
Calculation method	Reservoir area was measured using Google Earth.
Comments	-

Data / Parameter	PEFF,y		
Data unit	tCO2/yr		
Description	Project emissions from fossil fuel consumption in year y		
Source of data	Project site (Diesel generator)		
Description of measurement methods and procedures to be applied	Fuel Invoices		
Frequency of monitoring/recording	Annually		
Value monitored			
	Year	Diesel consumption (L)	Total Emissions (tCO2)
	2012 (01/05/2012 - 31/12/2012) (245 days)	672.00	1,779
	2013	1,000.00	2,646
	2014	1,000.00	2,646
	2015	1,000.00	2,646
	2016	1,000.00	2,646
	2017	1,000.00	2,646
	2018 (01/01/2018 - 31/03/2018) (90 days)	246.58	653
	Total	5,918.58	15,662

Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of the data	Project emission calculation
Calculation method	“Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion, ver03.0” has been used. The equations used are also mentioned below: $PE_{FC,i,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$ Where: $PE_{FC,i,y}$ = Are the CO₂ emissions from fossil fuel combustion in process j during the year y (tCO₂/yr); $FC_{i,j,y}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr); $COEF_{i,y}$ = Is the CO₂ emission coefficient of fuel type i in year y (tCO₂/mass or volume unit) i = Are the fuel types combusted in process j during the year y $COEF_{i,y} = NCV_{i,y} \times EF_{CO_2,i,y} \quad (4)$ Where: $COEF_{i,y}$ = Is the CO₂ emission coefficient of fuel type i in year y (tCO₂/mass or volume unit) $NCV_{i,y}$ = Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) $EF_{CO_2,i,y}$ = Is the weighted average CO₂ emission factor of fuel type i in year y (tCO₂/GJ) i = Are the fuel types combusted in process j during the year y
Comments	-

4.3 Monitoring Plan

Monitoring is a key procedure to verify the real and measurable emission reductions from the proposed project. To guarantee the proposed project's real, measurable and long-term GHG emission reductions, the monitoring plan has been established.

In order to demonstrate the emission reduction, only required data is the net electricity delivered to the grid by the project activity, internal combustion for the auxiliary diesel generator and project emissions from reservoir area.

Net electricity generation was measured and recorded by both TEIAS and project owners for billing purposes therefore no new additional protocol was needed for monitoring emission reduction. Power Plant Manager was responsible for the electricity generated, gathering all relevant data and keeping the records. He was informed about VER concepts and mechanisms and how to monitor and collect the data which was used for emission reduction calculations. The procedures to collect data were in line with the TEAIS requirements and rules. The project deploys software

to track the generation and consumption all times. As an internal audit step, the records extracted from the software were also checked with the manual records which were extracted by the project staff. The records were reported to the plant manager who acts as the final internal auditor. Should nonconformity was identified; the plant manager was responsible for communication with TEIAS and undertaking the corrective action in line with the TEIAS procedures and rules if it fell under the authority of the plant manager. However, this might need the involvement of TEIAS as well as the project owners were not allowed to make changes or fixes on the meters. Thus, in case of non-conformity, the plant manager reported it instantly to TEIAS.

Generation data collected during crediting period was submitted to Global Tan Energy who is responsible for calculating the emission reduction subject to verification: Generation data was used to prepare monitoring reports which were used to determine the vintage from the project activity. These reports were submitted to the duly authorized and appointed Designated Operational Entity 'DOE' before each verification period.

VER Team Members is expected to include the following staff of the HEPP:

Plant Manager: Responsibility for running the HEPP plant and compliance with VER monitoring plan

Accounting Manager: Responsible for keeping data about power sales, invoicing and purchasing.

GTE Karbon: Responsible for emission reduction calculations, preparing monitoring report and periodical verification process.

Installation of meter and data monitoring was carried out according to the regulations by TEIAS. 4 metering devices (two of them used as spare) were used for monitoring the electricity generated by the power plant. Readings were done using main metering devices and spare metering device was used for comparison only. Data from metering devices was recorded by TEIAS monthly and formed the basis for invoicing. In addition to the two metering devices, generation of the HEPP were cross checked from EPIAŞ website which is accessible using a password provided to electricity generation companies. The project owner extracted these data and send to GTE. Both the EPIAŞ data and the facility/TEIAS records were taken into account for comparison and to identify any anomalies.

All data was archived electronically and be kept at least for 2 years after the end of the last crediting period.

For internal auditing, TEIAS is in charge. Project owner is not responsible for any audit related to electricity meters, etc. In case of any problem with them, teams from TEIAS handle the issue.

Roles of the personnel are given in the table below.

Table 5. Role of personnel

No.	Name	Surname	Role
1	Erdem Erkin	Dede	Station Manager
2	Mehmet	Küçük	Operation and Maintenance Manager, Maintenance (by proxy)
3	Ali İhsan	Doğanlı	Station Operator
4	Burhan	Yanık	Station Operator
5	Eren	Öztürk	Mechanical Maintenance Technician
6	Güven	Acar	Mechanical Maintenance Technician
7	Mehmet	Vapor	Mechanical Maintenance Technician
8	Muhammet	Erdoğan	Warehouse and Administrative Support
9	Nail	Keşan	Station Operator
10	Osman	Oskay	Station Operator
11	Rüstem	Kurtcu	Station Operator
12	Turgay	Ünveren	Station Operator
13	Uğur	Toku	Station Operator
14	Zekayi	Şahin	Station Operator
15	Volkan	Aydın	Mechanical Engineer
16	Serkan	Akçay	Electrical Engineer
17	Mehmet	Pehlivan	Technical Draftsman

Test and calibration dates of the meters in the monitoring period are given in the table below. Calibration is done according to Measuring Instruments Directive.⁶

Table 6. Test dates of the meters

Year	Calibration Date
2010	27/10/2010
2012	18/07/2012
2013	17-18/07/2013
2014	23/07/2014
2015	14/07/2015
2017	11/07/2017
2018	27/07/2018
2019	03/04/2019
2021	21/01/2021

⁶ <https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=7&MevzuatNo=6381&MevzuatTertip=5>

TEİAŞ is responsible for the meters and their calibrations, thus project owner does not apply an additional internal audit. The test and calibration documents are provided to VVB.

Meters were replaced in April 2019 however; it is not in the length of this monitoring period. Technical information on the meters which had been active in the length of this monitoring period are given in the table below.

Table 7. Electricity meters that had been active in the length of this monitoring period

	Main Meter 1	Main Meter 2	Spare Meter 1	Spare Meter 2
Brand	ACTARIS	ACTARIS	ACTARIS	ACTARIS
Type	SL761A071	SL761A071	SL761A071	SL761A071
Class	0.2S	0.2S	0.2S	0.2S
Serial No.	530352242	53035241	53035240	53035243

Technical information on the electricity meters which were placed in April 2019 are given in the table below. These meters are currently active in Ulubat HEPP.

Table 8. Electricity meters that are currently active since April 2019

	Main Meter 1	Main Meter 2	Spare Meter 1	Spare Meter 2
Brand	ITRON	ITRON	EMH	EMH
Type	SL761W071	SL761W071	LXWJ-XC	LXWJ-XC
Class	0.2S	0.2S	0.2S - 0.5S	0.2S - 0.5S
Serial No.	84260258	84260260	10305689	10305690

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

$$BE_y = (1,988,633.20 \text{ MWh}) \times (0.562 \text{ tCO}_2/\text{MWh}) = 1,117,609 \text{ tCO}_2$$

5.2 Project Emissions

Emission from the reservoir

In the Project Design Document, the project emissions from the reservoir were indicated to be between 4 W/m² and 10 W/m², and the power density was calculated as 9.86 W/m². However, for the purposes of the monitoring report, the surface area of the river (0.47 km²) prior to the project is documented and deducted from the reservoir area. This has resulted in the power density increasing to 10.34 W/m² (calculated below), hence, the project emissions are ignored in the monitoring period.

The surface area of the river prior to the project could not be documented at the validation stage due to lack of objective evidence. However, it has been documented and deducted from the reservoir area during the first monitoring period. The surface area of the river when it is full before the implementation of the project activity is defined as 0.47 km² as confirmed through the General Layout Plan of Cinarcik Dam which is obtained from General Directorate Of State Hydraulic Works (DSI). This has resulted in the power density increasing to 10.34 W/m², and the project emissions are neglected in the monitoring period in accordance with ACM0002 version 10. This is a permanent change and project emissions will be neglected during the crediting period.

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/m²)

CapPJ = Installed capacity of the hydro power plant after the implementation of the project activity (W)

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

APJ = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m²)

ABL = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m²). For new reservoirs, this value is zero

For proposed project HEPP,

$$\text{CapPJ} = 100,000,000 \text{ W}$$

$$\text{CapBL} = 0 \text{ W}$$

$$\text{APJ} = 10,140,000 \text{ (m}^2\text{)} - 470,000 \text{ (m}^2\text{)} = 9,670,000^7$$

$$\text{ABL} = 0 \text{ (m}^2\text{)}$$

Therefore PD is calculated as ;

$$PD = \frac{100,000,000 - 0}{9,670,000 - 0}$$

$$PD = 10.34 \text{ W/m}^2$$

Since power density is calculated higher than 10 W/m², the reservoir emissions are ignored.

Emissions from Diesel Generator

Diesel generators are utilized at the powerhouse and dam which are used as auxiliary power source when there is no electricity generation in the plant or supply by the grid. For the proposed project, diesel oil was purchased. To be conservative, even though the whole amount is not utilized, it is assumed that all amount of diesel oil has been consumed. According to the "Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion" CO₂ emissions from fossil fuel combustion for process are calculated based on the quantity of fuels combusted and the CO₂ emission coefficient of those fuels, as follows:

⁷ The reservoir area is indicated as 10,140 km² in the Feasibility Report, Page 4-22. The surface area of the river has been deducted from the total reservoir area which is calculated as 0.47 km².

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

Where:

- $PE_{FC,j,y}$ = Are the CO₂ emissions from fossil fuel combustion in process j during the year y (tCO₂/yr);
- $FC_{i,j,y}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);
- $COEF_{i,y}$ = Is the CO₂ emission coefficient of fuel type i in year y (tCO₂/mass or volume unit)
- i = Are the fuel types combusted in process j during the year y

For calculating the COEF _{i,y} option B has been used which is given as;

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO_2,i,y} \quad (4)$$

Where:

- $COEF_{i,y}$ = Is the CO₂ emission coefficient of fuel type i in year y (tCO₂/mass or volume unit)
- $NCV_{i,y}$ = Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)
- $EF_{CO_2,i,y}$ = Is the weighted average CO₂ emission factor of fuel type i in year y (tCO₂/GJ)
- i = Are the fuel types combusted in process j during the year y

COEF for diesel fuel has been calculated and based on these parameters, PE due to diesel generator has been calculated for the monitoring period. Calculations and references are indicated in excel sheet.

The NCV (0.043 GJ/tonne) is obtained from the General Directorate for Renewable Energy's website.⁸

The EF is calculated based on the carbon conversion unit (20 t C/TJ) given in the Turkey's National Inventory Report.⁹

$$COEF_{i,y} = 0.043 * ((20 * (44/12) * 1000) * (0.845/1000)) \quad COEF_{i,y} = 2.646 \text{ t CO}_2/\text{lt}$$

Thus, the project emissions from the diesel generator is calculated as:

$$PE_{FC,j,y} = 1000 \text{ L} * 2.646 \text{ tCO}_2/\text{L} = 2,646 \text{ tonnes CO}_2$$

e.g. for the year 2015:

⁸ www.eie.gov.tr/duyurular/EV/EV_kanunu/cevrim_katsayilari.xls

⁹ UNFCCC Turkey National Inventory Report 2010 (Table 1A(b)). Value given in t C per TJ. Converted to kg CO₂e per kWh. Then converted to kg CO₂e per L using NCV.

Emissions from diesel consumption = 1000 L diesel * 2.646 tCO₂/L = 2,646 tCO₂

Diesel purchase invoices are provided. The amount purchased is assumed to be completely consumed by the plant, for the calculation of project emissions.

Table 9. Summary of emissions due to diesel consumption

Year	Diesel consumption (L)	Total Emissions (tCO₂)
2012 (01/05/2012 - 31/12/2012) (245 days)	672.00	1,779
2013	1,000.00	2,646
2014	1,000.00	2,646
2015	1,000.00	2,646
2016	1,000.00	2,646
2017	1,000.00	2,646
2018 (01/01/2018 - 31/03/2018) (90 days)	246.58	653
Total	5,918.58	15,662

Table 10. Summary of project emissions

	Diesel Emission (tCO₂)	Emissions from Reservoir (tCO₂)	Total Project Emission (tCO₂)
2012 (01/05/2012 - 31/12/2012) (245 days)	1,779	0	1,779
2013	2,646	0	2,646
2014	2,646	0	2,646
2015	2,646	0	2,646

2016	2,646	0	2,646
2017	2,646	0	2,646
2018 (01/01/2018 - 31/03/2018) (90 days)	653	0	653
TOTAL	15,662	0	15,662

5.3 Leakage

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

$$LEy = 0$$

5.4 Net GHG Emission Reductions and Removals

The ex-ante emission reductions (ERy) are calculated as follows:

$$ERy = BEy - PEy - LEy \quad (4) \quad \text{Where:}$$

ERy = Emission reductions in year y (tCO₂)

BEy = Baseline emissions in year y (tCO₂)

PEy = Project Emissions in year y (tCO₂)

LEy = Leakage emissions in year y (tCO₂)

$$ERy = 1,117,609 - 15,662 - 0$$

$$= 1,101,947 \text{ tCO}_2$$

Table 11. Summary of emission reductions

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Reservoir emissions (tCO ₂)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2012 (01/05/2012-31/12/2012)	175,065	1,779	0	0	173,286
2013	180,103	2,646	0	0	177,457
2014	75,432	2,646	0	0	72,786
2015	295,626	2,646	0	0	292,980

2016	236,183	2,646	0	0	233,537
2017	109,348	2,646	0	0	106,702
2018 (01/01/2018- 31/03/2018)	45,852	653	0	0	45,199
Total	1,117,609	15,662	0	0	1,101,947

Total emission reduction is realized as 1,101,947 tCO₂ for this monitoring period (Table 13). When the estimated electricity generation figure of the power plant for each year in the validated VCS PD (422,600 MWh/yr) is considered, the total emission reductions should be approximately 1,180,406 tCO₂ (Table 14) for the monitoring period (71 months). Percent difference is calculated as -6.7% which means the project reduced 6.7% less CO₂ 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.

In the first monitoring period, annual net electricity generation was 447,122 MWh/year. However, in this monitoring period, it has been 336,107 MWh/year. The electricity generation in hydropower plants are quite dependable to the natural and climatic conditions. As can be seen from the difference, the project has generated 33% less electricity than the first monitoring period. Therefore, the project owner needs the revenue obtained from this VCS project.

Table 12. 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)	Net Emission reductions (tCO ₂ e)	Net Electricity Supplied to the Grid (MWh)	Net Emission reductions (tCO ₂ e)
2012 (01/05/2012 - 31/12/2012)	283,663.01	133,888	311,504.11	145,250
2013	422,600.00	199,467	320,468.74	148,614
2014	422,600.00	199,467	134,221.64	60,706
2015	422,600.00	199,467	526,025.77	245,637
2016	422,600.00	199,467	420,254.53	195,714

2017	422,600.00	199,467	194,570.33	89,190
2018 (01/01/2018 - 31/03/2018)	104,202.74	49,183	81,588.08	37,856
Total	2,500,865.75	1,180,406	1,988,633.20	1,101,947

In 2015 and 2016, net electricity generation were significantly higher and thus, emission reduction was higher than the other years. This is due to the volumetric flows were significantly higher in years 2015 and 2016, than in the other years. In 2015 and 2016, total flows were 1,012,484,149 m³ and 649,594,723 m³, respectively, according to the information provided by the PP¹⁰.

¹⁰ Data from generation reports of the plant