

THE AKÇAY 28.78 MW HYDROELECTRIC POWER PLANT PROJECT



Document Prepared By Gaia Carbon Finance



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¹ The project has not been registered to VCS Database yet. Therefore, "Project ID" is not available at this stage.

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1 PROJECT DETAILS

1.1 Summary Description of Project

Akcay Hes Elektrik Üretim A.Ş. (AKCAY, hereafter) installed Akçay HEPP with 28.78 MW runoff-river hydropower electricity plant (HEPP) at the end point of Bozdoğan – Akçay Left Coast Main Irrigation Channel in Aydin, Turkey. The plant uses the water left from the channel to generate electricity, before conveying water to the Akcay river bed. Therefore, the project activity of Akcay HEPP does not include any reservoir area or diversion weir. The project not only produces electricity from water, but also plays a role of conveying water to the river bed as a part of the irrigation channel.

Implementation of the project consists of construction of the following main items:

- Penstock with length of 380.00 m.,
- Power house with Francis type turbines;

In the power house, three vertical shaft Francis turbines is installed, two 11.60 and one 5.58 MW (total capacity 28.78 MW). The first-hand turbines which are used in the project are supplied from Hangzhou Yatai Hydro Equipment Completing Co., Ltd., China. The efficiency of the turbines is 93% and there are three generators attached to the facility.

The net electricity production (delivered to the grid after losses and consumption in the plant) from the plant is estimated to be 76.915 GWh per annum. However, this estimated value has not been realized each year between the August 2009 and April 2013. Therefore, the total net electricity supplied to the grid is calculated as 140,459 MWh between these years. As a result, the total amount of emission reduction from the project between August 14th, 2009 and April 30th, 2013 is calculated as 90,596 tons. (Table 8)

1.2 Sectoral Scope and Project Type

This is a voluntary project, but it follows the CDM rules.

The approved baseline and monitoring methodology for small-scale project activities ACM0002-Version.10.0: *"Consolidated baseline methodology for grid-connected electricity generation from renewable sources"*² is applied.

According to Annex A of the Kyoto Protocol, the Project fits in:

Sectoral Scope Number: 1

Sectoral Scope: Energy Industries -Renewable Energy

The project is not a grouped project.

1.3 Project Proponent

² <http://cdm.unfccc.int/EB/015/eb15repan2.pdf> (Accessed on March 17, 2008)

The project developer:

In accordance with the Electric Market Law No. 4628, Akçay HES Elektrik Üretim A.Ş. (hereafter, AKÇAY) was founded to construct, commission, operate and transfer power plants in order to generate and market electric power.

Its mission is to be one of the energy companies that effectively utilize domestic and renewable resources by transforming advanced technology and knowledge into efficiency and making a maximum contribution to national economy without neglecting international quality standards.

The Akçay 28.78 Hydroelectric Power Plant project shall be registered as a Voluntary Carbon Standard (VCS-VER) project to enable the project implementation by means of financial inflows coming from the carbon credits sale. All elements mentioned in this document show that the proposed project activity is expected to fulfil the requirements of the Voluntary Carbon Standard.

The following table shows the project proponent's contact information:

Organization:	AKÇAY HES ELEKTRİK ÜRETİM A.Ş.
Street/P.O.Box:	1380 Sok. 2/1 Alyans Apt. B Blok
Building:	NO: 3/5
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State/Region:	
Postfix/ZIP:	
Country:	TURKEY
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Mobile:	
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The contacts person is Mr.Seçkin Demiryapan. His responsibilities regarding the carbon credits process are to analyse the related documents, the coordination between internal departments and to setup meetings with companies.

1.4 Other Entities Involved in the Project

The following table shows the Carbon consultants' contact information:

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GaiaCF's responsibilities regarding the carbon credits process are the preparation of the PD, Monitoring Report and assisting Akçay Elektrik Üretim A.Ş during the validation process.

1.5 Project Start Date

Project start date is 14/08/2009 (The commissioning date of the project)

1.6 Project Crediting Period

The crediting period of the project begins on 14/08/2009 which is the commissioning date of the plant and 10-years crediting period. VCS project crediting period will be renewed once which will make the total crediting period as 20 years. The end date of the first crediting period is 13/08/2019.

1.7 Project Location

The project is located in the Aegean Region of Turkey, within the province of Aydın. The project is on the Akçay creek. The altitude at the location is 65.00 m.

The project's geographical location is 37° 47' 13.95'' North and 28 ° 18' 34.77'' East.

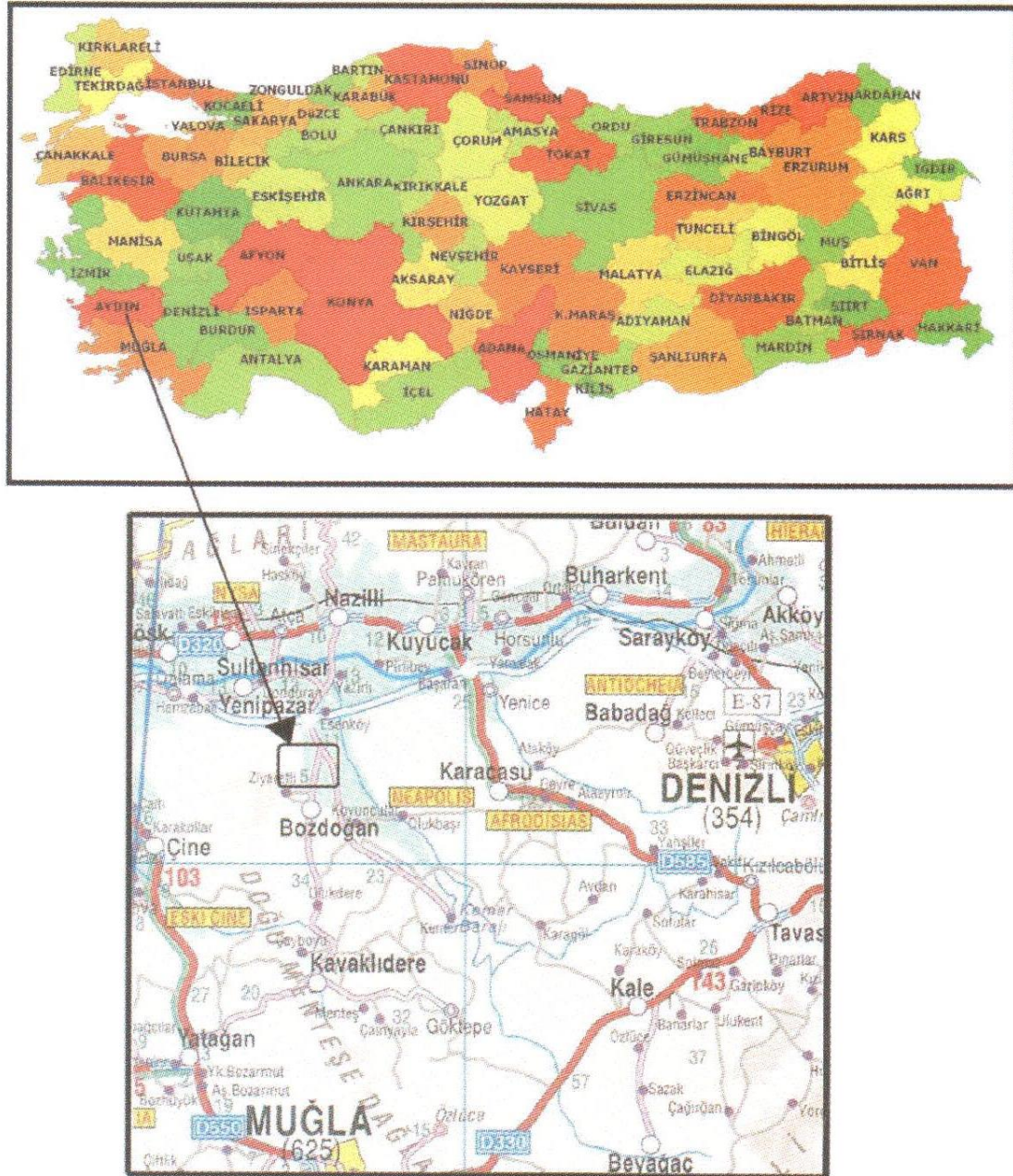


Figure 1: Project's Location on Turkey Map

1.8 Title and Reference of Methodology

Additionally, for the purpose of calculating the emission factor of the Turkish electricity grid, "Tool to calculate emission factor for an electricity system", Version 01 is employed. The baseline for the project was established through the official methodology of ACM0002 / Version 10.0, named

“Consolidated baseline methodology for grid-connected electricity generation from renewable sources” as approved by the CDM Executive Board. Conservative options and data were selected during the implementation of the methodology.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

Akçay HEPP was commissioned on August 14th, 2009. The carbon crediting period and therefore the monitoring starts when the plant commences electricity generation. The crediting life is a maximum of ten years which may be renewed it most twice.

The project activity has been connected to the Turkish interconnected electricity grid; therefore the produced electricity has been transmitted to TEIAS as per the agreement signed with Akçay HES Elektrik Üretim A.Ş..

During the first monitoring period (14/08/2009 to 30/04/2013), no emergencies or abnormal situations have been experienced. However, there was only one unit meter until the February 2013 and the company installed an addition unit meter (main and its back-up). All measurements are realized by the two unit meters for the Akçay Hydroelectric Power Plant since February 2013. Also, the first back-up meter (35662056) was de-installed on 17/02/2010 with respect to the TEIAS meter replacement protocol and instead in this meter, new back-up meter was installed (376486).

2.2 Project Description Deviations

During the monitoring plan, the following deviations are determined and the monitoring plan in the Project Description is revised:

- The source of the parameter “Quantity of net electricity generation supplied by the project plant/unit to the grid in year y” was given as “Monthly Meter Reading Protocols” in the VCS PD. The officials from TEİAŞ was performing monthly the measurements for both main and back up meters at Akçay HEPP, under the control of the plant personnel of Akçay HEPP. However, since the June 2011, TEİAŞ started to measure the produced electricity remotely. Therefore, the source of the parameter is given as ‘Monthly Meter Reading Protocols’ until June 2011 and also it is defined as “Market Financial Settlement Center (PMUM) records which includes the exact electricity productions and tractions since June 2011. PMUM records are the basis of the invoices made out to TEİAŞ. As description above production figures which are subject to sales to the grid are agreed with ‘Monthly Meter Reading Protocols’ and ‘PMUM records (Market Financial Reconciliation Centre)’. Therefore, before the June 2011 monthly meter reading protocols was considered in emission calculation figures and net electricity production figures announced by PMUM was used in emission calculation figures after the June 2011, The net electricity production figures will also be cross checked with the production and internal electricity usage

figures provided from the OSF forms which are provided to the company by TEIAS after the remote measurement of the meters.

- The source for the cross-check of the amount of produced electricity is also revised as” Monthly Reports of OSF Forms which are prepared by TEIAS after the remote measurements of the meters and sent to the plant engineer by e-mail at the end of each month.

2.3 Grouped Project

N/A

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	EFgrid,CMY
Data unit:	tCO2/MWh
Description:	Baseline emission factor: the combined emission factor of the project grid system.” Tool to calculate the emission factor for an electricity system”
Source of data:	Validated VCS Project Description (Version 07) of the Project.
Value applied:	0.645
Purpose of the data:	Used for baseline emission calculation.
Any comment:	EFgrid,CMY value (0.645 tCO2/MWh) is valid for the duration of the crediting period.

3.2 Data and Parameters Monitored

Data Unit / Parameter:	Electricity production / EG _{Facility,y}
Data unit:	MWh/yr
Description:	Quantity of net electricity delivered to the grid
Source of data:	Monthly meter reading protocols and PMUM (Market Financial Settlement Center) records (Meter reading records-OSF forms of main meters are cross-checked)

Description of measurement methods and procedures to be applied:	Monthly meter reading protocols and PMUM records provides the exact electricity generation of the facility and the imports from the grid. The electricity meters have been controlled and maintained by the grid owner. Before the June 2011 net electricity generation figures is based on monthly meter reading protocols; since the June 2011 the quantity of net electricity delivered to the grid has been cross checked with the meter reading records (OSF forms) provided to the company by TEIAS.
Frequency of monitoring/recording:	Continuous measurement and at least monthly recording
Value applied:	140,459 MWh/year
Monitoring equipment:	Electric meters
QA/QC procedures to be applied:	Cross check measurements results with records for sold electricity. Calibration of all the meters is undertaken at required intervals and faulty meters is duly replaced immediately.
Calculation method:	$EG_{Facility,y} = EG_{export,y} - EG_{import,y}$ ((Annual electricity generation of the plant is calculated as the sum of the monthly generations obtained from the monthly meter reading protocols and PMUM records. After deducting the amount of imported electricity from the generated electricity, the net electricity supplied to the grid is evaluated.)
Any comment:	-

Data Unit / Parameter:	Installed Capacity / 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.
Description of measurement methods and procedures to be applied:	Supplier information on the equipment
Frequency of monitoring/recording:	Yearly
Value applied:	28,780,000 W
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Supplier information on the related equipment and the existence of the equipment is checked. Also, this information may be checked from

	EMRA website.
Calculation method:	N/A
Any comment:	Coherence of the installed capacity measured annually with the figure displayed on the electricity generation licence is confirmed.

3.3 Description of the Monitoring Plan

The purpose of the monitoring plan is to ensure that the monitoring and calculation of emission reductions of the proposed project within the crediting period is complete, consistent, clear and accurate.

All relevant baseline emission factors are defined ex-ante. Hence, there are three sets of data to be monitored during the project activity.

The first one is the amount of electricity fed into the grid. There is already an electricity meter installation plan to provide the data that is required by the monthly invoicing process to TEIAS. Akçay HEPP is a new power unit which did not replace a fossil fuel plant on the project site. AKCAY is responsible for providing the bills which shows the monthly electricity generation of the company.

The second data to be monitored is the installed capacity of the project activity. The data is monitored from the digital displays on the equipments which show the installed capacity at the time, together with the electricity generation of the facility. The plant manager is responsible to provide the data.

The third data to be monitored is the reservoir area for HEPP projects in general. However, because the subject project use the water left from the irrigation channel and it has no reservoir area, this data is not applicable for the project.

The project is operated Akçay HES Elektrik Üretim A.Ş. which ensures the overall site management in accordance with Turkish Laws and technology providers' guidelines.

The monitoring has been performed in-house by the project proponent:

1. Plant Engineer is responsible for the control of the electricity supplied to the grid and imported from the grid with TEIAS. The electricity measurements are made by TEIAS remotely. The plant engineer checks these electricity measurement records and reports to the Operations Manager of the plant.
2. Accounting Manager is in charge of providing the electricity sales receipts to the Operations Manager of the plant.
3. Operations Manager is the VER coordinator. He is in charge of:
 - a. Ensuring that instrumentations and devices are available and properly suited to perform efficiently the monitoring.
 - b. Communicating and coordinating the monitoring tasks of all business units.
 - c. Developing, executing, analyzing and improving the VER Monitoring/Reporting Procedures. This includes the crosschecking and consolidation (with multiple sources whenever possible) of the data obtained from the plant engineer and the

accounting manager. He also records this operation properly to be able to provide it to the DOE during the verification process.

d. Calculating and reporting the emission reductions, and

In order to verify the generated units of emission reductions, the VER coordinator, Operation Manager reports the all necessary data to the head quarter of the company, in which the following important aspects include:

- Year
- Net electricity supplied by the project activity to the grid (in MWh)
- Annual gross electricity generation(in MWh)
- Annual electricity consumption (in MWh)
- Calculation of the emissions reductions: ERs per year (in tCO₂e/yr) produced from the activity of the project

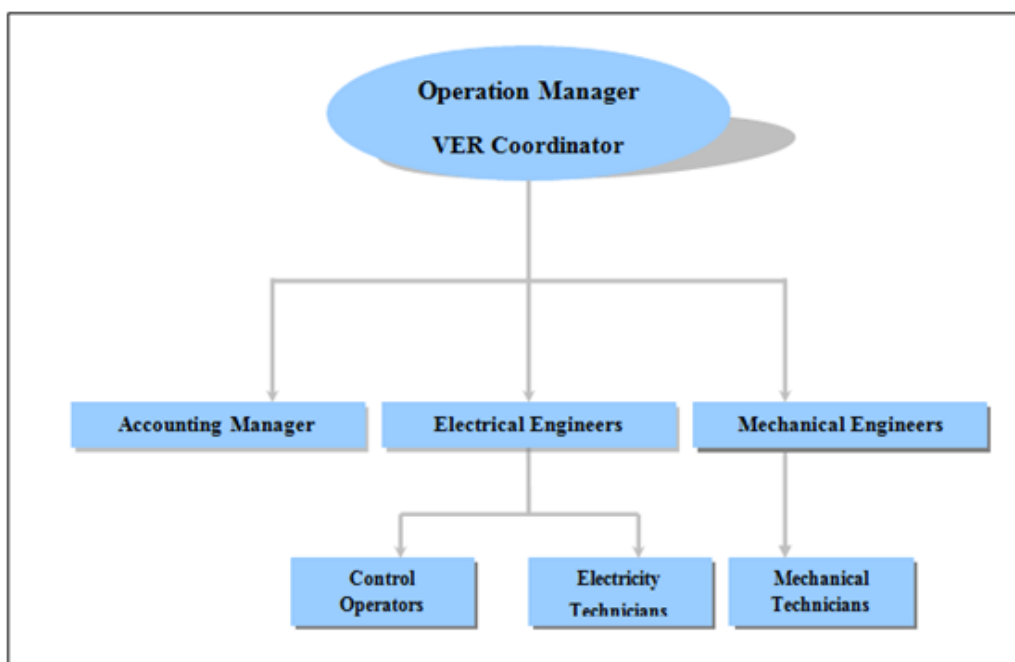


Figure 2: Site Organizational Chart

Each year, 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

Measuring

The officials from TEİAŞ was performing monthly the measurements for both main and back up meters at Akçay HEPP, under the control of the plant personnel of Akçay HEPP. However, since the June 2011, TEİAŞ obtains the readings from the meters remotely and reports them in a spread sheet (for measurement control and will store the data discharged from the meters electronically) to the Plant engineer. The project's electricity production is fed into the grid through a transformer station. All production figures which are subject to sales to the grid are agreed with monthly meter reading protocols and PMUM records (Market Financial Reconciliation Centre). These figures can be accesses from TEİAŞ and PMUM's web site by the seller. Therefore, net electricity production figures³ announced by monthly meter reading protocols and PMUM are used in emission calculation figures. These figures is also used to cross checked with the production and internal electricity usage figures since June 2011.

In line with the EMRA requirements, the company purchased and installed one unit electricity meter, but since the February 2013 company installed an addition unit meter and all measurements are realized by the two unit meters for the Akçay Hydroelectric Power Plant. The serial numbers of main meters are 376480 and 471186. The accuracy class of the product production is 0.5s. The serial number of first main meter's back-up was 35662056. However, this meter has been changed on 17/02/2010 with respect to the TEİAŞ meter replacement protocol and instead in this meter, new back-up meter has been installed. The serial number of new back-up meter is 376486. The serial number of second main meter's back-up is 471187. According to the test reports of meters, the first unit meters (376480 main and 376486 back-up) were tested by TEİAŞ on 20/07/2011 and the second unit meters (471186 and 471187) were tested by TEİAŞ on 17/10/2012.

	Unit 1	Unit 2
Brand	ABB ELSTER	
Model	A 1500	
Standard/Class	0.5s	
Serial Number	00376480	00471186

Table 2: Technical datas for each unit of The Akçay Hydroelectric Power Plant

The recalibration of these equipments will be done in line with the equipment requirements but recalibration periods are defined by national metrology institutes country by country and in Turkey this period is defined as 10 years⁴.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Accordingly the baseline emissions BEy are calculated as following:

³ Net electricity production figure = Electricity generation (operation base) – Electricity traction from grid

⁴ <http://www.mevzuat.adalet.gov.tr/html/21179.html>

$$BE_y = EGPJ_y \times EF_{grid, CM, y}$$

Where:

BE_y Baseline emissions in year y (tCO₂)

$EGPJ_y$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the VCS project activity in year y (MWh/yr)

$EF_{grid, CM, y}$ Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"

Y Refers to a given year

Since the project is an installation of a new grid-connected renewable power plant, the baseline scenario is formulated in ACM0002, Version 10.0.0: "Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the Combined Margin (CM) calculations described below". The baseline emission factor is the weighted average of the Operating Margin Emission Factor and Build Margin Emission Factor. The ACM0002 / Version 10.0.0 guideline recommends equal weight values for hydropower projects as seen in the formula below:

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

Where:

$EF_{grid, BM, y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)

$EF_{grid, OM, y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh)

w_{OM} = Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

The default values recommended by "Methodological tool (Version 01) Tool to calculate the emission factor for an electricity system" for w_{OM} and w_{BM} for activities other than wind and solar power generation projects are 0.5 and 0.5, respectively.

$$EF_{grid, CM, y} = 0.685 \times 0.5 + 0.605 \times 0.5$$

Therefore resulting $EF_{grid, CM, y}$ is 0.645 tCO₂/MWh

The total electricity generations, the electricity traction from the grid and the net electricity supplied to the grid are calculated based monthly meter reading protocols and PMUM (Market Financial Settlement Center) Records for 2009, 2010, 2011, 2012 and 2013. The results are as follows;

Monthly Meter Reading Protocols 2009				
The Akçay Hydroelectric Power Plant(kwh)				
	Net Electricity Generation(kwh)	Electricity Traction from Grid (kwh)	Net Electricity Supplied to the Grid (MWh)	Emission Reductions (Tons)
Jan-09	0	0	0	0
Feb-09	0	0	0	0
Mar-09	0	0	0	0
Apr-09	0	0	0	0
May-09	0		0	0
Jun-09	0		0	0
Jul-09			0	0
Aug-09	2,986,650	380	2,986	1,926
Sep-09	1,151,650	1,240	1,150	742
Oct-09	0	1,390	-1	-1
Nov-09	0	5,050	-5	-3
Dec-09	102,790	6,160	97	62
TOTAL	4,241,090	14,220	4,227	2,726.32

(tCO2)

EF:	0.645	tCO2/MWh
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Table 3 : Electricity Generations of The Akçay Hydroelectric Power Plant from 1st of August 2010 to 31st of December 2009

Monthly Meter Reading Protocols 2010				
The Akçay Hydroelectric Power Plant(kwh)				
	Net Electricity Generation(kwh)	Electricity Traction from Grid (kwh)	Net Electricity Supplied to the Grid (MWh)	Emission Reductions (Tons)
Jan-10	143,050	8,180	135	87
Feb-10	1,198,990	5,560	1,193	770
Mar-10	0	4,620	-5	-3
Apr-10	0	2,210	-2	-1

May-10	0	1,450	-1	-1
Jun-10	0	3,060	-3	-2
Jul-10	0	5,260	-5	-3
Aug-10	3,370,540	2,120	3,368	2,173
Sep-10	3,287,120	1,060	3,286	2,120
Oct-10	106,580	3,540	103	66
Nov-10	83,800	5,490	78	51
Dec-10	92,540	7,500	85	55
TOTAL :	8,282,620	50,050	8,233	5,310.00

(tCO₂)

EF:	0.645
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Table 4 : Electricity Generations of The Akçay Hydroelectric Power Plant from 1st of January 2010 to 31st of December 2010

Monthly Meter Reading Protocols 2011				
The Akçay Hydroelectric Power Plant(kwh)				
	Net Electricity Generation(kwh)	Electricity Traction from Grid (kwh)	Net Electricity Supplied to the Grid (MWh)	Emission Reductions (Tons)
Jan-11	198,560	7,610	191	123
Feb-11	257,660	6,920	251	162
Mar-11	130	6,660	-7	-4
Apr-11	40	3,830	-4	-2
May-11	0	1,800	-2	-1
PMUM 2011				
Jun-11	818143	2,612	816	526
Jul-11	5,399,968	2,440	5,398	3,481
Aug-11	12,474,966	24	12,475	8,046
Sep-11	655,831	3,903	652	420
Oct-11	0	5,014	-5	-3
Nov-11	0	7,593	-8	-5
Dec-11	796,966	8,022	789	509
TOTAL :	20,602,259	56,428	20,546	13,252.06

(tCO₂)

EF:	0.645
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Table 5: Electricity Generations of The Akçay Hydroelectric Power Plant from 1st of January 2011 to 31st of December 2011

PMUM 2012				
The Akçay Hydroelectric Power Plant(kwh)				
	Net Electricity Generation(kwh)	Electricity Traction from Grid (kwh)	Net Electricity Supplied to the Grid (MWh)	Emission Reductions (Tons)
Jan-12	6,626,900	2,773	6,624	4,273
Feb-12	9,125,089	726	9,124	5,885
Mar-12	11,314,687	3	11,315	7,298
Apr-12	9,084,093	572	9,084	5,859
May-12	5,749,661	1,220	5,748	3,708
Jun-12	7,840,509	81	7,840	5,057
Jul-12	12,573,686	2	12,574	8,110
Aug-12	10,401,650	330	10,401	6,709
Sep-12	4,747,893	0	4,748	3,062
Oct-12	995,436	1,622	994	641
Nov-12	0	4,680	-5	-3
Dec-12	0	8,071	-8	-5
TOTAL :	78,459,604	20,080	78,440	50,593.49

(tCO2)

EF:	0.645
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Table 6 : Electricity Generations of The Akçay Hydroelectric Power Plant from 1st of January 2012 to 31st of December 2012

PMUM 2013				
The Akçay Hydroelectric Power Plant(kwh)				
	Net Electricity Generation(kwh)	Electricity Traction from Grid (kwh)	Net Electricity Supplied to the Grid (MWh)	Emission Reductions (Tons)
Jan-13	0	9,422	-9	-6
Feb-13	10,836,454	1,845	10,835	6,988
Mar-13	11,853,803	533	11,853	7,645

Apr-13	6,336,669	902	6,336	4,087
May-13	0	0	0	0
Jun-13	0	0	0	0
Jul-13	0	0	0	0
Aug-13	0	0	0	0
Sep-13	0	0	0	0
Oct-13	0	0	0	0
Nov-13	0	0	0	0
Dec-13	0	0	0	0
TOTAL :	29,026,926	12,702	29,014	18,714.17

(tCO₂)

EF:	0.645
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Table 7 : Electricity Generations of The Akçay Hydroelectric Power Plant from 1st of January 2013 to 30th of April 2013

Net Electricity Supplied to the grid = Electricity supply - Electricity traction from grid

The total annual electricity generation of the project is as 140,459 MWh/year.

4.2 Project Emissions

No Project Emissions are considered.

4.3 Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing and transport). These emissions sources are neglected.

4.4 Summary of GHG Emission Reductions and Removals

The total emission reduction stemming from the electricity generation of the plant is calculated by using the ER factor calculated in 4.1. and the amount of electricity sold to through PMUM. As a result, the total amount of emission reduction from the project between August 14th, 2009 and April 30th, 2013 is calculated as 90,596 tons. (Table 8)

Date	Electricity Supply (kWh)	Electricity Traction (kWh)	Net Electricity Supplied to the Grid (MWh)	Emission Reductions [tCO ₂]
2009	4,241,090	14,220	4,226.87	2,726
2010	8,282,620	50,050	8,232.57	5,310
2011	20,602,264	56,428	20,545.84	13,252

2012	78,459,604	20,080	78,439.52	50,593
2013	29,026,926	12,702	29,014.22	18,714
TOTAL	140,612,504	153,480	140,459.02	90,596

Table 8: The Total Annual Electricity Generations and Emission Reductions of The Akçay Hydroelectric Power Plant through Market Financial Settlement Center (PMUM)

Total emission reductions realized as 90,596 tCO₂ for this monitoring period. When the estimated electricity generation figure of the power plant for each year in the validated VCS PD (76,915 MWh/yr) is considered, the total emission reductions period should be approximately 188,104.60 tCO₂ (Table 9) for between the August 2009 and April 2013. However, because of the less water availability and DSI channel issues, the realized figure is lower than the estimated figure between August 2009 and April 2013. This also led to lower emission reduction, but there is no problem with the efficiency of the power plant.

Date	Net Electricity Supplied to the Grid (MWh)	Emission Reductions [tCO₂]
2009	35,253.00	22,738.00
2010	76,915.00	49,610.00
2011	76,915.00	49,610.00
2012	76,915.00	49,610.00
2013	25,638.00	16,536.51
TOTAL	291,636.00	188,104.51

Table 9: Estimated Baseline Emission Reductions between 2009-2013

5 ADDITIONAL INFORMATION

N/A