



Verified Carbon Standard

AKBAS HYDROELECTRIC POWER PLANT MONITORING REPORT

Document Prepared by Sekans Enerji Ltd. Şti.

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Akbas Hydroelectric Power Plant (Akbas HPP) which was developed by Arı Su Enerji Üretim A.Ş. is located on the Büyük Menderes River, within the Aegean District of Turkey, in the borders of Çal Town in Denizli Province.

The project is a run-of-river, and the total installed capacity of the project is 13.047 MWm / 12.502 MWe, consisting of 3 horizontal axis Francis turbines whereby two of them are with 5.455 MWm / 5.227 MWe capacity and the other one is 2.137 MWm / 2.048 MWe in capacity. The project is expected to produce 45,520 MWh of electricity per year, based on revised feasibility studies. There is no new reservoir formation as it's just the collection of water. The project is in operation since 12/12/2013.¹ The estimated amount of GHG emission reduction is 24,573 tonnes CO₂ per year in the registered PDD. During its operation in this monitoring period, the actualized net electricity generation is 106,083.70MWh. By displacing equivalent amount of electricity consumed from the national grid, which is mostly comprised of fossil fired power plants, the actual emission reduction has been calculated as 57,264tonnes CO₂ for this monitoring period.

The purpose of the project activity is to generate power in an efficient, clean, reliable, and sustainable way with maximum respect on social and environmental aspects and to reduce emissions by partially substituting the electricity supply of fossil fuel fired power plants in Turkey.

The project has produced positive environmental benefits as displacing the electricity generated by fossil fuel fired power plants by utilising the renewable resources to avoid environmental pollution and GHG emissions.

Please see the Monitoring Timeline of the Project Activity as below:

Table 1 - Monitoring timeline of the Project Activity

¹ Ministry Acceptance Protocols are available to the VVB.

Date (Period)	Activity
03/08/2010	Generation License Date
01/07/2011	EIA Contract Date
12/12/2013	The Commissioning Date of the Turbines
12/12/2013 – 11/12/2023	Crediting Period
12/12/2013-30/11/2019	1 st Monitoring Period

The Akbas HPP is constructed, at the Büyük Menderes River, at the upstream of the Adigüzel Hydroelectric Power plant. The project is designed to be between the 535.00m – 457.72 m elevations.

The Akbas HPP is equipped with an unregulated weir that will direct water to the energy tunnel that will be 3,648.00 m in length, then the water is fed to the powerhouse via the penstock that trifurcates to feed each one of the three turbines, that will produce electricity via 3 horizontal type Francis turbines.

Please see the technical description of the Project Activity through Table 2:

Table 2 - Technical description of the Project Activity²

	Turbine 1 - 2	Turbine 3
Turbine brand	Andritz Hydro	Andritz Hydro
Serial numbers	11H017	11H018
Turbine type	Horizontal Axis Francis	Horizontal Axis Francis
Turbine Power	5.455 MW	2,137 kW
Net-head	72.92 m	74.09
Max. flow	8.21 m ³ /s	3.18 m ³ /s

² The photographic evidences of turbine name plates are available to the DOE.

1.2 Sectoral Scope and Project Type

According to UNFCCC sectoral scopes definition for CDM projects, the Project Activity is included in the Sectoral Scope 1, category “Energy industries (renewable - / nonrenewable sources)”. The project is a non- grouped, stand-alone project.

1.3 Project Proponent

Organization name	ARI SU ENERJİ ÜRETİM A.Ş.
Contact person	Merve Aydın
Title	Project Director
Address	Küçükbakkalköy mah. Beğendik sok. No: 1/4 Ataşehir – İstanbul - Turkey
Telephone	-
Email	merve.aydin@yilsanholding.com

1.4 Other Entities Involved in the Project

Organization name	Sekans Enerji Ltd. Şti.
Role in the Project	Consultant
Contact person	Sıla Duran
Title	Consultant
Address	Eski Büyükdere C. No:1/1 Sapphire AVM B:04 Kağıthane/İstanbul
Telephone	+905324383029

Email sila@sekansdanismanlik.com

1.5 Project Start Date.

The project start date is 12/12/2013 as the start date of commissioning.³

1.6 Project Crediting Period

The Project's crediting period type is renewable crediting.

As it is stated in PD, the project start date was going to be either the commissioning date or 03/08/2014. Since the start date of the commissioning is 12/12/2013, the Project's crediting period is ten years renewable twice: 12/12/2013 – 11/12/2023 (both days are included).

1.7 Project Location

The project is located at the Aegean geographical region of Turkey within the jurisdiction of Denizli, Province, near the Town Çal. The project is located at the Catchment of the Büyük Menderes River over the Büyük Menderes River, between the 535 and 457.72 m elevations. The project Location is shown in the following location Map (Figure 3):

³ Ministry Acceptance Protocols are available to the VVB.



Figure 3. Google Earth view showing the location of the project area within Turkey (above) and in the Aegean region .

The project lies between 29°21' 34" and 29°19'36" Eastern Longitudes and Between 38°12' 25" and 38° 13' 44" Northern Latitudes.

The coordinates of the weir and the powerhouse are given in the following table (Table 3)

Table 3: The coordinates of the weir and powerhouse of the project activity.

Point	Powerhouse		Weir	
	Latitude:	Longitude:	Latitude	Longitude
1	38°13'49.61"N	29°19'33.06"E	38°12'33.74"N	29°21'21.94"E
2	38°13'50.35"N	29°19'35.31"E	38°12'35.23"N	29°21'23.79"E
3	38°13'49.23"N	29°19'35.97"E	38°12'34.40"N	29°21'24.88"E
4	38°13'48.47"N	29°19'33.68"E	38°12'32.91"N	29°21'23.10"E

1.8 Title and Reference of Methodology

The following UNFFCC methodology and its related tools are utilised:

Approved consolidated small scale CDM and monitoring methodology AMS-I.D “Grid connected renewable electricity generation.” Version 17.0.

The Approved Methodology refers to the following tools:

- “Tool to calculate the emission factor for an electricity system”, (Version 2.2.1)
- "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", (Version 02)
- “Guidelines on the Demonstration of Additionality of Small-Scale Project Activities”, (Version 09.0)

1.9 Participation under other GHG Programs

The project has never been included in an emissions trading program or any other binding limits. It has neither received any kind of environmental credits nor been registered under any other GHG programs.

1.10 Other Forms of Credit

The project has not created another form of credit.

1.11 Sustainable Development

The project produces electricity from renewable energy sources using hydro as the power source and to contribute to Turkey's growing electricity demand through a sustainable and low carbon technology. The project displaces the same amount of electricity generated by the grid dominated with fossil fired power plants. The project is expected to generate 45,520 MWh annually. The project contributes to the Sustainable Development Goal, Affordable and Clean Energy. During this monitoring period, the project has generated 106,083.70 MWh as contributing to SGD 7 Affordable and Clean Energy.

The annual emission reduction estimated by the project is 24,573 tonnes CO₂eq, approximately. While this amount of emissions is mitigated, technology transfer is also realized as benefitting from hydropower. During this monitoring period, the project has contributed to SDG 13 Climate Action as reducing 57,264 tonnes CO₂.

The project contributes to improve the environmental situation in the region and in the country as avoiding fossil fuel-based electricity will enhance the air quality and help to reduce the negative effects on the climate. Through renewable technologies and hydro-based electricity sustainable and climate friendly development is promoted. The project contributes to the Sustainable Development Goal, Climate Action.

During construction and operational period, the project has created employment opportunities for the local community. As contributing to SGD 8 Decent Work and Economic Growth, 8 employees are working for the project activity.

The project contributes the economic development of the region by providing sustainable energy resources. The project provides workers with a safe and healthy work environment and is not complicit in exposing workers to unsafe or unhealthy work environments. Thus, the project contributes to the Sustainable Development Goal, Decent Work and Economic Growth.

2 SAFEGUARDS

2.1 No Net Harm

There isn't any negative environmental or socio-economic impact.

The project paid extra attention to maintaining social and environmental stability:

- The construction followed strict noise and dust standards to prevent any inconvenience to communities. Same standards are followed during the operation of the plant.
- The construction followed various strict standards for labor health and site safety.

- No pollution from any source is released into the river from the operation of the plant. Hazardous wastes are handled appropriately in closed containers and transported by licensed transporters to the licensed processing and disposal facilities.
- Wastewater is collected through within the septic tank and is transferred through the sewage truck⁴.
- Since the Project Activity is outside the municipal boundaries, the domestic wastes are taken by the vehicles of provincial special administration and taken to recycling site of Denizli Municipality⁵.
- Regarding the monitoring of “Water quality and quantity”, “Biodiversity and aquatic life”, streamgauge gauging station is built for the measurement of flow to assess the environmental flow. General directorate for state hydraulic works executes the monitoring and the Project complies with the regulations.⁶

2.2 Local Stakeholder Consultation

Local stakeholders have been contacted by the project owners to inform them about the Project and expropriation process and to gather their comments in a meeting.

The stakeholder meeting took place 20-10-2011. The villagers notified the validation team that they were glad to have the project in their vicinity and believe to profit from the project activity. The village inhabitants were involved in the construction phase of the project.

The common outcome of the stakeholder consultation was positive, and stakeholders were in favor of the Project.

Local people were employed during construction and are being employed during operation. This contributes to local economy and leads to improvement in living standards.

The Project has resulted in the creation of new jobs in the project region and improvement in local roads, contributing to living standards in the region. Moreover, the project owner has provided contribution in kind to the local community, although these activities are not required legally. As a result, the community is supporting the project and they believe that it creates a momentum for local sustainable development.

⁴ The wastewater transfer receipts are available to the DOE

⁵ The records are available to the DOE.

⁶ Flow measurement (lifeline water) reports are available to the DOE.

There was no specific environmental problem that concerned the locals more than others, and environmental issues need to be solved by the government. All people considered clear signs of climate change in the region in recent years.

The contact information of the plant responsible exist at the Mukhtar, the project owner and local community are always in touch. The project owner regularly checks with the Mukhtar if any complaint or a request exists. Any complaint or need from the local community could directly be received by the project owner and appropriate contributions or improvements are made to the local community. A signed letter by the Mukhtar has been provided as declaring that the related information has been available to the villagers, and they did not have any complaint.

Site visit meeting for the verification of the monitoring period was organize on 08/02/2022.

There is no update or any change to the project design after the registration of the project.

2.3 AFOLU-Specific Safeguards

N/A

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The description of the implementation and operational status of the project and the installed technology(ies), technical process and equipment are detailed in Section 1.1.

Operation of the project activity went on as expected during this monitoring period and no event that may impact the GHG emission reductions or removals and monitoring has been occurred.

Other entity involved in the Project was Ekobil Environmental Services and Consultancy in the project description. However, it's been changed as Sekans Enerji Ltd. Şti. during the first monitoring period.

3.2 Deviations

3.2.1 Methodology Deviations

There are no methodology deviations applied during this monitoring period.

The project's installed capacity is 12.768 MWm / 12.257 MWe but it has been changed on 03/08/2014 as 13.047 MWm / 12.502 MWe. This is a slight change which does not affect the expected annual generation. The project is still applicable under AMS-I. D, "Grid connected renewable electricity generation",

3.2.2 Project Description Deviations

- The project's installed capacity is 12.768 MWm / 12.257 MWe but it has been changed on 03/08/2014 as 13.047 MWm / 12.502 MWe.⁷ This change was realized due to technical requirements, however there wasn't any change for expected annual generation as it may be seen through the generation license. . There is not any impact on the applicability of the methodology, additionality or the appropriateness of the baseline scenario. Unfortunately, the project activity has generated %61 lower than the expected generation during the monitoring period. The project activity was expected to reduce 146,697 tCO₂e, however 57,264 tCO₂e was reduced during this monitoring period.
- Regarding, $EG_{PP-self\ consumption, y}$ and $EG_{PP-gross, y}$ the primary source was two TEIAS meter readings recorded at the monthly reading protocols and the secondary source was EPIAS web site screenshots in the PD. Since EPIAS web site screenshots show the exact invoiced generation and consumption values, the primary source has been determined as EPIAS web site screenshots for this monitoring period. This deviation does not have any negative impact since this is a change of the authorized entity for the official generation data. Additionally, this has a positive impact that EPIAS records provide more systematic base for dataflow.
- Since the emissions ($PEFC_{j,y}$) by the auxiliary diesel generators are negligible for hydropower plants, $PEFC_{j,y}$, $FC_{j,y}$, $NCV_{i,y}$ and $EFCO_{2,i,y}$ have been removed from the monitored parameters. They were put for the monitoring of diesel consumption. This deviation does not have any impact since the project activity is a hydro power plant and it exists only for emergency cases.
- Other entity involved in the project was Ekobil Environmental Services and Consultancy in the project description. However, it has been changed as Sekans

⁷ Generation License is available to the VVB.

Enerji Ltd. Şti. during the 1st Monitoring Period. There is not any impact on the project activity's cycle.

3.3 Grouped Projects

This is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$FC_{i,y}$
Data unit	Volume Unit (cubic meter)
Description	Amount of fuel i consumed by relevant power plants in Turkey in years, 2008, 2009, 2010.
Source of data	Turkish Electricity Transmission Company (TEİAŞ) website https://www.teias.gov.tr/tr-TR/turkiye-elektrik-uretim-iletim-istatistikleri
Value applied	Annex 2-Table-1 in PD
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to date and reliable data available for the Turkish grid.
Purpose of Data	Calculation of baseline emissions
Comments	Data used for the calculation of $EF_{grid,OM,Simple}$

Data / Parameter	$NCV_{i,y}$
Data unit	GJ/Mass or Volume Unit
Description	Net Calorific Values for fossil fuel type i in year, for the years 2008, 2009 and 2010
Source of data	Regional or national average default values that are reliable and documented in national energy statistics of the Turkish Electricity Transmission Company Web Site

	(http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/yakit46-49/49.xls http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/yakit46-49/47.xls)
Value applied	Annex-2-Table-5 in PD
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to date and reliable data available for the Turkish grid.
Purpose of Data	Calculation of baseline emissions
Comments	Data used for the calculation of $EF_{grid,OM,Simple,y}$. As data on the NCV is not published directly on the TEİAŞ website, this data is calculated using the heating values of fuels and the volume or mass of fuels consumed for each year.

Data / Parameter	$EF_{CO2,i,y}$
Data unit	tCO ₂ /GJ
Description	CO ₂ emission factor of fossil fuel type i in year y
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied	Annex 2-Table-2 in PD
Justification of choice of data or description of measurement methods and procedures applied	According to the “Tool to calculate the emission factor for an electricity system” version 03.0.0, if values provided by the fuel supplier of the power plants in invoices or regional or national average defaults values are not available the IPCC default values at the lower limit of uncertainty must be used.
Purpose of Data	Calculation of baseline emissions
Comments	Data used both for the calculation of $EF_{grid,OM,Simple,y}$ and $EF_{EL,m,y}$

Data / Parameter	EG _y
Data unit	MWh

Description	Net electricity generated in the project electricity system in other words, net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units in year y
Source of data	Turkish Electricity Transmission Company Web Site http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/uretim%20tuketim(22-45)/40(06-10).xls www.teias.gov.tr/istatistik2009/30(84-09).xls
Value applied	Annex 2-Table 3 and Table 4 in PD
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up to date and reliable data available for the Turkish grid.
Purpose of Data	-
Comments	Data used for the calculation of $EF_{grid,OM,Simple,y}$

Data / Parameter	$EG_{m,y}$
Data unit	MWh
Description	Net electricity generated and delivered to the grid by power unit m in year y
Source of data	Turkish Electricity Transmission Company Web Site (www.teias.gov.tr). Data is extracted from the relevant annexes of the capacity projection reports for the years 200823, 200924 and 201025.
Value applied	Annex 2-Table 8 in PD
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to-date and reliable data available for the Turkish grid.
Purpose of Data	-
Comments	Data used for the calculation of $EF_{grid,BM,y}$

Data / Parameter	$\eta_{m,y}$
Data unit	-
Description	Average net energy conversion efficiency of power unit m in year y
Source of data	The default values provided at the Annex 1 of the “Tool to

	calculate emission factor for an electricity sector (Version 02.2.1)” are used
Value applied	Please see Annex 1 of the “Tool to calculate emission factor for an electricity sector (Version 02.2.1)”
Justification of choice of data or description of measurement methods and procedures applied	According to the “tool to calculate emission factor for an electricity system if documented manufacturer’s specifications or data from the utility, the dispatch centre or official records are not available then the default values given in annex 1 of the tool shall be used. The first two options are not available for the power plants supplying the Turkish grid; therefore the default values are used.
Purpose of Data	Data used for the calculation of $EF_{grid,BM,y}$
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{PP-self\ consumption, y}$						
Data unit	MWh						
Description	Quantity of electricity imported by the power plant from the grid for self-consumption, in year y						
Source of data	The Primary source of data is EPIAS website screenshots. The secondary source of data is monthly reading protocols						
Description of measurement methods and procedures to be applied	Measurements are to be made by electricity meters that belong to the grid operator, TEİAŞ. The meters are in compliance with the collected data. Data is used to calculate the net electricity supplied to the grid.						
Frequency of monitoring/recording	Recorded continuously, reported monthly on TEİAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.						
Value monitored	<table border="1"> <thead> <tr> <th></th> <th>MWh</th> </tr> </thead> <tbody> <tr> <td>12.12.2013-31.12.2013</td> <td>4.71</td> </tr> <tr> <td>01.01.2014-31.12.2014</td> <td>10.81</td> </tr> </tbody> </table>		MWh	12.12.2013-31.12.2013	4.71	01.01.2014-31.12.2014	10.81
	MWh						
12.12.2013-31.12.2013	4.71						
01.01.2014-31.12.2014	10.81						

	01.01.2015-31.12.2015	7.63															
	01.01.2016-31.12.2016	7.92															
	01.01.2017-31.12.2017	20.16															
	01.01.2018-31.12.2018	9.06															
	01.01.2019-30.11.2019	11.07															
Monitoring equipment	<p>The net electricity is measured continuously by two electricity meters at the grid interface and recorded monthly.</p> <p>Power meters:</p> <table border="1"> <thead> <tr> <th></th> <th>Main Meter</th> <th>Spare Meter</th> </tr> </thead> <tbody> <tr> <td>Name</td> <td>Ana Sayaç</td> <td>Yedek Sayaç</td> </tr> <tr> <td>Brand</td> <td>ELSTER</td> <td>ELSTER</td> </tr> <tr> <td>Serial Number</td> <td>00480819</td> <td>00480820</td> </tr> <tr> <td>Accuracy class</td> <td>0.5 S</td> <td>0.5 S</td> </tr> </tbody> </table>			Main Meter	Spare Meter	Name	Ana Sayaç	Yedek Sayaç	Brand	ELSTER	ELSTER	Serial Number	00480819	00480820	Accuracy class	0.5 S	0.5 S
	Main Meter	Spare Meter															
Name	Ana Sayaç	Yedek Sayaç															
Brand	ELSTER	ELSTER															
Serial Number	00480819	00480820															
Accuracy class	0.5 S	0.5 S															
QA/QC procedures to be applied	<ul style="list-style-type: none"> A spare meter is used for crosschecking the accuracy and both meters are calibrated if required. EPIAS records are considered as the main source for the net electricity and the values are crosschecked with the Meter Reading Forms TEIAS is responsible for calibration and maintenance of the devices. The periodic calibration or maintenance is under the responsibility of TEIAS and has been fixed as once in 10 years⁸. Since TEİAŞ meters are sealed by TEİAŞ, the project proponent cannot intervene with the devices. The periodic tests are executed on annual basis⁹. 																

⁸ <http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.6381&MevzuatIliski=0&sourceXmlSearch>

⁹ The first index test protocol of the meters are available to the VVB.

	<ul style="list-style-type: none"> The initial calibration of the meters of the Project Activity was done on 12/12/2013.
Purpose of the data	Calculation of net electricity supplied to the grid and thus baseline emissions
Calculation method	Direct continuous measurement
Comments	-

Data / Parameter	EG _{PP-gross, y}														
Data unit	MWh														
Description	Quantity of electricity produced by the power plant, in y														
Source of data	<p>The Primary source of data is EPIAS website screenshots.</p> <p>The secondary source of data is monthly reading protocols.</p>														
Description of measurement methods and procedures to be applied	Measurements are to be made by electricity meters that belong to the grid operator, TEİAŞ. The meters will be in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid.														
Frequency of monitoring/recording	Monthly readings														
Value monitored	<table border="1"> <thead> <tr> <th></th> <th>MWh</th> </tr> </thead> <tbody> <tr> <td>12.12.2013-31.12.2013</td> <td>537.40</td> </tr> <tr> <td>01.01.2014-31.12.2014</td> <td>10,863.95</td> </tr> <tr> <td>01.01.2015-31.12.2015</td> <td>47,780.32</td> </tr> <tr> <td>01.01.2016-31.12.2016</td> <td>7,842.01</td> </tr> <tr> <td>01.01.2017-31.12.2017</td> <td>11,288.37</td> </tr> <tr> <td>01.01.2018-31.12.2018</td> <td>12,998.56</td> </tr> </tbody> </table>		MWh	12.12.2013-31.12.2013	537.40	01.01.2014-31.12.2014	10,863.95	01.01.2015-31.12.2015	47,780.32	01.01.2016-31.12.2016	7,842.01	01.01.2017-31.12.2017	11,288.37	01.01.2018-31.12.2018	12,998.56
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01.01.2017-31.12.2017	11,288.37														
01.01.2018-31.12.2018	12,998.56														

	01.01.2019-30.11.2019	14,844.46															
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Name	Ana Sayaç	Yedek Sayaç															
Brand	ELSTER	ELSTER															
Serial Number	00480819	00480820															
Accuracy class	0.5 S	0.5 S															
QA/QC procedures to be applied	<ul style="list-style-type: none"> A spare meter is used for crosschecking the accuracy and both meters are calibrated if required. The EPIAS records are considered as the main source for the net electricity and the values are crosschecked with the Meter Reading Forms. TEIAS is responsible for calibration and maintenance of the devices. The periodic calibration or maintenance is under the responsibility of TEIAS and has been fixed as once in 10 years¹⁰. Since TEİAŞ meters are sealed by TEİAŞ, the project proponent cannot intervene with the devices. The periodic tests are executed on annual basis. Initial meter test protocol date is 12/12/2013.¹¹ 																
Purpose of the data	Calculation of net electricity supplied to the grid and thus baseline emissions																
Calculation method	Direct continuous measurement																
Comments	-																
Data / Parameter	Cap _{PJ}																
Data unit	W																

¹⁰ <http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.6381&MevzuatIliski=0&sourceXmlSearch>

¹¹ Initial meter test protocols are available to the VVB.

Description	Installed capacity of the hydropower plants 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	12,502,000
Monitoring equipment	SCADA system of the Project Activity
QA/QC procedures to be applied	Can be confirmed also by the parameter readings on the design plates of each turbine and by summing the three units
Purpose of the data	Calculation of project emissions
Calculation method	N/A
Comments	-

Data / Parameter	AP _J
Data unit	m ²
Description	Area of the reservoir measured in the surface of the water, after the implementation of the Project Activity, when the reservoir is full.
Source of data	Topographic map showing the project activity structures.
Description of measurement methods and procedures to be applied	The reservoir area corresponding to maximum operational level has been determined via a topographic map, presented in Annex 4.
Frequency of monitoring/recording	Once during each monitoring period
Value monitored	Maximum value is 6,980 m ² as it is in line with PD. But there is no reservoir area in the project activity since it can be seen on the Google Earth file (.kmz file). However, the forebay has a 2,662.69 m ² area of surface.
Monitoring equipment	Scada system water level readings

QA/QC procedures to be applied	Can be checked and compared to satellite imagery available by Google Earth.
Purpose of the data	Measured over a topographic map
Calculation method	N/A
Comments	-

4.3 Monitoring Plan

The objective of the monitoring plan is to ensure the complete, consistent, clear, and accurate monitoring and calculation of the emission reductions during the whole crediting period. The Project proponent is responsible for the implementation of the monitoring plan.

The Project Proponent is responsible for the overall management of the monitoring procedures including recording, data collection, calculating emission reductions and project emissions. Please see below the management structure for the plant operation:

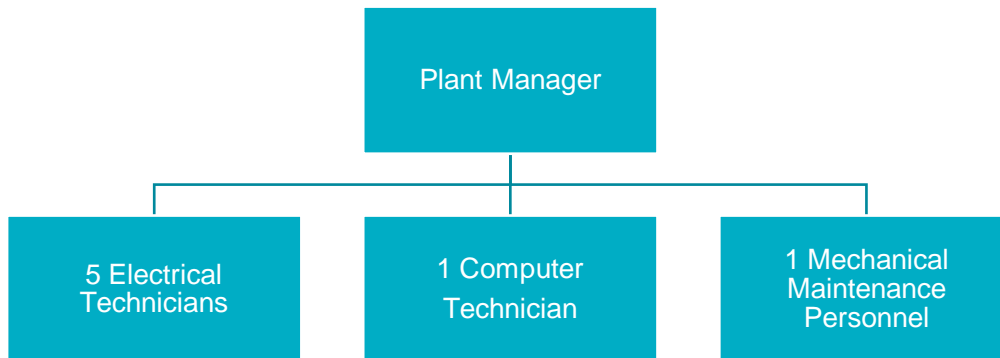


Figure 2. The management structure for the plant operation

In total, eight employees are working for the Project Activity. The plant manager is responsible for the whole management of the Project Activity and electrical technicians and computer technician are responsible for the implementation of the Project Activity. In addition to the technicians, there is one mechanical maintenance personnel.

Two power meters are installed at the grid interface of the project. There is one main meter, and the other is spare meter of the main meter for cross-checking. Both meters are jointly inspected and sealed in order to be protected from interference by any of the parties. Both the main and secondary meter are owned and installed by the grid operator (TEIAS). The grid operator is the only one authorized to deal with fixing, calibrating, or changing the meters, which will be done either by the grid operator or by a company authorized by the grid operator. During this monitoring period, there were no records of meter failure. In case of any urgent case TEIAS contacts the Plant Manager. Since the meters are within TEIAS' province, TEIAS executes all the procedures for handling non-conformities. Therefore, the Project Participant does not have any internal auditing for this purpose.

TEIAS is performing remote reading of the meters and monthly power meter readings are the basis for monitoring net electricity fed into the grid. A measuring protocol is prepared including day, peak and night hour electricity generation by the project owner and approved by governmental officers at the end of each month.

The primary source is EPIAS records Net electricity exported is crosschecked with the Meter Reading Forms (OSF). EPIAS is the financial settlement centre of TEIAS¹². The Meter Reading Forms are filled by the project owner and approved by the governmental officers. Additionally, the remote reading by the governmental body is also available. The website of EPIAS is accessible to Project Proponent with their unique user ID and password. Once accessed, the Project Proponent is able to call electricity generation and consumption reports of their own projects. The same reports are used by the Project Proponent for invoicing TEIAS. The electricity generation data is reported monthly basis.

Quality Control and Assurance (QC/QA)

Both the main and spare (control) meters are owned and installed by the grid company. Both meters are jointly inspected and sealed in order to be protected from interference by any of the parties.

The grid operator's Metering Officer should be notified of any failure of one of the meters. He is the only one authorized to deal with fixing, calibrating, or changing the meters, which will be done either by the grid operator or by a company authorized by the grid operator.

¹² PMUM has been replaced by EPIAS as of 01/09/2015 in Turkey during the verification period. Retrospective data is accessible via EPIAS.

During this monitoring period, there were no records of meter failure. The data is hourly recorded by the personnel on the plant. TEIAS Load Dispatching Center also executes remote reading during 24-hour period. The data could be remotely accessed by TEIAS.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline emission BE_y (tCO₂e) during the monitoring period results from:

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$$

Where:

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

$EF_{grid,CM,y}$ value is fixed as 0.5398 tCO₂/MWh for during the crediting period. Table 4 shows the baseline emissions for the verification period:

Table 4- Baseline emissions

Month	(A) Electricity supplied to the grid [MWh]	(B) Electricity consumption from the grid [MWh]	(C) = (A) - (B) EG (ID 8) Net electricity supplied to the grid [MWh]	EF [tCO ₂ /MWh]	Baseline emission: ER = EG * EF [t CO ₂ -eq]
Dec-13	537.40	4.71	532.69	0.5398	288
Jan-14	1,113.16	1.69	1,111.47	0.5398	600
Feb-14	1,072.61	2.12	1,070.49	0.5398	578
Mar-14	1,466.01	1.37	1,464.64	0.5398	791
Apr-14	1,162.12	0.96	1,161.16	0.5398	627
May-14	1,408.00	0.39	1,407.61	0.5398	760
Jun-14	233.35	0.04	233.31	0.5398	126
Jul-14	0.00	0.00	0.00	0.5398	0
Aug-14	0.00	0.00	0.00	0.5398	0
Sep-14	387.35	1.14	386.21	0.5398	208
Oct-14	1,313.68	0.91	1,312.77	0.5398	709
Nov-14	1,318.49	1.03	1,317.46	0.5398	711
Dec-14	1,389.18	1.17	1,388.01	0.5398	749
Jan-15	594.76	6.69	588.07	0.5398	317
Feb-15	597.05	0.14	596.91	0.5398	322
Mar-15	3,381.43	0.05	3,381.38	0.5398	1,825
Apr-15	8,226.35	0.02	8,226.33	0.5398	4,441
May-15	4,402.86	0.06	4,402.80	0.5398	2,377
Jun-15	7,393.60	0.01	7,393.59	0.5398	3,991
Jul-15	3,464.04	0.10	3,463.94	0.5398	1,870
Aug-15	2,150.16	0.09	2,150.07	0.5398	1,161
Sep-15	2,482.65	0.11	2,482.54	0.5398	1,340
Oct-15	4,275.09	0.11	4,274.98	0.5398	2,308
Nov-15	5,860.49	0.04	5,860.45	0.5398	3,163
Dec-15	4,951.84	0.21	4,951.63	0.5398	2,673
Jan-16	0.00	0.01	-0.01	0.5398	0
Feb-16	0.00	0.00	0.00	0.5398	0
Mar-16	0.00	0.04	-0.04	0.5398	0
Apr-16	0.00	0.19	-0.19	0.5398	0
May-16	1,492.14	0.13	1,492.00	0.5398	805
Jun-16	1,376.76	0.14	1,376.62	0.5398	743
Jul-16	1,088.26	0.33	1,087.93	0.5398	587
Aug-16	650.69	0.89	649.80	0.5398	351
Sep-16	717.12	0.87	716.25	0.5398	387

Oct-16	784.64	0.99	783.65	0.5398	423
Nov-16	908.38	1.84	906.54	0.5398	489
Dec-16	824.02	2.49	821.54	0.5398	443
Jan-17	1,085.80	2.94	1,082.86	0.5398	585
Feb-17	991.03	2.29	988.74	0.5398	534
Mar-17	1,094.93	2.30	1,092.63	0.5398	590
Apr-17	1,000.96	0.72	1,000.24	0.5398	540
May-17	862.53	1.34	861.19	0.5398	465
Jun-17	921.92	1.23	920.69	0.5398	497
Jul-17	805.22	1.42	803.80	0.5398	434
Aug-17	770.42	1.38	769.04	0.5398	415
Sep-17	646.48	1.80	644.68	0.5398	348
Oct-17	856.16	1.94	854.22	0.5398	461
Nov-17	1,073.78	1.48	1,072.30	0.5398	579
Dec-17	1,179.16	1.32	1,177.83	0.5398	636
Jan-18	1,225.44	0.64	1,224.80	0.5398	661
Feb-18	1,065.83	0.01	1,065.82	0.5398	575
Mar-18	1,249.27	0.03	1,249.24	0.5398	674
Apr-18	960.75	0.28	960.47	0.5398	518
May-18	969.88	0.72	969.16	0.5398	523
Jun-18	1,569.08	0.48	1,568.60	0.5398	847
Jul-18	865.34	1.06	864.28	0.5398	467
Aug-18	1,190.99	1.00	1,189.99	0.5398	642
Sep-18	842.32	1.04	841.28	0.5398	454
Oct-18	883.07	1.17	881.90	0.5398	476
Nov-18	982.56	1.22	981.34	0.5398	530
Dec-18	1,194.05	1.42	1,192.63	0.5398	644
Jan-19	1,514.85	1.65	1,513.20	0.5398	817
Feb-19	1,982.29	0.61	1,981.67	0.5398	1,070
Mar-19	1,860.29	0.77	1,859.52	0.5398	1,004
Apr-19	1,421.26	0.97	1,420.29	0.5398	767
May-19	1,089.34	1.03	1,088.31	0.5398	587
Jun-19	1,443.89	0.56	1,443.33	0.5398	779
Jul-19	1,499.63	0.51	1,499.12	0.5398	809
Aug-19	1,127.76	0.94	1,126.82	0.5398	608
Sep-19	816.40	1.84	814.56	0.5398	440
Oct-19	1,114.13	1.09	1,113.04	0.5398	601
Nov-19	974.64	1.10	973.54	0.5398	526
2013 Vintage 12.12.2013- 31.12.2013)	537.40	4.71	532.69	0.5398	288

2014 Vintage (01.01.2014- 31.12.2014)	10,863.95	10.81	10,853.13	0.5398	5,859
2015 Vintage (01.01.2015- 31.12.2015)	47,780.32	7.63	47,772.69	0.5398	25,788
2016 Vintage (01.01.2016- 31.12.2016)	7,842.01	7.92	7,834.09	0.5398	4,229
2017 Vintage (01.01.2017- 31.12.2017)	11,288.37	20.16	11,268.22	0.5398	6,083
2018 Vintage (01.01.2018- 31.12.2018)	12,998.56	9.06	12,989.50	0.5398	7,012
2019 Vintage (01.01.2019- 30.11.2019)	14,844.46	11.07	14,833.39	0.5398	8,007
Total	106,155.07	71.37	106,083.70	0.5398	57,264

5.2 Project Emissions

There is no project emission resulting from the reservoir area of the Project Activity as the power density of the project is greater than 4W/m². Accordingly, The Project Activity's power density was calculated as below:

$$= 12,502.000 \text{ W} / 2,662.69^{13}\text{m}^2^{14}$$

$$= 4695.25 \text{ W/m}^2$$

Therefore, PE= 0.

¹³ The current area has been considered for the calculation.

¹⁴ Calculation is also available in the ER Calculations file.

5.3 Leakage

No leakage is to be accounted by the Project Activity. This is in line with the registered PD and applicable methodology AMS-I. D, “Grid connected renewable electricity generation”, version 17.0. Therefore, the leakage from the Project Activity is zero.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2013	288	0	0	288
2014	5,859	0	0	5,859
2015	25,788	0	0	25,788
2016	4,229	0	0	4,229
2017	6,083	0	0	6,083
2018	7,012	0	0	7,012
2019	8,007	0	0	8,007
Total	57,264	0	0	57,264

Please see the vintage-based comparison of expected and achieved emission reductions for this monitoring period:

Table 5- Expected vs achieved emission reductions

Vintage	Period	Total Days	Amount achieved during this monitoring period (tCO2e)	Amount estimated ex ante (tCO2e)	Difference (tCO2e)	Difference (%)
2013	12.12.2013-31.12.2013	20	288	1,346	-1,059	-78.6%
2014	01.01.2014-31.12.2014	365	5,859	24,573	-18,714	-76.2%
2015	01.01.2015-31.12.2015	365	25,788	24,573	1,215	4.9%
2016	01.01.2016-31.12.2016	365	4,229	24,573	-20,344	-82.8%
2017	01.01.2017-31.12.2017	365	6,083	24,573	-18,490	-75.2%
2018	01.01.2018-28.02.2018	365	7,012	24,573	-17,561	-71.5%
2019	01.01.2019-30.11.2019	334	8,007	22,486	-14,479	-64.4%
Total		2179	57,264	146,697	-89,433	-61.0%

The actual emission reduction was %61 lower than expected during the monitoring period. The reason is that the rainfall was lower than expected. Higher hydro regime was estimated, unfortunately lower generation values have been realized.