



# Verified Carbon Standard

## FEKE II 69.58 MW HYDROELECTRIC POWER PLANT



Document Prepared by EKI Energy Services Limited

<b>Project Title</b>	FEKE II 69.58 MW HYDROELECTRIC POWER PLANT
<b>Version</b>	05
<b>Report ID</b>	534
<b>Date of Issue</b>	21-October-2022
<b>Project ID</b>	534
<b>Monitoring Period</b>	01-October-2012 to 30-September-2018 (inclusive of both dates)
<b>Prepared By</b>	Işıl Doğan
<b>Contact</b>	EnKing Embassy, Office No. 201, Plot 48, Scheme 78, Part 2 Vijay Nagar, Near brilliant Convention Centre, Indore- 452010 Madhya Pradesh, India Website: <a href="http://www.enkingint.org">www.enkingint.org</a> Ph: +39 379 288 2218 Email ID: <a href="mailto:registry@enkingint.org">registry@enkingint.org</a>

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# 1 PROJECT DETAILS

## 1.1 Summary Description of the Implementation Status of the Project

Feke II Hydroelectric power plant project is located at the south of Turkey, in the Mediterranean Region, on the Goksu Creek, a main branch of Seyhan River, within the province of Adana, about 9 km southwest of Feke I district. Feke I and Feke II projects were first developed by General Directorate of DSI (State Hydraulic Works) as a single project, to generate energy by utilizing the water potential of Goksu Branch in Seyhan Basin. However, it was seen during the feasibility studies that the project would cause whole of Feke district to be covered with water, therefore the project was divided into Feke I and Feke II projects which are developed as individual projects.

Akenerji Elektrik Üretim A.Ş. has been awarded the project after bidding by the Turkish Energy Market Regulatory Authority (EMRA) and won the rights of the license for a period of 49 years.

The project consists of compressed concrete dam with a crest length of 256 meters and a height of 60 meters from the riverbed; 317 meters long derivation tunnel, upstream and downstream cofferdams, spillway, 171 meters long penstock, a powerhouse of 44 by 32 meters dimensions and 2 vertical axis Francis turbines with a gross head of 63 meters. The maximum capacity of the dam surface is 2.47 km<sup>2</sup>. Feke II HEPP project have an installed capacity of 69.58 MW and is expected to have an annual generation of about 223.410 GWh of electricity. Electricity generated by the power plant is being delivered to the grid by a 7 km long 154 kV, 795 MCM overhead transmission line. An expected annual emission reduction of the project is approximately 122,205 tCO<sub>2</sub>-eq/year and a total reduction of 1,222,050 tCO<sub>2</sub>-eq over the 10-year crediting period.

Further during the current monitoring period of 01-October-2012 to 30-September-2018 the project has resulted in emission reductions of 396,881 tCO<sub>2</sub>e.

Major milestones of project activity are given at Table 1:

Table 1: Main Project Activities

Activity	Date
Issuance of Generation License	17-May-2007
Establishment of Plant Facilities	01-May-2008
Access Road Construction	01-June-2008
Start of Tunnel Construction	01-July-2008
Start of Dam Construction	01-December-2008
Start of Powerhouse Construction	01-December-2008
Start of EM Installation	01-January-2009
Start of Energy Transmission Line Construction	01-May-2009
Validation Report Date	26-July-2010
Provisional Acceptance & Commissioning	24-December-2010
First Monitoring Period	01-January-2011 to 30-September-2012
Second Monitoring Period	01-October-2012 to 30-

	September-2018
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## 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.<sup>1</sup>

It is an independent project with its own dam and its own powerhouse. It is not part of a grouped project.

## 1.3 Project Proponent

<b>Organization name</b>	Akenerji Elektrik Üretim A.Ş.
<b>Contact person</b>	MS. Özlem Palabıyık
<b>Title</b>	Strategic Planning and Risk Manager
<b>Address</b>	Miralay Sefik Bey Sk, Akhan No:15, Kat 3-4, Gumussuyu, 34437 Beyoglu/Istanbul, Türkiye
<b>Telephone</b>	+90 212 249 8282
<b>Email</b>	carbon.offset@akenerji.com.tr

## 1.4 Other Entities Involved in the Project

<b>Organization name</b>	EKI Energy Services Limited
<b>Role in the project</b>	Project Consultant
<b>Contact person</b>	Manish Dabkara
<b>Title</b>	MD/CEO
<b>Address</b>	Office No 201, Plot No 48, Scheme 78, Part 2, Vijay Nagar, Indore-452010, Madhya Pradesh, India.
<b>Telephone</b>	+91 731 428 9086

<sup>1</sup> <http://cdm.unfccc.int/DOE/scopes.html>

Email	<a href="mailto:manish@enkingint.org">manish@enkingint.org</a> <a href="mailto:registry@enkingint.org">registry@enkingint.org</a>
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### 1.5 Project Start Date

The project has started to feed energy to the grid as of 24-December-2010. The same has been considered as the start date of the project activity.

### 1.6 Project Crediting Period

The first crediting period started in 01-January-2011 and ends in 31-December-2020 since the first crediting period will be valid for 10 years which may be renewed at most two times as per the VCS rules.

### 1.7 Project Location

The project site lies between 35° 51' 41.7" - 35° 52' 2.2" E longitudes and 37° 44' 35.9" - 37° 44' 52.6"N latitudes. The closest settlement is the Feke Village, about 10 km north of the project site, within the province of Adana. The project lies on the Goksu creek basin, which is a branch of Seyhan River. The location of project is shown below:

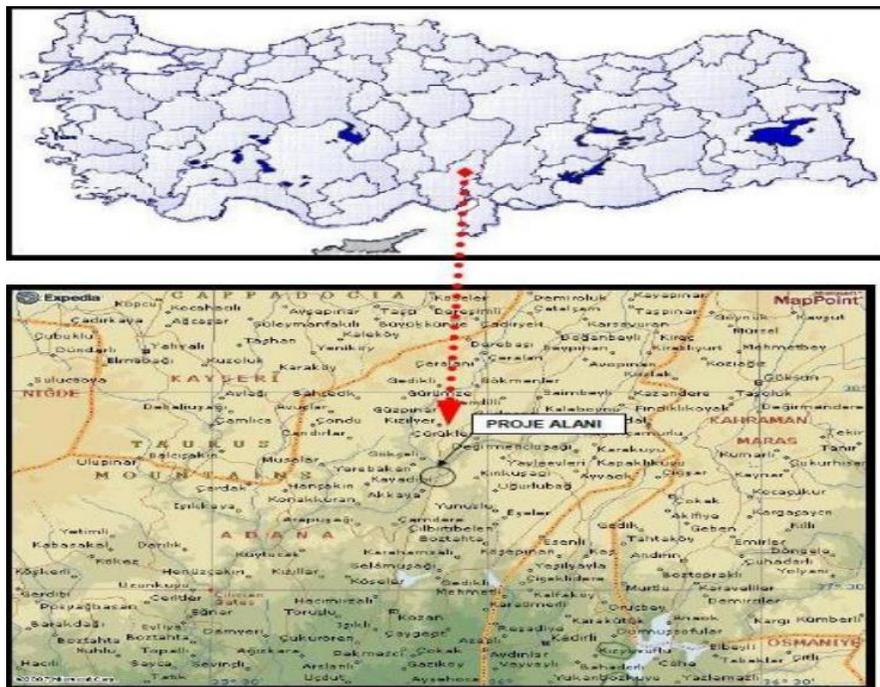


Figure 1. Location of the project site

## 1.8 Title and Reference of Methodology

The CDM approved consolidated baseline methodology applicable to this project is ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources”, Version 10<sup>2</sup>

ACM0002 refers to the following tools:

“Tool for the demonstration and assessment of additionality”, Version 05.2,<sup>3</sup> and

“Tool to calculate the emission factor for an electricity system”, Version 02.<sup>4</sup>

## 1.9 Participation under other GHG Programs

The project is not registered under any other GHG program except VCS.

## 1.10 Other Forms of Credit

The project has not created neither any other form of GHG-related environmental credit for GHG emission reductions nor any renewable energy certificate.

## 1.11 Sustainable Development Contributions

Akenerji Elektrik Üretim A.Ş., which is the investor of this project activity set up of 69.58 MW Hydro power Project to provide affordable and clean energy. Also, project investors have ensured productive employment to people in the region which has boosted the local economy. Job opportunities for total 24 people were provided.

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<sup>2</sup>

[https://cdm.unfccc.int/filestorage/N/F/9/NF9EDA0V5K382HW0JR14GS7XYQUMCP/EB47\\_repan07\\_ACM0002\\_ver10.pdf?t=b1B8cmszYmVkfDBfMgJfUtVJyR9CijSoD0Ja](https://cdm.unfccc.int/filestorage/N/F/9/NF9EDA0V5K382HW0JR14GS7XYQUMCP/EB47_repan07_ACM0002_ver10.pdf?t=b1B8cmszYmVkfDBfMgJfUtVJyR9CijSoD0Ja)

<sup>3</sup> [https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf/history\\_view](https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf/history_view)

<sup>4</sup> <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf>

Table 2: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	7.2.1: Renewable energy share in the total final energy consumption	Implemented activities to increase	The project has resulted in generation of 725,621.808 MWh of renewable energy during the current monitoring period from 01-October-2012 to 30-September-2018.	The project generated 1,051,733.254 MWh of renewable energy from the beginning of this crediting period until now, which is from 01-January-2011 to 30-September-2018.
2)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	Due to implementation of 69.58 MW Hydro Power Project, the project has prevented release of 396,881 Tonnes of carbon dioxide into the atmosphere during its current monitoring period which was from 01-October-2012 to 30-September-2018.	The project prevented release of 575,291 Tonnes of carbon dioxide into the atmosphere from the beginning of this crediting period until now, which is from 01-January-2011 to 30-September-2018.
3)	8.5	8.5.2: Unemployment rate, by sex, age and persons with disabilities	Implemented activities to decrease	The project has employed 24 workers who are permanently working for the operation of the project.	The project has employed 24 workers who are permanently working for the operation of the project from the beginning of this crediting period until now, which is from 01-January-2011 to 30-September-2018.

## 2 SAFEGUARDS

### 2.1 No Net Harm

The project does not have any negative effects on the environment because it is operated based on national and international regulations. The Hydro Electric Power Project does not change any water volume or cause any water pollution. Thus, the environmental impacts of the implemented 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.

Moreover, the project contributes to sustainable development in the region through creating new job opportunities. In addition to direct and indirect job opportunities, project was also expected to increase income of fishermen in the region, increase the agricultural income of the local community and support the development Adana region. Considering the contribution of the project on local and national economy, environment and local community, project has positive influences on sustainable development in the region and in Turkey.

### 2.2 Local Stakeholder Consultation

Stakeholder consultation for the project has been carried out at validation stage. Since the project was registered under previous version of VCS standard, hence, no specific mechanism defined for on-going stakeholder consultations post implementation.

Prior to validation, According to Article 9. of the Environmental Impact Assessment Regulation, a stakeholders meeting was held on 09-October-2007, at Karacaoglan Culture Center (Marriage Saloon) of Feke District, a location which was determined together with the Governor. The meeting hours and its location was announced on 04-October-2007 in the national (Aksam) newspaper and the local (Adana 5 Ocak) newspaper. During the meeting, information on the importance of the project, reasons for selection of the project location, employment, seismic activities and action required for environmental issues has been explained to the participants and stakeholders' views, considerations and questions were answered. Since no request for a change in the project was asked, no changes in the project were made. Participants mostly asked questions about employment and how the expropriation is going to be made. They pointed to the fact that the project shall be useful for the economy of the region as well as the whole country.

The second stakeholder meeting of the project was held on 13-November-2008 in Kisacikli region of Feke district in Adana. 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 about one hour 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. Mr. Guvenc Emre Sener, project manager of Akenerji Elektrik Üretim A.Ş. made the consultant company gave explanations regarding the carbon emissions savings of the renewable energy projects and the carbon trade. After the presentations and explanations, questions from the participants were answered by Mr. Guvenc Emre Sener, the project manager of Akenerji Elektrik Üretim A.Ş.

The comments from stakeholder have been positive in general. The main concerns raised by the participants were climate change which would occur due to the dams and power plants, so that the rain and snow would decrease. They have seen other examples of hydraulic dams which have caused less rain and snow causing draught. Also, they have seen agricultural lands turn into salty lands. Akenerji Elektrik Üretim A.Ş. has taken into account all comments and in general replied positively to the concerns and comments by the participants. It was explained that the project would not affect the climate negatively; otherwise, it would never get an approval for the Environmental Impact Assessment report and decrease of rain and river waters are not because of hydroelectric power plants, but mostly due to climate change. Also, it is pointed out that the change of land into salty lands is not due to dams and hydro power plants but due to excessive irrigation by landowners after the construction of dams and irrigation facilities.

As a part of continuous feedback from stakeholders, the grievances register is placed at project site and is being continuously monitored and addressed through the grievances cell on regular basis and maintained in a register at site office. The contact information of Company Executive of the company was given to mukhtar (head of the village) so that the local stakeholders will be able to reach company executive whenever they have any complaints, suggestions, or ideas about the project. Since mukhtar is the head of the village, he is the main contact person between the project owner and the local stakeholders. Mukhtar made sure that there is continuous communication between the two parties. Moreover, logbook was delivered to the head of village. This logbook is being checked at regular intervals to see whether there have been any complaints from the local stakeholders.

Further, no major grievances were being reported during the current monitoring period.

### 2.3 AFOLU-Specific Safeguards

Not Applicable.

## 3 IMPLEMENTATION STATUS

### 3.1 Implementation Status of the Project Activity

The project has been in operation since 24-December-2010. Crediting period for the project is 10 years between 01-January-2011 to 31-December-2020. and will be renewable for 2 times.

The project activities consist of only one site.

There isn't any event or any situation that occurred during the monitoring period, which can change the applicability of the methodology. The project underwent continued operation during the current monitoring period, other than scheduled maintenance and breakdowns.

Also EKI Energy Services Limited has been added as other entity involved in section 1.4 of the Monitoring Report.

The project underwent continued operation during the current monitoring period, other than scheduled maintenance and breakdowns which resulted in marginal decrease in power generation and actual emission reductions. The project activity has been implemented as per the actual capacity and no deviation has been observed from the registered monitoring plan which may have an adverse impact upon the project activity.

## 3.2 Deviations

### 3.2.1 Methodology Deviations

Not Applicable.

### 3.2.2 Project Description Deviations

Project owner had applied for 4 project deviations which are being explained below. First three deviations had been already approved in the previous monitoring period.

Deviation 1:

In the VCS PD, regarding electricity generation, it has been stated that “Generation data were recorded by four 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. 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 PMUM data”

However, the facility has settled the remote reading system. Thus, for electricity generation calculations, PMUM readings are deployed as there is no meter readings signed by TEIAS. The main and cross-check values are indicated below which accommodates this deviation:

Electricity generation calculations are based on the PMUM records. As cross-check Monthly Facility Reports are being used (For the years between 01-October-2012 and 31-December-2013, only net electricity values are available in the monthly facility reports, separate import and export values are not available.).

Deviation 2:

Moreover, even though it is mentioned in the previous MR of the project that installed capacity of the project has been decreased from 69.58 Mwe to 69.35 Mwe, project owner has confirmed that there has been no change in the capacity, which can be confirmed from the last page of the Production License, in item 6, (In the last decision numbered 2899-88 on 02-December-2010). The total installed capacity of the Facility was specified as 69.58 Mwe.

Deviation 3:

Regarding the project emissions from diesel generators, bills would be used for quantification. For conservativeness, working hours, have been deployed.

Deviation 4:

Furthermore, the project has been in operation since 24-December-2010 meanwhile crediting period for the project has been considered to start from 01-January-2011.

The above deviations are permanent in nature and does not have any implications upon baseline, additionality and applicability of methodology.

### 3.3 Grouped Projects

Not Applicable as the project is not a grouped project activity.

## 4 DATA AND PARAMETERS

### 4.1 Data and Parameters Available at Validation

<b>Data / Parameter</b>	EG <sub>y,Total</sub>
<b>Data unit</b>	MWh
<b>Description</b>	Net Electricity generated by power plants in Turkey
<b>Source of data</b>	TEIAS web page ( <a href="https://www.teias.gov.tr/">https://www.teias.gov.tr/</a> )
<b>Value applied:</b>	169,543.1 GWh for 2006, 183,339.7 GWh for 2007, 189,761.9 GWh for 2008
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, providing the most up-to-date and accurate information available.
<b>Purpose of Data</b>	Calculation of baseline emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	EF <sub>CO<sub>2</sub>, i, y i</sub>
<b>Data unit</b>	tCO <sub>2</sub> /TJ

<b>Description</b>	CO <sub>2</sub> emission factor of fossil fuel type “i” in year “y”																	
<b>Source of data</b>	For EF of fossil fuels, IPCC values at the lower limit has been used.																	
<b>Value applied:</b>	<table border="1"> <thead> <tr> <th>Fuel Source</th> <th>EF(tCO<sub>2</sub>/Tj)</th> </tr> </thead> <tbody> <tr> <td>Coal</td> <td>89.50</td> </tr> <tr> <td>Lignite</td> <td>90.9</td> </tr> <tr> <td>Fuel Oil</td> <td>75.5</td> </tr> <tr> <td>Diesel</td> <td>72.6</td> </tr> <tr> <td>LPG</td> <td>61.6</td> </tr> <tr> <td>Naphta</td> <td>69.3</td> </tr> <tr> <td>Natural Gas</td> <td>54.3</td> </tr> </tbody> </table>		Fuel Source	EF(tCO <sub>2</sub> /Tj)	Coal	89.50	Lignite	90.9	Fuel Oil	75.5	Diesel	72.6	LPG	61.6	Naphta	69.3	Natural Gas	54.3
Fuel Source	EF(tCO <sub>2</sub> /Tj)																	
Coal	89.50																	
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Diesel	72.6																	
LPG	61.6																	
Naphta	69.3																	
Natural Gas	54.3																	
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	According to ACM0002, IPCC default values at lower limit of 95% confidence interval can be used. Although, the actual emission reduction is expected to be higher due to high EF of fuels consumed in existing power plants, IPCC values have been used for conservativeness as requested by the methodology																	
<b>Purpose of Data</b>	Calculation of baseline emissions																	
<b>Comments</b>	-																	

<b>Data / Parameter</b>	FC <sub>i,y</sub>					
<b>Data unit</b>	Tons or 1000 m <sup>3</sup> for gases					
<b>Description</b>	Amount of fuels consumed by thermal power plants for electricity generation in terms of fossil fuel type i in year y					
<b>Source of data</b>	TEIAS web page ( <a href="https://webapi.teias.gov.tr/file/ee7ede69-2e11-4ec7-8356-bf9a604e881e?download">https://webapi.teias.gov.tr/file/ee7ede69-2e11-4ec7-8356-bf9a604e881e?download</a> )					
<b>Value applied:</b>		2006	2007	2008	Total Fuel Consumption 2006-2008	Total Emission 2006-2008
	Natural	17,034,	20,457,79	21,607,63	59,099,976	117.716.96

	Gas	548	3	5		6
	Lignite	50,583,810	61,223,821	66,374,120	178,181,751	111.311.693
	Hard Coal	5,617,863	6,029,143	6,270,008	17,917,014	35.571.662
	Fuel Oil	1,746,370	2,250,686	2,173,371	6,170,427	18.590.041
	Diesel Oil	61,501	50,233	131,206	242,940	751.393
	Lpg	33	0	0	33	0
	Naphta	13,453	11,441	10,606	35,500	107.934
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, providing the most up-to-date and accurate information available.					
<b>Purpose of Data</b>	Calculation of baseline emissions					
<b>Comments</b>						

<b>Data / Parameter</b>	$\eta_{m,y}$																
<b>Data unit</b>	%																
<b>Description</b>	Average net energy conversion efficiency of power unit m in year y																
<b>Source of data</b>	Annex I of "Tool To Calculate Emission Factor For An Electricity System 2.0"																
<b>Value applied:</b>	<table border="1"> <thead> <tr> <th></th> <th>Average Conversion Efficiency <math>\eta_{m,y}</math></th> </tr> </thead> <tbody> <tr> <td>Natural Gas</td> <td>60%</td> </tr> <tr> <td>Lignite</td> <td>39%</td> </tr> <tr> <td>Coal</td> <td>39%</td> </tr> <tr> <td>Fuel Oil</td> <td>39.5%</td> </tr> <tr> <td>Diesel Oil</td> <td>39.5%</td> </tr> <tr> <td>Naphtha</td> <td>60%</td> </tr> <tr> <td>LPG</td> <td>39.5%</td> </tr> </tbody> </table>		Average Conversion Efficiency $\eta_{m,y}$	Natural Gas	60%	Lignite	39%	Coal	39%	Fuel Oil	39.5%	Diesel Oil	39.5%	Naphtha	60%	LPG	39.5%
	Average Conversion Efficiency $\eta_{m,y}$																
Natural Gas	60%																
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Diesel Oil	39.5%																
Naphtha	60%																
LPG	39.5%																

<b>Justification of choice of data or description of measurement methods and procedures applied</b>	The average values of thermal plants in Turkey are taken from Tool to calculate the emission factor for an electricity system” 2.0.
<b>Purpose of Data</b>	Calculation of baseline emissions
<b>Comments</b>	

<b>Data / Parameter</b>	NCV																
<b>Data unit</b>	Tj/kt																
<b>Description</b>	Net Calorific Values of Fuel combusted in power plants.																
<b>Source of data</b>	TEIAS web page ( <a href="http://www.teias.gov.tr/istatistik2008/46.xls">http://www.teias.gov.tr/istatistik2008/46.xls</a> and <a href="https://www.teias.gov.tr/">https://www.teias.gov.tr/</a> )																
<b>Value applied:</b>	<table border="1"> <thead> <tr> <th></th> <th>NCV (Tj/kt) (1000 m<sup>3</sup> for gas)</th> </tr> </thead> <tbody> <tr> <td>Coal</td> <td>22.18</td> </tr> <tr> <td>Lignite</td> <td>6.87</td> </tr> <tr> <td>Fuel Oil</td> <td>39.90</td> </tr> <tr> <td>Diesel Oil</td> <td>42.60</td> </tr> <tr> <td>LPG</td> <td>0.00</td> </tr> <tr> <td>Naphtha</td> <td>43.87</td> </tr> <tr> <td>Natural Gas</td> <td>36.68</td> </tr> </tbody> </table>		NCV (Tj/kt) (1000 m <sup>3</sup> for gas)	Coal	22.18	Lignite	6.87	Fuel Oil	39.90	Diesel Oil	42.60	LPG	0.00	Naphtha	43.87	Natural Gas	36.68
	NCV (Tj/kt) (1000 m <sup>3</sup> for gas)																
Coal	22.18																
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Diesel Oil	42.60																
LPG	0.00																
Naphtha	43.87																
Natural Gas	36.68																
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, providing the most up-to-date and accurate information available.																
<b>Purpose of Data</b>	Calculation of baseline emissions																
<b>Comments</b>	-																

<b>Data / Parameter</b>	Cap <sub>BL</sub>
<b>Data unit</b>	W
<b>Description</b>	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
<b>Source of data</b>	Project site
<b>Value applied:</b>	0
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	Since project involves a new reservoir, this value is zero.
<b>Purpose of Data</b>	Calculation of project emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	A <sub>BL</sub>
<b>Data unit</b>	m <sup>2</sup>
<b>Description</b>	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m <sup>2</sup> ). For new reservoirs, this value is zero.
<b>Source of data</b>	Project site
<b>Value applied:</b>	0
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	Since project involves a new reservoir, this value is zero.
<b>Purpose of Data</b>	Calculation of project emissions
<b>Comments</b>	-

## 4.2 Data and Parameters Monitored

<b>Data / Parameter</b>	$EG_{\text{facility, y}}$
<b>Data unit</b>	GWh
<b>Description</b>	Net Electricity generated and delivered to the grid by Feke II HEPP in year y
<b>Source of data</b>	The energy generation data are obtained remotely by TEIAS and there are no signed meter readings. PMUM records are used for main calculation where “Monthly Facility Reports” (signed by the project owner) are used for cross-check
<b>Description of measurement methods and procedures applied</b>	Generation data were recorded by four metering devices continuously. The internal consumption of the facility was subtracted from the gross generation. PMUM records were used for main calculation where “Monthly Facility Reports” (signed by the project owner) were used for cross-check.
<b>Frequency of monitoring/recording</b>	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 gathered by TEIAS remotely
<b>Value applied:</b>	For 72 months period, total generation has been 725,621.808 MWh. Average monthly generation corresponds to 10,078.080 MWh and annual average generation of the plant corresponds to 120,936.96 MWh.
<b>Monitoring equipment</b>	<p>Four calibrated ammeters (two of them are spare) Meters used are in compliance with the regulation on meters issued by relevant government agencies<sup>5</sup> and have 0.5S accuracy class<sup>6</sup>.</p> <p>Please refer to Appendix I for the details of all meters had been used for the present monitoring period.</p>
<b>QA/QC procedures applied</b>	Maintenance and calibration of the metering devices is being made by TEIAS periodically. If there is a significant difference between the readings of two devices, maintenance and tests of

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

<sup>6</sup> First Index Protocol

	the metering devices and the associated equipment is being done before waiting for the periodical maintenance.
<b>Purpose of data</b>	To calculate the baseline emission
<b>Calculation method</b>	Not Applicable
<b>Comments</b>	-

<b>Data / Parameter</b>	Cap <sub>PJ</sub>
<b>Data unit</b>	W
<b>Description</b>	Installed capacity of the hydro power plant after the implementation of the project activity
<b>Source of data</b>	Project site
<b>Description of measurement methods and procedures applied</b>	The parameter was determined from the labels on the equipment and letter for approval of commissioning issued by Ministry of energy and Natural Resources
<b>Frequency of monitoring/recording</b>	Yearly
<b>Value applied:</b>	69.58 MWe <sup>7</sup>
<b>Monitoring equipment</b>	N/A
<b>QA/QC procedures applied</b>	N/A
<b>Purpose of data</b>	To calculate project emission
<b>Calculation method</b>	Not Applicable
<b>Comments</b>	-

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<sup>7</sup> FEKE II Generation licence

<b>Data / Parameter</b>	$A_{PJ}$
<b>Data unit</b>	$m^2$
<b>Description</b>	Area of the reservoir measured on the surface of the water, after the implementation of the project activity, when the reservoir is full
<b>Source of data</b>	Project site
<b>Description of measurement methods and procedures applied</b>	Measured from topographical surveys or maps
<b>Frequency of monitoring/recording</b>	Yearly
<b>Value applied:</b>	2,480,000 <sup>8</sup>
<b>Monitoring equipment</b>	Not applicable
<b>QA/QC procedures applied</b>	Not applicable
<b>Purpose of data</b>	To calculate project emission
<b>Calculation method</b>	Not applicable
<b>Comments</b>	Maximum area is already calculated in the feasibility report and considered in calculations.

<b>Data / Parameter</b>	$PE_{FF,y}$
<b>Data unit</b>	$tCO_2$
<b>Description</b>	Project emissions from fossil fuel consumption in year y
<b>Source of data</b>	Project site (Diesel generator)

<sup>8</sup> FEKE II Hepp Reservoir Map

<b>Description of measurement methods and procedures applied</b>	Total working hour of diesel generator and maximum fuel consumption are multiplied, and total fossil fuel consumption is calculated. According to the “Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion version 2.0” CO <sub>2</sub> emissions from fossil fuel combustion for process are calculated based on the quantity of fuels combusted and the CO <sub>2</sub> emission coefficient of those fuels.
<b>Frequency of monitoring/recording</b>	Yearly
<b>Value applied:</b>	0
<b>Monitoring equipment</b>	Not applicable
<b>QA/QC procedures applied</b>	Not applicable
<b>Purpose of data</b>	To calculate project emission
<b>Calculation method</b>	Not applicable
<b>Comments</b>	-

### 4.3 Monitoring Plan

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

To demonstrate the emission reduction, only required data is the net electricity delivered to the grid by the project activity and internal combustion for the auxiliary diesel generator.

Net electricity generation is measured and recorded by both TEIAS and project owners for billing purposes therefore no new additional protocol is needed monitoring emission reduction. Power Plant Manager, is responsible for the electricity generated, gathering all relevant data, and keeping the records. He is informed about VCU concepts and mechanisms and how to monitor and collect the data which is used for emission reduction calculations.

Generation data collected during crediting period is submitted to consultant who is responsible for calculating the emission reduction subject to verification: Generation data is used to prepare monitoring reports which is used to determine the vintage from the project activity. These reports are submitted to the duly authorized and appointed Validation/Verification Body (VVB) before each verification period.

The monitoring system organization chart is shown in Figure 2 below, in which the authority and responsibility of project management are defined.

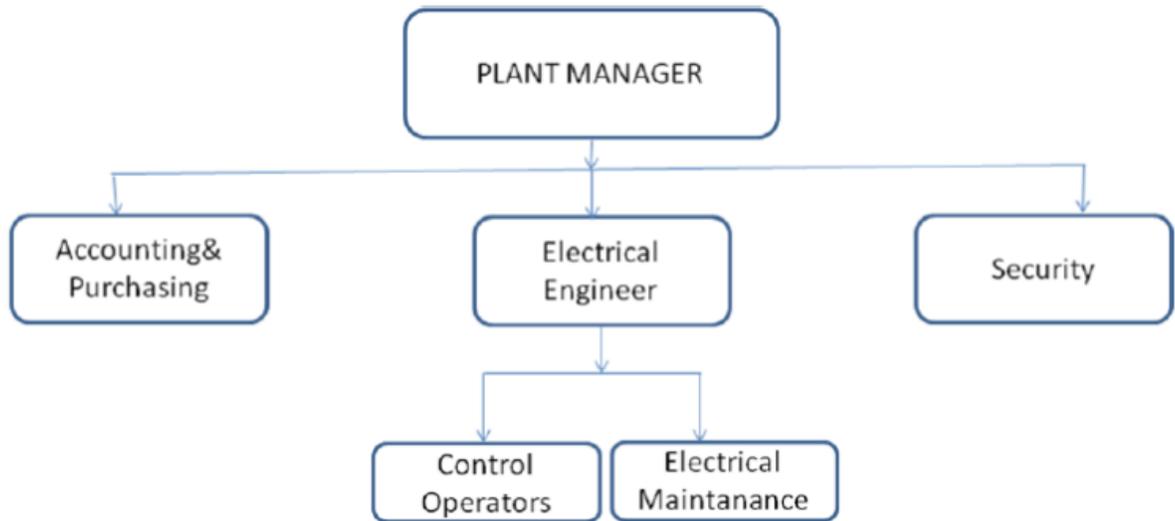


Figure 2. Operational structure of FEKE II HEPP

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

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

**Electrical Engineer:** Responsible for day electrical operations and recording and monitoring of relevant data and periodic reporting

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

**EKI Energy Services:** Responsible for emission reduction calculations, preparing monitoring report and periodical verification process.

Installation of meter and data monitoring are carried out according to the regulations by TEIAS. Four metering devices (two of them used as spare) are used for monitoring the electricity generated by the power plant. Readings are done using main metering devices and spare metering device is used for comparison only. Data from metering devices is recorded by TEIAS remotely. generation of the FEKE II HEPP are taken from TEIAS – PMUM web site(<http://pmum.teias.gov.tr> ) which is accessible using a password provided to electricity generation. The project owner extracted these data and send to EKI. Both the PMUM data and Monthly Facility Reports” (signed by the project owner) were taken into account for comparison and to identify any abnormalities.

In case of a major failure at both metering at the same time, electricity generation by the plant since the last measurement is able to be monitored by another metering device at the inlet of the main substation operated by TEIAS where the electricity is fed to the grid. Electricity generated by the power plant is also available at the SCADA (supervisory control and data acquisition system) of the grid operator TEIAS,

through the RTU (remote terminal unit) installed at the power plant and supervised by the Load Dispatch Centre of TEIAS.

The net electricity fed to the grid was measured continuously and recorded monthly by the TEIAS and plant staff. The project underwent continuous operation and maintenance other than scheduled breakdowns.

Calibration of the metering devices was made by TEIAS and sealed during first operation of the plant. The meters were calibrated by TEIAS when exists significant inconsistency between two devices using a fixed template<sup>9</sup> or upon request by either project owner or TEIAS<sup>10</sup>.

The maximum area of the reservoir is provided map of reservoir, the level of water was also checked from topographical surveys and maps and didn't exceed the limit value.

A<sub>BL</sub> value was takes as zero as the project is a new project and there was no reservoir area before the project is released, thus, as per the methodology.

Diesel generator is utilized at the powerhouse which is used as auxiliary power source when there is no electricity generation in the plant or supply by the grid. For the calculation of the project emission from diesel generator, purchasing bill is being used during the monitoring period. For this monitoring period, working hour of diesel generator and maximum fuel consumption were used. All data collected as part of monitoring is being archived electronically and be kept at least for 2 years after the end of the last crediting period.

Besides, single line diagram of the project can be seen below.

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<sup>9</sup> <https://www.teias.gov.tr/>

<sup>10</sup> <https://www.epdk.gov.tr/>

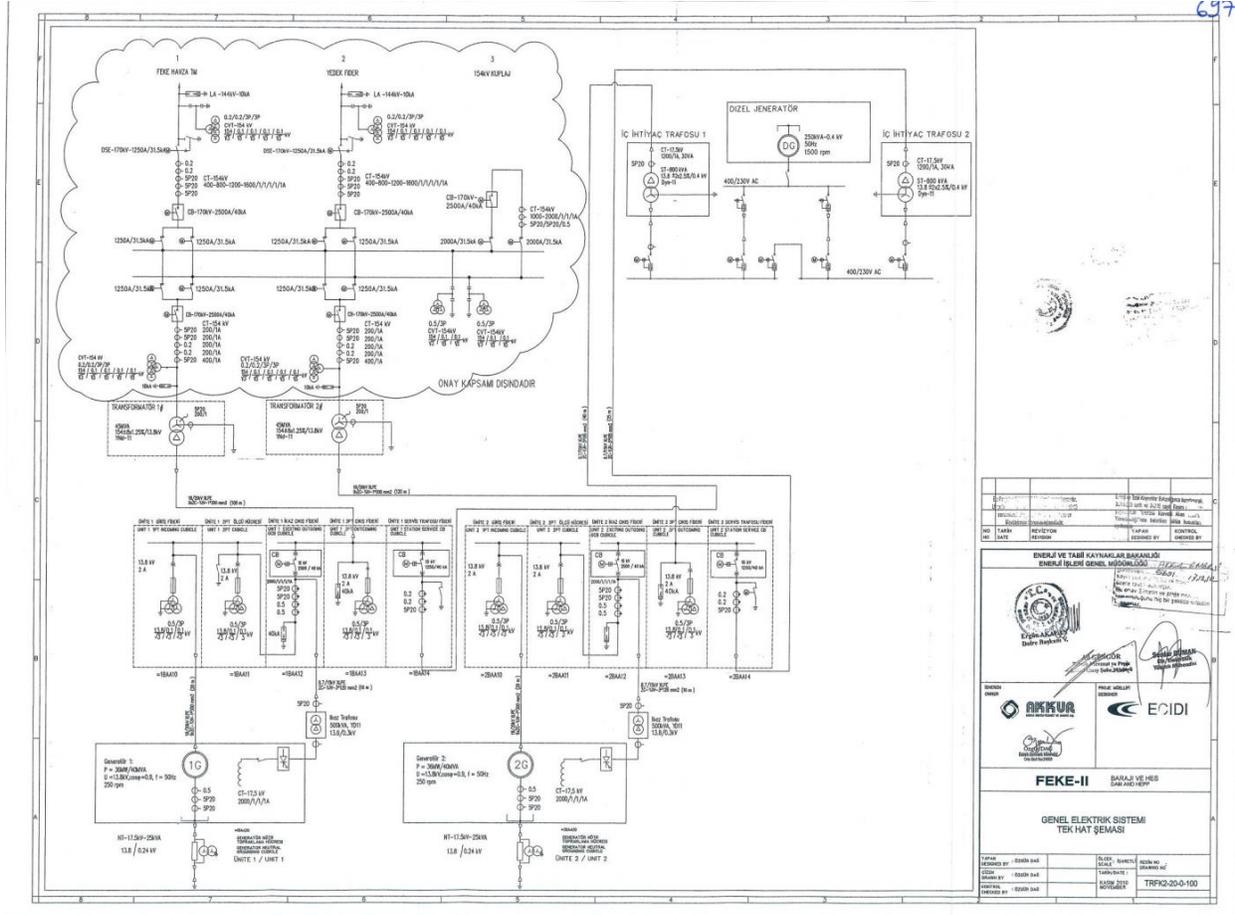


Figure 3. Single Line Diagram

# 5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

## 5.1 Baseline Emissions

Baseline emission is calculated according to the formula:

$$BE_y = EG_y \times EF_y$$

$$BE_y = 725,621.808 \text{ MWh} \times 0.5470 \text{ tCO}_2/\text{MWh} = 396,881 \text{ tCO}_2e$$

Where:

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

$EF_y$  = Emission factor calculated according to selected methodology

## 5.2 Project Emissions

The implemented project activity involves the generation of electricity by a hydroelectric power plant which has power density higher than 10W/m<sup>2</sup> therefore project emissions from reservoir is ignored as per the applied methodology.

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

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

Where:

PD = Power density of the project activity (W/m<sup>2</sup> )

Cap<sub>PJ</sub> = Installed capacity of the hydro power plant after the implementation of the project activity (W)

Cap<sub>BL</sub> = Installed capacity of the hydro power plant before the implementation of the project activity (W).  
For new hydro power plants, this value is zero

A<sub>PJ</sub> = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m<sup>2</sup>)

A<sub>BL</sub> = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m<sup>2</sup>). For new reservoirs, this value is zero

For proposed project HEPP,

$$Cap_{PJ} = 69,580,000 \text{ W}$$

$$Cap_{BL} = 0.0 \text{ W}$$

$$A_{PJ} = 2,477,000 \text{ (m}^2\text{)}$$

$$A_{BL} = 0.0 \text{ (m}^2\text{)}$$

Therefore, PD is calculated as:

$$PD = \frac{69,580,000 - 0}{2,477,000 - 0}$$

$$PD = 28.09 \text{ W/m}^2$$

Thus, PE<sub>y</sub> = 0

## 5.3 Leakage

As per ACM0002 Version 10.0 equation 11, leakage emissions are neglected.

$$LE_y = 0$$

## 5.4 Net GHG Emission Reductions and Removals

The net emission reductions achieved during the current monitoring period are being calculated as per below equation:

$$\begin{aligned} \text{Net Emission Reductions} &= BE_y - PE_y \\ &= 396,881 - 0 = 396,881 \text{ tCO}_2\text{e (Round down)} \end{aligned}$$

The vintage breakup has been tabulated below.

Year	Baseline emissions or removals (tCO <sub>2</sub> e)	Project emissions or removals (tCO <sub>2</sub> e)	Leakage emissions (tCO <sub>2</sub> e)	Net GHG emission reductions or removals (tCO <sub>2</sub> e)
01-October-2012 to 31-December-2012	18,393	0	0	18,393
01-January-2013 to 31-December-2013	72,732	0	0	72,732
01-January-2014 to 31-December-2014	34,460	0	0	34,460
01-January-2015 to 31-December-2015	97,574	0	0	97,574
01-January-2016 to 31-December-2016	62,650	0	0	62,650
01-January-2017 to 31-December-2017	54,200	0	0	54,200

<b>01-January-2018 to 30-September-2018</b>	56,872	0	0	56,872
<b>Total</b>	396,881	0	0	396,881

It is to be noted here that as per the estimated emission reduction to be achieved from the project activity for the current monitoring period is 733,564 tCO<sub>2e</sub>, whereas actual emission reductions achieved are 396,881 tCO<sub>2e</sub>, which is approximately 45.9% less than the estimated emission reductions for the same monitoring period. This deviation occurred due to less electricity generation than expected during the years of 2014 and 2017, which was caused by the decrease in the amount of water coming to the plants due to the change in the precipitation regime in Turkey in these years and thus was not in control of project owner. Also the plant went for scheduled maintenance and breakdowns which has resulted in lesser emission reductions than the estimated values and thus was not in control of project owner.

## APPENDIX 1 – MONITORING EQUIPMENT CALIBRATION SCHEDULE

Technical information of the meters is tabulated below:

Table 3. Technical Information

Brand	Type	Serial Number	Accuracy Class	Calibration Date	Validity	Calibration Frequency
ELSTER	A1500	00416326 (main-unit 1)	0.5S	20-May-2010	19-May-2020	10 years
ELSTER	A1500	00416327 (spare-unit 1)	0.5S	20-May-2010	19-May-2020	10 years
ELSTER	A1500	00416328 (main-unit 2)	0.5S	20-May-2010	19-May-2020	10 years
ELSTER	A1500	00416329 (spare-unit 2)	0.5S	20-May-2010	19-May-2020	10 years

No change or calibration of the metering devices has been necessary during the monitoring period since validity of calibration of meters expires in 19-May-2020 considering the 10 years calibration frequency.