

KEPEZKAYA HYDROELECTRIC POWER PLANT FIRST PERIODIC MONITORING REPORT



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1 PROJECT DETAILS

1.1 Summary Description of Project

The proposed project is the construction of Kepezkaya Hydroelectric Power Plant (the "Project Activity" or "Kepezkaya HPP" from this point onward), which has been planned on the Göksu River in the Eastern Mediterranean Region of Turkey. It has been developed by Selen Elektrik Üretim A.Ş. (one of the AES-IC İÇTAŞ Enerji Üretim ve Ticaret A.Ş. affiliates), hereafter referred to as the "Project Owner" or "The Owner" who owns the generation license (see Annex-5 in the Validated PD). The purpose of the Kepezkaya HPP is to utilize the hydropower potential of the Göksu river to generate electricity based on a renewable resource and thus to generate Verified Emission Reductions (VERs) by displacing electricity generation from grid connected fossil fuel-fired power plants.

The Energy Market Regulatory Authority (EMRA) tendered the Project Activity in 2005 and the generation license was awarded to the project owner in 05/07/2007 for the period of 48 years and 2 and half months (The license is presented as Annex 5 in the validated PD). The Project Activity started operation on October 1st, 2010.

The Major milestones at the project development history can be summarized as shown in the following table (Table 1):

Table 1: Major Milestones of Kepezkaya HPP Project

Date	Milestone	Reference
2-Sep-04	Selen Elektrik Üretim A.Ş. Applied to EMRA to acquire the production license	Referred in the letter came as an answer to the request
21-Oct-05	EMRA replied to Selen Elektrik Üretim. A.Ş. and invited them to the auction that will be organized to sell the license of the project.	
12-Sep-06	Correspondences starts to seek consultancy to develop Carbon asset of the project	Proposal
15-Nov-06	A proposal was taken from E&C Services GmbH Germany to develop the projects in the pipeline of the mother company	Correspondences
6-Feb-07	Project Owner Was Granted the Preliminary Forestry Permit to operate within the jurisdictions of the forestry authorities lands	The Preliminary permit proclamation
5-Jul-07	EMRA granted Electricity Production License to Selen Elektrik Üretim A.Ş.	License (see Annex-5in the validated PD)
13-Jul-07	EIA not Needed Certificate Issued by MoEF Karaman Province Representation	Certificate in Annex 3 of the validated PD
28-Sep-07	LSC Announced in local (Anadolu Manşet) and Regional (Türkiye Gazetesi) News Papers	News paper clips
2-Oct-07	LSC organized in Karaman	Date on nontechnical summary distributed in LSC meeting

28-Jan-08	Turnkey Engineering Procurement and Construction Contract Signed between Selen Elektrik Üretim A.S. and IC İnşaat	Agreement
6-Feb-08	Loan Agreement Signed	Agreement
18-Mar-08	Construction start Date	NHS record for the opening of the Work site
2-Apr-08	Project Owner Was Granted the Ultimate Forestry Permit to operate within the jurisdictions of the forestry authorities lands	The ultimate permit proclamation
15-Apr-08	Electromechanical equipment procurement agreement was signed between IC İnşaat (as the Turnkey EPC Contractor) and Harbin electric Co.	Agreement
1-Jun-08	Feasibility study Report Finalized	FSR Report
22-Sep-08	DSI Approval for the Feasibility Study	DSI Approval letter
23-Jan-09	Water Usage Agreement Signed between Selen and DSI	Agreement
7-Oct-09	TEIAS Connection Agreement Signed	Agreement
6-Sep-10	Government officials approved the project to be suitable to be connected to the grid	Ministry of Energy and Natural Resources approval committee report
29-Sep-10	Notice letter for readiness to Substantial Completion Sent to Selen Elektrik Üretim A.S. by IC İnşaat (EPC Contractor)	Letter sent to Selen Elektrik Üretim A.S. by IC İnşaat
30-Sep-10	Selen Elektrik Üretim A.S. accepted and issued official Substantial Acceptance Certificate	Substantial Acceptance Certificate
1-Oct-10	First Date Electricity is supplied to the grid	October 2010 PMUM Screen Printout

The Project Activity is planned as a run-of-river type which is composed of a weir, water intake structures, 3 610 m long conveyance tunnel, a head pond, penstocks and powerhouse equipped with 28.00 MWe installed capacity turbines and other facilities.

Other Project Developments at the upstream of the Project Activity

As was also explained in the DSI approved project feasibility study report, the Project Activity is a part of the Konya-Çumra 3rd Stage Irrigation Plan of DSI. At the upstream basin of the Kepezkaya HPP, a large-scale irrigation project was conducted by General Directorate of State Hydraulic Works (DSİ). Within the scope of this irrigation project at the upper elevation of 1,000 m of Göksu basin 3 dams: Namely Bağbaşı, Afşar and Bozkır dams, and 1 conveyance tunnel- Mavi tunnel, will be constructed. The stream flow of Göksu river will be regulated via these dams and will be diverted to Konya Çumra plain, which is situated in the neighboring basin (see Figure 1).

Bağbaşı dam and Bozkır dams are planned to be constructed on Göksu river; Afşar dam is planned to be constructed on one of the tributary of Göksu river. The Mavi tunnel, is planned to convey the water from Bağbaşı dam to Konya Çumra Plain. The water regulated in Afşar dam is planned to be diverted to Bağbaşı dam through a conveyance system. And Bozkır dam will be located in the upstream of Bağbaşı dam.

The third party feasibility study investigates in depth and takes into account the development of the upstream irrigation and energy projects, to determine the water flow and generation

calculations of the Kepezkaya HPP. Based on this comprehensive hydrological analysis that has been performed on the basis of the overall basin, the impact of the upstream water consumption of the irrigation project on the amount of water and hence on the generation potential available at the site of the Project Activity, was estimated. Accordingly it is revealed that the annual electricity generation of the Kepezkaya HPP and hence the emission reductions will decrease in the future depending on the development of these stages. The expected electricity generation over the 10 years crediting period was estimated to be an annual weighted average of 107,587 MWh as shown on table (Table 2) below:

Table 2: Table showing how the annual average electricity generation over the 1st crediting period is calculated.

		Upstream Development Phase			
		Phase 1	Phase 2	Phase 3	Phase 4
During the entire project life span	Number of Years	7	5	5	33
	Expected Annual Electricity Production (MWh)	124,051	107,970	81,934	81,298
During 1st Crediting Period	Production Time (years)	3	5	2	N/A
	Total Production(MWh)	372,153	539,850	163,868	N/A
	10 years Total (MWh)	1,075,871			
	Average Annual Production (MWh)	107,587			

The following figure shows the location of the Project Activity (black arrow) and its relation to other projects on Göksu River.

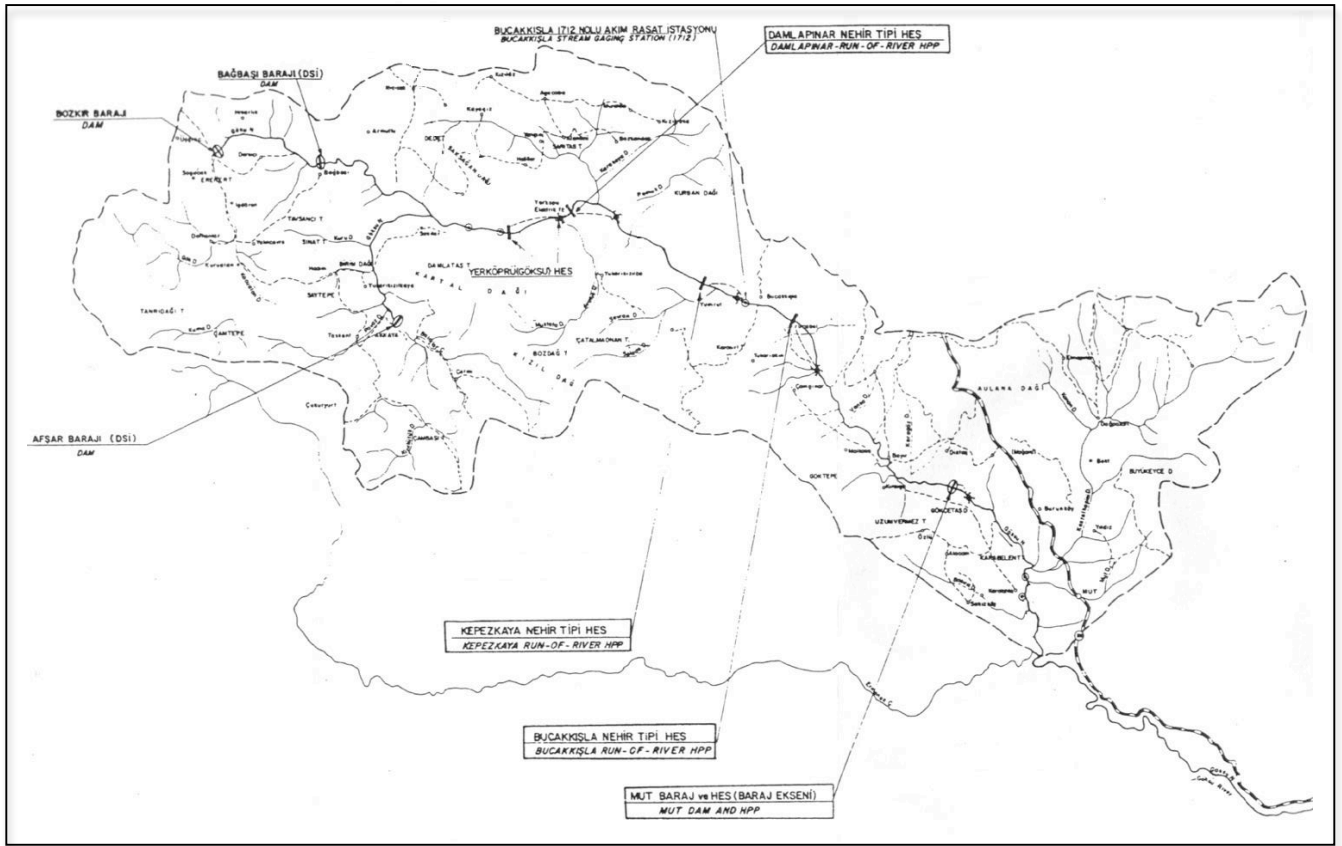


Figure 1: The location of the Project Activity (black arrow) and its relation to other projects on Göksu River. (Taken from the feasibility study report).

The Project Activity is a run-of-river type hydro power plant with a total installed capacity of 28 MW (2 x 14.00 MW). A concrete gravity weir diverts water into the conveyance tunnel with 40 m³/s flow rate capacity. A net water head of 81.57 m (gross head 87.88 m) is formed, and water is discharged into two vertical Francis turbines. A 30 km 33 kV transmission line interconnects to the national grid at the Kepezkaya Basin Transformer Substation. The following figure (Figure 2) summarizes the general layout of the project, and the next figure (Figure 3) schematically summarizes how the project activity will be operating and what needs to be considered within the physical project boundary.

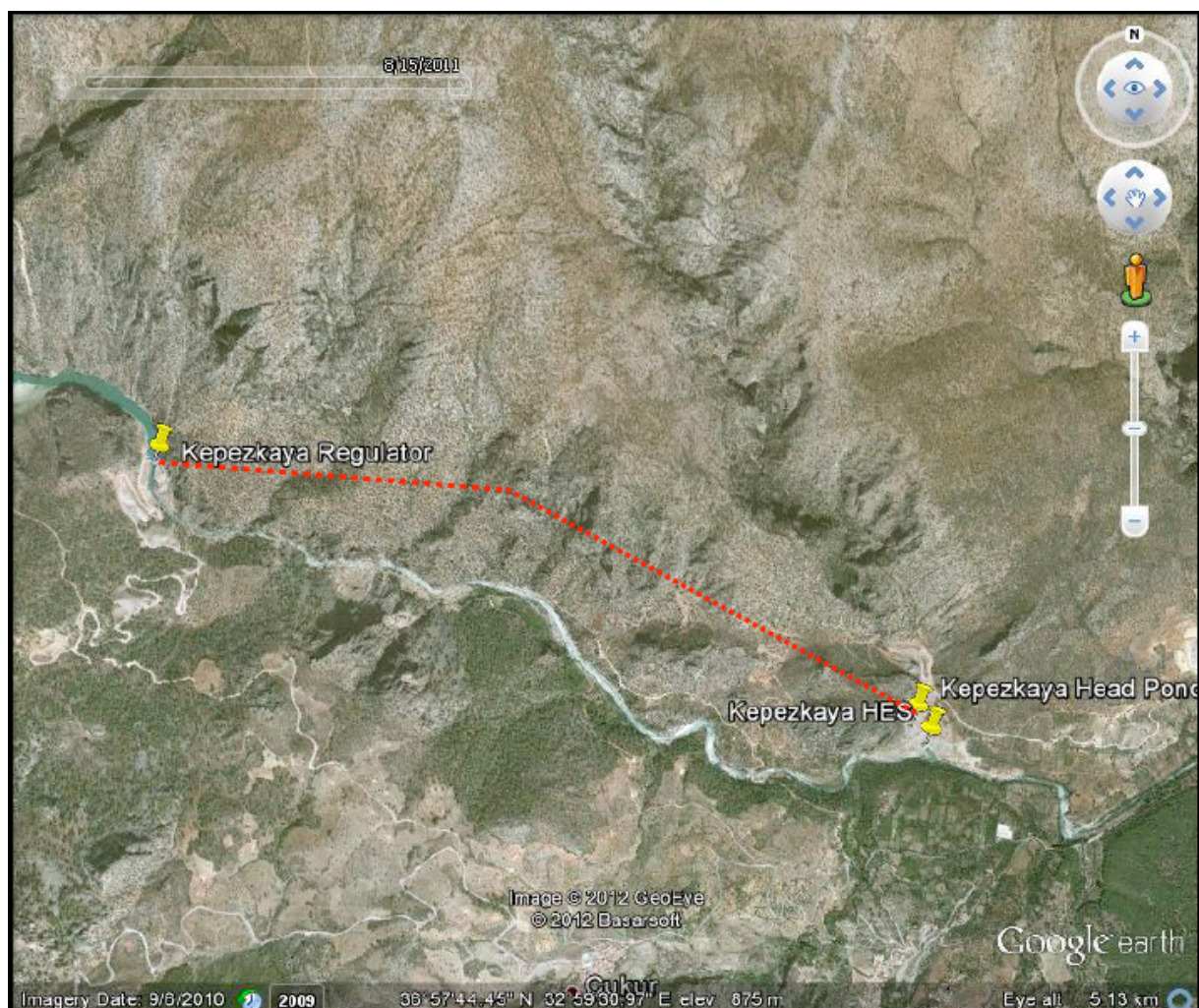


Figure 2: General Layout Plan of the Project Activity

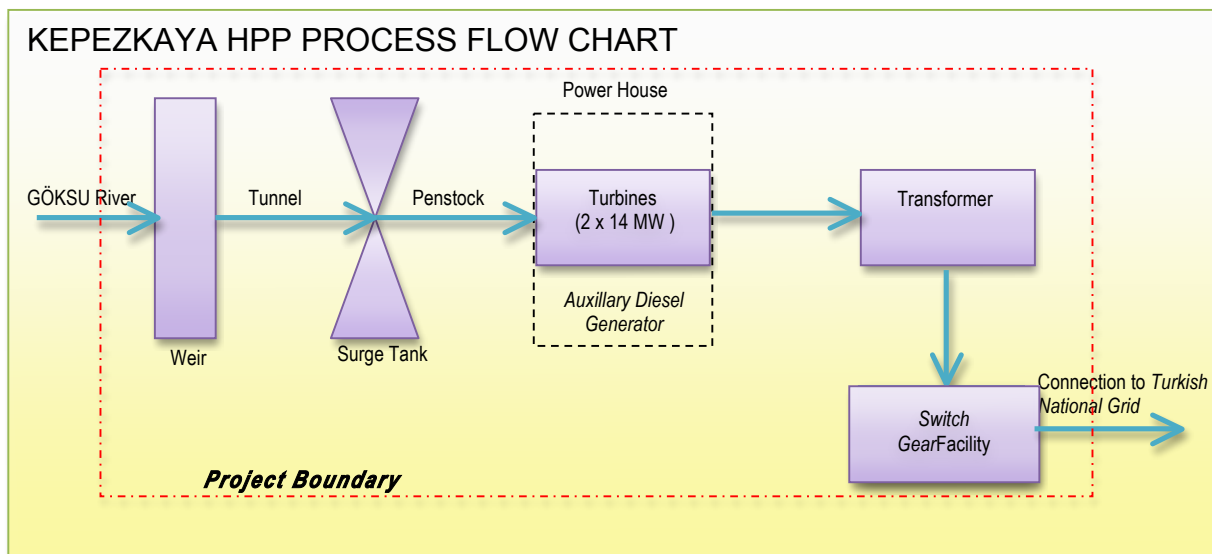


Figure 3: Flow chart showing the basic operational principles of the project activity.

1.2 Sectoral Scope and Project Type

The project category is Sectoral Scope 1: Energy industries (renewable-/non-renewable sources). The project type is grid connected electricity generation from renewable sources. The project is a non-grouped, stand-alone project.

1.3 Project Proponent

Project Proponent	Role and Responsibility	Contact Information
Selen Elektrik Üretim Anonim .Şti.	Project Owner – Implementation of the Project	Çetin Emeç Bulvarı 65. Sk. No 4 Balgat Ankara TEL: +90 312 285 8363 FAX: +90 312 285 8343

1.4 Other Entities Involved in the Project

Other Entities Involved	Role and Responsibility	Contact Information
Ekobil Environmental Services and Consulting Ltd. ¹	Preparation of the Project Description Document	Güneykent Sitesi 51. Cad. 1839 sk (OYSEKENT 116. Sk.) No: 56 Ahlatlıbel-ANKARA T:+90 312 489 13 38 E-mail:info@ekobil.com

¹Registered to the Ankara Chamber of Trade, with the full name of "Ekobil Çevre Hizmetleri Danışmanlık Eğt.Tar. Hayv. Mad. İnş. İth. İhr.Tur. ve Tic. Ltd. Şti."

1.5 Project Start Date

Project start date is: 1st of October, 2010.

1.6 Project Crediting Period

The project crediting period is 10 years: 01.10.2010 to 30.09.2020 (both dates inclusive). The crediting period is renewable twice.

1.7 Project Location

The Project Activity is located on the Göksu River in the Eastern Mediterranean region of Turkey, within the Karaman city borders. It is located between the elevations of 500 m and 410 between 32°57'15" - 33°01'25" east longitudes and 36°57'00" - 36°58'15" north latitudes (Figure 4).

The Following (Table 3) gives the coordinates of the Kepezkaya HPP weir location and Power house location.

Table 3: Coordinates of the Weir and Power house:

	Latitude	Longitude
Weir	36° 57'52.52"N	32°58'09.12"E
Powerhouse	36° 57'10.97"N	33°0'29.91"E



Figure 4: Map showing the location of Kepezkaya HEPP (black arrow within the inset map) on the Göksu River, Karaman, Turkey.

1.8 Title and Reference of Methodology

The following UNFFCC methodology and its related tools are utilised:

Approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources." Version 13.0.0.

The Approved Methodology refers to the following tools:

"Tool for the demonstration and assessment of additionality" (Version 06)

"Tool to calculate the emission factor for an electricity system". (Version 02.2.1)

"Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02).

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

- The project became operational on 1st of October, 2010.
- Since that date the operations run continuously without any interruption.

2.2 Deviations from the Monitoring Plan

Not Applicable

2.3 Grouped Project

Not Applicable

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

The following are the 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:	Official publications at the Turkish Electricity Transmission Company (TEİAŞ) Web Site (http://www.teias.gov.tr/istatistik2010/front%20page%202010-ççek%20kitap/yakıt46-49/47.xls)
Measurement procedures (if any):	-
Monitoring frequency:	Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation
Value applied:	Please see Annex 2-Table-1 in the validated PD
QA/QC Procedures	-
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.

Any comment:	Data used for the calculation of $EF_{grid,OM,Simple,y}$
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)
Measurement procedures (if any):	-
Monitoring frequency:	For Simple OM : Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation For BM: For the first crediting period, once for the ex ante and for the second and third crediting period, only once ex ante at the start of the second crediting period
Value applied:	Please see Annex-2-Table-1b in the validated PD
QA/QC Procedures	-
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.
Any comment:	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, (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf).
Measurement procedures (if any):	-
Monitoring frequency:	For Simple OM : Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation For BM: For the first crediting period, once for the ex ante and for the second and third crediting period, only once ex ante at the start of the second crediting period
QA/QC Procedures	-
Value applied:	Please see Annex 2-Table-2 in the validated PD.
Justification of choice of data or	According to the "Tool to calculate the emission factor for an

description of measurement methods and procedures applied:	electricity system" version 02.2.1 , 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.
Any comment:	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
Measurement procedures (if any):	-
Monitoring frequency:	For Simple OM : Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation For BM: For the first crediting period, once for the ex ante and for the second and third crediting period, only once ex ante at the start of the second crediting period (For BM VER projects are excluded).
QA/QC Procedures	-
Value applied:	Please see Annex 2-Table 3 and Table 4 in the validated 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.
Any comment:	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 2009 ² and 2010 ³ , and the projects that are listed in Gold Standard Registry, VCS project Database, and Blue Registry (VER+ Standard) are deducted.
Measurement procedures (if any):	-
Monitoring frequency:	For Simple OM : Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation For BM: For the first crediting period, once for the ex ante and for the second and third crediting period, only once ex ante at the start of the second crediting period

² <http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202010.pdf>
³ <http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2011.pdf>

QA/QC Procedures	-
Value applied:	Please see Annex 2-Table 8a and Table 8b in the validated 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.
Any comment:	Data used for the calculation of $EF_{grid,BM,y}$

Data / Parameter:	$\eta_{m,y}$
Data unit:	%
Description:	Specific electrical efficiency for all relevant energy sources (natural gas, lignite, coal/anthracite, fuel/motor oil).
Source of data:	1. Turkish Electricity Transmission Company (TEİAŞ), http://www.teias.gov.tr 2. European Commission Report (July 2006): Integrated Pollution Prevention and Control (IPPC) - Best Available Techniques for Large Combustion Plants. 3. German Federal Environmental Agency (UBA).
Measurement procedures (if any):	-
Monitoring frequency:	Once for the crediting period
QA/QC Procedures	N/A as the default values provided in Annex 1 are used.
Value applied:	See Table 14
Justification of choice of data or description of measurement methods and procedures applied:	As no plant specific efficiency data is available, average numbers were calculated with the help of statistical data from TEİAŞ.
Any comment:	Data used for the calculation of $EF_{grid,BM,y}$

Data / Parameter:	$NCVi,y$
Data unit:	GJ per mass or volume unit (GJ/ton)
Description:	Weighted average net calorific value of fuel type i in year y
Measured /Calculated /Default:	Default
Source of data:	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) of monitored parameter:	43.3 GJ/ton
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data will be used for Project Emission Calculations. The project emissions are those that are related to the burning of the diesel (fossil fuel) in the auxiliary power generators that produce electricity in the absence of the electricity obtained from the grid for self consumption.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Default values are used
Measuring/ Reading/ Recording frequency:	Default IPCC value is used. Any future revision of the IPCC Guidelines will be taken into account
Calculation method (if applicable):	Not Applicable as default value of the IPCC guidelines is utilized
QA/QC procedures applied:	Not Applicable as default value of the IPCC guidelines is utilized
Comments	Applicable as option B of the Methodological tool "Tool to calculate project or leakage CO2 emissions from fossil fuel"

	combustion" (Version 02) is chosen.
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3.2 Data and Parameters Monitored

The following are the data and parameters monitored subsequent to validation:

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
Measured /Calculated /Default:	Measured
Source of data:	The primary source of data is the Main TEIAS meters located at the Kepezkaya Powerhouse. The data read through these meters are recorded at the monthly reading protocols, the column related to electricity obtained from the Grid. There are two main meters, each record the generation of electricity from each line that transmit the electricity generated by each unit of generators, and there are two back-up meters, one for each of these main meters. The secondary source of data will be the PMUM/MFRC web site screen shots, the column with the heading UECM ⁴ .
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 will be used to calculate the net electricity supplied to the grid,
Frequency of monitoring/recording:	Recorded continuously, reported monthly on TEİAŞ Meter Reading Protocols, Reported annually on the VCS Monitoring Report.
Value applied:	1,078.52 MWh
Monitoring equipment:	Unit -1 Main Electricity Meter: <i>Elster A 1500:-Serial Number: 401726</i> Unit-1 Back-up Electricity Meter: <i>Elster A 1500:-Serial Number: 401725</i> Unit -2 Main Electricity Meter: <i>Elster A 1500:-Serial Number: 401723</i> Unit-2 Back-up Electricity Meter: <i>Elster A 1500:-Serial Number: 401724</i> All meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market ⁵ . They have an accuracy class of Class002 indicating an accuracy range of 0,2%.
QA/QC procedures to be applied:	Measurements are carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market. The minimum accuracy of the meters are Class02, that is to say should be within the $\pm 0.2\%$ (± 0.002) range. The monthly reported meter readings by the unit 1 main meter with serial number 401726, are cross-checked against the unit 1 back up meter that has the serial number 401725, and similarly the meter readings by the unit 2 main meter with serial number 401723, are

⁴ UECM: Uzlaştırmaya Esas Çekim Miktarı-Amount of Electricity taken from the grid based on Reconciliation.

⁵ The latest version of the communiqué (in Turkish) can be found in the following link: <http://www.epdk.gov.tr/web/elektrik-piyasasi-dairesi/44>

	cross-checked against the unit 2 back up meter that has the serial number 401724. If the reading difference is less than ± 0.002 ($\pm 0.2\%$) than the meter readings are considered to be OK, if not than the meters will be checked. The monthly reported readings are also cross checked against the monthly PMUM/MFRC screen shots. The PMUM/MFRC data of electricity sales are also the proof for quality and reliability of data.
Calculation method:	Direct continuous measurement
Any comment:	Data will be used to calculate net electricity supplied to the grid.

Data / Parameter:	EGPP-gross, y
Data unit:	MWh
Description:	Quantity of electricity produced by the power plant , in y
Measured /Calculated /Default:	Measured
Source of data:	The primary source of data is the Main TEIAS meters located at the Kepezkaya Powerhouse. The data read through these meters are recorded at the monthly reading protocols, the column related to electricity supplied to the Grid. There are two main meters, each record the generation of electricity from each line that transmit the electricity generated by each unit of generators, and there will be two back-up meters, one for each of these main meters. The secondary source of data is the PMUM/MFRC web site screen shots, the column with the heading ISVM ⁶ .
Description of measurement methods and procedures to be applied:	Measurements are made by electricity meters that belong to the grid operator TEİAŞ. Data is used to calculate the net electricity supplied to the grid,
Frequency of monitoring/recording:	Recorded continuously, reported monthly on TEİAŞ Meter Reading Protocols, Reported annually on the VCS Monitoring Report.
Value applied:	242,117.22 MWh
Monitoring equipment:	Unit -1 Main Electricity Meter: <i>Elster A 1500:-Serial Number: 401726</i> Unit-1 Back-up Electricity Meter: <i>Elster A 1500:-Serial Number: 401725</i> Unit -2 Main Electricity Meter: <i>Elster A 1500:-Serial Number: 401723</i> Unit-2 Back-up Electricity Meter: <i>Elster A 1500:-Serial Number: 401724</i> All meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market ⁷ . They have an accuracy class of Class002 indicating an accuracy range of 0,2%.
QA/QC procedures to be applied:	Measurements are carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market. The minimum accuracy of the meters are Class02, that is to say should be within the $\pm 0.2\%$ (± 0.002) range. The monthly reported meter readings by the unit 1 main meter with serial number 401726, is cross-checked against the unit 1 back up meter that has the serial number 401725, and similarly the meter readings by the unit 2 main meter with serial number

⁶ ISVM: İletim Sistemine Veriş Miktarı-Amount Supplied to the Grid

⁷ The latest version of the communiqué (in Turkish) can be found in the following link: <http://www.epdk.gov.tr/web/elektrik-piyasasi-dairesi/44>

	401723, is cross-checked against the unit 2 back up meter that has the serial number 401724. If the reading difference is less than ± 0.002 ($\pm 0.2\%$) than the meter readings are considered to be OK, if not than the meters will be checked. The monthly reported readings will also be cross checked against the monthly PMUM/MFRC screen shots. The PMUM/MFRC data of electricity sales will also be a proof for quality and reliability of data.
Calculation method:	Direct continuous measurement
Any comment:	Data will be used to calculate net electricity supplied to the grid.

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydropower plants after the implementation of the Project Activity.
Measured /Calculated /Default:	Measured
Source of data:	Project site
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 applied:	28,000,000 W
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 two units.
Calculation method:	N/A
Any comment:	-

Data / Parameter:	A_{PJ}
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.
Measured /Calculated /Default:	Indirectly measured based on depth readings from the Scada system
Source of data:	Scada System of the project
Description of measurement methods and procedures to be applied:	The reservoir area corresponding to maximum operational level has been determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings are taken and the corresponding reservoir area is determined using the same graphic, Presented in Annex 1.
Frequency of monitoring/recording:	Once during each monitoring period
Value applied:	197,724.00 m ²
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.
Calculation method:	-
Any comment:	-

3.3 Description of the Monitoring Plan

Objectives of the monitoring program

The Monitoring plan is developed to ensure that the Project Activity is well organized from the start in terms of the collection and archival of complete and reliable data that is needed to ensure reliable and accurate measurements of actual emission reductions.

Data to be monitored

Given that the emission factor is calculated on an ex-ante basis, the first data to be monitored is the electricity net supplied to the grid.

The second data to be monitored is the installed capacity of the Project Activity. Using the SCADA system installed capacity will be measured automatically.

The third data to be monitored is the reservoir area of the Project Activity. The reservoir area corresponding to maximum operational level has been determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings will be taken and the corresponding reservoir area will be determined using the same graphic, Presented in Annex 1.

Finally even if the amount of diesel consumption related emissions is expected to be lower than 1% of the total emission reductions, the amount of diesel consumed will also be monitored.

Monitoring procedures

The monitoring is conducted by the Verified Emission Reduction (VER) Monitoring Team. The VER Team Members, and their position and duties for the monitoring is outlined in the following table (Table 4):

Table 4: Positions and responsibilities of the VER monitoring team members.

Position	Responsibility
Kepezkaya HPP Manager	Day to day operation of the Kepezkaya HPP, Compliance of the project activity with the host country rules and regulations Coordination of the data collection and recording for the VCS monitoring report.
Chief Electrical Engineer	Day to day follow up of electrical equipment Recording and monitoring of the electricity generation data
Accounts Manager	Data keeping for power sales Keeping the track record of PMUM/MFRC data
Chief Mechanical Engineer	Day to day operation of the power plant Keeping records of malfunctions and repairs
Carbon Consultant	Emission reduction calculations Scripting of the periodic monitoring report Follow up of the verification process

The power generation meter readings are recorded by using the main metering devices and the back-up metering devices are used for accuracy checks only. Data from main metering devices are recorded by TEİAŞ on monthly agreed protocols and forms the basis for invoicing. In addition to the readings of the two main metering devices, generation data of the Kepezkaya HPP can be cross checked, via the TEİAŞ – PMUM web site (<http://pmum.teias.gov.tr>) which is accessible by a password available to the electricity generation companies. The monthly screen shot print outs and the relevant excel exported data sheets of the monthly PMUM data is made available to the verifying DOE during the verification process for cross checking. Electricity generation data at the Market Financial Reconciliation Centre (MFRC/PMUM) web page will exhibit the net electricity generated less transmission loss, to be able to produce comparable numbers, the figures taken from PMUM web site needs to be multiplied by the transmission loss factor of the grid.

Monitoring equipment

Electricity meters

The main and back-up electricity meters are bi-directional for quantifying the electricity delivered by the Project Activity to the grid.

The meters are in compliance with the standards of the Turkish Standards Institute and have obtained a “Type and System Approval” certificate from the Ministry of Trade and Industry. In case there are modifications to the standards, the modified standard shall be valid; and in case a valid standard is cancelled or abolished, the new standard shall be valid. The standards that are used are TS-620 EN 60044-1 and TS718 IEC60044.2 for main and back-up meters, respectively. The sensitivity of the main and back-up meters are CI = 0.2 for active and reactive energy. The

meters are factory calibrated by the manufacturer before installation. Records of the meter (type, made, model and calibration documentation) are retained in the quality control system.

Data collecting and recording

I. The net electricity generation by the project activity. Based on the baseline scenario presented above, this amount of electricity would have been produced by the Turkish National Grid.

The electricity produced is sold to TEİAŞ. Therefore, TEİAŞ measures the electricity produced by two main meters and two Back-up meters:

Meters:

A. Main Electricity Meters:

- a. Unit 1 Main Meter: ELSTER A 1500: Serial Number: 401726
- b. Unit 2 Main Meter: ELSTER A 1500: Serial Number: 401723

B. Back-up Electricity Meters:

- a. Unit 1 Back-up Meter: ELSTER A 1500: Serial Number: 401725
- b. Unit 2 Back-up Meter: ELSTER A 1500: Serial Number: 401724

These meters are placed at the Kepezkaya powerhouse where the power plant gets connected to the Turkish national grid. Those meters provide official data, which is read and recorded monthly and remotely by TEİAŞ officers for invoicing. TEİAŞ then sends the main meter readings to the “Kepezkaya HPP Manager” via monthly e-mails that contain the monthly readings as an attachment. TEİAŞ also conducts the calibration and maintenance of these meters and thus, ensures the accuracy and quality of the measurements. The quality standards that the meters need to comply is “The ICE/TSE 62053-22: Electricity metering equipment (a.c) – Particular requirements - Part 22: Static meters for active energy (Classes 0,2 S and 0,5 S)” The calibration of the meters is done and the meters will be checked continuously if there is a difference of 0.2 % in the readings of the main and the auxiliary meters, the calibration is repeated.

As mentioned above, at the end of each month, the monthly generation is downloaded remotely from the main meters by a TEİAŞ representative and mailed to the Kepezkaya HPP Manager to determine the invoiced generation amount. In case of failure of the main meter, secondary meter is used to determine the invoiced generation amount. But there was no such incidence during this monitoring period. The meter readings were remotely done by the systems that are placed by the grid operator TEİAŞ.

The net electricity produced ($EG_{PP-net, y}$) in year y is calculated by subtracting the total electricity consumed by the hydroelectric power plant ($EG_{PP-self\ consumption, y}$), from the gross electricity generation ($EG_{PP-gross, y}$). After obtaining the net electricity production value, the emission reductions is calculated by multiplying the net electricity with the Ex-ante Combined Margin Emission Factor calculated in the validated PDD's chapter 3.

Measuring Installed Capacity

By means of the SCADA system established in the plant all kinds of technical parameters related with turbines and generators including installed capacity is measured and stored in the system on

real time basis. The installed capacity of the plant is also measured from SCADA once a year while the plant is operated with full load and the related data is stored as requested by the monitoring program.

Measuring Reservoir Area

The reservoir area corresponding to maximum operational level is determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings are taken and the corresponding reservoir area is determined using the same graphic, Presented in Annex 1.

Project Emissions related to Diesel Generator usage:

The project is forced to use an auxiliary diesel generator in cases when there may be a power outage. Project owner's technicians are keeping a track record of the diesel consumed by the diesel generators located at the power house and at the weir and the hours of diesel generator usage is recorded by the generator's computers on a day-to-day basis. A picture of the total work hours of each diesel generator is made available to the validating DOE.

Data management

At the end of each month, electricity supplied to the grid is transferred to an electronic spread sheet. The data to be measured for installed capacity and reservoir area is entered into an electronic spread sheet at the end of each year. The electronic files are backed up on both hard drives and on a Compact Disc (CD).

Quality Control and Assurance (QC/QA)

All of the main and back-up meters are owned and installed by the grid operator, TEIAS. The Project Owner will sign an agreement with the grid operator to specify the QA procedure for measurement and calibration to ensure the measurement accuracy of the main and back-up meters are in compliance with national regulations. The factory sealed Calibrations of the electricity meters are valid for the next 10 years after calibration,

The grid operator's Metering Officer is notified of any failure of one of the meters. TEIAS is the only one entity, authorized to deal with fixing, calibrating, or changing the meters, which is done either by the grid operator or by a company authorized by the grid operator. The Project Owner is keeping electricity sale and purchase records, to which the recorded data can be compared.

All written documentation such as maps, drawings, the EIA and the Feasibility study, is stored and made available to the verifier so that the reliability of the information may be checked.

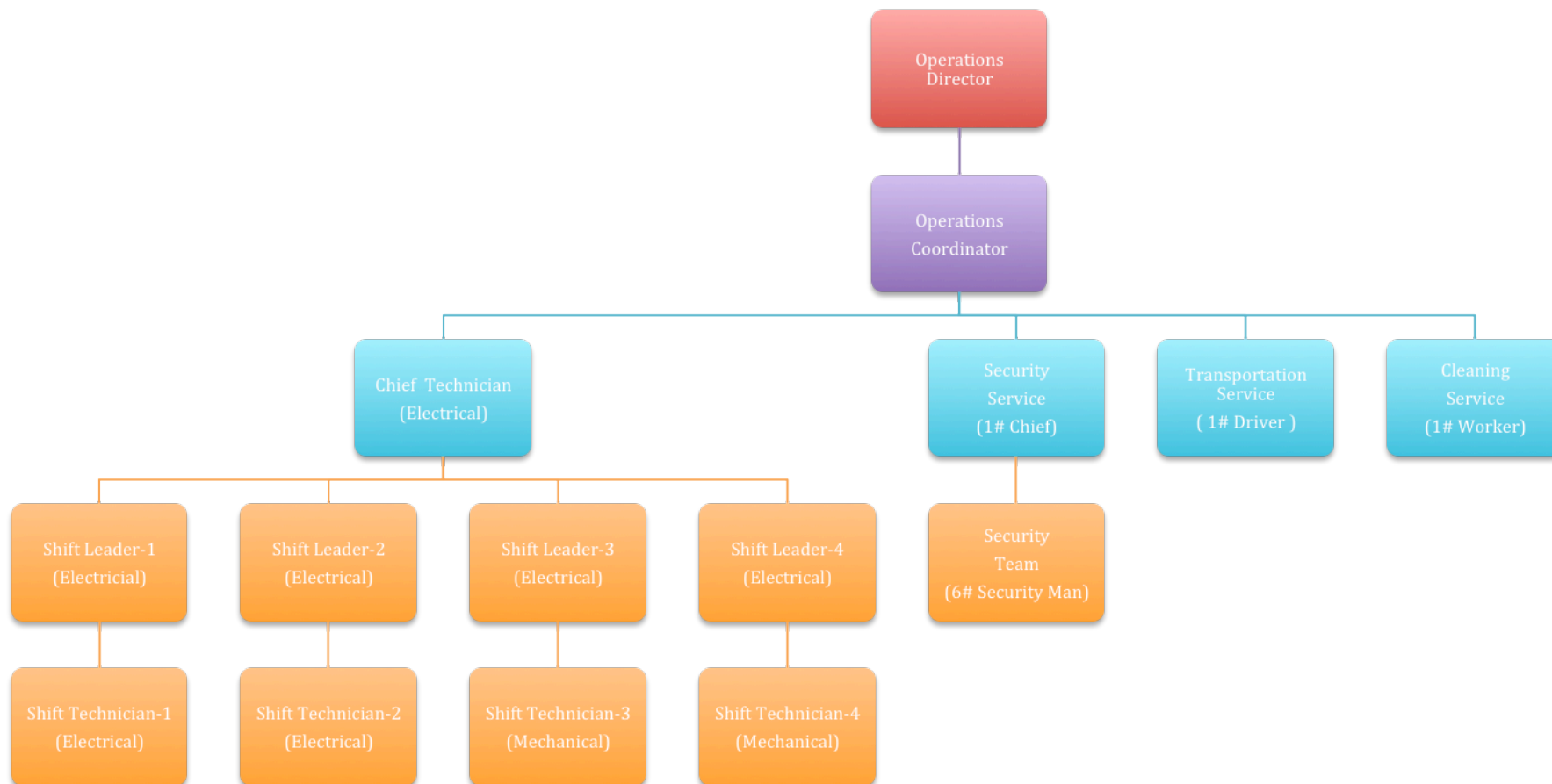
All data records are kept for at least 2 years from the last project-credited year.

Further detailed information on the monitoring procedures is presented in the following Table (Table 5), and the following table (Table 6) exhibits a typical plant operation organization chart

Table 5: Table outlining the details of the monitoring Procedures

Parameter	Monitoring location	Superintendent	Procedure (monitoring and calibration)	Data collection and archiving
EG _y	Four electricity meters (two main, one for each line, and two back up, one for each line of measurement) are installed for reading all the electricity delivered from the hydroelectric power plant to the local grid and the electricity consumed by the power plant. The main and secondary back-up meters are installed at the Kepezkaya Power House.	TEIAS inspector & Project Owner's Representative/Or remote Access by the TEIAS operator.	Continuous measuring monthly recording: On every month's last day, the production index is taken from the main as well as the back-up meter: Meter readings are carried out at 00:00 on the last day of every month by authorized representatives of TEIAS or the distribution licensee in the region where the generation facility and consumers are located. Every month the meters are read and recorded in the meter reading forms electronically. A form, which shows the measured data is then e-mailed by the Grid operator to the "Kepezkaya HPP Manager" The two meters are factory calibrated directly at the installation point by the grid company (TEIAS) supplier representative. A periodic or random examination of the calibration are held to all four of the meters, from time to time by the grid operator. Otherwise the calibration of the meters are valid for the next 10 years after calibration. The monthly meter reading are remotely arranged by the grid operator and are approved by the project owner's authorized personnel via e-mail correspondence.	The meter reading data is sent to PMUM which is "Financial Settlement Centre" a branch of system operator and is responsible for preparing the invoices reacted with market participants generation volume and the amount of electricity delivered to the system or energy purchased from the system. On the 18th of every next month, PMUM announces the settlement amount and sends invoices to the energy purchasers and take the invoices from the sellers. In reference to the checked data from the protocol and the PMUM data-base, Project Owner prepares the invoice for the generated electricity. The monthly meter reading documents are stored by Project Owner and TEIAS on electronic spreadsheets with back-up files.
Cap _{PJ}	Installed capacity of the hydropower plant after the implementation of the Project Activity.	Project Owner's Assigned Technician	Using the SCADA system installed capacity is measured automatically.	By means of the SCADA system established in the plants all kinds of technical parameters related with turbines and generators including installed capacity is measured and stored in the system on real time basis. The installed capacity of the plants is measured from SCADA once a year while the plant is operated with full load and the related data is stored as per the monitoring program.
AP _j	Area of the reservoir measured in the surface of the water, after the implementation of the Project Activity when the reservoir is full	Project Owner's Assigned Technician	The reservoir area corresponding to maximum operational level is determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings are taken and the corresponding reservoir area is determined using the same graphic, Presented in Annex 1.	The Google Earth image of the reservoir at maximum operational level will be made available to the verifying DOE as a means of secondary comparison.
FC _{j,y}	Quantity of fuel type <i>i</i> combusted in process <i>j</i> during the year <i>y</i>	Project Owner's Assigned Technician	1. The auxiliary diesel generator work hours are recorded precisely and the annual work hours are summed and conservatively round up to the nearest whole hour. 2. For the Diesel generator at power house, the total hours multiplied by the diesel fuel consumption of 56.8 L at a conservative 75% load factor, and for the diesel generator at the weir the total work hours are multiplied by 6.5 L at 100% load factor of the diesel generator at the weir, as described in the facts sheet of Diesel generators . 3. The Mass is calculated based on the following formula: • $M = d \times V$ where : • M = Mass in kg, • d = the average density of diesel fuel (0.845 kg/L) and • V is the Volume in liters •The Mass in kg is converted to Tonnes by dividing into 1000.	The Diesel generators work hours are recorded by the integrated data recorders of the generators. And the picture of the work hours is taken and recorded in the Kepezkaya HPP Manager's log files and also recorded in the relevant sheet of the excel work book that will be used to monitor all the data related to emission reduction monitoring. The excel sheet will be backed up and copied to a CD.

Table 6: Table showing a typical plant operation organization chart:



4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The baseline emissions (BE_y) are calculated based on the following formula a:

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

Where:

BE_y = Baseline emissions in year y (tCO_2/yr)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO_2 emissions factor in year y (tCO_2/MWh)

And

$$EG_{PJ,y} = EG_{facility,y}$$

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant to the grid in year y (MWh/y)

The Combined margin CO_2 emissions factor in year y (tCO_2/MWh), $EF_{grid,CM,y}$, is fixed ex-ante for the duration of the crediting period, and is $0.5711 tCO_{2e}/MWh$.

The following table shows the original data as reported in the monthly meter reading records, which are the result from a meter reading by TEIAS staff being e-mailed to Kepezkaya Operation management, at the end of each month⁸. The meter reading records serve as basis for all subsequent processes, especially settlement and billing for electricity supplied to the grid. The collected data is kept by Selen Elektrik Üretim A.Ş. during the crediting period and until two years after the last issuance of VCUs for the Kepezkaya HPP project activity for the crediting period under consideration.

The following table (Table 7) exhibits the baseline emissions for the project activity.

⁸ A sample of the e-mails have been presented to the verifying DOE.

Table 7: Baseline Emissions (01 October 2010 to 31 August 2012-Both days inclusive)

		A-Gross Electricity Production	B-Self Electricity Consumption	C-Net electricity production C=A-B	Baseline Emissions = $EG_{PP-net,y} * EF_{CM}$	National Grid Emission Factor
	Symbol	$EG_{PP-gross,y}$	$EG_{PP-self}$ consumption, y	$EG_{PP-net,y}$	BE1	EF_{CM}
YEAR	Units	MWh	MWh	MWh	tCO ₂ e	tCO ₂ e/MWh
2010	October	3,235.54	29.26	3,206.28	1,831.12	0.571103733
	November	3,748.41	31.22	3,717.20	2,122.90	
	December	7,840.56	26.50	7,814.06	4,462.64	
Total in 2010 (Between October 1st, 2010 to December 31st, 2010)					8,416	
2011	January	12,130.32	11.25	12,119.07	6,921.25	
	February	14,755.44	10.09	14,745.35	8,421.12	
	March	21,275.75	0.57	21,275.17	12,150.33	
	April	20,521.90	0.17	20,521.73	11,720.03	
	May	21,133.71	685.01	20,448.70	11,678.33	
	June	10,352.97	16.91	10,336.07	5,902.97	
	July	4,969.39	25.43	4,943.97	2,823.52	
	August	3,998.56	31.39	3,967.16	2,265.66	
	September	3,771.16	29.37	3,741.79	2,136.95	
	October	6,056.38	53.30	6,003.09	3,428.38	
	November	3,654.44	29.01	3,625.43	2,070.49	
	December	6,661.16	24.64	6,636.52	3,790.14	
Total in 2011 (Between January 1st, 2011 to December 31st, 2011)					73,309	
2012	January	11,236.59	8.03	11,228.56	6,412.67	
	February	13,274.31	7.27	13,267.04	7,576.86	
	March	18,617.50	0.82	18,616.68	10,632.05	
	April	19,497.77	0.78	19,496.99	11,134.80	
	May	20,225.33	0.01	20,225.31	11,550.75	
	June	7,530.22	17.67	7,512.55	4,290.44	
	July	4,441.12	17.36	4,423.76	2,526.42	
	August	3,188.72	22.47	3,166.243	1,808.25	
Total in 2012 (Between January 1st, 2012 to December 31st, 2012)					55,932	
GRAND TOTAL					137,657	

4.2 Project Emissions

There is no project emissions resulting from the reservoir area of the project activity as the power density of the project is greater than 10W/m². The aerial extent of the reservoir is calculated based on the Volume Area curve presented in Annex-1, during this verification period, the maximum water level was 502.98 m. This gives an aerial extend of 197,724.00 m² and with the generation capacity of 28,000,000 W, the power density of the project activity calculates as 141.61 W/m² which is greater than 10 W/m².

However, there are 2 auxiliary diesel generators in the project area that produce electricity; one for the operation of the gate over the weir, and the other one is installed in the powerhouse. These generators are logged to work for 131 hours 39 minutes and 491 hours respectively. During this monitoring period the project owner was unable to observe the exact fuel consumption, but their average measurement for the hourly fuel consumption of diesel generator

at the power house is 16 L per hour and for the diesel generator at the weir is 1.6 L per hour, and this accounts to a diesel consumption of 2898 Liters (rounded up). Converting this diesel consumption into Gigagrams, and using the formula given in the tool for the calculation of diesel consumption, the project emissions related to diesel consumption calculates to be 8 tCO₂e. However making the conservative most approach and assuming that the diesel generators have been working at 75% load at the powerhouse and 100% load at the weir, the hourly fuels consumptions can be considered as high as 56.8L per hour for the diesel generator at the power house and as high as 6.5 L for the diesel generator at the weir, and this leads to a total diesel consumption of 10689.1 L and the corresponding emission can be maximum 30 tCO₂, as shown in the table below (Table 8). This amount is still insignificant and less than 1% of the average emission reductions by the project activity, and therefore the Project Emissions is considered to be "0" (Zero).

Table 8: The Maximum estimated Diesel Consumption by the diesel generators at the Kepezkaya HPP site.

Parameter	Value			
	Powerhouse	Weir		
Location of the Generator	Powerhouse	Weir		
Brand I of the Generator	Broadcrown	NK-Power		
Model of the Generator	BCV 360-50-E2	MI-33 Isuzu	Total	Unit
Average load factor during verification period	75%	100%		
Work hours during verification Period	132	491		h
Diesel consumption per hour (75% load)	56.8	6.5		L
Total Diesel consumption during verification period	7,497.6	3,191.5	10,689.1	L
Calculating Emissions due to diesel consumption : $Pe = (FDy) \times NCV_{diesel} \times COEF_{diesel}$ Pe: Project emissions from diesel generator (tCO ₂) FDy : Annual diesel fuel consumption (Litres) NCV _{diesel} : Net Calorific Value for diesel oil (TJ/m ³) COEF _{diesel} : CO ₂ emission coefficient for diesel oil (tCO ₂ /TJ)				
Density of Fuel	0.845	0.845	0.845	kg/L
$M=dxV$	6335.472	2696.818	9032.290	kg
Fuel in Gigagrams:	0.006335472	0.002696818	0.00903229	Gg
$EF_{CO_2,i,y}$	74,800	74,800	74,800	kgCO ₂ /TJ
$NCV_{i,y}$:	43.3	43.3	43.3	TJ/Gg
$COEF_{i,y}$	3,238,840	3,238,840	3,238,840	kgCO ₂ /Gg
$PE=COEF \times Fuel \text{ in Gigagrams}$	20519.580	8734.560	29254.141	kgCO ₂
PE=	21	9	30	tCO ₂

As shown in the above table (Table 8) the project emissions related to auxiliary diesel consumption is low that it can be neglected.

4.3 Leakage

According to the ACM0002, version 13.0.0 methodology no leakage is expected, as the energy generating equipment is brand new, state of the art technology, and is not transferred from another activity. Therefore, the **leakage from the project activity is zero**.

4.4 Summary of GHG Emission Reductions and Removals

The project emissions that result from the combustion of diesel fuel in the auxiliary generators are calculated to be negligible, and the leakage equals also zero, therefore the emission reductions in 2010, 2011 and 2012 are equal to the corresponding baseline emissions.

Below table (Table 9) provides a summary of the project activity related emission reductions:

Table 9: Table showing a summary of the GHG emission reductions by the project activity.

Emission Reduction Calculations: Kepezkaya Hydroelectric Power Plant Project, Turkey

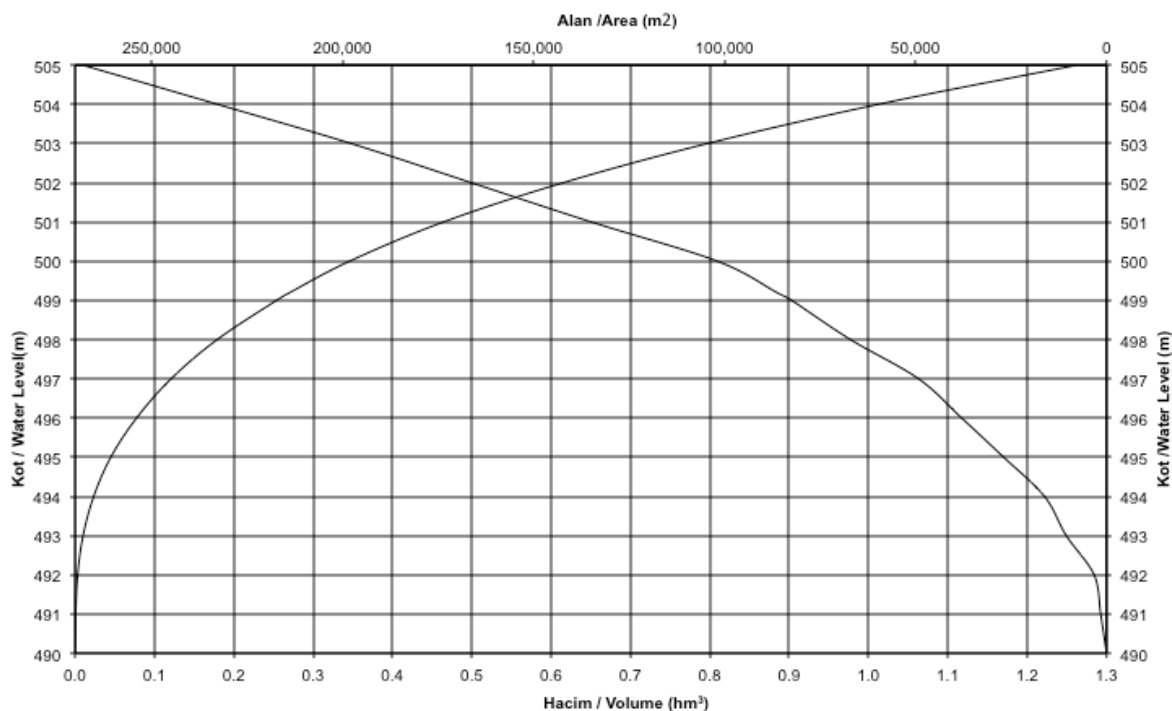
			VER01		
Data	Symbol	Units	2010	2011	2012
Net electricity generated	EG _{net,y}	MWh	14,737.53	128,364.04	97,937.13
Total Electricity Generated	TEGy	MWh	14,824.51	129,281.16	98,011.55
National Grid Emission Factor	EF _{CM}	tCO ₂ e/MWh	0.5711	0.5711	0.5711
Reservoir Emission Factor	EF _{RES}	kgCO ₂ e/MWh	0.00	0.00	0.00
Baseline Emissions	Symbol	Units	2010	2011	2012
Kepezkaya Electricity Generation = E1 * EF _{CS}	BE1	tCO ₂ e	8,416.00	73,309.00	55,932.00
Project Emissions	Symbol	Units	2010	2011	2012
PE=(EF _{res} *TEGy)/1000	PE	tCO ₂ e	0.00	0.00	0.00
PE=Diesel Generator Emission ⁹	PE	tCO ₂ e	0.00	0.00	0.00
Leakage	Symbol	Units	2010	2011	2012
N/A	LE	tCO ₂ e	0	0	0
Emission Reductions	Symbol	Units	2010 (October 1 st to December 31 st)	2011 (January 1 st to Decemeber 31 st)	2012 (January 1 st to August 31 st)
= BE1 - PE - LE	ER	tCO ₂ e	8,416.00	73,309.00	55,932.00
TOTAL ERs			137,657		

5 ADDITIONAL INFORMATION

Not Applicable

⁹ Less than 1 % of the expected annual emissions so it is neglected and considered as "0" zero.

Annex-1: Volume vs Area Curve



Volume Area Correlation curve taken from the DSI Approved Feasibility Study Report. Lower horizontal Axis (Hacim) gives the metric volume of the reservoir The Vertical Axis (Kot) gives the water level and the Upper horizontal Axis (Alan) gives the Aerial Extent of the reservoir. The Curve running from top right to bottom left gives the volumetric correlation to water level and the curve running from top left to bottom right gives the aerial correlation to water level.