ALKUMRU HYDROELECTRIC POWER PLANT PROJECT

MONITORING REPORT

Document Prepared By Ekobil Environmental Services and Consulting Ltd.

Contact Information: info@ekobil.com

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Prepared By	Ekobil Environmental Services and Consulting Ltd.
Contact	Ahlatlıbel Mahallesi, Güneykent Sitesi 1839. Sk. No 56, 06805 Ankara,Turkey. Tel:+90 312 489 1338 e-mail: info@ekobil.com

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The Alkumru Hydroelectric Power Plant (Alkumru HPP from this point onward) project is constructed at the Eastern Anatolia Geographical district of Turkey over the Botan River that is one of the major tributaries of the Tigris.

The Alkumru HPP produces electricity by utilizing the energy of the Botan river, a major tributary to the River Tigris. Energy is produced using the head difference between the 647 m maximum water level and 541.80 m tail water levels. Based on the Electricity Studies Institution's report dated 1991, the Alkumru HPP is proposed to be developed with 222 MW capacity and with an annual energy production capacity of 812.48 GWh, and after completion of the upstream Çetin and Pervari Hydroelectric Power plants the annual electricity production was envisaged to be 817.26 GWh. The initial feasibility report submitted to State Hydraulic Works (DSI) of the Republic of Turkey proposed the project to be 240 MW with an annual electricity production of 822.13 GWh. The investment decision for the project activity considers these parameters.

Later, with a minor design change the and an adjustment in the turbines the project owner revealed that with the same amount of water flow, the project capacity can be increased to 261.27 MW and the annual electricity production is calculated to be 875.84 GWh. The design change is presented to the Electricity Market Regulatory Agency and the terms of the electricity production license have been amended.

With these conditions project owner also presented a fish passage project so that the fish populations are not effected from the dam blocking the river, and it is agreed to release 14m^3/s of water at all times to the river bed to support aquatic life. However, the design of the project turbines are realized not to be suitable to release the required amount of water, therefore an other addition is made at the tail water part of the project and a new horizontal Francis turbine with 14.250 MWe capacity is added to the project. During this monitoring period, the fourth additional unit was not operational. This fourth additional turbine is expected to be operational by the beginning of year 2014[1]. This way by the third year of the project activity the electricity production is estimated to increase to 881,210 MWh, with the total project capacity of 275.520 MWe.

The Alkumru HPP has a reservoir area of 10.99 km^2 and a dam that is designed to be clay cored, sand, gravel rock filled. The project activity will be constructed between the 611.80 minimum operation elevation and 647 m maximum operation elevation. With the latest design updates the project is expected to produce an annual amount of 881,210 MWh of electricity. This accounts for 475,143 tonnes of VCUs per year.

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

[1] When The second version of the monitoring report was submited on February 17th, 2014 the fourth unit was already comissioned on January 17th, 2014. The document indicating the date of commissioning was provided to the verifying DOE.

Table 1: Major Milestones of Alkumru HPP Project

Date	Milestones	Reference
October-06	Feasibility Study Report	Feasibility Study Report
10 Sep. 2007	Water Usage Agreement signed with DSI	Water Usage Agreement
Sep. 27, 2007	Electricity Production License issued by Energy Market Regulatory Authority (EMRA) and the license modification	EMRA License
Jan., 2008	Project granted EIA Affirmative certification	EIA Affirmative certification
Aug. 15, 2008	Construction Started	Memorandum by Limak Insaat (owner: Limak Hidroelektrik / contractor: Limak Insaat)
Dec. 18, 2008	Signing of the E&M contract	The E&M contract
June 19, 2009	TEIAS system connection agreements signed	TEIAS Connection agreement
Aug. 19, 2009	The start of the construction of the TEIAS electricity transmission line	The subcontractor agreement for construction of the transmission line
April 13, 2010	EMRA Approved capacity upgrade	The updated special terms of license agreement
May 17, 2010	Water Usage Agreement Updated.	DSI agreement amendment
Dec. 14, 2010	TEIAS system agreements signed	TEIAS system usage agreement
16 Dec. 2010	Expropriation Moderation and Information Meeting 1 Held in the Project site	Summary of Expropriation by the Company Lawyers
Dec. 22, 2010	The completion of the construction of the TEIAS electricity transmission line and the preliminary acceptance by the Ministry of Energy	Substantial completion protocol- transmission line
Mar. 10, 2011	The preliminary acceptance of the Dam and the HEPP for two units and the start of the electricity generation	Alkumru Preliminary acceptance protocol for units 1 and 2
April 12, 2011	The preliminary acceptance of the Dam and the HEPP for the third unit	Alkumru Preliminary acceptance protocol for unit 3
12 May 2011	Expropriation Moderation and Information Meeting 2 Held in the Project site	Summary of Expropriation by the Company Lawyers
Oct. 1, 2012	Feasibility report finalized	FSR
Oct. 12, 2012	Ministry of Environment approved the design upgrade	Environment and Urban Planning Correspondence with Ministry of
Jan. 17, 2014	The preliminary acceptance of the Dam and the HEPP for the fourth unit (Please note that this event occurred outside the monitoring period covered by this report)	Alkumru Preliminary acceptance protocol for unit 4

The Project Activity is a hydro power plant with a total installed capacity of 261.27 MW (3 x 87.09 MW), it is expected that the capacity increases to 275.52 MWe by January 2014.

The following figure (Figure 1) schematically summarizes how the project activity will be operating and what needs to be considered within the physical project boundary.

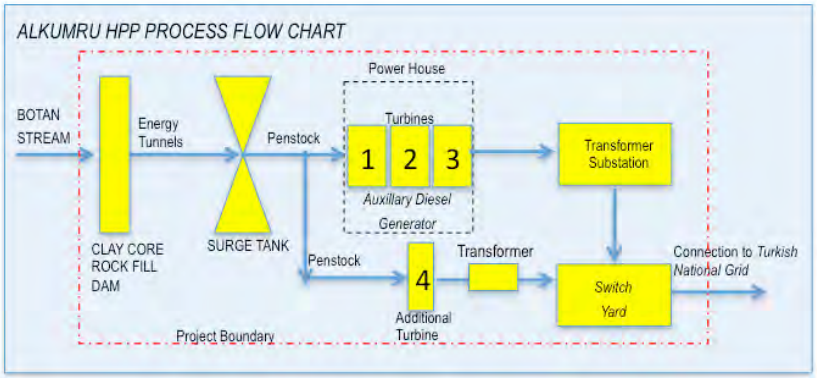


Figure 1: Flow chart showing the basic operational principles of the project activity.

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

Organization name	Limak Hidroelektrik Santral Yatırımları Anonim Şirketi
Contact person	Taner Ercömert
Title	Mr.
Address	Hafta Sokak No:9 G.O.P. Çankaya/Ankara-Turkey
Telephone	Tel: +90 312 446 88 00 and F:+90 312 437 38 46
Email	tercomert@limak.com.tr

1.4 Other Entities Involved in the Project

Organization name	Ekobil Environmental Services and Consulting Ltd.[2]
Role in the project	Preparation of the Project Description Document
Contact person	G.Aslı Sezer Özçelik
Title	Dr.
Address	Güneykent Sitesi 1839. Sk. No: 56 Ahlatlıbel-ANKARA
Telephone	+90 312 489 13 38

[2]Registered 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."

Email	info@ekobil.com

1.5 Project Start Date

Project start date is: 10-March-2011.

1.6 Project Crediting Period

The project crediting period is 10 years: 10.03.2011 to 09.03.2021 (both dates inclusive). The crediting period is renewable twice.

1.7 Project Location

The Project Activity is located on the Botan River in the Eastern Anatolia region of Turkey, within the Siirt city borders. It is located between the elevations of 647 m and 541.80 between 42°05'04''–42°05'54'' east latitudes and 37°57'0''–37°57'46'' North latitudes (Figure 2).

The Following (Table 2) gives the coordinates of the Alkumru HPP Dam location and Power house location.

Table 2: Coordinates of the Weir and Power house:

	Latitude	Longitude
Dam	37°57'36.94"N	42° 5'34.94"E
Powerhouse	37°57'25.24"N	42° 5'30.08"E

Below figure indicates the project location.



Figure 2: Map showing the location of Alkumru HPP on the Botan River, Siirt, Turkey (The project is indicated as a red balloon-http://goo.gl/maps/6sAMS).

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 06.0.0)

“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).

1.9 Other Programs

Not applicable:

- Emission Trading Programs and Other Binding Limits: The project reduces GHG emissions from activities that are not included in an emissions trading program or any other mechanism that includes GHG allowance trading, therefore the net GHG emission reductions or removals generated during this monitoring period are not to be used for compliance under such programs or mechanisms.The host country does not have binding emissions limits and the project is not elligible to produce any compliance emmmions reductions.
- Other Forms of Environmental Credit: The project has not sought or has not received another form of GHG-related environmental credit, including renewable energy certificates, during this monitoring period. Additionally, the project activity is not eligible to create another form of GHG-related environment credit.
- Participation under Other GHG Programs: The project is not registered under any other GHG programs and, the project activity does not have any GHG credits claimed under such programs.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project start date is 10 March 2011. Since that date, there is no special event that may have impact on monitoring of GHG emission reductions. The following table summarizes the project milestones:

Table 3: Significant dates for the project monitoring period:

Date	Milestone
14.12.2012	Final Validation Report
10.03.2011	Date of commissioning of the plant Unit 1 and 2 became operational
12.04.2011	Third Unit became operational
13.06.2008	Factory Calibration date of meters
19 to 22.01.2011	Test of Meters prior to project commissioning
12.06.2018	End of Calibration validity
30.11.2013	End of the first monitoring period
17.01.2014	The fourth unit became operational[3]

2.2 Deviations

2.2.1 Methodology Deviations

N/A. There is no deviations from the implemented methodology.

2.2.2 Project Description Deviations

The measurement point and mesurement descriptions of the internal consumption data ($EG_{PP\text{-}self\ consumption,\ y}$) that is used to calculate net electricity generation is deviated from the monitoring plan envisaged and presented in the validated Project Description. Details of this deviation and how the internal consumption is accounted for is explained in section 2.5 at the related parameter ($EG_{PP\text{-}self\ consumption,\ y}$) and in Appendix 2.

2.3 Grouped Project

N/A Project is not a grouped project activity.

[3] Please note that the fourth unit production is not considered during this monitoring period as it is commissioned after the end date of the first monitoring period.

2.4 Data and Parameters Available at Validation

Data / Parameter	$FC_{i,y}$
Data unit	Volume Unit (cubic meter)
Description	Amount of fuel consumed by relevant power plants in Turkey in years, 2008, 2009, 2010.
Source of data	Official publications at the Turkish Electricity Transmission Company (TEIAŞ) Web Site (http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/ istatistik2010/front%20page%202010-çiçek%20kitap/yakıt46-49/47.xls)[4]
Value applied:	Please see Annex 2-Table-1 in the validated PDD
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to date and reliable data available for the Turkish grid.
Purpose of the data	Data used for the calculation of $EF_{grid,OM,Simple,y}$
Comments	-

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/yakıt46-49/49.xls http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/yakıt46-49/47.xls)[20]
Value applied:	Please see Annex-2-Table 5 in the validated PDD.
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to date and reliable data available for the Turkish grid.
Purpose of the data	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.

[4] If the provided link does not work please try the following link and look for the tittle and number of the excel sheet referred in the reference. “http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2010/İstatistik%202010.htm”

Comments	-

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).
Value applied:	Please see Annex 2-Table-2 in the validated PDD.
Justification of choice of data or description of measurement methods and procedures applied	According to the "Tool to calculate the emission factor for an electricity system" version 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.
Purpose of the data	Data used both for the calculation of $EF_{grid,OM,Simple,y}$ and $EF_{EL,m,y}$
Comments	

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[5]
Value applied:	Please see Annex 2-Table 3 and Table 4, in the validated PDD.
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to-date and reliable data available for the Turkish grid.
Purpose of the data	Data used for the calculation of $EF_{grid,OM,Simple,y}$
Comments	-

Data / Parameter	$EG_{m,y}$
Data unit	MWh

[5] If the provided link does not work please try the following link and look for the tittle and number of the excel sheet referred in the reference. "http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2010/İstatistik%202010.htm"

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[6] and 2010[7], and the projects that are listed in Gold Standard Registry, VCS project Database, and Blue Registry (VER+ Standard) are deducted.
Value applied:	Please see Annex 2-Table 8a and Table 8b, in the validated PDD.
Justification of choice of data or description of measurement methods and procedures applied	Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to-date and reliable data available for the Turkish grid.
Purpose of the data	Data used for the calculation of $EF_{grid,BM,y}$
Comments	-

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	Default values provided at the Annex 2 of the "Tool to calculate the emission factor for an electricity system" version 02.2.1
Value applied:	See Table 14, in the validated PDD.
Justification of choice of data or description of measurement methods and procedures applied	There is no up to date country specific data, and this is the most conservative approach.
Purpose of the data	Data used for the calculation of EFgrid,BM,y
Comments	-

2.5 Data and Parameters Monitored

Data / Parameter	$EG_{PP\text{-self consumption, y}}$
Data unit	MWh
Description	Quantity of electricity imported by the power plant from the Grid for self consumption, in year y
Source of data	Please see Appendix 2 for a detailed explanation of the source of the data.
Description of measurement methods and procedures to be	Please see Appendix 2 for a detailed explanation of the measurement process.

[6] http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202010.pdf
[7] http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2011.pdf

applied	
Frequency of monitoring/recording	For all the meters involved, measurement is made continuous and recording is made monthly.
Value monitored:	2,723.39
Monitoring equipment	All meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market[8]. They have an accuracy class of Class002 indicating an accuracy range of 0,2%.
QA/QC procedures to be applied	Measurements to be carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market.
Purpose of the data	Data to be used to calculate net electricity supplied to the grid. The internal consumption will be recorded this way until the commissioning of the 4th turbine that will be constructed to utilize the energy of the water discharged to support life in the river. As soon as the construction site will be removed the internal consumption will be recorded by the 4th unit's electricity meters that also measure the electricity export.
Calculation method	N/A
Comments	Please see Appendix-2 for the details of how the data is obtained.

Data / Parameter	$EG_{PP\text{-}gross,\ y}$
Data unit	MWh
Description	Quantity of electricity produced by the power plant , in y
Source of data	The primary source of data is the Main TEIAS meters located at the Alkumru Powerhouse. The data read trough these meters are recorded at the monthly reading protocols, the column related to electricity supplied to the Grid. There are three 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 three back-up meters, for each one of these main meters. The secondary source of data will be the PMUM/MFRC web site screen shots, the column with the heading ISVM[9].
Description of measurement methods and procedures to be applied	Measurements are to be made by electricity meters. That belong to the grid operator TEIAŞ. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid,

[8] 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
[9] ISVM: İletim Sistemine Veriş Miktarı-Amount Supplied to the Grid

<table>
<tr><td>Frequency of monitoring/recording</td><td>Recorded continuously, reported monthly on TEIAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.</td></tr>
<tr><td>Value monitored:</td><td>2,175,521.66</td></tr>
<tr><td>Monitoring equipment</td><td>All Meters are be Elster 1500, and their corresponding serial numbers are as tabulated below:
<table>
<tr><td></td><td>Unit 1</td><td>Unit 2</td><td>Unit 3</td></tr>
<tr><td>Main Meter Serial No:</td><td>00419607</td><td>00419609</td><td>00419611</td></tr>
<tr><td>Back Up Serial No:</td><td>00419608</td><td>00419610</td><td>00419612</td></tr>
</table>
All meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market[10]. They have an accuracy class of Class002 indicating an accuracy range of 0,2%.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>Measurements will be 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 ±0.2% (±0.002) range. The monthly reported readings are cross checked against the monthly PMUM/MFRC screen shots, to exhibit the quality and reliability of data.</td></tr>
<tr><td>Purpose of the data</td><td>Data is used to calculate net electricity supplied to the grid.</td></tr>
<tr><td>Calculation method</td><td>Direct, continuous measurement</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data / Parameter	**Cap_{PJ}**
Data unit	W
Description	Installed capacity of the hydropower plant after the implementation of the Project Activity.
Source of data	Scada system or name plate of each generator unit
Description of measurement methods and procedures to be applied	Observed via the SCADA system of the Project Activity
Frequency of monitoring/recording	Once for each monitoring period
Value monitored:	261,270,000
Monitoring equipment	SCADA system of the Project Activity
QA/QC procedures to be applied	Can be confirmed also by the parameter readings on the design plates of each turbine and by summing the four[11] units.
Purpose of the data	To calculate power density

[10] 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

[11] For this monitoring period by summing up the three operational units. Please note that fourth unit will be operational during the next monitoring period.

Calculation method	N/A
Comments	-

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.
Source of data	Indirectly measured based on depth readings from the SCADA system
Description of measurement methods and procedures to be applied	SCADA System of the project
Frequency of monitoring/recording	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.
Value monitored:	11,530,000
Monitoring equipment	SCADA system water level readings
QA/QC procedures to be applied	Can be checked and compared to satellite imagery available by Google Earth.
Purpose of the data	Power density calculation
Calculation method	Obtained by checking the corresponding depth from the graph provided in Annex-1.
Comments	-

2.6 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. This parameter is obtained indirectly as a subtraction of electricity imported from electricity exported 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.

Monitoring procedures

The monitoring will be 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
Alkumru HPP Manager	Day to day operation of the Alkumru 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 performed by using the main metering devices and the back-up metering devices that are used for accuracy checks only. Data from metering devices will be recorded by TEİAŞ on monthly agreed protocols and will form the basis for invoicing. In addition to the readings of the three metering devices, generation data of the Alkumru 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 of the PMUM data will be 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.

The measurement point and mesurement descriptions of the internal consumption data ($EG_{PP\text{-}self\ consumption,\ y}$) that is used to calculate net electricity generation is deviated from the monitoring plan envisaged and presented in the validated Project Description. Details of this deviation and how the internal consumption is accounted for is explained in section 2.5 at the related parameter ($EG_{PP\text{-}self\ consumption,\ y}$) and in Appendix 2.

The internal consumption will be recorded this way until the commissioning of the 4th turbine that will be constructed to utilize the energy of the water discharged to support life in the river. As soon as the construction site will be removed the internal consumption will be recorded by two of the meters that measure the electricity export.

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 will 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 will be used are TS-620 EN 60044-1 and TS718 IEC60044.2 for main and back-up meters, respectively. The sensitivity of the main and secondary meters are CI = 0.2 for active and reactive energy. The meters shall be factory calibrated by the manufacturer before installation. Records of the meter (type, made, model and calibration documentation) will be 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 will be sold to TEİAŞ. Therefore, TEİAŞ measures the electricity produced by three main meters and three Back-up meters:

Meters:

A. Main Electricity Meters:
    a. Unit 1 Main Meter: ELSTER A 1500: Serial Number: 00419607
    b. Unit 2 Main Meter: ELSTER A 1500: Serial Number: 00419609
    c. Unit 3 Main Meter: ELSTER A 1500: Serial Number: 00419611

B. Back-up Electricity Meters:
    a. Unit 1 Back-up Meter: ELSTER A 1500: Serial Number: 00419608
    b. Unit 2 Back-up Meter: ELSTER A 1500: Serial Number: 00419610
    c. Unit 3 Back-up Meter: ELSTER A 1500: Serial Number: 00419612

These meters are placed at the Alkumru powerhouse where the power plant gets connected to the Turkish national grid. Those meters provide official data, which are read and recorded monthly by TEİAŞ officers for invoicing. 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.

At the end of each month, the monthly generation is read remotely and e-mailed to the project owner. In case of failure of the main meter, the control meter is used to determine the invoiced generation amount. These readings can be on site as well as remotely by the systems that will be put in place by the grid operator TEIAS.

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

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 will be measured and stored in the system on real time basis. The installed capacity of the plant will be measured from SCADA once a year while the plant is operated with full load and the related data will be stored as per the monitoring program.

Measuring Reservoir Area

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.

Data management

At the end of each month, electricity supplied to the grid will be entered into an electronic spread sheet. The data to be measured for installed capacity and reservoir area will be entered into an electronic spread sheet at the end of each year. The electronic files will be 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 Calibrations of the electricity meters are valid for the next 10 years after calibration,

The grid operator's Metering Officer should be 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 will be done either by the grid operator or by a company authorized by the grid operator. The Project Owner will keep electricity sale and purchase records, to which the recorded data will be compared.

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

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

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 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 0.53985 tCO_{2e}/MWh.

The following table shows the original data as reported in the monthly meter reading records, which are the result from remote meter readings sent by TEIAS staff being e-mailed to Alkumru Operation management, at the end of each month. The meter reading records serve as basis for all sub-sequent processes, especially settlement and billing for electricity supplied to the grid. The collected data is kept by Limak Hidroelektrik Santral Yatırımları A. Ş. during the crediting period and until two years after the last issuance of VCUs for the Alkumru HPP project activity for the crediting period under consideration. The following table (table 5) is the Baseline emissions of the project calculated for the monitoring period (10 March 2011 to 30 November 2013 –both days inclusive).

Table 5: The monthly baseline emissions of the project for the monitoring period.

		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_2e	tCO_2e/MWh
2011	**March**	27,259.16	233.94	27,025.21	14,589.56	0.53985
	April	133,283.60	119.82	133,163.78	71,888.47	
	May	176,444.07	85.70	176,358.37	95,207.07	
	June	125,280.29	94.57	125,185.73	67,581.51	
	July	66,608.73	228.39	66,380.34	35,835.43	
	August	30,136.35	196.81	29,939.54	16,162.86	
	September	29,856.35	199.96	29,656.40	16,010.00	
	October	35,119.76	186.19	34,933.57	18,858.89	
	November	33,876.13	231.51	33,644.63	18,163.05	
	December	7,887.02	333.13	7,553.89	4,077.97	
Total in 2011 (10 March 2011 to 31 December 2011)						358,374.00
2012	**January**	28,441.52	92.01	28,349.52	15,304.49	
	February	36,793.10	38.61	36,754.49	19,841.91	
	March	36,198.04	48.65	36,149.39	19,515.25	
	April	137,197.20	5.75	137,191.45	74,062.80	
	May	180,011.26	2.53	180,008.73	97,177.71	
	June	86,154.98	25.82	86,129.16	46,496.83	
	July	48,338.49	43.31	48,295.18	26,072.15	
	August	34,924.81	33.65	34,891.16	18,835.99	
	September	25,449.36	49.18	25,400.18	13,712.29	
	October	16,088.95	45.17	16,043.79	8,661.24	
	November	39,808.63	40.31	39,768.32	21,468.93	
	December	18,269.17	53.81	18,215.36	9,833.56	
Total in 2012 (01 January 2012 to 31 December 2012)						370,983.00
2013	January	32,258.63	76.49	32,182.14	17,373.53	
	February	52,836.88	42.06	52,794.82	28,501.28	
	March	95,128.45	9.92	95,118.53	51,349.74	
	April	166,444.12	0.46	166,443.66	89,854.61	
	May	183,212.28	1.79	183,210.49	98,906.18	
	June	124,826.13	14.28	124,811.85	67,379.68	
	July	83,428.18	19.14	83,409.03	45,028.36	
	August	32,049.25	32.10	32,017.15	17,284.46	
	September	25,903.92	45.57	25,858.36	13,959.63	
	October	1,023.05	55.07	967.98	522.57	
	November	24,983.81	37.71	24,946.10	13,467.15	
Total in 2013 (01 January 2013 to 30 Nov 2013)						443,627.00
GRAND TOTAL						1,172,984.00

3.2 Project Emissions

As the methodology states the PEy in case of a hydro power project can be calculated:

"Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoir, estimated as follows:"

"...the power density of the project activity (PD) is greater than 4 W/m^2 and less than or equal to 10 W/m^2:"

During this monitoring period the maximum lake level is observed to be 647.5 m, rounding up this value gives a maximum water level of 650 m at this level reservoir lake covers an aerial extent of 11,530,000 m^2. The project capacity during the monitoring period was 261,270,000 W therefore the power density of the project calculates as (261,270,000/11,530,000=22.66 W/m^2) which is >10 W/m^2 therefore:

$$PE_{HP,y} = 0$$

Where:

$PE_{HP,y}$	Project emissions from water reservoirs (tCO_2e/yr)

Although there will be auxiliary diesel generators installed within the project boundary, the emissions from these have been deemed negligible as per the ACM0002 (version 13.0.0) methodology.

3.3 Leakage

There are no leakage emissions related to project activity.

3.4 Net GHG Emission Reductions and Removals

Below table (Table 6) provides a summary of the project activity related emission reductions :

Table 6: Net GHG Reduction Summary

Emission Reduction Calculations
Alkumru Hydroelectric Power Plant Project

			VER01		
Data	***Symbol***	***Units***	**2011**	**2012**	**2013**
Net electricity generated	$EG_{net,y}$	MWh	663,841.45	687,196.72	821,760.10
National Grid Emission Factor	EF_{CM}	tCO_2e/MWh	0.5399	0.5399	0.5399
Reservoir Emission Factor	EF_{RES}	$kgCO_2e/MWh$	N/A	N/A	N/A

Baseline Emissions	***Symbol***	***Units***	**2011**	**2012**	**2013**
Alkumru Electricity Generation = E1 * EF_{CS}	BE1	tCO_2e	358,374.81	370,983.15	443,627.19

Project Emissions	***Symbol***	***Units***	**2011**	**2012**	**2013**
PE=(EF_{res}*TEGy)/1000	PE	tCO_2e	0.00	0.00	0.00

Leakage	***Symbol***	***Units***	**2011**	**2012**	**2013**
N/A	LE	tCO_2e	0	0	0

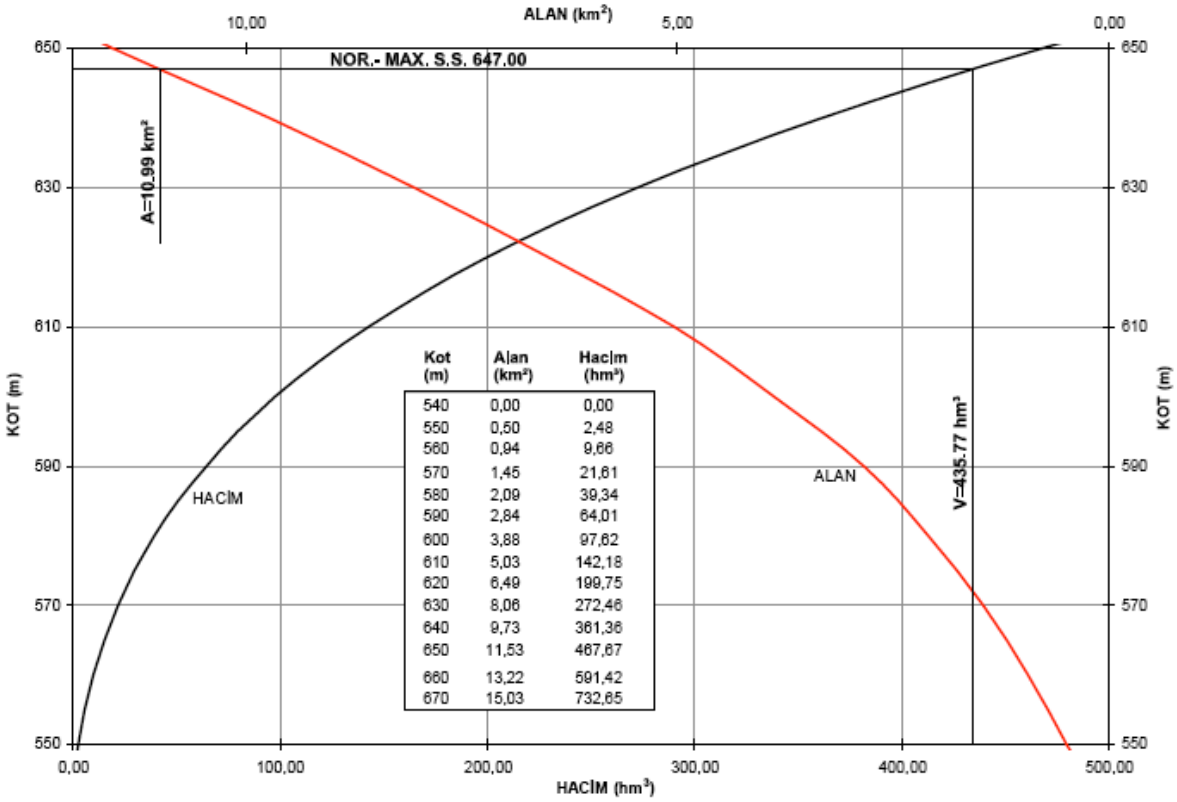
Emission Reductions	***Symbol***	***Units***	**2011**	**2012**	**2013**
= BE1 - PE - LE	ER	tCO_2e	**358,374.00**	**370,983.00**	**443,627.00**

TOTAL ERs	1,172,984

The following table (Table 7) gives a summary of the project activity related emission reductions with respect to vintage years:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2011 (March 10th to December 31st)	358,374.00	0	0	358,374.00
2012 (January 1st to December 31st)	370,983.00	0	0	370,983.00
2013 (January 1st to November 30th)	443,627.00	0	0	443,627.00
Total	1,172,986	0	0	1,172,984

APPENDIX 1: VOLUME VS AREA CURVE



Kot (m)	Alan (km²)	Hacim (hm³)
540	0,00	0,00
550	0,50	2,48
560	0,94	9,66
570	1,45	21,61
580	2,09	39,34
590	2,84	64,01
600	3,88	97,62
610	5,03	142,18
620	6,49	199,75
630	8,06	272,46
640	9,73	361,36
650	11,53	467,67
660	13,22	591,42
670	15,03	732,65

This curve is taken from the uptodate feasibility report prepared by SuYapı Ltd. It is given as Figure 4.6.1 in the fourth chapter of the report.

It is a correlation curve between water depth, reservoir volume and reservoir area.

The aereal extend that corresponds to the maximum operation level of 647 m is 10.99 km^2.
During this monitoring period the maximum water level recorded was 647.07 m. Rounding that value up to 650 m yields a reservoir area of 11,530,000 m^2.
Therefore the power density calculates as follows:

Power Density Calculation:		
Parameter	**Value**	**Unit**
Capacity During Monitoring Period:	261,270,000	W
Maximum Lake Area:	11,530,000	m^2
Power Density (=261,270,000/11,530,000)	22.66	W/m^2

Since Power Density (22.66 W/m^2) is greater than 10 Project Emissions are zero (0)

APPENDIX 2: INTERNAL CONSUMPTION

The internal consumption of the project activity comprises of the electricity used for the running up of the computers, automatisation systems, internal and external lightings, and electricity used to pump water to the fish passage. In case of the project activity, during the construction process of the fourth unit the internal consumption was obtained from two different major sources, depending on the operational status of the turbines.

1. When the Turbines were operational the internal consumption was obtained via Turbine Unit 1 and Turbine Unit 3, and this consumption was recorded via bi-directional meters.

2. When the turbines were not operational the electricity for the internal consumption needs were obtained by the electricity obtained via the mid voltage (33KVa) distribution grid. This consumption is recorded by the TEDAŞ meter that produces invoices, but these invoices also include the electricity consumed by the construction work site camp. The schematic representation of how internal consumption is measured is shown in the following figure (Figure3):

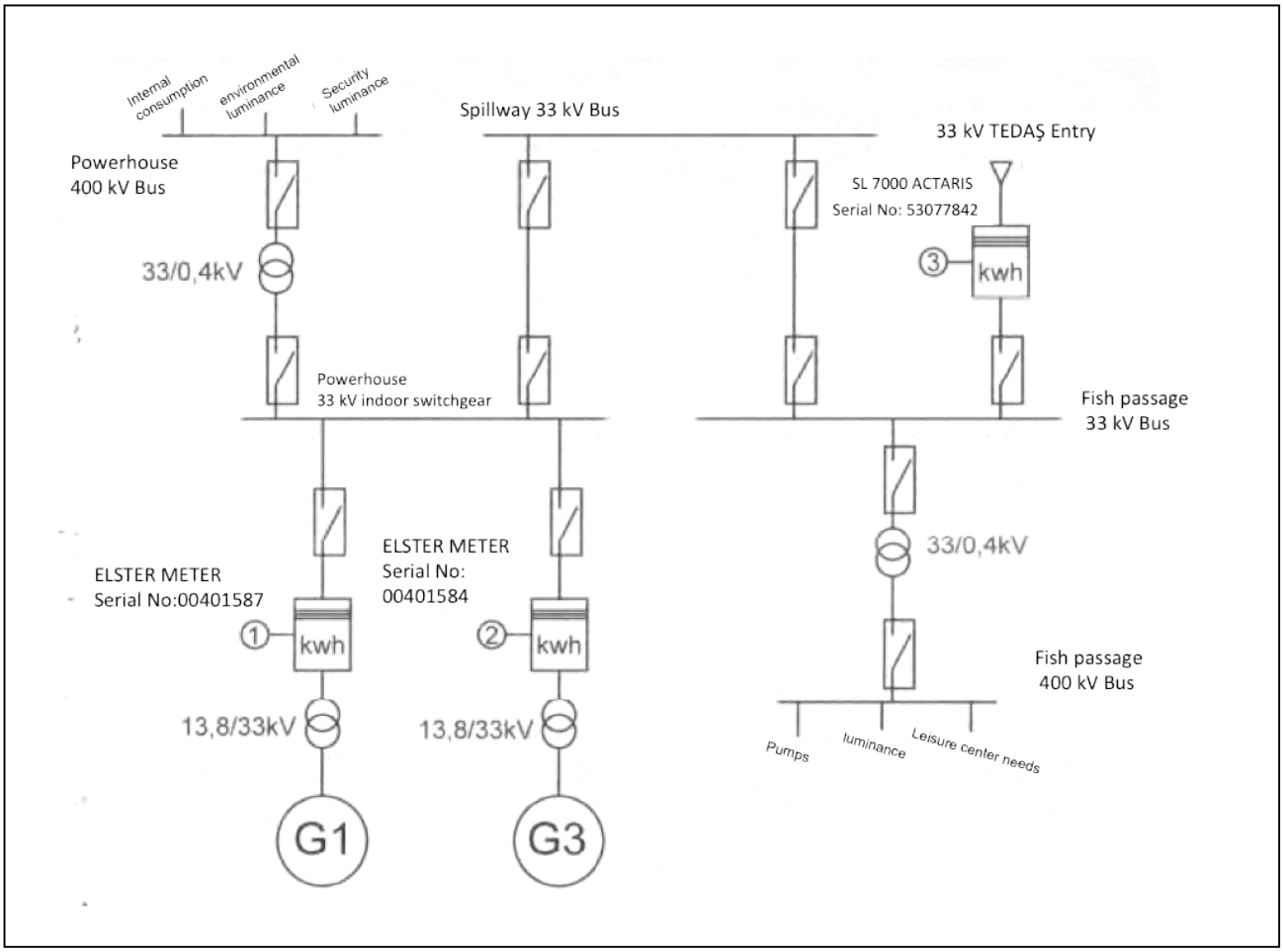


Figure 3: Schematic represenation of the points where internal consumption is measured.

Therefore, another meter, that is located at the fish passage location, that belongs to the project owner records the electricity consumed by the project activity when it is not operational. Information about this meter and the meter that is installed as a back-up/control meter can be found below (Table 7 and Figure 4):

Table 7: Information about the meters that measures internal consumption when the power plant is not operational.

	Main Meter	**Control Meter**
Brand:	Actaris SL7000	Actaris SL7000
Serial Number:	53077842	53077843

Main Meter	**Control Meter**
	

Figure 4: The pictures of the meters that measures internal consumption when the power plant is not operational.

Monitoring of the internal consumption for the vintage year 2011:

The project was commissioned on March 10th, 2011. From this date until January 1st, 2012, the meter readings from the "fish passage meter" have been observed to be faulty, therefore to be conservative for the time span between 10/03/2011 to 31/12/2011 (both days inclusive) we have utilized the TEDAŞ meter recorded electricity consumption values. This approach is a conservative approach as the TEDAŞ meter measures not only the electricity consumed by Alkumru HPP, but also the electricity consumed at the construction base camp, a facility beyond the project boundary.