CEVİZLİK RUN-OF-RIVER HYDROELECTRIC POWER PLANT

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"A company of SANKO ENERJI

Project Title	Cevizlik Run of River Hydroelectric Powerplant
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Monitoring Period	29 May 2010 – 30 Jun 2011
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1 PROJECT DETAILS

1.1 Summary Description of Project

The project is located in the Eastern Blacksea Region of Turkey, within the province of Rize province. The project is on the İyidere river. Akım Enerji Üretim Sanayi ve Ticaret A.Ş. (hereafter, Akım Enerji) is in the phase of installing run of river hydropower plant near İyidere river in Rize province, Turkey. The project aims the installation of a 92,96 MW run of river hydropower electricity plant (HEPP) in Rize province, Turkey. The objective of the project is to generate electricity and supply it into the public grid.

The main purpose of the project is to generate approximately 335,03 GWh/year of electricity to supply the national grid using a renewable resource and tapping the significant hydropower potential in the region. The project activity reduces greenhouse gases (GHGs) emissions that would have otherwise occurred in the absence of the project activity by avoiding electricity generation from fossil fuel sources.

The project is located in the Eastern Blacksea Region of Turkey, within the province of Rize province. The project is on the İyidere river. The altitude at the location is 235 m. As the project activity is a Greenfield project, the conditions prior to the project initiation is the continuation of the current situation, i.e. the equivalent amount of energy would have been produced by other grid-connected units, which are mainly thermal power plants, undertaking business as usual maintenance.

The theoretical annual average energy production of the facility is based on the waterflow data which was collected by “General Directorate of State Hydraulic Works” of Turkey which is the primary executive state agency of Turkey for national overall water resources planning, managing, execution and operation. The annual average electricity production figure is based on the theoretical annual production figures with historical annual water flows.

The project was started the construction on 2 January 2008, the turbine started the commissioning 29 May 2010. This monitoring period is from 29 May 2010 to 30 June 2011. The total emission reduction of first monitoring period is 199.710,84 tCO2e.

1.2 Sectoral Scope and Project Type

The project comes under sectoral scope 1, energy Industries renewable resources.

Project Category: Renewable electricity in grid connected applications.

1.3 Project Proponent

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1.4 Other Entities Involved in the Project

No other entities.

1.5 Project Start Date

The project started commissioning on 29 May 2010, and construction started on 2 January 2008.

1.6 Project Crediting Period

The project crediting period is from 29 May 2010 to 28 May 2020.

1.7 Project Location

The project is located in the Eastern Blacksea Region of Turkey, within the province of Rize province. The project is on the İyidere river. The project's geographical location is 40º 50´ 37´´ - 40º 50´ 38´´ North, and 40º 28´ 29´´ - 40º 28´ 31´´ East.

1.8 Title and Reference of Methodology

Approved consolidated baseline and monitoring methodology ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources, Version 10"[1] was applied. In addition, as referred in the methodology, "Tool to calculate the emission factor for an electricity system, Version 01.1."[2] was applied.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project was started construction on 02.02.2008. The first unit started to commissioning on 28 May 2010. The electric generated to TEIAS according to signed agreement with Akım Enerji.

Power plant operates normally during this monitoring period. There have been no emergencies happened to the monitoring system in this monitoring period.

2.2 Deviations from the Monitoring Plan

N/A

2.3 Grouped Project

N/A

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1 http://cdm.unfccc.int/filestorage/N/F/9/NF9EDAOV5K382HW0JR14GS7XYQUMCP/EB47_repan07_ACM0002_ver10.pdf?t=Y3l8bHoyZmlifDCxxFMjAiWSFl_JzwXFbAXI

2 http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	$EF_{grid,Cmy}$
Data unit:	tCO_2e/MWh
Description:	Baseline emission factor: the combined emission factor of the project grid system." Tool to calculate the emission factor for an electricity system"
Source of data:	Source from the registered PDD for the Project.
Value applied:	0.559
Purpose of the data:	Used for baseline emission calculation.
Any comment:	

3.2 Data and Parameters Monitored

Data Unit / Parameter:	EG
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data:	Meter reading record of onsite main meters.
Description of measurement methods and procedures to be applied:	Two sets of meters measuring continuously then calculate the net electricity generation supplied by the project to grid.
Frequency of monitoring/recording:	Measuring continuously/ recording monthly
Value monitored:	Electricity generation figure is 168,424 MWh for 2010 and 188,839 MWh for 2011
Monitoring equipment:	The meters are owned by Actaris has calibrated the meters in the year 2010. The model of the meters is Actaris SL761A and the serial numbers of the main meters (53035222 & 53035223) and control (check) meters (53035224 & 53035225) are respectively. The meters are firsthand and the supplier company commits that these meters fully conforms or exceeds all relevant IEC standards including those dealing with electronic metering equipment IEC61036 for class 1 equipment and IEC60687 for class 0.2S equipment. There is no possibility for human error in the measurement of the electricity. All the measurements and calculations are done via tested meters.
QA/QC procedures to be applied:	As per "tool calculate the emission factor for an

	electricity system"
Calculation method:	$EG_{fac,y} = EG_{export,y} - EG_{import,y}$
Any comment:	-

Data Unit / Parameter:	Cap_{PJ}
Data unit:	MW
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data:	Project site
Description of measurement methods and procedures to be applied:	The installed capacity will be determined based on recognized standards.
Frequency of monitoring/recording:	Yearly
Value monitored:	92.96
Monitoring equipment:	The data is monitored from the electricity generation license which was granted by Energy Market Regulatory Authority. The company has not made any change on the project design up to know and therefore, there is no increase or decrease in the installed capacity of the power plant.
QA/QC procedures to be applied:	-
Calculation method:	The installed capacity figure is 51,21 MW for each of the turbines. The total installed capacity of the project is 92,96 MW.
Any comment:	-

Data Unit / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the regulation pond measured in the surface of the water, after the implementation of the project activity. when is full
Source of data:	Project site
Description of measurement methods and procedures to be applied:	Measured from topographical surveys, maps, satellite pictures, etc
Frequency of monitoring/recording:	Yearly
Value monitored:	14,091 m^2
Monitoring equipment:	-
QA/QC procedures to be applied:	-

Calculation method:	-
Any comment:	Please see Appendix-I for the reservoir area calculation details.

3.3 Description of the Monitoring Plan

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

The project is operated by Akım Enerji which ensures the overall site management in accordance with Turkish Laws and technology providers' guidelines.

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

1. Electrical Engineers undertake the specific actions required by the monitoring plan, i.e. they measure the electricity generation, make calibration according to procedures, the electricity supplied to the Turkish grid by the power plant, the electricity imports and the amount of fuel consumed, if fuel is consumed.
2. Mechanical Engineers ensure that all the instrumentations and devices to perform the monitoring are working properly.
3. Accounting Manager is in charge of providing the electricity sales receipts to the Operations Manager of the plant.
4. Operations Manager is the VER coordinator. He is in charge of:

    a. Ensuring that instrumentations and devices are available and properly suited to perform efficiently the monitoring.
    b. Communicating and coordinating the monitoring tasks of all business units.
    c. Developing, executing, analyzing and improving the VER Monitoring/Reporting Procedures. This includes the crosschecking and consolidation (with multiple sources whenever possible) of the data obtained from the electrical engineers and the accounting manager. He also recorded this operation properly to be able to provide it to the DOE during the verification process.
    d. Calculating and report the emission reductions, and
    e. Organizing in-house seminars to inform and train the company staff to the monitoring procedures.

Please refer to Figure where the site organizational chart is presented.

In order to verify the generated units of emission reductions, the VER coordinator, Operation Manager has prepared an annual Report of Vigilance of the Project, in which the following important aspects include:

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

Each year the monitoring report will submit to DOE for the verification. The report covers the monitoring of grid-connected power generation, check report; report on calculation of the emission reductions and records of monitoring instrument repair and calibration, etc.

Data will be recorded for each crediting period and maintained at least 2 years after its end. The company will establish a dedicated maintenance system to ensure the data availability for the required period.

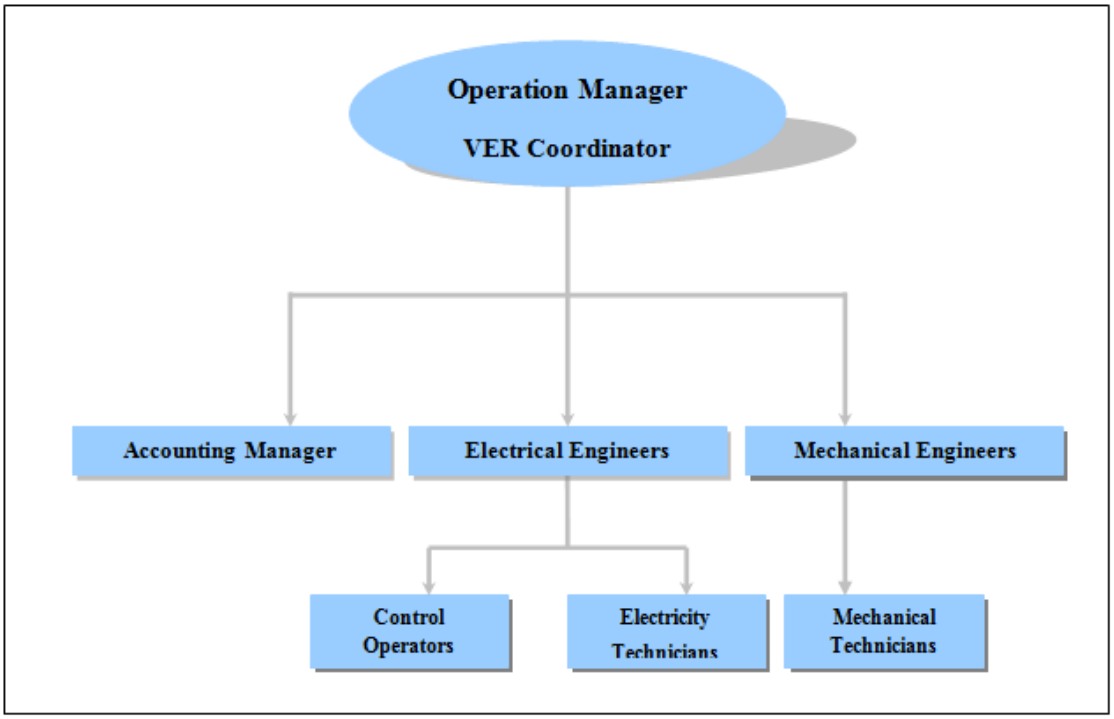


Figure 1: *Site Organizational Chart*

Measuring

The Electrical Engineers obtain the readings from the meters, report them in the spreadsheet (please refer to *Figure*) for measurement control and store the data discharged from the meters electronically.

The meter (ACE SL7000 series developed for Turkey) which was used in the switchyard building is produced by Actaris and is in line with the EMRA requirements for electricity meters. (Please find the information on the technical specifications of the meter and its conformity with the EMRA requirements on the website of Aktif Enerji which is the exclusive distributor for Actaris products in Turkey.)

Also, the Actaris meter fully conforms to or exceeds all relevant IEC standards for electronic metering equipments. (IEC61036 for class 1 equipment and IEC60687 for class 0.2S equipment)# The Actaris meter ensures long term stability of the accuracy, and achieves a maintenance free design which makes unnecessary the re-calibration of the meter. However re-calibration periods are defined by national metrology institutes country by country and in Turkey this period is defined as 10 years.

Besides, in order to measure the electricity production figure of the plant accurately, there are two sets of meters in the switchyard building. One is the main meter for measuring and the other is the check meter for control. Both of these meters are metering the energy in two directions (consumption and production). If there is a measuring difference between these two meters and one of the parties (TEIAS or the company) requests for calibration of the meters, in this case, the meters will be calibrated without waiting for the periodic calibration date. (TEIAS System Usage Agreement, Art 3, B./2./b))# This calibration process is done by another third party under the control of TEIAS. The company is not responsible for calibration of the meters in Turkey according to the local standards.

On the other hand, the emission reductions calculated according to the measurements of the main electricity meter, since the electricity production invoices are made out based on this meter. During the each monitoring period, the invoices were presented to the DOE, together with the calculation details.

The Electrical Engineers received sufficient and continuous training (such as for operations and using system, scada etc. from TEIAS and equipment suppliers) in terms of monitoring and verification on aspects such as meter's reading and calibration and reading's recording, adjustment and reporting. If new personnel are hired, they will have to follow up a training program and will be trained in the specific skills required to carry out the Monitoring Plan

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Accordingly the baseline emissions BE_y are calculated as following:

$BE_y = (EG_y - EG_{baseline}) \times EF_{grid, CM, y}$

Where:

BE_y	Baseline emissions (tCO2e)
EG_y	Annual electricity supplied by the project to the grid (MWh)
$EG_{baseline}$	Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.
$EF_{grid,CM,y}$	Baseline emission factor (tCO2e/MWh)
Y	Refers to a given year

Since the project is an installation of a new grid-connected renewable power plant, the baseline scenario is formulated in ACM0002, Version 10: *"Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the Combined Margin (CM) calculations described below".*

The baseline emission factor is the weighted average of the Operating Margin Emission Factor and Build Margin Emission Factor. The ACM0002 / Version 10 guideline recommends equal weight values for hydropower projects as seen in the formula below:

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

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

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

Therefore resulting $EF_{grid,CM,y}$ is 0.559 tCO_2/MWh

The total electricity generations, the electricity traction from the grid and the net electricity supplied to the grid are as follows:

Year 2010							
Emission Factor: 0.559	**Net Electricity Generation (kWh)*(53035222)**	**Electricity traction from grid (kWh) (53035222)**	**Net Electricity Generation (kWh)*(53035223)**	**Electricity traction from grid (kWh) (53035223)**	**Net Electricity Generation (kWh)***	**Electricity traction from grid (kWh)**	**Net elect. Supplied to the grid (kWh)**(EGpj,y)**
Jan 2010					0.00	0.00	0.00
Feb 2010					0.00	0.00	0.00
Mar 2010					0.00	0.00	0.00
Apr 2010					0.00	0.00	0.00
May 2010	3,316,760	14,687	2,130,990	27,757	5,447,750.00	42,444.00	5,405,306.00
Jun 2010	32,789,172	2,603	32,500,919	1,121	65,290,091.00	3,724.00	65,286,367.00
Jul 2010	17,670,471	19,203	20,877,749	7,977	38,548,220.00	27,180.00	38,521,040.00
Aug 2010	7,525,846	41,753	6,634,581	23,950	14,160,427.00	65,703.00	14,094,724.00
Sep 2010	3,708,390	31,642	6,888,755	29,434	10,597,145.00	61,076.00	10,536,069.00
Oct 2010	7,478,101	13,388	10,257,097	13,506	17,735,198.00	26,894.00	17,708,304.00
Nov 2010	5,865,640	39,410	5,069,660	20,220	10,935,300.00	59,630.00	10,875,670.00
Dec 2010	2,829,010	33,750	3,230,240	28,100	6,059,250.00	61,850.00	5,997,400.00
Total 2010					**168,773,381.00**	**348,501.00**	**168,424,880.00**
Year 2011							
Emission Factor: 0.559	**Net Electricity Generation (kWh)*(53035222)**	**Electricity traction from grid (kWh)(53035222)**	**Net Electricity Generation (kWh)*(53035223)**	**Electricity traction from grid (kWh)(53035223)**	**Net Electricity Generation (kWh)***	**Electricity traction from grid (kWh)**	**Net elect. Supplied to the grid (kWh)**(EGpj,y)**
Jan 2011	2,460,780	24,040	2,410,890	36,740	4,871,670	60,780	4,810,890
Feb 2011	3,259,190	16,750	3,418,240	34,890	6,677,430	51,640	6,625,790
Mar 2011	7,527,500	34,110	6,690,380	23,240	14,217,880	57,350	14,160,530
Apr 2011	19,368,290	22,890	19,935,890	7,350	39,304,180	30,240	39,273,940
May 2011	32,352,510	890	32,048,690	600	64,401,200	1,490	64,399,710
Jun 2011	29,682,960	940	29,887,320	610	59,570,280	1,550	59,568,730
Jul 2011							0
Aug 2011							0
Sep 2011							0
Oct 2011							0
Nov 2011							0
Dec 2011							0
Total 2011	**94,651,230**	**99,620**	**94,391,410**	**103,430**	**189,042,640**	**203,050**	**188,839,590**
Total 2010+2011					**357,816,021.00**	**551,551.00**	**357,264,470.00**

** Net electricity corresponds the measured electricity generation by the meters. This value does not include the internal consumption of*

*** Net elct. Supplied to the grid = Net Electricity Generation - Electricity traction from grid*

***Table 1:** Electricity generation readings of the Cevizlik HEPP from 29th May 2010 to 30th June 2011*

Based on the above electricity generation figures, baseline emissions for years 2010 and 2011 are calculated as follows:

BE_{2010} = EG_{2010} x $EF_{grid,CM,2010}$
= 168,424 MWh x 0.559
= **94,149 tCO_2**

BE_{2011} = EG_{2011} x $EF_{grid,CM,2011}$
= 188,839 MWh x 0.559
= **105,561 tCO_2**

4.2 Project Emissions

The Project emissions are calculated with the formula mentioned in ACM0002/Version 10 as:

Where:
PEy = Emission from reservoir expressed as tCO_2e/year
$EF_{Re}s$ = Is the default emission factor for emissions from reservoirs, and the default value as per EB23 is 90 Kg CO2e /MWh
TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh).

However, again according to ACM0002 / Version 10 if the power density (PD) of the hydro power plant is above 10 W / m^2 , PEy is 0.

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

Where:
PD = Power density of the project activity, in W/m^2
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W)
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)
A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Cap_{PJ} = 92.960.000 W
Cap_{BL} = 0 (Justification: The project is a new hydro power plant)
A_{PJ} = 14091 m^2
A_{BL} = 0 (Justification: The project is a new hydro power plant))

Therefore;

PD = (92.960.000 – 0)/(14.091 – 0) = 6.597W/m^2
Therefore;

Since the Power Density of the Project is greater than 10 W/m^2 PE_y is assumed to be 0 as suggested in ACM 0002 / Version 10.

Also, as suggested in ACM0002 / Version 10, the leakage emissions are not considered. Therefore:

PE_y = 0 tCO_2/year

4.3 Leakage

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

Therefore:

LE_y = 0 tCO_2

4.4 Summary of GHG Emission Reductions and Removals

Also, according to ACM0002/Version 10 the emission reductions in year "y" should be calculated as the following formula

$ER_y = BE_y - PE_y - LE_y$

Where:
ER_y = Emission reductions in year *y* (t CO_2e/yr)
BE_y = Baseline emissions in year *y* (t CO_2e /yr)
PE_y = Project emissions in year *y* (t CO_2/yr)
LE_y = Leakage emissions in year *y* (t CO_2/yr)

Since PE_y and LE_y are assumed to be 0, emission reductions are equal to baseline emissions.

Please see the tables below for the emission reduction of the project for 2010 and 2011:

Year 2010								
Emission Factor: 0.559	Net Electricity Generation (kWh)*(53035222)	Electricity traction from grid (kWh) (53035222)	Net Electricity Generation (kWh)*(53035223)	Electricity traction from grid (kWh) (53035223)	Net Electricity Generation (kWh)*	Electricity traction from grid (kWh)	Net elect. Supplied to the grid (kWh)**(EGpj,y)	Emission Reductions (tC02e)
Jan 2010					0.00	0.00	0.00	0.00
Feb 2010					0.00	0.00	0.00	0.00
Mar 2010					0.00	0.00	0.00	0.00
Apr 2010					0.00	0.00	0.00	0.00
May 2010	3,316,760	14,687	2,130,990	27,757	5,447,750.00	42,444.00	5,405,306.00	3,021.57
Jun 2010	32,789,172	2,603	32,500,919	1,121	65,290,091.00	3,724.00	65,286,367.00	36,495.08
Jul 2010	17,670,471	19,203	20,877,749	7,977	38,548,220.00	27,180.00	38,521,040.00	21,533.26
Aug 2010	7,525,846	41,753	6,634,581	23,950	14,160,427.00	65,703.00	14,094,724.00	7,878.95
Sep 2010	3,708,390	31,642	6,888,755	29,434	10,597,145.00	61,076.00	10,536,069.00	5,889.66
Oct 2010	7,478,101	13,388	10,257,097	13,506	17,735,198.00	26,894.00	17,708,304.00	9,898.94
Nov 2010	5,865,640	39,410	5,069,660	20,220	10,935,300.00	59,630.00	10,875,670.00	6,079.50
Dec 2010	2,829,010	33,750	3,230,240	28,100	6,059,250.00	61,850.00	5,997,400.00	3,352.55
Total 2010					**168,773,381.00**	**348,501.00**	**168,424,880.00**	**94,149.51**
Year 2011								
Emission Factor: 0.559	Net Electricity Generation (kWh)*(53035222)	Electricity traction from grid (kWh)(53035222)	Net Electricity Generation (kWh)*(53035223)	Electricity traction from grid (kWh)(53035223)	Net Electricity Generation (kWh)*	Electricity traction from grid (kWh)	Net elect. Supplied to the grid (kWh)**(EGpj,y)	Emission Reductions (Tons)
Jan 2011	2,460,780	24,040	2,410,890	36,740	4,871,670	60,780	4,810,890	2,689.29
Feb 2011	3,259,190	16,750	3,418,240	34,890	6,677,430	51,640	6,625,790	3,703.82
Mar 2011	7,527,500	34,110	6,690,380	23,240	14,217,880	57,350	14,160,530	7,915.74
Apr 2011	19,368,290	22,890	19,935,890	7,350	39,304,180	30,240	39,273,940	21,954.13
May 2011	32,352,510	890	32,048,690	600	64,401,200	1,490	64,399,710	35,999.44
Jun 2011	29,682,960	940	29,887,320	610	59,570,280	1,550	59,568,730	33,298.92
Jul 2011							0	0
Aug 2011							0	0
Sep 2011							0	0
Oct 2011							0	0
Nov 2011							0	0
Dec 2011							0	0
Total 2011	**94,651,230**	**99,620**	**94,391,410**	**103,430**	**189,042,640**	**203,050**	**188,839,590**	**105,561.33**
Total 2010+2011					**357,816,021.00**	**551,551.00**	**357,264,470.00**	**199,710.84**

** Net electricity corresponds the measured electricity generation by the meters. This value does not include the internal consumption of the plant*

*** Net elct. Supplied to the grid = Net Electricity Generation - Electricity traction from grid*

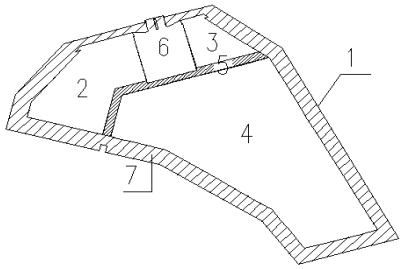
***Table 2:** Emission Reductions of the Cevizlik HEPP from 29th May 2010 to 30th June 2011*

5 ADDITIONAL INFORMATION

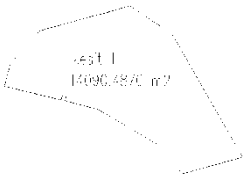
N/A

APPENDIX – I

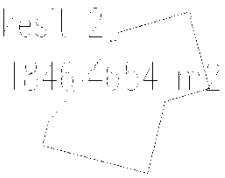
Water Level
456.00 m



Section 1	(456.00-447.50)			
Water Level		8,5		
Area			14090,49	

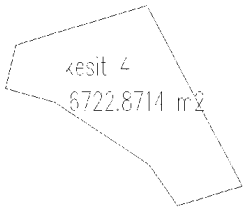


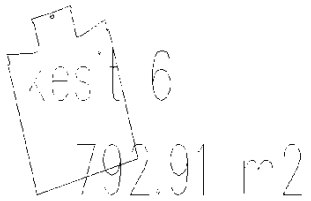
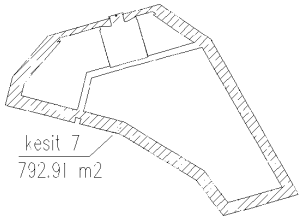
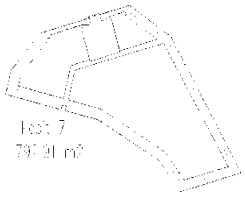
Section 2	(447.50-440.50)			
Water Level		7		
Area:			1846,465	



Section 3	(447.50-440.50)			
Water Level		7		
Area:			601,4026	

Section 4	(447.50-440.50~441.70)			
Water Level		6,4		
Area			6722,871	



Section 5	(447.50-440.50)			
Water Level Area		7	412,3924	
Section 6	(between 447.50-440.50~435.50 level cal.			
Water Level Area:		9,5	792,91	
Section 7	(between 447.50-447.50~440.50 level calculation			 
Water Level Area		3,5	3714,446	
Total Area(m2)	**Cross Section 2+3+4+5+6+7**		14090,49m^2	