

**MONITORING REPORT FORM (CDM-MR)**
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**MONITORING REPORT**

Version 05.4 - -12/09/2011

Grid-connected electricity generation from renewable sources:**DARICA-1 99 MW Hydro Power Plant Project, Turkey****PC0059A****(Monitoring Report number 1 Report Period: 10/10/2009 - 30/11/2010)****SECTION A. General description of the project activity**

Title : DARICA-1 99 MW HYDRO POWER PLANT PROJECT, TURKEY
Version : 5.1.0
Date : 28/06/2011
Report Period : 10/10/2009 - 30/11/2010 (both days inclusive)
MONITORING REPORT NUMBER: 1

A.1. Brief description of the project activity: >>

Darıca-1 Hydroelectric Power Plant (HPP) is designed by the YAPISAN Elektrik Üretimi Anonim Şirketi (YAPISAN Power Generation Company Incorporated) which is a private company set up by Bilgin Energy Holding. The Power plant is constructed on the Melet River in the Mesudiye district, Ordu Province, 4 km Northeast of Topçam District, on the tail water downstream of the Topçam Hydroelectric Power Plant.

The objective of the Project activity is to supply about 99 MW of renewable electricity to the rapidly growing Turkish electricity market. The Project is expected to generate about 327,690 MWh of electricity annually and to reduce 209,722 tonnes of CO₂ emissions per year, by supplying renewable energy that would be supplied by the existing power grid that generates electricity mainly from fossil fuel powered thermal power plants..

The generation capacity of the project was initially designed as 99 MW, however during the operation phase the capacity of the project is increased to 112.42 MW (2 x 56.21 MW turbines) and the generator capacity is increased to 110.32MWe (2x 55.16 MW), This is done by the help of the manufacturer, by adjusting the turbines to their maximum limits. To be able to do this the electricity production license is renewed and the EIA is updated by an additional report submitted to Ordu Provincial Directorate of Environment and Forestry. The EIA exemption certificate is granted to the project and the capacity increase is completed.

Please see Section B.5. Below for a discussion of how this change to the project design may have affected the additionality of the Project.

Darıca-1 HPP is fed by the Karıca Diversion Regulator which diverts the water used by the state owned Topçam HPP upstream to Darıca-1 HPP. The water is taken from the Karıca Regulator to the plant site by means of the transmission tunnel and penstock. The power generated is transmitted to the switchgear area upstream approximately 1.3 km away by transformers and then is fed to the national grid. The process flow chart is given in Figure 1.

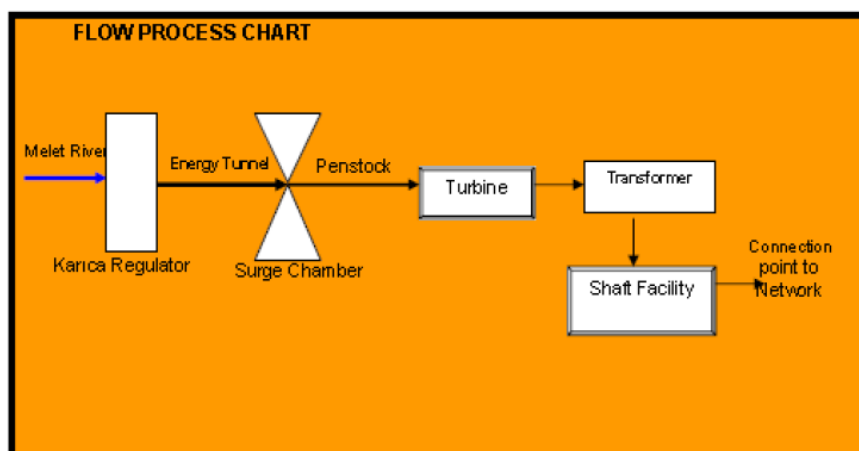


Figure 1. Process flow chart

The electricity is produced by means of two turbines with 49.5 MW generation capacity each.

The Melet River flows in a Northerly direction with a length of 165 kms. The annual mean flow rate, fed by snow and rain water, is 27 m³/sec. The region has steep topography and the altitude of the catchment area extends to 1,469 metres. The river itself falls from 650 meters to 335 meters at the Project site.

The construction of the project has started on April 2007. The first turbine started to operate on 10th of October 2009 and the second one started to operated on 23rd of December 2009, and the HEPP is operational since then.

This first monitoring period covers the dates between 10th of October 2009 and 30th of November 2010 (both days inclusive) . Total Emission reductions achieved in this period is 294,014 tonnes CO_{2e}.

A.2. Project Participants

Name of Party involved (*) ((Host) indicates a host Party)	Private and or Public enty(ies) pğroject participants (*) (as applicable)	Kindly indicate if the Part involved wishes to be considered as project participant (Yes/No)
Turkey (Host)	Yapısan Elektrik Üretimi Anonim Şirketi	No

A.3. Location of the project activity:

The Power Plant will be constructed on Melet River in the Mesudiye District of Ordu Province in the Northern Black Sea region of Turkey. (Figure 2 &3). The Location of the plant will be on Melet River in Mesudiye District and 12 km Northeast of Topçam district.



Figure 2: Location of Project Activity

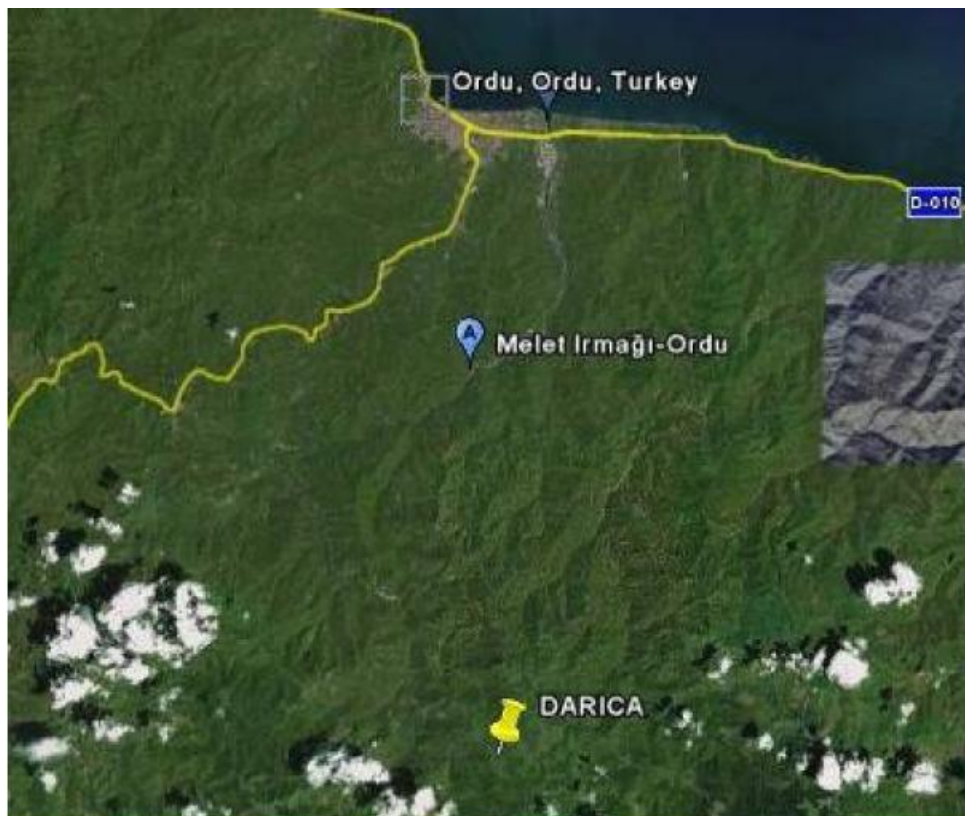


Figure 3: Detailed Location Of Project Activities



The Turbine House is located at 40° 42' 39 N 35° 51' 10 E.

A.4. Technical description of the project

DARICA-I Hydroelectric Power Plant (HPP), which is a run of river type HPP, is established on the tail water of TOPÇAM HPP, constructed upstream from the Project. The main structures in the Project are the KARICA regulator, a diversion tunnel of 124 m in length between regulator and penstock, power generation turbines, office buildings and switchgear area. The regulator is built in order to regulate and divert water downstream from TOPÇAM HPP. Through regulator and diversion tunnel, 315 meters of altitude drop is obtained. Power generated by the turbines is then, transmitted to the switchgear area and then connected to the main electricity grid of Turkey. The power plant originally consists of 2x 49.5 MW turbines and 2x54 MVA generators. The capacity of the power plant is increased to 2 x 56.21 MW turbines and the generator capacity is increased to 110.32MWe (2x 55.16 MWe), on 17th June,2010.

The Plant load factor of a power plant is defined as the actual output of a power plant over a period of time and its output if it had operated a full capacity of that time period. This can be formulated as follows:

Plant Load Factor = Gross Generation / (Installed Capacity * Number of Hours)

Therefore, the plant load factor of the project can be calculated by dividing the expected amount of annual electricity production (MWh) to the multiplication of total hours in a year by the capacity of the power plant. The annual electricity production is determined by running the design software (HidroE v1.4.1) that models the electricity production based on design parameters and the historical river flow data. In the original design the PLF was :

$$=327,690.00 \text{ MWh/year}/(99 \text{ MW} \times 8760 \text{ h})$$

$$=37.78\%$$

When the capacity was improved the total annual generation also slightly increased. Based on the new annual electricity generation value of 409,537 MWh¹, computed using the same software, the new PLF can be calculated as :

$$=409,537.00 \text{ MWh}/(112.42 \text{ MW} \times 8760 \text{ h})$$

$$=41.59\%$$

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

“Consolidated baseline methodology for grid connected electricity generation from renewable sources (ACM0002 version 7)”

The above methodology is hereafter referred to as the “Baseline Methodology”. The Baseline Methodology is used in conjunction with the approved monitoring methodology ACM0002 version 7 (“Monitoring Methodology”).

The PDD also draws upon:

- Tool for assessment and demonstration of additionality, ver 5.2

¹ The generation value computed for the new capacity is also given as 410,000 MWh per year as a round up number in the renewed electricity generation license.



- Tool to calculate the emission factor for an electricity system, ver 01

A.6. Registration date of the project activity:

Project Activity is registered to the APX-VCS registry with the project number VCS167 and the registration date as 25 October 2010 which is the date the project was uploaded to the VCS Registry.

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

July 2009 was the expected date of commissioning and this was given in the validated PDD as the start date, however, the commissioning of the project and thus the start date is realized on 10th of October 2009,

The crediting period is chosen to be 10 years.

A.8. Name of responsible person(s)/entity(ies):

Contact Person: G.Aslı Sezer Özçelik

Telephone: +90 312 439 95 03

Fax: +90 312 439 95 06

E-mail: asli.ozcelik@jpmorganclimatecare.com

environmental.markets@jpmorgan.com

Address: Refik Belendir Sokak 35/3 Y. Ayrancı - ANKARA / TURKEY

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

The Darica-1 HPP started to produce and provide electricity to the Turkish National Grid On 10th of October 2009 as its first turbine of 49.5 MW capacity became operational. Later on 23rd of December 2009 the second turbine of 49.5 MW capacity became operational. On June 17th, 2010 by the approval of EMRA² this capacity is increased to 112.42 MW (2 x 56.21 MW turbines) and the generator capacity is increased to 110.32MWe (2x 55.16 MW)

Despite the capacity change the “Power Density” of the project activity is greater than 4W/m², thus the project is still eligible to apply ACM0002.

The new power density of the project based on designed reservoir area value is calculated as follows:

$$\frac{\text{Project Activity}}{\text{Darica-1 HEPP}} \quad \frac{\text{Installed Capacity}}{112,420,000 \text{ W}} \quad / \quad \frac{\text{Reservoir Area}}{104,000 \text{ m}^2} = \frac{\text{Power Density}}{1080 \text{ W/m}^2}$$

As the power density of the project is very high (>10) the CH₄ emissions is not considered among the project emissions as was also indicated in page 9 of the validated PDD.

² Energy Market Regulatory Agency

³ The Reservoir Area is given in the technical specifications section of the EIA which is approved by the Ministry of Environment and Forestry.



During this first verification the reservoir area is monitored using the reservoir area map shown in Annex 2. It is observed that the reservoir area at maximum water level was realized slightly bigger than that estimated at the approved EIA.

The realized reservoir area is 114,800.00 m² and the power density calculated according to that value is as follows:

$$\frac{\text{Project Activity}}{\text{Darica-1 HEPP}} \quad \frac{\text{Installed Capacity}}{112,420,000 \text{ W}} \quad / \quad \frac{\text{Reservoir Area}}{114,800 \text{ m}^2} = \frac{\text{Power Density}}{979 \text{ W/m}^2}$$

The realized Power density is about 9.35 % less than that was estimated. Despite this change the power density is much higher than both 4 and 10 W/m² that the project is an eligible project and that the project is not expected to emit significant amounts of CH₄.

During this monitoring period, the Darica-1 HPP produced worked with 51% efficiency. In the PDD efficiency of the project was estimated to be 38% but the project performed about 36% more than that estimated in the validated PDD.

The maintenance and repairs occurred during this period is summarized below in Table 1.

Table 1: The Major Maintenance and Repair events that occurred during the monitoring period.

Date	Equipment Maintained	Period of Maintenance
02/11/2009	Unit-1 Hydro Lock Sensor	-
11/12/2009	Butterfly valve pressure sensor screen	-
20/12/2009	Maintenance of Gate number 2 at the Gravel Passage and check up of the hydraulic Pressure units	-
22/12/2009	Check up of the turbine wheel and adjustment wings	every 6 months
04/01/2010	Energy tunnel discharge valve change	every 3 months
18/02/2010	Unit -1 cooling water pump unit's filter clean up.	every 6 months
25/02/2010	Unit-1 braking system	-
10/03/2010	Stop by gate Unit-1 repairing of the by pass seal is repaired	every 6 months
13/03/2010	Unit 1 Turbine upper cover Change (revision)	Revision
18/03/2010	Unit -2 cooling water pump unit's filter clean up.	every 6 months
29/03/2010	Unit-1 and Unit -2 transformer hardware	-
03/04/2010	400 V AC Heating Ventilation Common Control Fuse (malfunction)	-
04/04/2010	Regulator Water intake door debris cleaning machine	every 6 months
14/04/2010	Draft tube clean up	every 6 months
16/04/2010	Unit 1 Valve position sensor	-
20/04/2010	Transformer (internal needs) open switch gear area	-
04/05/2010	Regulator Generator board	-
06/05/2010	Unit-1 antifriction lining lubricator level	-
20/05/2010	Expansion Valve tightening and maintenance	every 6 months
25/05/2010	Unit 1MSD switch	-

⁴ The Reservoir Area is given in the technical specifications section of the EIA which is approved by the Ministry of Environment and Forestry.



08/06/2010	Open Switch gear area internal use conduit cable	every 3 months
10/06/2010	Power Plant Crane lubrication and direction wheel change	every 6 months
19/06/2010	Unit-1 warning coals	every 6 months
23/06/2010	Cleaning up of the sliding abutments and construction of protective cover plates	every 6 months
26/06/2010	Unit-1 warning coals	every 6 months
10/07/2010	Open Switch gear area iREDRESSER (110 V DC)	-
11/07/2010	Unit II- Turbine heat exchanger clean up	every 6 months
13/07/2010	Unit -1 cooling water pump unit's filter	every 6 months
20/07/2010	Unit 1- Turbine heat exchanger clean up	every 6 months
24/07/2010	Unit-1 warning coals	every 6 months
24/10/2010	cooling water pipe installment revision	Revision

During the monitoring period, there was no event or situation that occurred, which may impact the applicability of the methodology.

B.2. Revision of the monitoring plan

For the parameter EGy (Net Electricity generated and delivered to the grid by the power plant in year y), the monitoring plan in the validated PDD implies the use of “Metering devices measuring the electricity generated at the exit of the plant and invoices Prepared for billing the transmission company”. However due to a regulatory change the invoices do not anymore contain the data about the amount of the electricity produced. Therefore instead of the invoices the output of the Market Financial Reconciliation Center (MFRC/PMUM) Data is utilized.

B.3. Request for deviation applied to this monitoring period

N/A

B.4. Notification or request of approval of changes

N/A

B.5. Potential change to Additionality of the Project

The guidelines published in EB48 Annex 66 state that if the Project has never been implemented in accordance with the PDD then the case must be made as to why the change to the Project does not affect its additionality. Section B.5. of the PDD shows that the Additionality of the project was proven using Option 3: Barrier Analysis. Below we analyse how these Barriers may have been affected by the increase in size of the turbines.

The barriers in Option 3

Investment Barrier

- The developer had to use a high level of equity as there were difficulties raising debt: This barrier has not changed
- Lenders had a perceived risk of low flow and variable climatic data in the region. Whilst rainfall has been higher for one year, it does not indicate a long term trend: This barrier has not changed

Technological Barriers



- Tunnel Construction and Terrain: The upgrading of the turbines has made no change to these barriers

Next, we analyse the Common Practice in 4a

- The increase in turbine capacity has not affected the given evidence that government is the largest investor in large scale hydro: The upgrading of the turbines has made no change to this situation.
- The maximum size of hydro is private ownership was 48.5MW: The upgrading of the turbines has made no change to this situation

Common Practice 4b

- Public vs Private Sector Investment in electricity generation: The upgrading of the turbines has made no change to this situation
- Public sector investment in Thermal and Hydro Generation sources: The upgrading of the turbines has made no change to this situation
- Private Sector Investment in Hydro Sector Generation: The upgrading of the turbines has made no change to this situation

Conclusion

Therefore, we can conclude that the original conclusions continue to be correct:

- The Project faces significant Investment Barriers
- The Project is not Common Practice

SECTION C. Description of the monitoring system

Monitoring methodology applied to the Project is ACM0002 version 7, “Approved consolidated baseline and monitoring methodology for grid connected electricity generation from renewable resources”

The amount of net electricity generated by the plants is monitored in order to demonstrate the emission reduction. In addition, the fuel consumption by the auxiliary equipment (diesel generator) is also considered in the calculations. Monthly generation data is measured and recorded by both TEIAS and the Project Manager. Data is recorded in an Excel workbook and kept in electronic and paper form, both at the project site and at the Developer’s Head Office in Ankara.

The annual emission reduction by the Project is calculated by multiplying the net electricity generated with combined margin emission factor. The process of verification of the Project will be followed up by JP Morgan.Ventures Energy Corporation.

The plant manager is responsible to maintain credible, transparent, and adequate data estimation, measurement, collection, and tracking systems of the net electricity generation of the plant. Those records and monitoring systems is provided to the selected DOE to verify project performance as part of the verification process.

Emission reductions by the project activity is calculated using electricity generated by Darıca-1 HPP. This electricity is displacing the power generated by other plants in the grid. A spreadsheet prepared in Excel is used in order to calculate the emission reduction from the renewable electricity generated.



Gross electricity production is measured and recorded monthly through two high precision measuring devices sealed and controlled by TEIAS, the electricity distribution company and the buyer of the electricity according to the regulations issued of the TEIAS and recorded in the Excel workbook. SCADA metering devices. The electrical engineer or the plant manager accompany the officer during monthly measurements. This data also form the basis for monthly invoicing to TEIAS. The periodical maintenance of the metering devices is made by TEIAS every two years. In case the accuracy of metering devices is less than 0.2%, a test is carried by TEIAS officers, accordingly the calibration and maintenance of the meters is carried out by TEIAS. If the accuracy passes the 0.2% range the meters are re-calibrated. Other than this, under normal conditions the calibration is repeated out in every 5 years. The calibration, the type of the meters that are allowed to be used in power plants and their accuracy class which is 0.2S is determined by the communiqué on the Electricity Meters declared by EMRA (Electricity Market Regulatory Agency). According to this communiqué the electricity meters has to be in compliance with the IEC-EN 60687 Standard.

The electricity produced is sold to TEIAS, using a system called PUMUM⁵. TEIAS reconciles by this system the demand and supply and buys electricity from the producers. At the end of the month the electricity sold from each power plant of YAPISAN A.Ş. is summed up under one monthly invoice. Therefore, the invoices are not exhibiting the monthly electricity production data by the Darica-1 HPP. But the Monthly PMUM data can be used to cross check the electricity production data.

The fuel consumption of the standby generator at the project is monitored by hours of usage tracked by a counter on the equipment. The hourly usage data is multiplied by the 50 % load hourly consumption data of the diesel generator and the amount utilised in tons is calculated multiplying the liters used by the density of the fuel declared by the TUPRAŞ refinery (the sole distributor of standard diesel fuel in Turkey). This data is compared with the sampled plant daily electricity consumption values and shown that the estimate is conservative. The emission from the generator is calculated by multiplying the annual fuel consumption with NCV and EF values for diesel. This is used to calculate the project emissions. The project emissions does not include CH₄ emissions from the reservoir as the power density of the project is about a hundred fold bigger than 10, and hence the CH₄ emissions from the reservoir is negligible as was also indicated in page number 9 of the validated PDD..

The Plant Manager is responsible for electricity generation in the plant and is assisted by mechanical and electrical engineers as seen in the figure below (Figure 4). All relevant data is recorded by the Plant Manager on a monthly basis. Data is kept by the Project owner both at the project site and at the Head Office in Ankara for two years following the completion of the crediting period in electronic and paper form.

⁵ PMUM: Piyasa Mali Uzlaştırma Merkezi: The Market Financial Reconciliation Center.

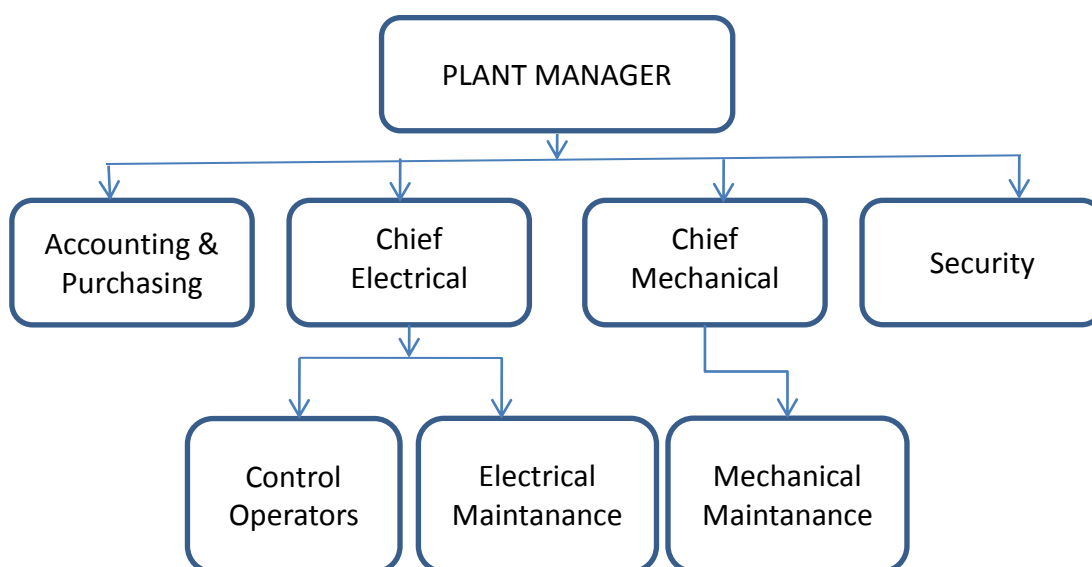


Figure 4: Organization Chart in Darica-I HPP

The single line diagram that exhibits the location of the main and back-up electricity meters are provided in Annex 1 of this report with an English translation at the back.

SECTION D. Data and parameters

Parameters used to calculate baseline, project, and leakage emissions as well as other relevant parameters required by the approved methodology and the monitoring plan are as follows:

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / parameter:	$FC_{i,y}$
Data unit:	m ³ or tons
Description:	Amount of fossil fuel type i consumed by the Project electricity system
Source of data:	TEİAŞ web page (www.teias.gov.tr)
Measurement procedures (if any):	-
Monitoring frequency:	• <u>Once</u> for each crediting period
QA/QC procedures:	
Any comment:	Data is published by the transmission company (TEİAŞ) annually. It will be used once for the crediting period

Data / parameter:	$NCV_{i,y}$
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Data unit:	Tj/kt
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data:	Calculated for Turkish grid using the TEİAS data(www.teias.gov.tr)
Measurement procedures (if any):	-
Monitoring frequency:	• <u>Once</u> for each crediting period
QA/QC procedures:	
Any comment:	Applied in the calculation of the simple OM, where fuel consumption data is available for all power plants.

Data / parameter:	EF_{CO₂}, i, y_i
Data unit:	tCO ₂ /GJ
Description:	CO ₂ emission factor of fossil fuel type i in year y
Source of data:	2006 IPCC Guidelines for National Greenhouse Inventories
Measurement procedures (if any):	-
Monitoring frequency:	• <u>Once</u> for each crediting period
QA/QC procedures:	
Any comment:	Applied in the calculation of the simple OM, where fuel consumption data is available for all power plants.

Data / parameter:	EF_{CO₂}, y
Data unit:	tCO ₂ /t
Description:	CO ₂ emission factor of fossil fuel type i in year y
Source of data:	2006 IPCC Guidelines for National Greenhouse Inventories
Measurement procedures (if any):	-
Monitoring frequency:	• <u>Once</u> for each crediting period
QA/QC procedures:	
Any comment:	Fossil fuel used in Standby generator

**D.2. Data and parameters monitored**

Data / Parameter:	EGy
Data unit:	MWh
Description:	Net Electricity generated and delivered to the grid by the power plant in year y
Measured /Calculated /Default:	Measured
Source of data:	TEİAŞ installed electricity meters
Value(s) of monitored parameter:	The net electricity generated during the monitoring period (10/10/2009 to 30/11/2010 both days inclusive) is 464,832 MWh.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used to calculate Emission Reductions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	• TR-1: Main Electricity Meter 1: ELSTER 361509-Official Code:11047 Date of Last Calibration 06.02.2008, Calibration valid for the next 5 years, from date of calibration. • Yedek -1 Back-up Electricity Meter : Elster 361510 • Date of Last Calibration 06.02.2008, Calibration valid for the next 5 years, from date of calibration. • TR-2: Main Electricity Meter 2: ELSTER 364713-Official Code:11048; Date of Last calibration 2.04.08; Calibration valid for the next 5 years, from the date of calibration. • Yedek-2 Back-up Electricity Meter : Elster 364714 • Date of Last Calibration 02.04.2008, Calibration valid for the next 5 years, from date of calibration. • All the Meters are Elster A1500-W043 Model. • The line diagram showing the position of the meters is given in Annex-1.
Measuring/ Reading/ Recording frequency:	Continuous Measuring/hourly Reading and Recording/Monthly Reporting
Calculation method (if applicable):	N/A
QA/QC procedures applied:	There will be two main electricity meters that will be backed up by two auxiliary meters. Maintenance and calibration of the metering devices will be made by TEİAŞ in every 5 years. If the difference between the readings of the main meter and the auxiliary meter exceeds 0.2%, maintenance and calibration will be done before waiting for the calibration period to end.

Data / Parameter:	$PE_{FC,i,y}$
Data unit:	tCO ₂ /yr



Description:	CO ₂ emissions from fossil fuel combustion in process j during the year y
Measured /Calculated /Default:	As per the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion”
Source of data:	As per the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion”
Value(s) of monitored parameter:	The Calculated value is 3,478.50 tCO ₂ /year during the monitoring period (10/10/2009 to 30/11/2010 both days inclusive)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	As per the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion”
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	As per the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion”
Measuring/ Reading/ Recording frequency:	As per the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion”
Calculation method (if applicable):	As per the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion Calculated based”
QA/QC procedures applied:	As per the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion”

Data / Parameter:	FC _{j,y}
Data unit:	Mass or volume unit per year (tonne/yr)
Description:	Quantity of fuel type i combusted in process j during the year y
Measured /Calculated /Default:	- 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. - The total hours multiplied by the diesel fuel consumption of 31 L at 50% load factor as described in the facts sheet of ACQ 350 AKSA Diesel generator. - The Mass is calculated based on the following formula: - M=dXV where : - M = Mass in kg, - d = the average density of diesel fuel (0.845 kg/L⁶) and - V is the Volume in litres - The Mass in kg is converted to Tonnes by dividing into 1000.
Source of data:	Onsite logs and measurements
Value(s) of monitored parameter:	41 hours of Generator use X31 L= 1,271 L of diesel usage 1,271 LX0.845kg/L=1,073.99 kg=.1.07 tonnes of Diesel Fuel
Indicate what the data are used for (Baseline/ Project/ Leakage emission)	Data is utilised to calculate Project Emissions

⁶ <http://www.tupras.com.tr/detailpage.en.php?strProductKey=403&lRedirectPageID=1145>



calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Site Manager's log book
Measuring/ Reading/ Recording frequency:	Continuous
Calculation method (if applicable):	Calculated based on the records of generator work hours multiplied by the diesel fuel consumption of 31 L at 50% load factor as described in the facts sheet of ACQ 350 AKSA Diesel generator.
QA/QC procedures applied:	Calculated amount is cross checked with the diesel power output over time data and graphics to make sure that the power output of the diesel generator is always less than 50% of the total capacity of the generator.

Data / Parameter:	NCV_{i,y}
Data unit:	GJ per mass or volume unit (GJ/ton)
Description:	Weighted average net calorific value of fuel type <i>i</i> in year <i>y</i>
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 (default value used for calculations-does not change throughout the monitoring period)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is used for Project Emission Calculations
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 CO ₂ emissions from fossil fuel combustion" (Version 02) is chosen.

Data / Parameter:	EF_{CO₂,i,y}
Data unit:	tCO ₂ /GJ
Description:	Weighted average CO ₂ emission factor of fuel type <i>i</i> in year <i>y</i>
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 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) of monitored parameter:	74.80 tCO ₂ /GJ (default value used for calculations-does not change throughout the monitoring period)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data will be used for Project Emission Calculations
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 CO ₂ emissions from fossil fuel combustion” (Version 02) is chosen.

Data / Parameter:	Cap _{PJ}
Data unit:	W
Description:	installed capacity of the hydro power plant after the implementation of the project activity
Measured /Calculated /Default:	Monitored
Source of data:	Renewed Project Licence
Value(s) of monitored parameter:	112,420,000 W
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is utilised to calculate power density and thus calculate project emissions if necessary
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	-
Measuring/ Reading/ Recording frequency:	Yearly recording
Calculation method (if applicable):	Summing up of the capacity of each turbine
QA/QC procedures applied:	Amount indicated in the licence is cross checked with the relevant technical specification, nameplate observed on site.

Data / Parameter:	APJ
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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:	Monitored and measured
Source of data:	Map showing the boundaries of the reservoir
Value(s) of monitored parameter:	114,800 m ²
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Data is utilised to calculate power density and thus calculate project emissions if necessary
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	The area on the map is measured using a millimetre paper and determining the approximate area with respect to the scale.
Measuring/ Reading/ Recording frequency:	Once at the initial verification
Calculation method (if applicable):	-
QA/QC procedures applied:	-

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

Based on ACM0002, version 7, the emission factor for the grid system is calculated in accordance with the “Tool to calculate the emission factor for an electricity system”, ver 01. According to the tool, the following four methods may be used to calculate the operating margin:

- Simple OM,
- Simple adjusted OM,
- Dispatch Data Analysis OM and
- Average OM.

Below, Table 2 shows the share of primary sources in electricity generation for the five most recent years, in the time when the validated PDD was prepared. . Hydro and other renewable energy sources are accepted as low cost/must run sources and their share is below 50%, therefore, in accordance with the Tool, (a) Simple OM method is used in the calculations.

Table 2: Share of primary sources in electricity generation, 2002 – 2006⁷

YEAR	THERMAL		HYDRO		GEOTHERM.WIND		TOTAL
	MW	%	MW	%	MW	%	
2002	19,569	73.8	12,241	26.8	36.4	0.2	31,846

⁷Annual Development of Turkey's Gross Electricity Generation by Share of Primary Energy Resources (1970-2006) (<http://www.teias.gov.tr/ist2006/32.xls>)

2003	22,974	74.8	12,579	25.1	33.9	0.1	35,587
2004	24,145	69.2	12,645	30.6	33.9	0.2	36,824
2005	25,902	75.4	12,906	24.4	35.1	0.2	38,844
2006	27,420	74.8	13,063	25.1	81.9	0.2	40,565

The following steps show the Simple Operating Margin approach provided in the “Tool to calculate the emission factor for an electricity system”, Version 01 that was used to calculate the combined margin emission factor for Turkey.

Step 1. Identification of the relevant electric power system

The spatial extent of the Project boundary includes the Project power plants and all power plants that are connected physically to the Turkish national electricity grid system. The total installed capacity of the Turkish electricity grid system has reached to 40,565 MW in 2006 and the total annual generation has become 176,299.8 GWh^{8,9}

Step 2. Selecting an operating margin

The Simple Operating Margin (OM) emission factor ($EF_{grid, OMsimple, y}$) is calculated as the generation-weighted average CO₂ emissions per unit of net electricity generation (tCO₂/MWh) of all the generating plants serving the system, not including low-cost/must-run power plants. The electricity generation from solar and low cost biomass a facility are insignificant in Turkey and there is no nuclear power plants, therefore the only low cost /must run plants are hydro, wind and geothermal facilities.

The Ex-ante option defined as a 3 year generation-weighted average based on the most recent data available has been selected for data vintage. The step-wise approach provided in ACM0002 to calculate the combined margin emission factor for Turkey is described below.

Step 3. Calculating the operating margin emission factor according to the selected method

According to the “Tool to calculate the emission factor for an electricity system”, Version 01, the following option C equation is preferred and is therefore applied:

$$EF_{grid, OMsimple, y} = \sum FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y} / \sum EG_y \quad (1)$$

Where:

$EF_{grid, OMsimple, y}$	=	Simple operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the Project electricity in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /GJ)

⁸ Annual Development of Turkey's Installed Capacity (1913-2006), <http://www.teias.gov.tr/ist2006/1.xls>

⁹ Annual Development of Installed Capacity and Generation in Turkey (1970-2006), <http://www.teias.gov.tr/ist2006/13.xls>

$EG_{m,y}$ = Net electricity generated and delivered to the grid by power plant / unit m in year y (MWh)
i = All fossil fuel types combusted in power sources in the Project electricity system m in year y
y = Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

The following data are available on the Turkish Electricity Transmission Company (TEİAŞ) web site:

- Annual fuel consumption by fuel type¹⁰,
- Annual heating values for fuels consumed for electricity generation¹¹,
- Annual electricity generation by fuel type, import and export¹²

Annual heating values for each fuel type are directly related with the fuel consumption and are used to calculate average Net Calorific Values (TJ/kt) (Table.3).

Table 3. Net Calorific Values for each fuel type for Turkey.

Fuel Type	NCV (TJ/kt)
<i>Hard Coal+ Imported Coal</i>	21.87
<i>Lignite</i>	6.82
<i>Fuel Oil</i>	40.12
<i>Diesel Oil</i>	42.64
<i>LPG</i>	45.99
<i>Naphtha</i>	44.10
<i>Natural Gas</i>	37.08

The operating calculation has been based on data from 3 most recent years available: 2004, 2005 and 2006. The coefficients required for calculation of CO₂ emission factor (tCO₂/TJ) have been obtained through IPCC 2006 guidelines for GHG inventories¹³. Using the available data and ACM0002 methodology, overall CO₂ production by electricity generation is calculated as given in Table 4 and Table 5 below.

¹⁰ Fuel Consumed in thermal P.P in Turkey by the Electric Utilities (2000-2005)&(2006) (<http://www.teias.gov.tr/ist2006/42.xls>)& (<http://www.teias.gov.tr/ist2006/43.xls>)

¹¹ Heating Values Of Fuels Consumed In Thermal P.Ps In Turkey By The Electric Utilities (2000-2005) &(2006), (<http://www.teias.gov.tr/ist2006/44.xls>)& (<http://www.teias.gov.tr/ist2006/45.xls>).

¹² Annual Development of Turkey's Gross Electricity Generation by Primary Energy Resources and The Electric Utilities (2001-2005) & Turkey's Gross Electricity Generation by Primary Energy Resources and The Electric Utilities (2006), ([http://www.teias.gov.tr/ist2006/35\(2001-2005\).xls](http://www.teias.gov.tr/ist2006/35(2001-2005).xls))& ([http://www.teias.gov.tr/ist2006/36\(06\).xls](http://www.teias.gov.tr/ist2006/36(06).xls)).

¹³ Table 2.2.Default Emission Factors for Stationary Combustion in the Energy Industries, Vol.2. Energy, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf)



Table 4 - Calculation of total emission by electricity generation

	NCV (TJ/kt)	Lower COEF (tCO ₂ /TJ)	Consumption (2004 - 2006) (tons or 1000m ³)	Total Emission (2004 - 2006) (tCO ₂)
<i>Hard Coal+ Imported Coal</i>	21.87	94.6	15,441,634	31,947,227.47
<i>Lignite</i>	6.82	90.9	132,679,613	82,242,778.28
<i>Fuel Oil</i>	40.12	75.5	6,155,607	18,645,702.94
<i>Diesel Oil</i>	42.64	72.6	119,084	368,615.23
<i>LPG</i>	45.99	61.6	25,614	72,564.05
<i>Naphtha</i>	44.10	69.3	306,683	937,333.96
<i>Natural Gas</i>	37.08	54.3	46,117,033	92,789,290.64
Total Emissions				227,003,512.57

Net electricity generated and supplied to the grid by thermal plants has been calculated using data obtained from the TEİAŞ web page¹⁴. The ratio between gross and net generation has been calculated first, and assuming that the same ratio is valid for thermal plants; gross generation by thermal power plants has been multiplied by this ratio in order to find net generation by thermal plants. Summing up this with the imported electricity, total supply excluding low cost / must run sources are determined as given in Table.5 below.

Table 5

. Net Electricity Generation from thermal power plants (units in GWh)

Year	Gross generation	Net generation	Net/Gross (1)	Gross Gen. Thermal (2)	Net Gen Thermal (1x2)	Import	Total Supply to the grid
2004	150,698	145,066	0.963	104,464	100,559	464	101,023
2005	161,956	155,469	0.960	122,242	117,346	636	117,982
2006	176,299	169,543	0.962	131,835	126,783	573	127,356
Total Net Thermal Gen.					344,688	1,673	346,360

Finally, using the data tabulated in the previous two tables, the OM emission factor considering years 2004 - 2006 has been calculated as simply dividing the total CO₂ emission by total electricity supply to the grid which is (from equation (1) above;

$$EF_{\text{grid, OMsimple, y}} = 227,003,512.57 \text{ tCO}_2 / 346,360,200 \text{ MWh} = \mathbf{0,655 \text{ tCO}_2/\text{MWh}}$$

The Operating Margin emission factor calculated above will be constant throughout the 10-year crediting period.

Step 4. Identification of the cohort of power units to be included in the build margin (BM)

¹⁴ Annual Development of Electricity Generation-Consumption and Losses in Turkey ([http://www.teias.gov.tr/ist2006/30\(84-06\).xls](http://www.teias.gov.tr/ist2006/30(84-06).xls))

The Build Margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units m during the most recent year y for which power generation data is available.

According to the “Tool to calculate the emission factor for an electricity system”, Version 01, the sample group of power units m used to calculate the built margin consists of either:

The cohort of power units to be included in calculation of the Build Margin consists of either:

- Set of 5 power plants/units that have been built most recently, or
- Set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The larger annual generation set of power plants shall be used from those options. Therefore; set of power plants that comprise 20% of the system generation and have been recently added to the system is chosen for BM calculations.

The gross electricity generation in year 2006 is taken as reference for determination of plants that comprise 20% of the system generation. The gross generation was 176,299.8 GWh in 2006 and 20% of that amount is calculated as 35,259.96 GWh. Summing up all the plants build in 2006, 2005 and 2004, the total generation is 35,289.8 GWh.

The lists of most recent capacity additions to the grid by year and their average and firm generation capacities are available at the TEİAŞ web page^{15,16,17}. However; for the year 2006, the annual generation capacity data for each plant is not available. Two datasets are published for the year 2006; which are: (1) Annual generation capacity by fuel type²³ (2) List of plants added in 2006 with their installed capacity¹⁸. Comparing two datasets, it is concluded that 1080 MW of installed capacity mentioned in the first dataset belongs to the power plants working with lignite in the second dataset. Therefore; the generation capacity 7,020 GWh out of 11,155 GWh of thermal total has been accepted to be produced by lignite while the rest is assumed to be produced by natural gas.

BM has been calculated ex-ante using the most recent data available. (Option 1)

Step 5. Calculating the build margin emission factor

The Build Margin emission factor $EF_{grid, BM, y}$ is calculated as the generation-weighted average emission factor of a sample of power plants m for a specific year, as follows:

$$EF_{grid, BM, y} = \sum EG_{m,y} \cdot EF_{EL,m,y} / \sum EG_{m,y}$$

Where:

$EF_{grid, BM, y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)

¹⁵ Generation Units Put Into Operation and Out of Operation in 2006, (<http://www.teias.gov.tr/ist2006/8.xls>)

¹⁶ Generation Units Put Into Operation and Out of Operation in 2005, (<http://www.teias.gov.tr/ist2005/7.xls>)

¹⁷ Generation Units Put Into Operation and Out of Operation in 2004, (<http://www.teias.gov.tr/ist2004/7.xls>)

¹⁸ Türkiye Elektrik Enerjisi 10 yıllık Üretim Kapasite Projeksiyonu, (2007-2016), pg.76-77
(<http://www.teias.gov.tr/projeksiyon/projeksiyon%20Temmuz2007.pdf>)

m = Power units included in the build margin
y = Most recent historical year for which power generation data is available

Data for oxidation index and default values for effective CO₂ emission factor have been obtained through IPCC¹⁹ guidelines. For the generation efficiencies, the real values of present thermal power plants have been used from Türkiye Çevre Atlası prepared by Ministry of Environment and Forestry²⁰. The average generation efficiencies have been calculated from the published values for existing plants. The rest of the generation efficiencies (for LPG and Naphta) have been obtained from the reference documents for best available techniques of European Integrated Pollution Prevention and Control Bureau (EIPPCB)²¹ (Table 6). The Build Margin emission factor has been determined for most recent capacity additions using the EF values calculated for each fuel source (Table 7). The emission factor has been taken as “zero” where no data is available.

Table 6- Calculation of emission factor from most recent plants.

	A	B	C	D
	COEF (tCO ₂ /Tj)	OXID	Generation Efficiency %	EF _{BAT} (tCO ₂ /MWh) (A*B/C*278)
Coal	94.6	1	33.6%	1.014
Lignite	90.9	1	32.8%	0.998
Fuel Oil	75.5	1	35.1%	0.774
Diesel	72.6	1	27.5%	0.949
LPG	61.6	1	45.0%	0.492
Naphtha	69.3	1	45.0%	0.554
Natural Gas	54.3	1	46.0%	0.425

The Build margin emission factor in the last column has been determined by multiplying each EF value with the corresponding electricity generation for that fuel and dividing by the total generation by selecting most recent capacity additions.

Table 7 - Distribution of most recent capacity additions by fuel source.

	G	H (=G/35289.8)	E	EF _w (=G*H)
Fuel Source	Generation (MWh)	Percent Generation	EF	Weighted EF
Coal	1,463	4.1%	1.014	0.04
Lignite	11,480	32.5%	0.999	0.32
Fuel Oil	565	1.6%	0.775	0.01
Diesel oil	6	0.0%	0.949	0.00
LPG	50	0.1%	0.493	0.00
Naphtha	323	0.9%	0.554	0.01

¹⁹ Table 1.4.Default CO₂ emission factors for Combustion,Vol.2. Energy, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf)

²⁰ TabloX.3.1. Türkiye'deki termik santrallerin adları, bulunduğu yer ve diğer bilgiler, Türkiye Çevre Atlası, MoEF, Ankara 2004, pg.197, (http://www.cedgm.gov.tr/dosya/cevreatlasi/atlasin_metni.pdf)

²¹ EIPPCB, Reference Document on Best Available Techniques for Large Combustion Plants, (<http://eippcb.jrc.es/pages/FActivities.htm>).



Natural Gas	19,811	56.1%	0.425	0.24
Renewable and wastes	85	0.2%	0.000	0.00
Solid	5	0.0%	0.000	0.00
Total Renewable	1,502	4.3%	0.000	0.00
<i>TOTAL Capacity additions</i>	35,289.8			0.624

Finally, by summing up the weighted EF_{BAT} values, overall build margin emission factor have been calculated as:

$$EF_{grid, BM, y} = 0.624$$

STEP 6 - Calculate the combined margin emission factor

Based on ACM0002, weighted average baseline emission factor is calculated as follows;

$$EF_{grid, CM, y} = w_{OM} * EF_{grid, OM, simple, y} + w_{BM} * EF_{grid, BM, y} \quad (13)$$

Where:

$EF_{grid, BM, y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh) as calculated from equation (12) above.

$EF_{grid, OM, y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh) as calculated from equation (1) above.

w_{OM} = Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

The default values of the weights, w_{OM} and w_{BM} , as recommended by the selected methodology are both equal to 0.5 and. These default values have been used.

Based on the formula above, baseline emission factor is calculated as;

$$EF_{grid, CM, y} = 0.5 * 0.655 + 0.5 * 0.624 = 0.640$$

The combined margin emission factor is therefore **0.640 tCO₂/MWh**, which will be used as the baseline factor in calculation of emission reduction by project activity.

The emission reduction of the project is calculated by multiplying the net produced electricity by the ($EF_{grid, CM}$) combined margin emission factor calculated above. The emission reductions are calculated according to the following formula:

$$ER (tCO_{2e}) = [EG_y (MWh) * EF_{grid, CM} (tCO_{2e}/MWh)] - LE - PE$$

Where:



ER: Emission Reduction in tCO_{2e}
EG_y: Electricity Generated in MWh
EF_{grid, CM}: Combined Margin Emission Factor in $\text{tCO}_{2e}/\text{MWh}$
LE: Leakage Emissions (Which is zero in case of hydro power plants)
PE: Project Emissions (Which may come as CH₄ emissions from the reservoir but is accepted as zero since the power density of the project is significantly high but to be conservative the emissions from the auxiliary diesel power generator is accounted)

The following table (table 8) shows the ER calculations as a result of the renewable energy supplied to the grid.



Table 8.- Emission Reductions Calculated based on the above formula without taking into account the PE resulting from the consumption of diesel fuel by the auxiliary diesel generator.

Year	Months	A-Gross Generation (Kwh)	B-Plant Consumption (KWh)	C=A-C Net Generation (Kwh)	D=C*EF _{CM} Emission Reduction Achieved (Emission Factor 0.640) kg CO _{2e}	E=(D/1000) Emission Reduction Achieved (Emission Factor 0.640tCO ₂ /MWh) tCO _{2e}
2009	October	12,485,000	22,800	12,462,200	7,975,808	7,976
	November	24,746,800	10,200	24,736,600	15,831,424	15,831
	December	35,381,908	9,240	35,372,668	22,638,508	22,639
2010	January	54,157,565	11,126	54,146,439	34,653,721	34,654
	February	46,869,027	10,014	46,859,013	29,989,768	29,990
	March	60,738,639	13,475	60,725,164	38,864,105	38,864
	April	59,007,526	10,819	58,996,707	37,757,892	37,758
	May	54,589,150	17,363	54,571,787	34,925,944	34,926
	June	21,805,245	37,499	21,767,746	13,931,357	13,931
	July	28,098,802	13,937	28,084,865	17,974,314	17,974
	August	28,809,088	13,629	28,795,459	18,429,094	18,429
	September	18,279,184	28,298	18,250,886	11,680,567	11,681
	October	12,823,926	41,541	12,782,385	8,180,726	8,181
	November	7,332,000	51,800	7,280,200	4,659,328	4,659
Total		465,123,860	291,741	464,832,119	297,492,556	297,493

E.2. Project emissions calculation

An auxiliary diesel generator operates occasionally in the event of electricity cut off. The project emissions are calculated based on the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” (Version 02) The project emissions are calculated based on the following formula

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

:

Where,

$PE_{FC,j,y}$ = Are the CO₂ emissions from fossil fuel combustion in process j during the year y (tCO₂/yr);

$FC_{i,j,y}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)

$COEF_{i,y}$ = Is the CO₂ emission coefficient of fuel type i in year y (tCO₂/mass or volume unit)

i = Are the fuel types combusted in process j during the year y

The CO₂ emission coefficient $COEF_{i,y}$ is calculated based on option B of the “ Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion Version 02) Because there is no available data related to option A, the chemical composition of the fossil fuel type i . The option B is applied as follows:

Option B: The CO₂ emission coefficient COEF_{i,y} is calculated based on net calorific value and CO₂ emission factor of the fuel type i^{22} , as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO_2,i,y}$$

COEF_{i,y} = Is the CO₂ emission coefficient of fuel type i in year y (tCO₂/mass or volume unit)

NCV_{i,y} = Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)

EF_{CO₂,i,y} = Is the weighted average CO₂ emission factor of fuel type i in year y (tCO₂/GJ)

i Are the fuel types combusted in process i during the year y

Based on the Above formula the Project Emissions is calculated as follows:

Project Emissions:

Parameter	Value	Units	Explanation
ΣDiesel Work Hours:	41	hours	Calculated as a summation of the work hours recorded in the Project Site log books.
Diesel consumption per hour at 50% Load	31	L/hours	Determined based on the technical specifications of the AKSA-ACQ350 Diesel Generator
Total Diesel Consumption (L):	1271	L	Calculated by Multiplying work hours and hourly consumption.
Cap_{PJ APJ, _i,y} (Weighted Average Density of Fuel type)	0.845	kg/L	Taken from the technical specifications of the diesel fuel provided to the market by the refineries of Turkey owned by a single company TUPRAS ²³
M=dxV	1073.995	kg	Mass of Diesel Generator in kg
FCi,j,y:	1.073995	tonne	In tonnes
NCV_{i,y}:	43.3	GJ/tonne	-
EF_{CO₂,i,y}	74.8	tCO ₂ /GJ	-
COEF_{i,y}	3.238	tCO ₂ /tonne	-
PE (t CO₂e):	3.478	tCO ₂	-
PE (kgCO₂e):	3,478	kgCO ₂	-

E.3. Leakage calculation

There is no leakage related to the project activity.

²² i indicates Diesel Fuel in our case.

²³ <http://www.tupras.com.tr/detailpage.en.php?strProductKey=403&lRedirectPageID=1145>

**E.4. Emission reductions calculation / table**

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Net emission reduction achieved by the project activity during monitoring period is calculated by subtracting the leakage emission and project emissions from the total emission reduction (that was shown to be calculated in table 8 of section E.1.) which is;

$$ER = \text{Total ER} - LE - PE$$

$$\begin{aligned} ER &= 297,492,556 \text{ kgCO}_2\text{e} - 0 \text{ kgCO}_2\text{e} - 3,478.5 \text{ kgCO}_2\text{e} \\ &= 297,489,078 \text{ kgCO}_2\text{e} \\ &= 297,489.07 \text{ tCO}_2\text{e} \text{ which rounds down to} \\ &= 297,489 \text{ tCO}_2\text{e} \end{aligned}$$

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

This section shall include a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD.

The monitoring period covers a time frame that is longer than one year, whereas the PDD considers emission reductions annually. To be able to compare the amount estimated in the PDD we have considered the sum of the first 12 months of Emission reductions as shown in the following table:

Table 9: Emission reductions by the project activity for the first year.

Year		Months	Emission Reduction Achieved (tCO _{2e})
2009	1	October	7,976
	2	November	15,831
	3	December	22,639
2010	4	January	34,654
	5	February	29,990
	6	March	38,864
	7	April	37,758
	8	May	34,926
	9	June	13,931
	10	July	17,974
	11	August	18,429
	12	September	11,681
		Total 12 Months	284,653
		<i>Project emissions over the entire monitoring period</i>	3.5
		Net Emission Reductions over 1st 12 months operations	284,649



The amount of annual Emission Reductions for a twelve month period estimated in the PDD is 209,722 tCO_{2e}. The amount that could be expected to be produced in two months can be found by dividing the annual value in 12 and multiplying it by 2 (therefore 34,954 t tCO_{2e}.)

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period (Total Emission Reductions)
Emission reductions expected during 12 months (tCO _{2e})	209,722 tCO _{2e}	284,650 tCO _{2e}
Emission reductions during the following 2 months (tCO _{2e})	34,954 tCO _{2e}	12,840 tCO _{2e}

Please note that Project Emissions (3.5 tonnes for the entire 14 month Monitoring Period) have been subtracted from the first 12 months' operation for the purposes of this Section E.5.

E.6. Remarks on difference from estimated value in the PDD

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The Annual Emission reduction of the project was estimated to be 209,722 (tCO_{2e}) in the PDD. This estimation was based on:

- an installed capacity of 99MW
- the annual electricity production data estimated considering most likely river flow data and calculations made in the feasibility report.

The project produced approximately 35.73% more electricity and therefore the ERs were also more as they are calculated based on the net electricity production over the entire monitoring period.

This increase is attributed to:

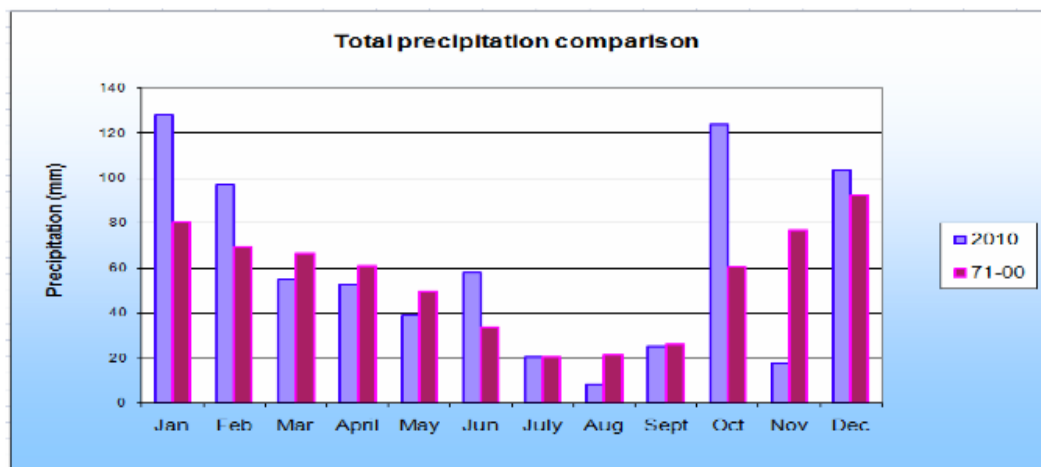
- the increase in capacity of the project to 112.42 MW, as discussed in Sections A.1 and B.5 above which meant that the project had the capacity to generate 13.5% more electricity.
- the higher water availability during the first 12 months of the monitoring period. This down to two factors:
 - o During the construction phase of the project water was stored in the regulator dam to its full capacity and this was drawn down completely over the year before the wet season, meaning that the dam could run at full capacity.
 - o Rainfall was higher during the period than expected which meant that more power could be generated. Exact data from the site is not available but the DOE is referred to the following report, page 8-11: 'State of the Climate In and Around Turkey 2010' published by the Turkish State Meteorological Service²⁴. The report states (page 9),

"Generally, western and **northeastern** parts of the country had precipitation above the mean total . . ."

²⁴ <http://emcc.dmi.gov.tr/FILES/State-of-the-Climate-in-and-Around-Turkey-in-2010.pdf> (please note the file is 4.4MB and may take time to download)

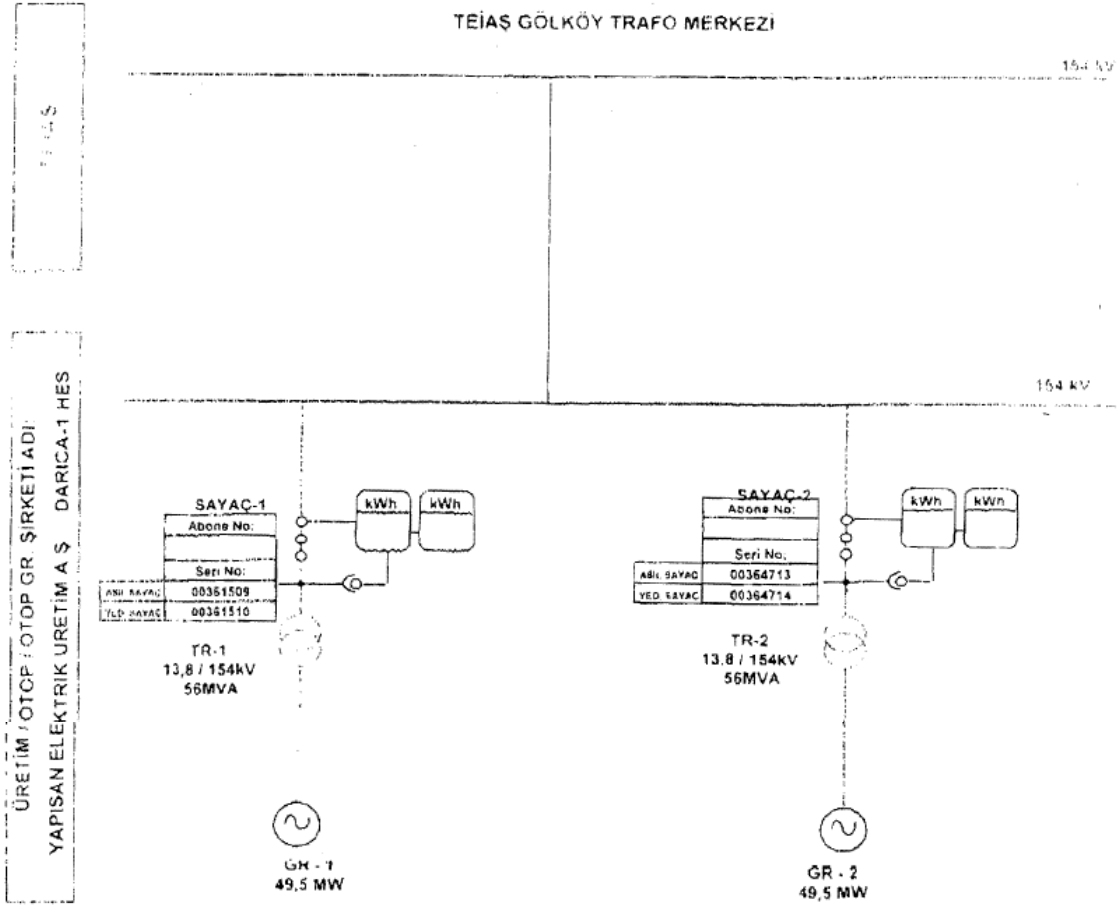


Nationally, the anomaly was +27% in 2009 and +15% in 2010, having had a rainfall below the long term mean for four of the previous five years, the one positive anomaly in that period being very small. Monthly precipitation for 2010 compared to the long-term average is shown in the table below:



ANNEX-1
THE OFFICIALLY APPROVED LINE DIAGRAM OF THE PROJECT ACTIVITY

FORM NO: K.03.01

İLETİM SİSTEMİNE YG GERİLİM SEVİYESİNDEN BAĞLI ÜRETİM TESİSLERİNİN SAYAÇLARININ BAĞLANTI
NOKTALARINI GÖSTEREN TEK HAT ŞEMASI

SAYAC KODU*	SAYAC SERİ NO	TK	Pb	Pcu	HK	Devre Sayısı	İletken Tipi	Uzunluk	Kesit	İletim Sistemi Kaybı*	Dağıtım Sistemi Kaybı OG*	Dağıtım Sistemi Kaybı AG*
		EVET/HAYIR			EVET/HAYIR							
	00361509	HAYIR			HAYIR							
	00364713	HAYIR			HAYIR							

TK=Trfo Kaybı HK=Hat Kaybı

TK ve HK "Evet" olarak işaretlenmesiyle ilgili bölümler doldurulmalıdır

* Bu bölümler, PMUM tarafından doldurulacaktır.

NOT 1. Üretim tesisine ait bilgiler, sayac sayısı, trafo ve bara gerilim seviyeleri örnek olarak gösterilmiştir. Formu bozulmadan tesisin durumuna göre sadece mevcut olan bilgileri sayısal olarak doldurmalıdır.

2. Yukarıdaki tablolardaki satır sayısı, sayac sayısına göre arttırılabilir.

	İLETİM ŞİRKETİ YETKİLİ KİŞİLER	TARİH	İMZA
1.	Aynur DOĞDAŞ AGİT	25.09.2009	X X X X
2.	Kenan KOLDERE	25.09.2009	f. k. l. d. e. r. e.

* İletim Şirketi mührü ve iki yetkili kişi imzası olmayan form geçersizdir.



History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory Document Type: Guideline, Form Business Function: Issuance		



THE ENGLISH TRANSLATION OF THE LINE DIAGRAM:

FORM NO: K.03.01

SINGLE LINE DIAGRAM INDICATING THE CONNECTION POINTS OF ELECTRICITY METERS OF ELECTRICITY GENERATING FACILITIES THAT CONNECT TO THE GRID SYSTEM VIA HIGH VOLTAGE TRANSFORMERS

