



**Monitoring report form
(Version 05.1)**

MONITORING REPORT		
Title of the project activity	7.11 MW BULAM HYDROELECTRIC POWER PLANT	
UNFCCC reference number of the project activity	GS642	
Version number of the monitoring report	04	
Completion date of the monitoring report	21.06.2016	
Monitoring period number and duration of this monitoring period	1 st Period. 01/08/2010-31/07/2015	
Project participant(s)	1-MEM Enerji Elektrik Üretim AŞ.(MEM) (Private Entity, Project Owner) 2-GTE Carbon (Private Entity, Project Developer)	
Host Party	Turkey	
Sectoral scope(s)	Sectoral scope 1: Energy Industries (Renewable-/non-renewable sources)	
Selected methodology(s)	Applied methodology: ACM0002 v.11	
Selected standardized baseline(s)	-	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	22,019 tCO ₂ annually and 110,095 tCO ₂ for the entire monitoring period (monitoring period consists 60 months)	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 July 2015	GHG emission reductions or net GHG removals by sinks reported from 6 August 2010 onwards
	76,466 tCO ₂	

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

Bulam Weir and HEPP aims utilization of the hydraulic potential for electricity generation. Project facilities occupy lands within a 5 km area starting from southeast of Recep Village and extending in east-west direction. There exists an irrigation dam at the upstream of the plant which is operational since 1987 and irrigate about 1,097ha land. Also, there exists another project at the upstream which is at design phase for providing potable water to Adıyaman which is expected to be operational by 2015. In addition, there are a hatchery and a bottling plant at the upstream which do not interact with the project. The region has a high precipitation rate and an uneven topography. There exists no protected area within the project boundaries. The project land is mainly owned by government.

Main goals of the Bulam HEPP project include;

- Utilization of the hydroelectric potential of Turkey in order to meet the increasing electricity demand and guarantee energy security.
- Increase share of run-of-river HEPPs in electricity generation mix of Turkey and reduce GHG emissions.
- Wider use of distributed energy generation systems which help to decrease the transmission loss in the grid,
- Contribute to economic development by creating direct and indirect job opportunities during construction and operation phases.
- Reduce import dependency of fossil fuel weighed electricity sector and diversify generation mix through use of local resources.

Project contributes to sustainable development in the region through creating new job opportunities during construction and operational phases. According to the research conducted by State Planning Organization(SPO) on socio-economic level of Districts in Turkey, Celikhan District is ranked as 617th among 872 Districts in Turkey in terms of development level and classified in fourth(out of six) group. About 80% of the population works on agriculture and 18.65 % works on service sector whereas only 1.4% works on industry which has caused about 18% decrease in population mainly due to lack of employment opportunities in the region. Celikhan is ranked as 867th out of 872 districts in terms of per capita income. In that respect, direct and indirect contribution of project activities to local economy through employment and supplying of needs from the region supposed to have a significant effect on local economy.

Main milestones of the project are given in table below.

Activity	Date
Issuance of Generation License	31/05/2006
EM Equipment Agreement*	06/06/2008
Start of Construction	01/08/2008
Preliminary Stakeholder Consultation Meeting	13/01/2009
SFR Meeting	17/02/2010
Approval and Commissioning	01/08/2010
End of License Period	30/05/2054

Table 1. Main project activities

* Investment Decision Date

Project uses conventional hydroelectric power generation technology. Main characteristics of the power plant are as follows:

Total installed capacity	: 7.11 MWe
Number of units	: 2
Capacity of units	: 2 x 3.55 MWe
Type of turbine	: Horizontal Francis
Gross Head	: 177.00 m
Net Head (for designed flow rate)	: 168.10 m
Synchronous speed of generators	: 750 rpm
Efficiency of turbines	: 0.930
Efficiency of generators	: 0.975

The installed capacity of the plant is designed as 7.11 MWe. Therefore, the project is expected to generate about 43.194 GWh electricity (until the end of 2015 as stated in PDD) and reduce about 22,019 tCO₂ emissions annually through replacing the electricity that would need to be supplied via the National grid in the absence of the project activity

Net electricity generation during monitoring period has been calculated as 136,088.3 MWh or 136.1 GWh nearly whereas net emission reduction is 76,466 tons CO₂ (tons of carbon dioxide equivalents). Therefore, annual electricity generation and emission reduction become 27.22 GWh and 15,293.2 tons CO₂ respectively.

Baseline emissions for the monitoring period calculated during this monitoring period is given in detail below:

Year	Value (tCO ₂)
2010	1.097,01
2011	17.590,84
2012	15,992.74
2013	17,470.6
2014	10,795.2
2015	13,535.3
Total	76,481.6

A.2. Location of project activity

Bulam Weir and HEPP Project is located on River Bulam which is a tributary of River Fırat. The project activity is located in Southeast Anatolia, within the borders of Adiyaman province. The project location is near the highway joining Adiyaman and Celikhan district of Malatya, approximately 35 km away from Adiyaman centrum and 12 km from Kocali village.

The coordinates of the project is given as;

Latitude	37° 58' 48.5" - 59' 22.6" – N
Longitude	38° 17' 46.8" - 15' 02.7" – E



Figure 1: Project Location

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether the Party involved wishes to be considered as project participant (yes/no)
Turkey	1-MEM Enerji Elektrik Üretim AŞ.(MEM) (Private Entity, Project Owner) 2-GTE Carbon (Private Entity, Project Developer)	No

A.4. Reference of applied methodology and standardized baseline

The United Nations approved consolidated baseline methodology applicable to this project is ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources”, Version 11¹

ACM0002 refers to the following tools:

- “Tool for the demonstration and assessment of additionality”, Version 05.2² and
- “Tool to calculate the emission factor for an electricity system”, Version 01.1³.

A.5. Crediting period of project activity

Crediting period of the project is 7 years which is twice renewable between 01/08/2010-01/08/2017.

A.6. Contact information of responsible persons/entities

Project Participants	Role/Responsibilities	Contact Information
MEM Enerji Elektrik Üretim AŞ.(MEM)	Owner of the VER rights of the project. Construction and Operation of the power plant in line with regulations. Implementation of monitoring plan and collecting and archiving monitoring data	Özlem Palabıyık Gümüşsuyu, Miralay Şefik Bey Sokak, Akhan, No:15 Beyoğlu, İstanbul Phone: 0 (212) 249 82 82 E-Mail: opalabiyik@akenerji.com
GTE Carbon	Development of project documents. Managing validation and verification processes for the project.	M.Kemal Demirkol Ehlibeyt Mahallesi 1259 sk 7/2 Balgat Cankaya Ankara TURKEY Tel:90 312 472 35 00 Fax: 90 312 472 33 66 E-mail: kemal@gtecarbon.com

¹

https://cdm.unfccc.int/filestorage/H/G/Y/HGY3TLRFPQVM016WA4I7XCZD92KE5S/EB52_repan07_ACM0002_ver11.pdf?t=Mk18bzdkNHpvfDBBqLJf3YLSBs1ZDKMgTDwX

² http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

³ See: http://cdm.unfccc.int/methodologies/Tools/EB35_repan12_Tool_grid_emission.pdf

SECTION B. Implementation of project activity**B.1. Description of implemented registered project activity**

Bulam Weir and HEPP Project is made up of a weir, a transmission pipe, a headrace tunnel, a forebay dam, a penstock and a power house. Held and channelized by a weir to be built at 1,240 m riverbed elevation and 1,251 m crest elevation, water from Bulam creek is taken into the first section of transmission pipe of 1.50 m diameter and 524.93 m length at the take off base elevation of 1,245.00 m. Then, same water flow passes through the modified horseshoe tunnel of 3.00 m inner diameter and 2,421.29 m length to reach into the second section of transmission pipe of 1.50 m diameter and 1,247.70 m length, which is followed by the surge tank and the valve chamber. Total length of the transmission system is 4,193.92 m of which 1,772.63 m is made up of CTP pipe. All of the transmission plants are under pressure.

Installed capacity of Bulam HEPP is 7.11 MWe (7.9 MWm). It was commissioned after 2 years of construction period. The annual electricity production capacity is around 32.4 GWh.

Since in the preliminary license application, the project which supplies drinking water to Adiyaman province from the Bulam River was not finalized, the license for the project was taken as 9 MW. However the license was revised in November 2008 and the installed capacity was reduced to 7.11 MWe.

The energy which is to be generated at the Hydroelectric Power Plant transmitted to Celikhan grid substation, located 12 kilometres away at the northeast of the project site, with a power transmission line. Length of the transmission line is 12 km, double circuit, 34.5 kV, 2 x 3/0 AWG conductors.

B.2. Post-registration changes**B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline**

No temporary deviations from registered monitoring plan or applied methodology is reported during the monitoring period.

B.2.2. Corrections

No corrections to project information or parameters have been made.

B.2.3. Changes to start date of crediting period

No changes to the start date of crediting period have been approved during this monitoring period or submitted with this monitoring report

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

No change on project design has been made.

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

No permanent changes from the registered monitoring plan or applied methodologies have been approved during this monitoring period or submitted with this monitoring report.

B.2.6. Changes to project design of registered project activity

N/A

B.2.7. Types of changes specific to afforestation or reforestation project activity

N/A

SECTION C. Description of monitoring system

Monitoring is a key procedure to verify the real and measurable emission reductions from the proposed project. To guarantee the proposed project's real, measurable and long-term GHG emission reductions, the monitoring plan is established. Project has been registered as a GS-VER project. In addition to the parameters monitored in PDD, there exist sustainable development indicators as given in GS passport document.

In order to demonstrate the emission reduction, only the required data is the net electricity delivered to the grid by the project activity.

Net electricity generation was measured and recorded by both TEIAS (EPIAŞ) and project owners for billing purposes. Therefore, no new additional protocol was needed for monitoring emission reduction. Power Plant Manager was responsible for the electricity generated, gathering all relevant data and keeping the records.

Generation data collected during crediting period was submitted to GTE Carbon who was responsible for calculating the emission reduction subject for verification. Generation data was used to prepare monitoring reports which is used to determine the vintage from the project activity. These reports were submitted to the duly authorized and appointed Designated Operational Entity (DOE) during each verification period.

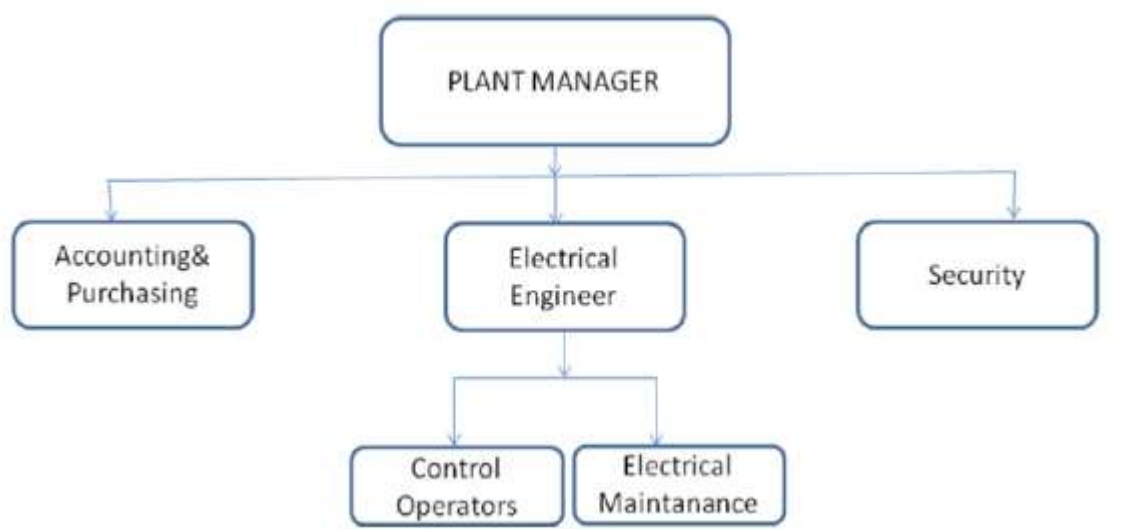
Verification Team is composed from;

Plant Manager & Electrical Engineer: Plant Manager has been assigned as both plant manager and for the general responsible of compliance with VER monitoring plan. He is responsible for day to day running of plant, recording and monitoring of relevant data.

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

GTE Carbon: Responsible for emission reduction calculations, preparing monitoring report and periodical verification process.

Installation of metering devices and data monitoring were carried out according to the regulations and control process of TEIAS. Two metering devices (one of them used as spare) were used for monitoring the electricity generated by the power plant. Readings were done using main metering device and spare metering device was used for comparison only. The calibration of the meters has been carried out on 17/11/2009. Maintenance and test of metering devices are done regularly by TEIAS annually. Moreover, diesel consumption of the generator is calculated based on diesel used in the related monitoring period. Related figure to understand the recording and grid connection line are shown below.



SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

(Copy this table for each piece of data and parameter)

Data/parameter:	EG _{y, Total}
Unit	GWh
Description	Net Electricity delivered to the grid by power plants in Turkey in year 2011
Source of data	http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2014/istatistik2014.htm (Annual Development of Installed Capacity and Generation in Turkey (1970-2014))
Value(s) applied)	229.395
Choice of data or measurement methods and procedures	Data is used for OM calculation and value. The remaining calculation and value is from the previous monitoring report and the related date of the PDD, since this is an ex-ante situation for this project.
Purpose of data	Data used for emission reduction calculation (for calculation of OM, Net-to-Gross electricity ratio and share of low-cost must-run sources)
Additional comments	N/A

Data/parameter:	EFCO _{2, i, y i}
Unit	tCO ₂ /TJ
Description	CO ₂ emission factor of fossil fuel type "i" in year "y"
Source of data	-For EF of fossil fuels, IPCC values at the lower limit have been used.

Value(s) applied)	Fuel Source	EF(tCO₂/Tj)
	Coal	89.5
	Lignite	90.9
	Fuel Oil	75.5
	Diesel	72.6
	LPG	61.6
	Naphta	69.3
	Natural Gas	54.3
Choice of data or measurement methods and procedures	According to ACM0002, IPCC default values at lower limit of 95% confidence interval can be used. Although, the actual emission reduction is expected to be higher due to high EF of fuel consumed in existing power plants, IPCC values have been used for conservativeness as requested by the methodology.	
Purpose of data	Data is used for baseline/project emission calculations.	
Additional comments	N/A	

Data/parameter:	FC_{i,y}
Unit	Tons or 1000 m ³ for gases
Description	Amount of fuels consumed by thermal power plants for electricity generation in terms of fossil fuel type i in year y
Source of data	http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2014/istatistik2014.htm (Fuels Consumed In Thermal P.Ps In Turkey By The Electricity Utilities (2006-2014))
Value(s) applied)	See Annex 3 of the PDD
Choice of data or measurement methods and procedures	Data is chosen for the country specific calculation for the OM value. Also, see Annex 3 of the PDD
Purpose of data	Data is used for OM calculation
Additional comments	N/A

Data/parameter:	GE
Unit	%
Description	Generation efficiency of thermal power plants
Source of data	Annex I- Tool to calculate the emission factor for an electricity system
Value(s) applied)	See Annex 3 of the PDD
Choice of data or measurement methods and procedures	Data is chosen for the country specific calculation for the BM value.
Purpose of data	Data used for BM calculation
Additional comments	N/A

Data/parameter:	NCV
Unit	Tj/kt
Description	Net Calorific Values of Fuel combusted in power plants.
Source of data	http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2014/istatistik2014.htm
Value(s) applied)	See Annex 3 of the PDD
Choice of data or measurement methods and procedures	Data is chosen to exact calculation of the project emission caused by the specific combustion features of fuel type in this project.
Purpose of data	Data used for OM and BM calculation
Additional comments	N/A

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter)

Data/parameter:	EG_{facility,y}																						
Unit	MWh																						
Description	Net Electricity generated and delivered to the grid by the Bulam HEPP in year "y"																						
Measured/calculated/default	Measured																						
Source of data	Metering devices used in power plants, monthly records signed by TEIAS & recorded in the page of EPIAŞ and plants manager and invoices are used.																						
Value(s) of monitored parameter	136,088.3 MWh or 136.1 GWh nearly during monitoring period.																						
Monitoring equipment	<p>Specifications of the metering devices are as follows:</p> <table border="1"> <thead> <tr> <th>Manufacturer</th> <th>Device Model</th> <th>Serial Number</th> <th>Accuracy Class</th> <th>Last Calibration</th> <th>Precision</th> </tr> </thead> <tbody> <tr> <td>ABB-ELSTER</td> <td>A1500</td> <td>00401677</td> <td>0.5S</td> <td rowspan="2">17/11/2009</td> <td>< 0.05 %</td> </tr> <tr> <td>ABB-ELSTER</td> <td>A1500</td> <td>00401678</td> <td>0.5S</td> <td>< 0.05 %</td> </tr> </tbody> </table> <p>Meter with the serial number 00401677 is the main meter.</p> <p>Meter with the serial number 00401678 is the back-up meter</p>						Manufacturer	Device Model	Serial Number	Accuracy Class	Last Calibration	Precision	ABB-ELSTER	A1500	00401677	0.5S	17/11/2009	< 0.05 %	ABB-ELSTER	A1500	00401678	0.5S	< 0.05 %
Manufacturer	Device Model	Serial Number	Accuracy Class	Last Calibration	Precision																		
ABB-ELSTER	A1500	00401677	0.5S	17/11/2009	< 0.05 %																		
ABB-ELSTER	A1500	00401678	0.5S		< 0.05 %																		
Measuring/reading/recording frequency:	Continuous measurement and at least monthly recording																						
Calculation method (if applicable):	N/A																						
QA/QC procedures:	Maintenance and test of the metering devices will be made by accredited laboratory and TEIAS annually. The calibration of the meters has been carried out on 10/12/2009 (calibration certificates are shared during the first and verified monitoring period) and it will be valid till the 2019 as per the related regulations.																						

Purpose of data:	Data is used for baseline emission calculation
Additional comments:	N/A

Data/parameter:	Cap_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Measured/calculated/default	Determined for once before the construction of the project
Source of data	Project site and official documents of the project
Value(s) of monitored parameter	2* 3.515 MWe = 7,110,000 W
Monitoring equipment	N/A
Measuring/reading/recording frequency:	Yearly
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	Power density calculation of the plant
Additional comments:	N/A

Data/parameter:	A_{PJ}
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	Project site. Determined for once before the construction of the project.
Source of data	Project map.
Value(s) of monitored parameter	18,670
Monitoring equipment	N/A
Measuring/reading/recording frequency:	Yearly
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	Calculation of project emissions
Additional comments:	Project involves a small weir and will not cause any new flooded area or reservoir formation.

Data/parameter:	FC_{i,i,y}
Unit	Mass or Volume unit per year (e.g. ton/yr or m ³ /yr or lt/monitoring period)
Description	Quantity of fuel type i combusted in Diesel power generator during the year y
Measured/calculated/default	Project site
Source of data	Fuel (diesel) invoices
Value(s) of monitored parameter	5,481.4 Lt
Monitoring equipment	N/A
Measuring/reading/recording frequency:	Continuous monitoring

Calculation method (if applicable):	Formula is used which is referred in the applied methodology
QA/QC procedures:	N/A
Purpose of data:	Calculation of project emissions
Additional comments:	N/A

D.3. Implementation of sampling plan

Data and parameters above are not determined by a sampling approach.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

Baseline emission is calculated according to the formula

$$BE_y = E_{Gy} \times EF_y$$

Where:

E_{Gy} = Net electricity delivered to the grid by the project activity in year y excluding transmission losses of the grid.

EF_y = Emission factor calculated according to selected methodology

E_{Gy} (from August 2010 to July 2015) = 136,088.3 MWh,

EF_y = 562 tCO₂/GWh and so,

BE_y = 76,481.6

According to the registered PDD the EF was calculated for the project as 562 tCO₂/GWh.

Section E5 summarized the net emission reductions achieved by the project.

E.2. Calculation of project emissions or actual net GHG removals by sinks

The proposed project activity involves the generation of electricity by a hydroelectric power plant which do not cause any newly flooded area or formation of a new reservoir. However, to be conservative, existing river bed was assumed as "0" and power density was calculated accordingly.

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

$$PD = \frac{CapPJ - CapBL}{APJ - ABL}$$

$$APJ - ABL$$

Where:

PD = Power density of the project activity (W/m²)

CapPJ = Installed capacity of the hydro power plant after the implementation of the project activity (W)

CapBL = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

APJ = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m²)

ABL = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m²). For new reservoirs, this value is zero

For proposed project HEPP,

$$CapPJ = 7,110,000 \text{ W}$$

$$CapBL = 0.0 \text{ W}$$

$$APJ = 18,670 \text{ (m}^2\text{)}$$

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

Therefore PD is calculated as ;

$$PD = \frac{7110000 - 0}{18670 - 0}$$

$$18670 - 0$$

$$PD = 380.8 \text{ W/m}^2$$

Emissions from Diesel Generator

In this monitoring period, 5,481.4 liters of diesel oil is calculated to be consumed by all of the generators.

According to the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” CO₂ emissions from fossil fuel combustion for process are calculated based on the quantity of fuels combusted and the CO₂ emission coefficient of those fuels, as follows:

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

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

For calculating the COEF_{i,y} option B has been used which is given as;

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO_2,i,y} \tag{4}$$

Where:

- 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 j during the year y

COEF for diesel fuel has been calculated and based on these parameters, PE due to diesel generator has been calculated for the monitoring period. Calculations and references are indicated in excel sheet.

The NCV (0.043 GJ/tonnes) is obtained from the IPCC 2006 Guidelines.⁴ The density of diesel is obtained from TUPRAS website.⁵

The EF is calculated based on the carbon conversion unit (20 t C/TJ) given in the Turkey’s National Inventory Report.⁶

$$COEF_{i,y} = [0.043 * (20 * (44/12)) * 1000] / ((1/845) * 1,000,000)$$

$$COEF_{i,y} = 2.646 \text{ kg CO}_2/\text{lt}$$

Thus, the project emission from the diesel generator is calculated as:

⁴ IPCC 2006. Vol.2, Ch.1, pg.1.18-1.19

⁵ <http://www.tupras.com.tr/detailpage.tr.php?strProductKey=403&IRedirectPageID=145>

⁶ UNFCCC Turkey National Inventory Report 2015 (Table 1A(b)). Value given in t C per TJ. Converted to kg CO₂e per kWh. Then converted to kg CO₂e per L using NCV. http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php

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

$PE_{FC,i,y} = 800 \text{ Lt (between 31/06/2013 - 31/07/2015)} + 4681.4 \text{ Lt (between 06/08/2010 - 31/06/2013)}$
 $* 0.00246(\text{t CO}_2) = 15.00 \text{ tones CO}_2$

E.3. Calculation of leakage

The energy generating equipment is not transferred from or to another activity. Therefore leakage is also considered as "0".

$$LE_y = 0$$

As a result: Total Emission Reduction is;

$$ER_y = BE_y - PE_y$$

E.4. Summary of calculation of emission reductions or net GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	GHG emission reductions or net GHG removals by sinks (t CO ₂ e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	76,481.6	15	0	34,668.2 tCO ₂	41,798.947 tCO ₂	76,466 tCO ₂

E.5. Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO ₂ e)	110,095 (for 60 months of this monitoring period)	76,466 (for 60 months of this monitoring period)

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

The value in the registered PDD is calculated ex-ante for a duration of one complete year and assuming the plant is working at optimum output rate. Since the project is an HPP, seasonal effects are significant on the monthly generation rates and minor deviations from the calculated values are acceptable. In this monitoring period, the realized generation has been lower than the expected amount taking ground from uncertainties in water regimes and over estimation of annual gross or net electricity output.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	<input checked="" type="checkbox"/> Project participant <input checked="" type="checkbox"/> Responsible person/ entity for completing the CDM-MR-FORM
Organization name	GTE Carbon
Street/P.O. Box	Ehlibeyt Mah 1259. Sk. Balgat
Building	7
City	Ankara
State/Region	-
Postcode	06520
Country	Turkey
Telephone	(0090) 312 472 35 00
Fax	(0090) 312 472 33 66
E-mail	gte@gtecarbon.com
Website	www.gtecarbon.com
Contact person	
Title	Managing Director
Salutation	Mr
Last name	Demirkol
Middle name	Kemal
First name	Mehmet
Department	Management
Mobile	-
Direct fax	(+90) 312 472 33 66
Direct tel.	(+90) 312 472 35 00 - 19
Personal e-mail	kemal@gtecarbon.com

Project participant and/or responsible person/ entity	<input checked="" type="checkbox"/> Project participant <input type="checkbox"/> Responsible person/ entity for completing the CDM-MR-FORM
Organization name	MEM Enerji Elektrik Üretim AŞ.(MEM) (Project Owner)
Street/P.O. Box	Gümüşsuyu, Miralay Şefik Bey Sokak, Akhan, No:15 Beyoğlu, İstanbul
Building	15
City	İstanbul
State/Region	-
Postcode	-
Country	Turkey
Telephone	0 (212) 249 82 82
Fax	0 (212) 249 73 55
E-mail	-
Website	-
Contact person	
Title	Manager
Salutation	Mrs
Last name	Palabiyik
Middle name	-
First name	Özlem
Department	Management
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	opalabiyik@akenerji.com

Monitoring of Sustainable Development Parameters:

Indicator	Air Quality	
Mitigation measure	N/A	
Chosen Parameters	1- SO ₂ emissions reductions 2- NO _x emissions reductions	
Current Situation of the Parameters	<p>Plant is operational and has started contributing to the air quality. Total SO₂ emission related to electricity generation is about 167.89 Gg in 2012 according to National Inventory of Turkey (http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php) Considering that electricity generation in 2012 is 239,496.8 GWh, SO₂ emission per MWh is calculated as 0.70 kg/MWh.</p> <p>In parallel to the electricity generation, actual SO₂ emission reduction has been realized as about 95.40 tons during monitoring period.</p> <p>Plant is operational and has started contributing to the air quality. Total NO_x emission related to electricity generation is about 324.30 Gg in 2012 according to National Inventory of Turkey (http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php). NO_x emission per MWh is calculated as 1.35 kg.</p> <p>NO_x emission reduction corresponding to actual electricity generation is calculated as 184.28 tons.</p>	
Future Target for Parameters	Reductions based on maximum annual output of 43.194 GWh/y are aimed.	
Way of Monitoring	How	Electricity generated by the project activity, NO _x and SO ₂ emission data from GHG inventory of Turkey will be used as reference in calculation of the emission reduction.
	When	Every Monitoring Period
	By Who	Project Developer

Indicator	Biodiversity	
Mitigation measure	Building a functional fish passage. Fish passage has been designed by experienced engineering company considering river characteristics and also reviewed by Province Directorate of Agriculture's experts. The functionality of the fish passage also is monitored by the experts after commissioning.	
Chosen Parameter 1.1	Impact on Aquatic Life	
Current Situation of the Parameters	On July 2012, Bulam HPP was evaluated for fish passage and environmental flows. In this report, it was determined that fish passage was not appropriate for fish migration. Hence, relevant changes proposed to the project owner. In order to determine the changes in the fish passage, a new examination was made for Bulam HPP in 17 June 2013 and it was observed that the issue has been resolved. ⁷ As a result, the fish passage of the Bulam Hydroelectric power Plant gained functionality after the structural revision.	
Future Target for Parameters	The project activity will remain neutral for the regional biodiversity	
Way of	How	Through site visits and observation reports.

⁷ SUPPLEMENTARY REPORT ABOUT BULAM HYDROELECTRIC POWER PLANT (HPP)

	When	Until it's been decided that the passage is appropriate and functional
	By Who	Project Owner
Chosen Parameter 1.2		Planting of trees around the project site
Current Situation of the Parameters		As per the report dated 16/06/2011, approved by the regional Administration of Forestry, it has been confirmed that approximately 35,000 new saplings and young trees were planted in a 190ha area near the project site. ⁸
Future Target for Parameters		The project activity will remain neutral for the regional biodiversity
Way of Monitoring	How	Through site visits and observation reports.
	When	Until it's been decided that the passage is appropriate and functional
	By Who	Project Owner



Figure: Afforestation Activities

Indicator	Quality of Employment
Mitigation measure	Recruited people will be trained for increasing technical skills and awareness about health, safety and environmental issues.
Chosen Parameters	Number of people trained (certificates)

⁸ Afforestation Field Report

Current Situation of the Parameters		<p>Existing and new staff are being continuously trained in relevant disciplines. (High voltage equipment, HSE, fire extinguishing, first aid etc.)</p> <p>Trainings covering several issues have been provided to the staff during this monitoring period. Brief summary of documents is given below for the period of after 2013. Documents related with before 2013 and all the other for the entire monitoring period are shared via attachments.</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Certificates & Trainings</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Tuncay KÖK</td> <td>Instrumentation & Calibration (2013)</td> </tr> <tr> <td>Health & Safety (2013, 2014, 2015)</td> </tr> <tr> <td>Environmental Legislation & Waste Management (2013, 2015)</td> </tr> <tr> <td rowspan="4">Erdihan DEMİR</td> <td>Instrumentation & Calibration (2013)</td> </tr> <tr> <td>Health & Safety (2013, 2014, 2015)</td> </tr> <tr> <td>Environmental Legislation & Waste Management (2013, 2015)</td> </tr> <tr> <td>ISO9001, ISO14001</td> </tr> <tr> <td rowspan="3">Hasari TAYMAZ</td> <td>Instrumentation & Calibration (2013)</td> </tr> <tr> <td>Health & Safety (2013, 2014, 2015)</td> </tr> <tr> <td>Environmental Legislation & Waste Management (2013, 2015)</td> </tr> <tr> <td rowspan="3">Habip IŞIK</td> <td>Instrumentation & Calibration (2013)</td> </tr> <tr> <td>Health & Safety (2013, 2014, 2015)</td> </tr> <tr> <td>Environmental Legislation & Waste Management (2013)</td> </tr> <tr> <td rowspan="3">Abdurrahman ÇAVUŞ</td> <td>Instrumentation & Calibration (2013)</td> </tr> <tr> <td>Health & Safety (2013, 2014, 2015)</td> </tr> <tr> <td>Environmental Legislation & Waste Management (2013, 2015)</td> </tr> <tr> <td rowspan="3">Mehmet BAKIR</td> <td>Instrumentation & Calibration (2013)</td> </tr> <tr> <td>Health & Safety (2013, 2014, 2015)</td> </tr> <tr> <td>Environmental Legislation & Waste Management (2013, 2015)</td> </tr> </tbody> </table>	Name	Certificates & Trainings	Tuncay KÖK	Instrumentation & Calibration (2013)	Health & Safety (2013, 2014, 2015)	Environmental Legislation & Waste Management (2013, 2015)	Erdihan DEMİR	Instrumentation & Calibration (2013)	Health & Safety (2013, 2014, 2015)	Environmental Legislation & Waste Management (2013, 2015)	ISO9001, ISO14001	Hasari TAYMAZ	Instrumentation & Calibration (2013)	Health & Safety (2013, 2014, 2015)	Environmental Legislation & Waste Management (2013, 2015)	Habip IŞIK	Instrumentation & Calibration (2013)	Health & Safety (2013, 2014, 2015)	Environmental Legislation & Waste Management (2013)	Abdurrahman ÇAVUŞ	Instrumentation & Calibration (2013)	Health & Safety (2013, 2014, 2015)	Environmental Legislation & Waste Management (2013, 2015)	Mehmet BAKIR	Instrumentation & Calibration (2013)	Health & Safety (2013, 2014, 2015)	Environmental Legislation & Waste Management (2013, 2015)
Name	Certificates & Trainings																												
Tuncay KÖK	Instrumentation & Calibration (2013)																												
	Health & Safety (2013, 2014, 2015)																												
	Environmental Legislation & Waste Management (2013, 2015)																												
Erdihan DEMİR	Instrumentation & Calibration (2013)																												
	Health & Safety (2013, 2014, 2015)																												
	Environmental Legislation & Waste Management (2013, 2015)																												
	ISO9001, ISO14001																												
Hasari TAYMAZ	Instrumentation & Calibration (2013)																												
	Health & Safety (2013, 2014, 2015)																												
	Environmental Legislation & Waste Management (2013, 2015)																												
Habip IŞIK	Instrumentation & Calibration (2013)																												
	Health & Safety (2013, 2014, 2015)																												
	Environmental Legislation & Waste Management (2013)																												
Abdurrahman ÇAVUŞ	Instrumentation & Calibration (2013)																												
	Health & Safety (2013, 2014, 2015)																												
	Environmental Legislation & Waste Management (2013, 2015)																												
Mehmet BAKIR	Instrumentation & Calibration (2013)																												
	Health & Safety (2013, 2014, 2015)																												
	Environmental Legislation & Waste Management (2013, 2015)																												
Future Target for Parameters		All technical staff will be provided with necessary trainings.																											
Way of Monitoring	How	Through evaluation of training certificates and new job opportunities created.																											
	When	Once for crediting period or yearly																											
	By Who	Project developer																											

Indicator	Quantitative employment and income generation																
Mitigation measure	N/A																
Chosen Parameters	People employed during operation																
Current Situation of the Parameters	<p>List of employees:</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Period</th> </tr> </thead> <tbody> <tr> <td>Tuncay KÖK</td> <td>14.04.2010 - Present</td> </tr> <tr> <td>Erdihan DEMİR</td> <td>15.04.2010 - Present</td> </tr> <tr> <td>Hasari TAYMAZ</td> <td>10.05.2010 - Present</td> </tr> <tr> <td>Ahmet KONAKLI</td> <td>01.07.2010 - Present</td> </tr> <tr> <td>Mehmet BAKIR</td> <td>01.07.2010 - Present</td> </tr> <tr> <td>Habip IŞIK</td> <td>21.07.2010 - 2015</td> </tr> <tr> <td>Abdurrahman ÇAVUŞ</td> <td>19.01.2012 - Present</td> </tr> </tbody> </table>	Name	Period	Tuncay KÖK	14.04.2010 - Present	Erdihan DEMİR	15.04.2010 - Present	Hasari TAYMAZ	10.05.2010 - Present	Ahmet KONAKLI	01.07.2010 - Present	Mehmet BAKIR	01.07.2010 - Present	Habip IŞIK	21.07.2010 - 2015	Abdurrahman ÇAVUŞ	19.01.2012 - Present
Name	Period																
Tuncay KÖK	14.04.2010 - Present																
Erdihan DEMİR	15.04.2010 - Present																
Hasari TAYMAZ	10.05.2010 - Present																
Ahmet KONAKLI	01.07.2010 - Present																
Mehmet BAKIR	01.07.2010 - Present																
Habip IŞIK	21.07.2010 - 2015																
Abdurrahman ÇAVUŞ	19.01.2012 - Present																

Future Target for Parameters		Local labour will be prioritized when additional work force is required.
Way of Monitoring	How	Through evaluation documents for wages paid and social security documents.
	When	Once for crediting period or yearly
	By Who	Project developer

Indicator		Balance of payments
Mitigation measure		Decrease dependency on fossil fuel through increasing use of local resources.
Chosen Parameters		Currency saving.
Current Situation of the Parameters		In 2014, about 25.426 bn m ³ natural gas been used ⁹ for about 120,576 GWh electricity generation ¹⁰ and about € 6.7 bn has been spent. ¹¹ During monitoring period, about 28.697 million m ³ NG has been saved which approximately corresponds to 7,149,638.657 €.
Future Target for Parameters		Decreasing natural gas consumption for electricity generation within the increasing net electricity generation of the project via nearing to expected generation value annually.
Way of Monitoring	How	Through comparing electricity generated by the project and natural gas that would be used to produce the same amount of electricity according to baseline scenario.
	When	Yearly
	By Who	Project developer

Indicator		Water Quality and quantity
Mitigation measure		Release of required minimum flow to protect aquatic life and provide access of local people to water resources.
Chosen Parameters 1.1		Flow rate of water released from the weir.

⁹ <http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2014/istatistik2014.htm> (Türkiye Termik Santrallerinde Kullanılan Yakıt Miktarlarının Üretici Kuruluşlara Göre Dağılımı (2006 - 2014) - Fuels Consumed In Thermal P.Ps In Turkey By The Electricity Utilities (2006-2014))

¹⁰ <http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2014/istatistik2014.htm> (Türkiye Elektrik Enerjisi Üretimine Birincil Kaynaklarına ve Üretici Kuruluşlara Göre Dağılımı (2014) - The Distribution of Gross Electricity Generation by Primary Energy Resources and The Electricity Utilities in Turkey (2014))

¹¹ <http://www.igdas.istanbul/SatisTarifesi/Index/0?lang=tr&sc=1&tarih=1.1.2011>

(from; <http://www.igdas.istanbul/satistarifesi>)

<p>Current Situation of the Parameters</p>	<p>To compare the released environmental flow and minimum environmental flow reported in the expert report, depths of environmental flows are more reliable to compare than the flow rate. The cross-sectional parameters of gauging station in Bulam Stream may be calculated in different ways by DSI, expert and company who measures the flow on the behalf of project owner (Akim Elektronik).</p> <p>In the light of this concept, environmental flow depth was a little bit lower than the minimum flow depth determined by the report of the expert ("0.26 m" in between October and March and "0.27" m in between April and September) in April-December period of 2014 (varied between 0.15-0.25 m) and in July 2015 (varied between 0.19-0.26 m).</p> <p>When the expected annual electricity generation of this project (43,194 MWh or 43.194) and generated electricity in reality (27.22 GWh) are compared to each other, it is clear that the expected generation is close to the two times of output in reality. It is obvious that the hydraulic water regime affected the project activity in the worst case. Therefore, keeping the limits of the minimum flow which is reported by expert was highly challenging case for the project in most of the months of this monitoring period.</p> <p>Additionally, net electricity generation of the June-July-August-September-October of the 2014 were 1261.057 - 678.804 – 451.472 – 472.-080 – 884.187 MWh respectively while the monthly net average electricity generation of 2014 is 1,600.714 MWh. Moreover, while July 2015 net electricity generation was 2677.456 MWh, monthly net average electricity generation of 2015 is 3440.586 MWh. As it could be understand from these values, problematic months of environmental flow are the months when the project activities came face to face with highly challenging hydraulic water flow regime for electricity production. Detailed analysis and values could also be seen in the emission reduction calculation sheet of the verification calculation excel document.</p> <p>Additionally, water availability statement of the head of Soğukpınar Village is given in figure below.</p>	
<p>Future Target for Parameters</p>	<p>As stated in PDD of this project; minimum flow has initially been determined as 100l/s but later has been increased to minimum 10% of average natural flow in recent 10 years which can be increased by DSI if necessary. The figure 10% is the minimum amount derived from Tennant (Montana) method which is the most commonly applied model. By using Tennant (Montana) method, environmental flow rate was estimated as "0.345 m³/s" in between October and March and "0.387 m³/s" in between April and September. Accordingly, The depths for environmental flow rates were estimated as "0.26 m" (in between October and March) and "0.27" m (in between April and September) for Tennant method. Minimum flow can be increased anytime in the future if it is seen that 10% is not sufficient as per the water right utilization agreement between the project owner and DSI.</p>	
<p>Way of Monitoring</p>	<p>How</p>	<p>Flow measurements from the weir and expert assessment on adequacy of flow released. A gauging station has been installed at the downstream of the weir to monitor the minimal flow released continuously. Gauging station has been purchased by project owner and installed at a location determined by DSI. Adequacy of the flow released will also be assessed by an independent expert. The expert report will include references and data relevant to local conditions and fieldwork. Any recommendations or need for additional measures will be discussed in the report.</p> <p>Access of locals to water resources will also assessed by the expert</p>
	<p>When</p>	<p>Continuously</p>
	<p>By Who</p>	<p>Project owner</p>
<p>Mitigation measure</p>	<p>Isolation of tunnel to prevent leakages and disappearing springs.</p>	

Chosen Parameters 1.2	Change in amount of water available to Soğukpınar village	
Current Situation of the Parameters	Natural flow of spring and river	
Future Target for Parameters	Same as before project implementation	
Way of Monitoring	How	Interviews with locals.
	When	Continuously
	By Who	Project owner

İlgili Makama;

Mem Enerji Bulam Hidroelektrik Santrali inşaat esnasında soğukpınar su kaynaklarında azalma olduğu görülmüştü, 16.07.2013 Tarihindeki kontrollerde su kaynağının aktif olduğu ve şu an için herhangi bir sıkıntı olmadığı gözlenmiştir.


Ali ATAY

Doğanlı köyü Muhtarı

Figure. Water Amount Observation Statement

Indicator	Soil Condition	
Mitigation measure	Proper storage and use of aggregates from excavation works.	
Chosen Parameters 1.1	Soil erosion within the project site	
Current Situation of the Parameters	No soil erosion within project boundaries. Related pictures given below to show the situation of project site.	
Future Target for Parameters	Aggregates should be stored appropriately and no erosion should occur due to project activities.	
Way of Monitoring	How	Site investigation and interviews with locals.
	When	Once after construction activities are over.
	By Who	Project owner
Mitigation measure	Ensuring proper design without disrupting the sediment flow in the river	
Chosen Parameters 1.2	Sediment transport along the river	
Current Situation of the Parameters	Natural regime	
Future Target for Parameters	No accumulation at the upstream and downstream of the weir.	
Way of	How	Visual observations and pictures taken on site.

	When	Yearly
	By Who	Project owner



Figure. Proper storage and use of aggregates from excavation Works at the Project site. Planting trees helps to take precautions against erosion problem



Figure. Proper storage and use of aggregates from excavation Works at the Project site. Planting trees helps to take precautions against erosion problem



Indicator	Other Pollutants – Dust and Waste Oil
Mitigation measure	Collecting waste oil and disposing appropriately

Chosen Parameters	Records for waste oil generation and disposal	
Current Situation of the Parameters	Waste oil is being handled in line with the national regulations. Related documents are shared via attachments with DOE for the period of 2010-2012. After 2012 there was not any waste oil existence to dispose.	
Future Target for Parameters	All wastes will be collected and disposed as required by relevant regulations and company standards.	
Way of Monitoring	How	Review of waste oil generation and disposal records.
	When	Annually
	By Who	Project owner