

# KOYULHISAR HYDRO ELECTRICITY POWER PLANT

Document Prepared By Turkuaz Carbon Finance

|                          |                                                                                                                                                                                     |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Title</b>     | Koyulhisar Hydro Electricity Power Plant                                                                                                                                            |
| <b>Version</b>           | 1.2                                                                                                                                                                                 |
| <b>Date of Issue</b>     | 04/09/2013                                                                                                                                                                          |
| <b>Project ID</b>        | 713                                                                                                                                                                                 |
| <b>Monitoring Period</b> | 1 November 2011 to 31 July 2013 (Second Monitoring Period)                                                                                                                          |
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## 1 PROJECT DETAILS

### 1.1 Summary Description of Project

Bereket Enerji Üretim San. ve Tic. A. Ş. constructed Koyulhisar Hydro Electric Power Plant (HPP) on the Kelkit Stream, within the jurisdiction of Koyulhisar Town of Sivas Province. The purpose of the project is electricity production using the potential energy of Kelkit Stream as a renewable resource. Therefore, the electricity is going to be produced without causing airborne pollutants or Green House Gas (GHG) emissions.

The set capacity of Koyulhisar HPP is 63 MW, with 3 turbines of 21 MW each. One of these three turbines is installed as a standby unit, intended to operate only whenever one of the other two turbines will not be operating for the purpose of maintenance and repair. The annual average electricity production of the project activity is estimated to be a maximum of around 220,000 MWh. Based on Turkey's Combined Margin Emission Factor of 0.52826 tCO<sub>2e</sub>/MWh, the project is expected to produce 116,217 tonnes of CO<sub>2e</sub> GHG reductions each year<sup>1</sup>.

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

**Table 1: Major Milestones of Koyulhisar HPP**

| Date        | Milestone                                                                          | Reference                                |
|-------------|------------------------------------------------------------------------------------|------------------------------------------|
| 24/09/2003  | The Project is acquired from State Water Affairs(DSI)                              | DSI WEB site <sup>2</sup>                |
| 28/06/2004  | The initial Feasibility Approved by DSI                                            | Approval letter of DSI                   |
| 18/01/2005  | Water Usage Agreement co-signed with DSI                                           | DSI Water usage Agreement                |
| 02/10/2005  | Electricity Production License issued by Energy Market Regulatory Agency (EMRA)    | EMRA License                             |
| 01/06/2005  | EIA Exemption Certificate issued                                                   | See Annex-3                              |
| 07/08/2006  | Financial Closure and Investment Decision date                                     | Credit Agreement(first Trench)           |
| 23/10/2006  | Invitation letters sent to Village heads for a Local Stakeholders Meeting          | Invitation Letters                       |
| 13/11/2006  | Stake Holder Consultation Meeting Held at Kılıçpınar Village                       | Meeting Minutes                          |
| 05/01/2009  | Carbon Finance considered                                                          | Board Decision                           |
| 06/01/2009  | Construction Started                                                               | NHS Record                               |
| 03/09/2009  | Application for the addition of the third unit and approval of revised feasibility | Application Letter to DSI                |
| August 2009 | Final version of Revised Feasibility released                                      | Feasibility Report                       |
| 17/11/2009  | The First two units of the project became operational (Project Start Date)         | Provisional Acceptance Protocol by MoENR |
| 17/11/2009  | Application for license Revision to EMRA                                           | Application Letter to EMRA               |
| 02/09/2011  | Turkuaz Contracted for Carbon Finance                                              | Contract                                 |
| 10/09/2011  | Validating DOE Contracted                                                          | Mail Order                               |
| 19/09/2011  | PDD submitted to DOE                                                               | E-mail                                   |
| 5-6/10/2011 | Site Visit for Validation                                                          | DOE Testimonial                          |
| 23/08/2012  | DSI Approval For Revised feasibility (The addendum to Water usage Agreement)       | Addendum to Water Usage Agreement        |

<sup>1</sup> Please visit the validated PDD for more details on how the annual electricity amount and the Combined Margin Emission factor is calculated for the project activity.

<sup>2</sup> <http://www2.dsi.gov.tr/skatablo/Tablo2.htm> (please search for Koyulhisar the application date is indicated on the column before last column.)

The Koyulhisar HPP is constructed at the downstream of two state owned dams, namely: Kılıçkaya Dam (124 MW) and Çamlığöze Dam (33MW)<sup>3</sup> that were constructed for irrigation and energy production purposes around 90s. The project is collecting the water that leaves the spillway of Çamlığöze Dam. The water is collected by the spill weir regulator of the Koyulhisar HPP and is then transferred to a set of open canals and tunnels that bring the water to a head pond from which it is loaded to the penstock that pass the water to the power house where it reaches the 3 vertical axis Francis turbines with 21 MW capacity each. The electricity is produced by the two of these three turbines as one of the turbines is a stand-by unit. The spill weir regulator is located at an altitude of 724m and the tail water of Koyulhisar is at an altitude of 623 m. This brings a head difference of approximately 101 m.

How the project activity is operating is shown schematically below in Figure 1:

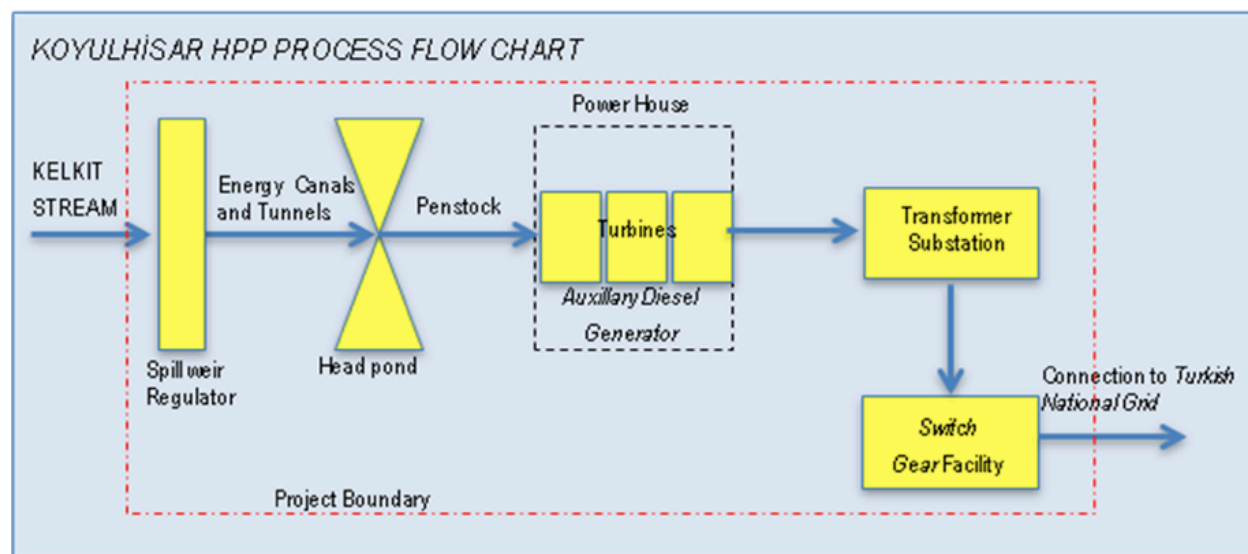


Figure 1: Flow chart showing the basic operational principles of the project activity.

## 1.2 Sectoral Scope and Project Type

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

## 1.3 Project Proponent

| Project Proponent                              | Role and Responsibility                       | Contact Information                                                                                                          |
|------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Bereket Enerji<br>Üretim San. ve Tic.<br>A. Ş. | Project Owner – Implementation of the Project | 15 Mayıs Mh.. 832 Sk. No:2 K:2 75. Yıl<br>Esnaf Sarayı DENİZLİ-Türkiye<br><br>T : +90 258 242 27 76<br>F : +90 258 265 15 85 |

<sup>3</sup> <http://www2.dsi.gov.tr/bolge/dsi19/sivas.htm#kilickaya>

## 1.4 Other Entities Involved in the Project

| Other Entities Involved                                                      | Role and Responsibility                         | Contact Information                                                                                                                                                            |
|------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Turkuaz Karbon Varlık Yönetimi Enerji Proje ve Dan. San. İth. İhr. Ltd. Şti. | Preparation of the Project Description Document | Turan Güneş Bulvarı 100/3<br>06550 Çankaya ANKARA<br>Tel:90.312 438 45 00 (pbx)<br>Fax:+90.312 438 46 00<br><a href="mailto:info@turkuazkarbon.com">info@turkuazkarbon.com</a> |

## 1.5 Project Start Date

Project Start Date is: 17.11.2009.

## 1.6 Project Crediting Period

The project crediting period is 10 years: 17.11.2009-16.11.2019 (both days inclusive). The crediting period is renewable twice.

## 1.7 Project Location

The project is located at the Central Anatolian geographical region of Turkey at the Sivas Province. The coordinates of the power house is as follows and as indicated on the location Map below (Figure 2):

Coordinates of the Power House:

Latitude: 40°16'13,48" North

Longitude: 37°50'55,58" East



Figure 2: Google Earth Satellite imagery showing the location of the project area. Project is indicated with the blue balloon on the map.

## 1.8 Title and Reference of Methodology

The following UNFFCC methodology and its related tools are utilized:

Approved consolidated baseline and monitoring methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources.” Version 12.1.0.

The Approved Methodology refers to the following tools:

“Tool for the demonstration and assessment of additionality” (Version 05.2.1)

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

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

## 2 IMPLEMENTATION STATUS

### 2.1 Implementation Status of the Project Activity

The project start date is 17 November 2009. Since that date, there is no special event that may have impact on monitoring of GHG emission reductions. The following table summarizes the project milestones:

Table 2: Significant dates for the project monitoring period:

| Date       | Milestone                                                                                 |
|------------|-------------------------------------------------------------------------------------------|
| 11.11.2011 | Final Validation Report                                                                   |
| 17.11.2009 | Date of commissioning of the plant                                                        |
| 13.08.2009 | Calibration date of meters (Main Meter-S.n. 53030781 and the control meter-S.n. 53030782) |
| 12.08.2019 | End of Calibration validity                                                               |
| 17.11.2009 | Start of first monitoring period                                                          |
| 31.10.2011 | End of the first monitoring period                                                        |
| 1.11.2011  | Start of second monitoring period                                                         |
| 31.07.2013 | End of the second monitoring period                                                       |
| 16.11.2019 | End of first crediting period                                                             |

### 2.2 Project Description Deviations

In the validated Project Description the parameters to be monitored include:

Diesel Fuel Consumption by the emergency generators.

Since in the previous verification period, it was clearly shown that the use of emergency diesel generators is only creating emissions that are less than 1% of the total emission reductions and since during this monitoring period, we have again monitored the diesel consumption by the emergency generators and observed that it is still below 1 % of the total emission reductions, we decided not to observe this parameter, in the next verification period, as it is also suggested by the methodology (ACM0002).

### 2.3 Grouped Project

The Koyulhisar HEPP Project is not a grouped project.



### 3 DATA AND PARAMETERS

#### 3.1 Data and Parameters Available at Validation

The following are the data and parameters available at validation:

|                                                                                               |                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                                             | $FC_{i,y}$                                                                                                                                                                                                                        |
| Data unit:                                                                                    | Volume Unit (cubic meter)                                                                                                                                                                                                         |
| Description:                                                                                  | Amount of fuel $i$ consumed by relevant power plants in Turkey in years, 2007, 2008, 2009                                                                                                                                         |
| Source of data:                                                                               | Official publications at the Turkish Electricity Transmission Company (TEİAŞ) Web Site ( <a href="http://www.teias.gov.tr/istatistik2009/44.xls">http://www.teias.gov.tr/istatistik2009/44.xls</a> )                              |
| Measurement procedures (if any):                                                              | -                                                                                                                                                                                                                                 |
| Monitoring frequency:                                                                         | once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation                                                        |
| Value applied:                                                                                | Please see Annex 2-Table-1 in the validated PD.                                                                                                                                                                                   |
| QA/QC Procedures                                                                              | -                                                                                                                                                                                                                                 |
| Justification of choice of data or description of measurement methods and procedures applied: | Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to date and reliable data available for the Turkish grid. |
| Any comment:                                                                                  | Data used for the calculation of $EF_{grid,OM,Simple,y}$                                                                                                                                                                          |

|                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                                             | $NCV_{i,y}$                                                                                                                                                                                                                                                                                                                                                                                 |
| Data unit:                                                                                    | GJ/Mass or Volume Unit                                                                                                                                                                                                                                                                                                                                                                      |
| Description:                                                                                  | Net Calorific Values for fossil fuel type $i$ in year $y$ , for the years 2007, 2008 and 2009                                                                                                                                                                                                                                                                                               |
| Source of data:                                                                               | Regional or national average default values that are reliable and documented in national energy statistics of the Turkish Electricity Transmission Company Web Site ( <a href="http://www.teias.gov.tr/istatistik2009/46.xls">http://www.teias.gov.tr/istatistik2009/46.xls</a> <a href="http://www.teias.gov.tr/istatistik2009/44.xls">http://www.teias.gov.tr/istatistik2009/44.xls</a> ) |
| Measurement procedures (if any):                                                              | -                                                                                                                                                                                                                                                                                                                                                                                           |
| Monitoring frequency:                                                                         | For Simple OM : Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation<br>For BM: For the first crediting period, once for the <i>ex ante</i> and for the second and third crediting period, only once <i>ex ante</i> at the start of the second crediting period       |
| Value applied:                                                                                | Please see Annex-2-Table-1b in the validated PD.                                                                                                                                                                                                                                                                                                                                            |
| QA/QC Procedures                                                                              | -                                                                                                                                                                                                                                                                                                                                                                                           |
| Justification of choice of data or description of measurement methods and procedures applied: | Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to date and reliable data available for the Turkish grid.                                                                                                                                                           |

|              |                                                                                                                                                                                                                                                 |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Any comment: | Data used for the calculation of $EF_{grid,OM,Simple,y}$ . As data on the NCV is not published directly on the TEİAŞ website, this data is calculated using the heating values of fuels and the volume or mass of fuels consumed for each year. |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                                             | $EF_{CO2,i,y}$                                                                                                                                                                                                                                                                                                                                                                        |
| Data unit:                                                                                    | tCO <sub>2</sub> /GJ                                                                                                                                                                                                                                                                                                                                                                  |
| Description:                                                                                  | CO <sub>2</sub> emission factor of fossil fuel type <i>i</i> in year <i>y</i>                                                                                                                                                                                                                                                                                                         |
| Source of data:                                                                               | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories                                                                                                                                                                                |
| Measurement procedures (if any):                                                              | -                                                                                                                                                                                                                                                                                                                                                                                     |
| Monitoring frequency:                                                                         | For Simple OM : Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation<br>For BM: For the first crediting period, once for the <i>ex ante</i> and for the second and third crediting period, only once <i>ex ante</i> at the start of the second crediting period |
| QA/QC Procedures                                                                              | -                                                                                                                                                                                                                                                                                                                                                                                     |
| Value applied:                                                                                | Please see Annex 2-Table-2 in the validated PD..                                                                                                                                                                                                                                                                                                                                      |
| Justification of choice of data or description of measurement methods and procedures applied: | According to the "Tool to calculate the emission factor for an electricity system" version 02.2.1 , if values provided by the fuel supplier of the power plants in invoices or regional or national average defaults values are not available the IPCC default values at the lower limit of uncertainty must be used.                                                                 |
| Any comment:                                                                                  | Data used both for the calculation of $EF_{grid,OM,Simple,y}$ and $EF_{EL,m,y}$                                                                                                                                                                                                                                                                                                       |

|                                  |                                                                                                                                                                                                                                                                                                          |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                | $EG_y$                                                                                                                                                                                                                                                                                                   |
| Data unit:                       | MWh                                                                                                                                                                                                                                                                                                      |
| Description:                     | Net electricity generated in the project electricity system in other words, net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year <i>y</i>                                                        |
| Source of data:                  | Turkish Electricity Transmission Company Web Site<br><a href="http://www.teias.gov.tr/istatistik2009/37(06-09).xls">www.teias.gov.tr/istatistik2009/37(06-09).xls</a><br><a href="http://www.teias.gov.tr/istatistik2009/30(84-09).xls">www.teias.gov.tr/istatistik2009/30(84-09).xls</a>                |
| Measurement procedures (if any): | -                                                                                                                                                                                                                                                                                                        |
| Monitoring frequency:            | For Simple OM : Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation<br>For BM: For the first crediting period, once for the <i>ex ante</i> and for the second and third crediting |



|                                                                                               |                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                               | period, only once <i>ex ante</i> at the start of the second crediting period                                                                                                                                                      |
| QA/QC Procedures                                                                              | -                                                                                                                                                                                                                                 |
| Value applied:                                                                                | Please see Annex 2-Table 3 and Table 4 in the validated PD.                                                                                                                                                                       |
| Justification of choice of data or description of measurement methods and procedures applied: | Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to-date and reliable data available for the Turkish grid. |
| Any comment:                                                                                  | Data used for the calculation of $EF_{grid,OM,Simple,y}$                                                                                                                                                                          |

|                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                                             | $EG_{m,y}$                                                                                                                                                                                                                                                                                                                                                                            |
| Data unit:                                                                                    | MWh                                                                                                                                                                                                                                                                                                                                                                                   |
| Description:                                                                                  | Net electricity generated and delivered to the grid by power unit m in year y                                                                                                                                                                                                                                                                                                         |
| Source of data:                                                                               | Turkish Electricity Transmission Company Web Site ( <a href="http://www.teias.gov.tr">www.teias.gov.tr</a> ). Statistical Reports are taken for the years 2004 and 2005 and capacity projection reports are used for the years 2007, 2008 and 2009.                                                                                                                                   |
| Measurement procedures (if any):                                                              | -                                                                                                                                                                                                                                                                                                                                                                                     |
| Monitoring frequency:                                                                         | For Simple OM : Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation<br>For BM: For the first crediting period, once for the <i>ex ante</i> and for the second and third crediting period, only once <i>ex ante</i> at the start of the second crediting period |
| QA/QC Procedures                                                                              | -                                                                                                                                                                                                                                                                                                                                                                                     |
| Value applied:                                                                                | Please see Annex 2-Table 8 in the validated PD..                                                                                                                                                                                                                                                                                                                                      |
| Justification of choice of data or description of measurement methods and procedures applied: | Data used is taken from the TEİAŞ website, which is the website of the Turkish Electricity Distribution Company. The data published on the TEİAŞ website is the most up-to-date and reliable data available for the Turkish grid.                                                                                                                                                     |
| Any comment:                                                                                  | Data used for the calculation of $EF_{grid,BM,y}$                                                                                                                                                                                                                                                                                                                                     |

|                                  |                                                                                                                                           |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                | $\eta_{m,y}$                                                                                                                              |
| Data unit:                       | -                                                                                                                                         |
| Description:                     | Average net energy conversion efficiency of power unit m in year y                                                                        |
| Source of data:                  | The default values provided at the Annex 1 of the "Tool to calculate emission factor for an electricity sector (Version 02.2.1)" are used |
| Measurement procedures (if any): |                                                                                                                                           |
| Monitoring frequency:            | Once for the crediting period                                                                                                             |
| QA/QC Procedures                 | N/A as the default values provided in Annex 1 are used.                                                                                   |
| Value applied:                   | Please see Annex 1 of the "Tool to calculate emission factor for an electricity sector (Version 02.2.1)"                                  |

|                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Justification of choice of data or description of measurement methods and procedures applied:                         | According to the "tool to calculate emission factor for an electricity system if documented manufacturer's specifications or data from the utility, the dispatch center or official records are not available then the default values given in annex 1 of the tool shall be used. The first two options are not available for the power plants supplying the Turkish grid, therefore the default values are used. |
| Any comment:                                                                                                          | Data used for the calculation of EF <sub>grid,BM,y</sub>                                                                                                                                                                                                                                                                                                                                                          |
| Data / Parameter:                                                                                                     | NCV <sub>i,y</sub>                                                                                                                                                                                                                                                                                                                                                                                                |
| 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                                                                                                                                                                                                                                                                                                                                                                                                       |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)                                | Data will be used for Project Emission Calculations. The project emissions are those that are related to the burning of the diesel (fossil fuel) in the auxiliary power generators that produce electricity in the absence of the electricity obtained from the grid for self consumption.                                                                                                                        |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | Default values are used                                                                                                                                                                                                                                                                                                                                                                                           |
| Measuring/ Reading/ Recording frequency:                                                                              | Default IPCC value is used. Any future revision of the IPCC Guidelines will be taken into account                                                                                                                                                                                                                                                                                                                 |
| Calculation method (if applicable):                                                                                   | Not Applicable as default value of the IPCC guidelines is utilized                                                                                                                                                                                                                                                                                                                                                |
| QA/QC procedures applied:                                                                                             | Not Applicable as default value of the IPCC guidelines is utilized                                                                                                                                                                                                                                                                                                                                                |
| Comments                                                                                                              | Applicable as option B of the Methodological tool "Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion" (Version 02) is chosen.                                                                                                                                                                                                                                            |

|                                                                                                                       |                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                                                                                              | <b>EF<sub>CO<sub>2</sub>,i,y</sub></b>                                                                                                                                                                 |
| Data unit:                                                                                                            | tCO <sub>2</sub> /GJ                                                                                                                                                                                   |
| Description:                                                                                                          | Weighted average CO <sub>2</sub> emission factor of fuel type <i>i</i> in year <i>y</i> ( <i>I stands for diesel fuel in this case</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 <sub>2</sub> /GJ                                                                                                                                                                             |
| 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 <sub>2</sub> emissions from fossil fuel combustion" (Version 02) is chosen. |

### 3.2 Data and Parameters Monitored

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

|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                | EGPP-self consumption, y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Data unit:                                                       | MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Description:                                                     | Quantity of electricity imported by the power plant from the Grid for self consumption, in year y                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Measured /Calculated /Default:                                   | Measured                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Source of data:                                                  | The Primary source of data will be the Main TEIAS meter recorded at the monthly reading protocols, the column related to electricity obtained from the Grid.<br>The main meter has the serial number: 53030781.<br>The secondary source of data will be the PMUM/MFRC web site screen shots, the column with the heading UECM <sup>4</sup> .                                                                                                                                                                                                        |
| Description of measurement methods and procedures to be applied: | Measurements are to be made by electricity meters. That belong to the grid operator TEİAŞ. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid,                                                                                                                                                                                                                                                                                                                           |
| Frequency of monitoring/recording:                               | Recorded continuously, reported monthly on TEIAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Value applied:                                                   | Total for the monitoring period: 138.09 MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Monitoring equipment:                                            | Main Electricity Meter: ACTARIS SL7000-Serial Number: 53030781<br>Back-up Electricity Meter: ACTARIS SL7000-Serial Number: 53030782<br>Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market <sup>5</sup> . They have an accuracy class of Class002 indicating an accuracy range of 0,2%.                                                                                                                                                                                                     |
| QA/QC procedures to be applied:                                  | Measurements will be carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market. The minimum accuracy of the meters are Class02, that is to say should be within the $\pm 0,2\%$ ( $\pm 0,002$ ) range. The monthly reported meter readings by the main meter with serial number 53030781, will be cross-checked against the back up meter that has the serial number 53030782, if the reading difference is less than $\pm 0,002$ ( $\pm 0,2\%$ ) than the meter readings are considered to be OK, if |

<sup>4</sup> UEÇM: Uzlaştırılmaya Esas Çekim Miktarı-Amount of Electricity based on Reconciliation.

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

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | not than the meters will be checked. The monthly reported readings will also be cross checked against the monthly PMUM/MFRC screen shots. The PMUM/MFRC data of electricity sales will also be a proof for quality and reliability of data. The main meter and the control meter reads both the electricity produced and the electricity consumed by the power plant. These readings can be seen on the screen of the meters by changing the reading mod of the meter. |
| Calculation method: | Direct continuous measurement                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Any comment:        | Data will be used to calculate net electricity supplied to the grid.                                                                                                                                                                                                                                                                                                                                                                                                   |

|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                | EG <sub>PP-gross, y</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Data unit:                                                       | MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Description:                                                     | Quantity of electricity produced by the power plant , in y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Measured /Calculated /Default:                                   | Measured                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Source of data:                                                  | The Primary source of data will be the Main TEIAS meter recorded at the monthly reading protocols, the column related to gross electricity supplied to the Grid.<br>The main meter has the serial number: 53030781.<br>The secondary source of data will be the PMUM/MFRC web site screen shots, the column with the heading ISVM <sup>6</sup> .                                                                                                                                                                                                                                                                                                                                            |
| Description of measurement methods and procedures to be applied: | Measurements are to be made by electricity meters. That belong to the grid operator TEİAŞ. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid,                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Frequency of monitoring/recording:                               | Recorded continuously, reported monthly on TEIAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Value applied:                                                   | Total for the monitoring period: 391,812.63                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Monitoring equipment:                                            | Main Electricity Meter: ACTARIS SL7000-Serial Number: 53030781<br>Back-up Electricity Meter: ACTARISSL7000-Serial Number: 53030782<br>Both meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market <sup>7</sup> . They have an accuracy class of Class 002 indicating an accuracy range of 0,2%.                                                                                                                                                                                                                                                                                                                                             |
| QA/QC procedures to be applied:                                  | Measurements will be carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market. The minimum accuracy of the meters are Class02, that is to say should be within the $\pm 0,2\%$ ( $\pm 0,002$ ) range. The monthly reported meter readings by the main meter with the serial number 53030781, will be cross-checked against the back up meter, that has the serial number 53030782. if the reading difference is less than $\pm 0,002$ ( $\pm 0,2\%$ ) than the meter readings are considered to be OK, if not than the meters will be checked. The monthly reported readings will also be cross checked against the monthly PMUM/MFRC screen |

<sup>6</sup> ISVM: İletim Sistemine Veriş Miktarı-Amount Supplied to the Grid

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

|                     |                                                                                                                                                                                                                                                       |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | shots. The PMUM/MFRC data of electricity sales will also be a proof for quality and reliability of data. The main meter and the back up meter both reads the electricity consumed by the power plant and the electricity supplied to the power plant. |
| Calculation method: | Direct continuous measurement                                                                                                                                                                                                                         |
| Any comment:        | Data will be used to calculate net electricity supplied to the grid.                                                                                                                                                                                  |

|                                                                                                                       |                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                                                                     | PEFC,j,y                                                                                                                                                                                                                                                     |
| Data unit:                                                                                                            | L of diesel per year                                                                                                                                                                                                                                         |
| Description:                                                                                                          | Fossil fuel consumption from auxiliary diesel generators during the year y                                                                                                                                                                                   |
| Measured /Calculated /Default:                                                                                        | Measured                                                                                                                                                                                                                                                     |
| Source of data:                                                                                                       | Onsite logs and measurements                                                                                                                                                                                                                                 |
| Value(s) of monitored parameter:                                                                                      | 580 L                                                                                                                                                                                                                                                        |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)                                | Data is utilized to calculate Project Emissions                                                                                                                                                                                                              |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | The data is retrieved from the log book of site manager                                                                                                                                                                                                      |
| Measuring/ Reading/ Recording frequency:                                                                              | Continuous                                                                                                                                                                                                                                                   |
| Calculation method (if applicable):                                                                                   | Fuel consumption will be used to calculate CO <sub>2</sub> emissions from the combustion of diesel fuel as set forth in the rules specified in the "Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion" (Version 02) |
| QA/QC procedures applied:                                                                                             | Measured amount is cross checked with the diesel fuel purchase receipts.                                                                                                                                                                                     |

### 3.3 Description of the Monitoring Plan

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

The electricity produced will be sold to TEİAŞ. Therefore, TEİAŞ measures the electricity produced by two meters:

1. Main Electricity Meter: ACTARIS SL7000-Serial Number: 53030781
2. Back-up Electricity Meter: ACTARISSL7000-Serial Number: 53030782

These meters are capable of measuring the electricity in two directions. They measure both the electricity produced by the power plant and the electricity consumed by the power plant. The meters are located in the control room of the Power Plant over the line where the power plant gets connected to the Turkish national grid. Those meters will provide official data which will be read and recorded monthly by TEİAŞ officers for invoicing.

The data reading and recording procedure can be described as follows:

- The data is measured by the TEİAŞ meters and stored in the memory of the meter for a period of 12 months.

- Every hour the command operators read the electricity produced and the electricity consumed by the power plant, and record it to their files. These manual records are stored and archived.
- They communicate these readings to TEIAS upon request by TEIAS.
- TEIAS is able to see the meter readings remotely.
- TEIAS visits the site monthly (at the first days of the month) and downloads the data stored in the meter's memory, TEIAS produces the monthly reading protocols for the past months and the protocols are both signed by both the Bereket Enerji Üretim A.Ş., and The TEIAS officers.
- These protocols are faxed to the Bereket Enerji Üretim A.Ş. headquarters and the data is also stored there.
- The trade officer of the Enerji Üretim A.Ş. fills in the electricity production data to the PMUM/MFRC system.
- TEIAS determines the overall grid loss and deducts the grid losses from the electricity producers, and the total amount of electricity amount that is sold is less than the actual amount supplied to the grade. However these losses are outside the project boundary.
- The main meter with the serial number 53030781 measures the data that is used to calculate the emission reductions, and the data recorded by the control meter with the serial number 53030782 is used to check the accuracy of the main meter readings. The difference between the two meter readings needs to be within the range of  $\pm 0,2\%$ .
- PMUM-MFRC data is also used to check the accuracy of the meter readings. The difference between the net production and the amount invoiced needs to be within the range of  $\pm 4\%$ .

TEİAŞ is responsible for the calibration and maintenance of these meters and thus, ensures the accuracy and quality of the measurements. The quality standards that the meters need to comply is "The ICE/TSE 62053-22: Electricity metering equipment (a.c) – Particular requirements - Part 22: Static meters for active energy (Classes 0,2 S and 0,5 S)" The calibration of the meters is done and the meters will be checked continuously if there is a difference of 0.2 % in the readings of the main and the auxiliary meters, the calibration is repeated.

The meters need to comply with the communiqué for Metering Devices to be used in the Electricity Market<sup>8</sup>, the legislation also describes the calibration frequency as 10 years. If the electricity meters are observed to exhibit a difference of  $\pm 0.2$  % in the readings, then the meters needs to be recalibrated.

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

The monitoring will be conducted by the Verified Emission Reduction (VER) Monitoring Team. The VER Team Members, and their position and duties for the monitoring is outlined in the following table (Table 3):

<sup>8</sup> The latest version of the communiqué (in Turkish) can be found in the following link: <http://www.epdk.gov.tr/web/elektrik-piyasasi-dairesi/44>



Table 3: Positions and responsibilities of the VER monitoring team members.

| Position                                                                           | Responsibility                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Koyulhisar HPP Manager                                                             | <ul style="list-style-type: none"> <li>Day to day operation of the Koyulhisar HPP,</li> <li>Compliance of the project activity with the host country rules and regulations</li> <li>Coordination of the data collection and recording for the VCS monitoring report.</li> </ul> |
| Chief Electrical Engineer                                                          | <ul style="list-style-type: none"> <li>Day to day follow up of electrical equipment</li> <li>Recording and monitoring of the electricity generation data</li> </ul>                                                                                                             |
| Accounts Manager                                                                   | <ul style="list-style-type: none"> <li>Data keeping for power sales</li> <li>Invoicing</li> </ul>                                                                                                                                                                               |
| Chief Mechanical Engineer                                                          | <ul style="list-style-type: none"> <li>Day to day operation of the power plant</li> <li>Keeping records of malfunctions and repairs</li> </ul>                                                                                                                                  |
| Turkuaz Karbon Varlık<br>Yönetimi Enerji Proje ve Dan.<br>San. İth. İhr. Ltd. Şti. | <ul style="list-style-type: none"> <li>Emission reduction calculations</li> <li>Scripting of the periodic monitoring report</li> <li>Follow up of the verification process</li> </ul>                                                                                           |

The power generation meter readings will be performed by using the main metering devices and the backup metering devices for accuracy checks only. Data from metering devices will be recorded by TEİAŞ on monthly agreed protocols and will form the basis for invoicing. In addition to the readings of the two metering devices, generation data of the Koyulhisar HPP can be cross checked, via the TEİAŞ – PMUM web site (<http://pmum.teias.gov.tr>) which is accessible by a password available to the electricity generation companies. The electricity generation data at the Market Financial Reconciliation Centre (MFRC/PMUM) web page will exhibit the net electricity generated less transmission loss, to be able to produce comparable numbers, the figures taken from PMUM web site needs to be multiplied by the transmission loss factor of the grid.

## 4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

### 4.1 Baseline Emissions

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

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad \text{Where:}$$

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

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

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

And

$$EG_{PJ,y} = EG_{PP-net,y}$$

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

The Combined margin  $CO_2$  emissions factor in year y ( $tCO_2/MWh$ ),  $EF_{grid,CM,y}$ , is fixed ex-ante for the duration of the crediting period, and is  $0.52826 tCO_{2e}/MWh$ .

The following table shows the original data as reported in the monthly meter reading records, which are the result from a joint meter reading by TEIAS and Koyulhisar HEPP staff at the end of each month. The meter reading records are signed by both parties and serve as basis for all sub-sequent processes, especially settlement and billing for electricity supplied to the grid. The collected data is kept by Bereket Enerji Üretim A.Ş. during the crediting period and until two years after the last issuance of VCUs for the Koyulhisar HEPP project activity for the crediting period under consideration.

Table 4: Baseline Emissions (1 November 2011 to 31 July 2011-Both days inclusive)

|             |                                                            | <b>A-Gross<br/>Electricity<br/>Production</b> | <b>B-Self<br/>Electricity<br/>Consumption</b> | <b>C-Net<br/>electricity<br/>production<br/>C=A-B</b> | <b>Baseline<br/>Emissions =<br/><math>EG_{PP-net,y} * EF_{CM}</math></b> | <b>National Grid<br/>Emission<br/>Factor</b> |
|-------------|------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------|
|             | <b>Symbol</b>                                              | $EG_{PP-gross, y}$                            | $EG_{PP-self}$<br>consumption, y              | $EG_{PP-net, y}$                                      | BE1                                                                      | $EF_{CM}$                                    |
| <b>YEAR</b> | <b>Units</b>                                               | MWh                                           | MWh                                           | MWh                                                   | tCO <sub>2</sub> e                                                       | tCO <sub>2</sub> e/MWh                       |
| <b>2011</b> | <b>November</b>                                            | 11,161.35                                     | 14.44                                         | 11,146.91                                             | 5,888.47                                                                 | 0.528                                        |
|             | <b>December</b>                                            | 9,981.87                                      | 17.66                                         | 9,964.21                                              | 5,263.69                                                                 |                                              |
|             | <b>Total in 2011 (1 November 2011 to 31 December 2011)</b> |                                               |                                               |                                                       |                                                                          | <b>11,152</b>                                |
| <b>2012</b> | <b>January</b>                                             | 18,178.03                                     | 4.08                                          | 18,173.95                                             | 9,600.57                                                                 |                                              |
|             | <b>February</b>                                            | 13,214.60                                     | 15.33                                         | 13,199.27                                             | 6,972.65                                                                 |                                              |
|             | <b>March</b>                                               | 2,703.67                                      | 29.97                                         | 2,673.70                                              | 1,412.41                                                                 |                                              |
|             | <b>April</b>                                               | 14,256.56                                     | 10.98                                         | 14,245.58                                             | 7,525.37                                                                 |                                              |
|             | <b>May</b>                                                 | 23,937.89                                     | 4.75                                          | 23,933.14                                             | 12,642.92                                                                |                                              |
|             | <b>June</b>                                                | 25,296.08                                     | 1.19                                          | 25,294.89                                             | 13,362.28                                                                |                                              |
|             | <b>July</b>                                                | 21,080.22                                     | 4.28                                          | 21,075.94                                             | 11,133.58                                                                |                                              |
|             | <b>August</b>                                              | 20,571.59                                     | 2.43                                          | 20,569.16                                             | 10,865.86                                                                |                                              |
|             | <b>September</b>                                           | 21,275.38                                     | 2.40                                          | 21,272.98                                             | 11,237.66                                                                |                                              |
|             | <b>October</b>                                             | 16,715.05                                     | 10.09                                         | 16,704.96                                             | 8,824.56                                                                 |                                              |
|             | <b>November</b>                                            | 18,451.77                                     | 7.10                                          | 18,444.67                                             | 9,743.58                                                                 |                                              |
|             | <b>December</b>                                            | 25,169.90                                     | 1.43                                          | 25,168.47                                             | 13,295.50                                                                |                                              |
|             | <b>Total in 2012 (1 January 2012 to 31 December 2012)</b>  |                                               |                                               |                                                       |                                                                          | <b>116,617</b>                               |
| <b>2013</b> | <b>January</b>                                             | 28,981.42                                     | 0.81                                          | 28,980.61                                             | 15,309.30                                                                |                                              |
|             | <b>February</b>                                            | 23,320.34                                     | 4.02                                          | 23,316.32                                             | 12,317.08                                                                |                                              |
|             | <b>March</b>                                               | 28,507.89                                     | 0.76                                          | 28,507.13                                             | 15,059.18                                                                |                                              |
|             | <b>April</b>                                               | 26,029.58                                     | 0.32                                          | 26,029.26                                             | 13,750.22                                                                |                                              |
|             | <b>May</b>                                                 | 24,020.67                                     | 1.56                                          | 24,019.11                                             | 12,688.34                                                                |                                              |
|             | <b>June</b>                                                | 18,958.77                                     | 4.49                                          | 18,954.28                                             | 10,012.79                                                                |                                              |
|             | <b>July</b>                                                | 14,715.64                                     | 9.73                                          | 14,705.91                                             | 7,768.54                                                                 |                                              |
|             | <b>Total in 2013 (1 January 2013 to 31 July 2013)</b>      |                                               |                                               |                                                       |                                                                          | <b>86,905.00</b>                             |
|             | <b>Grand Total</b>                                         | <b>406,528.27</b>                             |                                               |                                                       | <b>214,674.000</b>                                                       |                                              |

## 4.2 Project Emissions

There is no project emissions resulting from the reservoir area of the project activity as the power density of the project is greater than 10W/m<sup>2</sup>. The aerial extent of the reservoir is shown in the reservoir area map (Annex-1). Based on an aerial extend of 1,204,039.77 m<sup>2</sup> and a generation capacity of 63,000,000 W, the power density of the project activity calculates as 52.32 W/m<sup>2</sup> which is greater than 10 W/m<sup>2</sup>.

However, there are 4 auxiliary diesel generators in the project area that produce electricity for the operation of gates controlling the canals, and two more are installed in the powerhouse and regulator body. These generators are logged to consume 580 L of diesel fuel during the occasional power outages. Converting this diesel consumption into Gigagrams, and using the formula given in the tool for the calculation of diesel consumption, the project emissions related to diesel consumption calculates to be 1.5 tCO<sub>2</sub>e, as shown in the table below (Table 5):

Table 5: Calculation of project emission related to diesel consumption

|                                                                                                     |           |                       |                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------|-----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Total Diesel consumption during monitoring period                                                   | 580       | L                     |                                                                                                                                                                                                         |
| Project Emissions due to diesel consumption :                                                       |           |                       |                                                                                                                                                                                                         |
| $Pe = (FDy) \times NCV_{diesel} \times COEF_{diesel}$                                               |           |                       |                                                                                                                                                                                                         |
| Pe: Project emissions from diesel generator (tCO <sub>2</sub> )                                     |           |                       |                                                                                                                                                                                                         |
| FDy : Annual diesel fuel consumption (Liters)                                                       |           |                       |                                                                                                                                                                                                         |
| NCV <sub>diesel</sub> : Net Calorific Value for diesel oil (TJ/m <sup>3</sup> )                     |           |                       |                                                                                                                                                                                                         |
| COEF <sub>diesel</sub> : CO <sub>2</sub> emission coefficient for diesel oil (tCO <sub>2</sub> /TJ) |           |                       |                                                                                                                                                                                                         |
|                                                                                                     |           | Units:                | Source:                                                                                                                                                                                                 |
| Density of Fuel                                                                                     | 0,845     | kg/L                  |                                                                                                                                                                                                         |
| M=dxV                                                                                               | 490.100   | kg                    |                                                                                                                                                                                                         |
| Fuel in Gigagrams:                                                                                  | 0.0004901 | Gg                    |                                                                                                                                                                                                         |
| EF <sub>CO<sub>2</sub>,i,y</sub>                                                                    | 74,800    | kgCO <sub>2</sub> /TJ | 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  |
| NCV <sub>i,y</sub>                                                                                  | 43.3      | TJ/Gg                 | 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 |
| COEF <sub>i,y</sub>                                                                                 | 3,238,840 | kgCO <sub>2</sub> /Gg | EF <sub>CO<sub>2</sub>,i,y</sub> X NCV <sub>i,y</sub>                                                                                                                                                   |
| PE=COEFXFuel in Gigagrams                                                                           | 1587.355  | kgCO <sub>2</sub>     |                                                                                                                                                                                                         |
| PE=                                                                                                 | 1.587     | tCO <sub>2</sub>      | A very low amount that can be neglected as was also recommended by the methodology.                                                                                                                     |

As shown in the above table (Table 5) The project emissions related to auxiliary diesel consumption is very low that it can be neglected.

We observed that the diesel generator related emissions are below 1 % of the total emission reductions, we decided not to observe this parameter, in the next verification period, as it is also suggested by the methodology (ACM0002).

### 4.3 Leakage

According to the ACM0002, version 12.1.0 methodology no leakage is expected, as the energy generating equipment is brand new state of the art technology, and is not transferred from another activity. Therefore, the **leakage from the project activity is zero**.

### 4.4 Summary of GHG Emission Reductions and Removals

The project emissions that result from the combustion of diesel fuel in the auxiliary generators is calculated to be negligible, and the leakage equals also zero, therefore the emission reductions in 2011, 2012 and 2013 are equal to the corresponding baseline emissions.

Below table (Table 6) provides a summary of the project emissions:

Table 6 : A summary of the GHG emission reductions by the project activity.

Emission Reduction  
Calculations

|                                                   |                    |                            | VER02                                  |                                       |                                                    |
|---------------------------------------------------|--------------------|----------------------------|----------------------------------------|---------------------------------------|----------------------------------------------------|
| <i>Data</i>                                       | <i>Sym<br/>bol</i> | <i>Units</i>               | 2011                                   | 2012                                  | 2013                                               |
| Net electricity generated                         | E1                 | MWh                        | 21,111.12                              | 220,756.71                            | 164,512.62                                         |
| National Grid Emission Factor                     | EF <sub>CS</sub>   | tCO <sub>2</sub> e/<br>MWh | 0.528                                  | 0.528                                 | 0.528                                              |
|                                                   |                    |                            |                                        |                                       |                                                    |
| <i>Baseline Emissions</i>                         | <i>Sym<br/>bol</i> | <i>Units</i>               | 2011                                   | 2012                                  | 2013                                               |
| Koyulhisar HPP<br>Üretim. = E1 * EF <sub>CS</sub> | BE1                | tCO <sub>2</sub> e         | 11,152.16                              | 116,616.94                            | 86,905.44                                          |
|                                                   |                    |                            |                                        |                                       |                                                    |
| <i>Project Emissions</i>                          | <i>Sym<br/>bol</i> | <i>Units</i>               | 2011                                   | 2012                                  | 2013                                               |
| N/A                                               | PE                 | tCO <sub>2</sub> e         | 0                                      | 0                                     | 0                                                  |
|                                                   |                    |                            |                                        |                                       |                                                    |
| <i>Leakage</i>                                    | <i>Sym<br/>bol</i> | <i>Units</i>               | 2011                                   | 2012                                  | 2013                                               |
| N/A                                               | LE                 | tCO <sub>2</sub> e         | 0                                      | 0                                     | 0                                                  |
|                                                   |                    |                            |                                        |                                       |                                                    |
| <i>Emission Reductions</i>                        | <i>Sym<br/>bol</i> | <i>Units</i>               | 2011<br>(November 1 to<br>December 31) | 2012<br>(January 1 to<br>December 31) | 2013<br>(1 January to<br>31 <sup>st</sup> of July) |
| = BE1 - PE - LE                                   | ER                 | tCO <sub>2</sub> e         | 11,152.06                              | 116,616.84                            | 86,905.44                                          |
|                                                   |                    | <b>TOTAL<br/>ERs</b>       | <b>214,674</b>                         |                                       |                                                    |

## 5 ADDITIONAL INFORMATION

N/A