

# SIRMA HPP RUN-OF-RIVER HYDRO PROJECT

Document Prepared By FutureCamp Turkey

|                          |                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Title</b>     | SIRMA Run-of-river hydro project                                                                                                                        |
| <b>Version</b>           | Version 2                                                                                                                                               |
| <b>Report ID</b>         | 02 (2nd Monitoring Period)                                                                                                                              |
| <b>Date of Issue</b>     | 23.09.2013                                                                                                                                              |
| <b>Project ID</b>        | VCS 603                                                                                                                                                 |
| <b>Monitoring Period</b> | 01-January-2011 to 30-June-2013                                                                                                                         |
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## 1 PROJECT DETAILS

### 1.1 Summary Description of Project

The 5.88 MW Sirma run-of-river HPP produces electricity for transmission into the national grid. For this purpose it uses kinetic energy of the water at Akçay River downstream of the existing Kemer weir. Water is taken from the existing irrigation canal that leads down from Kemer weir. Kemer dam and weir generates electricity from the Akçay River and feeds it to the national electricity grid. It belongs to DSI. In the project 3 Axis Kaplan turbines with 1960KW each is used.

The purpose of the Project is to export the generated electricity to the regional grid, thereby contributing to the Turkey's electricity demand and rapidly growing economy. Since the Project generates electricity from renewable energy resources, it makes a significant contribution to climate protection. According to the validated VCS-PD, the Project was expected to generate ca. 23,230 MWh of electricity annually, and to reduce 12,780 tonnes of CO<sub>2</sub> emissions per year, by supplying renewable energy that would have been supplied by the existing power grid that generates electricity predominantly from fossil fuel powered thermal power plants.

This second monitoring period covers the 30 months from 01/01/2011 to 30/06/2013 (both days included). Total emission reductions achieved in this period are 23,984 tons of CO<sub>2</sub>e.

### 1.2 Sectoral Scope and Project Type

Sectoral Scope: Energy (Renewable / Non-Renewable), Not a Grouped Project

### 1.3 Project Proponent

The HPP is operated and owned by Beyobası Enerji Üretimi A.Ş. Sirma is also VCS project proponent and for contact please refer to the directions given below.

**Table 1:** Project Contact Data-Sirma

|                 |                             |
|-----------------|-----------------------------|
| Organization:   | Beyobası Enerji Üretimi A.Ş |
| Street/P.O.Box: | Koza Sok.                   |
| Building:       | No:22 GOP                   |
| City:           | Ankara                      |
| State/Region:   | N/A                         |
| Postcode/ZIP:   | 06700                       |

|                   |                                              |
|-------------------|----------------------------------------------|
| Country:          | Turkey                                       |
| Personal Contact: | Mustafa Kemal GÜNGÖR                         |
| Direct FAX:       | 0090 0312 441 68 14                          |
| Direct tel:       | 0090 312 408 10 00                           |
| Personal e-mail:  | akfen@akfen.com.tr ;<br>mgungor@akfen.com.tr |

The project documentation at hand was defined by Beyobası in cooperation with FutureCamp Türkiye. FutureCamp Türkiye is not a participant of the project.

**Table 2:** Contact Data of PD Consultant

|                   |                                                                    |
|-------------------|--------------------------------------------------------------------|
| Organization:     | FutureCamp İklim ve Enerji Ltd.                                    |
| Street/P.O.Box:   | Cetin Emec Bulvarı                                                 |
| Building:         | Beste Apartmanı 19/18 Cankaya                                      |
| City:             | Ankara                                                             |
| State/Region:     | Ankara                                                             |
| Postcode/ZIP:     | 06460                                                              |
| Country:          | Turkey                                                             |
| Personal Contact: | Engin Mert                                                         |
| Direct FAX:       | 0090 312 480 88 10                                                 |
| Direct tel:       | 0090 312 481 21 42                                                 |
| Personal e-mail:  | <a href="mailto:info@futurecamp.com.tr">info@futurecamp.com.tr</a> |

## 1.4 Other Entities Involved in the Project

No other entities are involved in the project.

## 1.5 Project Start Date

07/06/2009

## 1.6 Project Crediting Period

.Commissioning date of the project is 07 June 2009..

Start: 07/06/2009

End: 06/06/2019

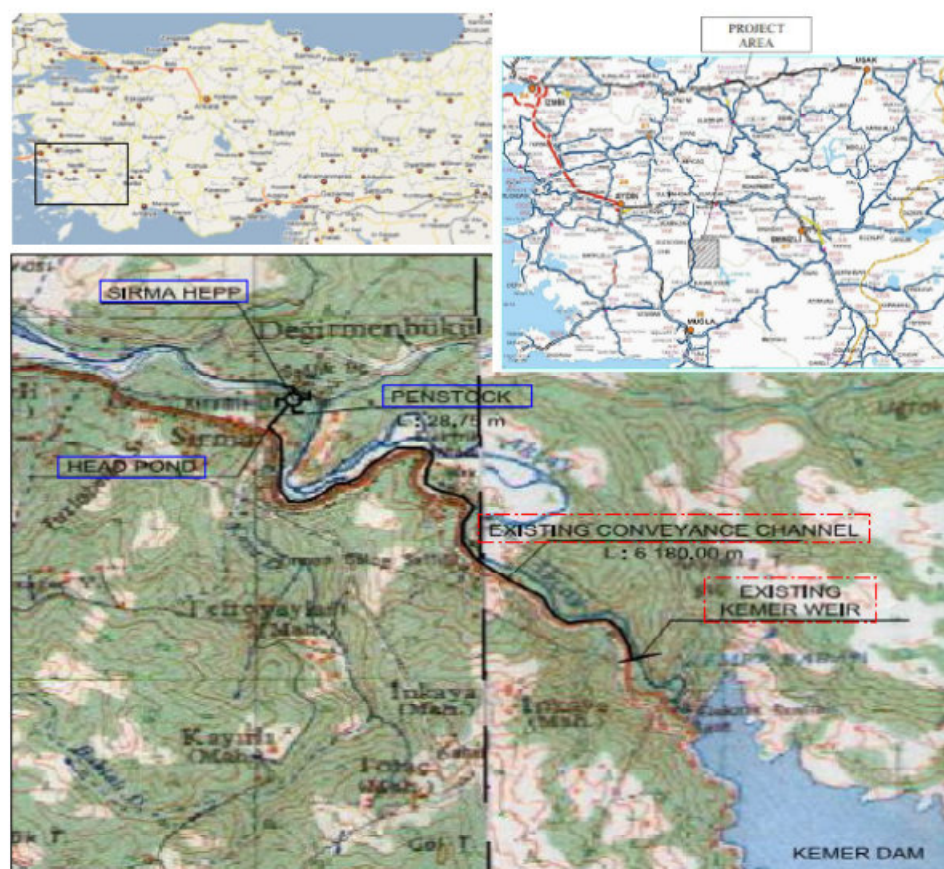
10-years two-times renewed crediting period.

## 1.7 Project Location

The project is located in Aegean Region, Aydın City, Bozdoğan district, close to Sırma village. The site is accessible via the pre-existing Kemer dam road. The geographical coordinates of the hydro power plant are. The geographical coordinates of the Weir and the Power plant are as follows:

**Table 3:** Geographical coordinates of the Weir and the Power plant

|           | Head pond          | Power Houe         |
|-----------|--------------------|--------------------|
| Latitude  | 37° 36" 24.960"" N | 37° 36" 26.280"" N |
| Longitude | 28° 28" 26.460"" E | 28° 28" 26.340"" E |



**Figure 1:** Location of the project

### 1.8 Title and Reference of Methodology

“Grid-connected renewable electricity generation” (AMS I.D. version 16)

The above methodology is hereafter referred to as the “Baseline Methodology”. The Baseline Methodology is used in conjunction with the approved monitoring methodology AMS I.D. version 16 (subsequently referred to as “Monitoring Methodology”).

The monitoring report also draws upon the:

- “Tool for assessment and demonstration of additionality”, Version 5.2
- “Tool to calculate the emission factor for an electricity system”, Version 2.2.5

## 2 IMPLEMENTATION STATUS

## 2.1 Implementation Status of the Project Activity

Sirma HPP started to generate and provide electricity to the Turkish National Grid on 07/06/2009. During the monitoring period, there was no event or situation that occurred, which may impact the applicability of the methodology.

## 2.2 Project Description Deviations

There is no project description deviations.

## 2.3 Grouped Project

N/A

## 3 DATA AND PARAMETERS

### 3.1 Data and Parameters Available at Validation

|                        |                                                                                                                                                                                                            |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | <b>EF<sub>grid,CM,y</sub></b>                                                                                                                                                                              |
| Data unit:             | tCO <sub>2</sub> /MWh                                                                                                                                                                                      |
| Description:           | Combined margin CO <sub>2</sub> emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" |
| Source of data:        | As per "Tool to calculate the emission factor for an electricity system"                                                                                                                                   |
| Value applied:         | <b>0.5502 tCO<sub>2</sub>/MWh</b>                                                                                                                                                                          |
| Purpose of the data:   | For calculation emission factor                                                                                                                                                                            |
| Any comment:           |                                                                                                                                                                                                            |

|                        |                                                                                                                                                                                                                                                                               |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | <b>Gross electricity generation</b>                                                                                                                                                                                                                                           |
| Data unit:             | MWh                                                                                                                                                                                                                                                                           |
| Description:           | Gross Electricity supplied to the grid by relevant sources (2006-2008)                                                                                                                                                                                                        |
| Source of data:        | Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Turkey's Gross Electricity Generation of Primary Energy Resources (1975-2008) TEİAŞ, see; <a href="http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C">http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C</a> |

|                      |                                                                                                                                |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------|
|                      | <a href="#">4%B0statistikleri/istatistik2008/32(75-08).xls</a>                                                                 |
| Value applied:       | 131,681,100 MWh; 154,982,500 MWh;163,919,400 MWh                                                                               |
| Purpose of the data: | Combined Margin Calculations                                                                                                   |
| Any comment:         | TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey. |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | <b>Net Electricity Generation</b>                                                                                                                                                                                                                                                                                                                                                                             |
| Data unit:             | MWh                                                                                                                                                                                                                                                                                                                                                                                                           |
| Description:           | Net electricity fed into the grid. Used for the calculation of the net/gross relation (Including Import and Export figures)                                                                                                                                                                                                                                                                                   |
| Source of data:        | Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Electricity Generation-Consumption and Losses in Turkey (1984-2008) TEİAŞ, see <a href="http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/30(84-08).xls">http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/30(84-08).xls</a>                                                |
| Value applied:         | 169,543.1 GWh; 183,339.7 GWh; 189,761.9 GWh                                                                                                                                                                                                                                                                                                                                                                   |
| Purpose of the data:   | Combined Margin Calculations                                                                                                                                                                                                                                                                                                                                                                                  |
| Any comment:           | <p>This data is used to find relation between the gross and net electricity delivered to the grid by fossil fuel fired power plants.</p> <p>Import and Export data is used to identify total net electricity fed into the grid in the years of 2006, 2007 and 2008.</p> <p>TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.</p> |

|                        |                                                                                                           |
|------------------------|-----------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | <b>Sample Group for BM emission factor</b>                                                                |
| Data unit:             | Name of the plants, MW capacities, fuel types, annual electricity generations and dates of commissioning. |
| Description:           | Most recent power plants which compromise 20%                                                             |

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | of total generation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Source of data:      | <p>Annual Development of Fuels Consumed in Thermal Power Plants in Turkey by the Electric Utilities, TEİAŞ:</p> <p>For plants in 2004:<br/><a href="http://www.teias.gov.tr/KAPASITE%20PROJEKSIYONU%202005.pdf">http://www.teias.gov.tr/KAPASITE%20PROJEKSIYONU%202005.pdf</a></p> <p>For plants in 2005:<br/><a href="http://www.teias.gov.tr/KAPASITE%20PROJEKSIYONU%202006.pdf">http://www.teias.gov.tr/KAPASITE%20PROJEKSIYONU%202006.pdf</a></p> <p>For plants in 2006:<br/><a href="http://www.teias.gov.tr/KAPASITE%20PROJEKSIYONU%202007.pdf">http://www.teias.gov.tr/KAPASITE%20PROJEKSIYONU%202007.pdf</a></p> <p>For plants in 2007:<br/><a href="http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2008.pdf">http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2008.pdf</a></p> <p>For plants in 2008:<br/><a href="http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2009.pdf">http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2009.pdf</a></p> |
| Value applied:       | See Validated VCS-PD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Purpose of the data: | Combined Margin Calculations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Any comment:         | TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey. The latest data available during PD preparation was for 2008.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                        |                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | <b>EF<sub>CO<sub>2</sub>,i,y</sub></b>                                                                                                                                                                                                                                                                                                                                 |
| Data unit:             | tCO <sub>2</sub> /GJ                                                                                                                                                                                                                                                                                                                                                   |
| Description:           | Emission factor for fuel type i                                                                                                                                                                                                                                                                                                                                        |
| Source of data:        | <p>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 IPCC Guidelines on National GHG Inventories. See</p> <p><a href="http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1">http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1</a></p> |

|                      |                                      |
|----------------------|--------------------------------------|
|                      | <a href="#">Ch1 Introduction.pdf</a> |
| Value applied:       | See Validated VCS-PD                 |
| Purpose of the data: | Combined Margin Calculations         |
| Any comment:         |                                      |

|                        |                                                                               |
|------------------------|-------------------------------------------------------------------------------|
| Data Unit / Parameter: | $\eta_{m,y}$                                                                  |
| Data unit:             | -                                                                             |
| Description:           | Average energy conversion efficiency of power unit m in year y                |
| Source of data:        | Annex I the "Tool to calculate the emission factor for an electricity system" |
| Value applied:         | See Validated VCS-PD                                                          |
| Purpose of the data:   | Combined Margin Calculations                                                  |
| Any comment:           |                                                                               |

|                        |                                                                                                                                                                                                                                                                                                        |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | $HV_{i,y}$                                                                                                                                                                                                                                                                                             |
| Data unit:             | Mass or volume unit                                                                                                                                                                                                                                                                                    |
| Description:           | Heating Values of fuels consumed for electricity generation in the years of 2006, 2007 and 2008                                                                                                                                                                                                        |
| Source of data:        | Heating Values Of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See:<br><a href="http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/46.xls">http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/46.xls</a> |
| Value applied:         | There is no national NVC data in Turkey. However, TEİAŞ announces Heating values of fuels. This data is used to calculate annual NCVs for each fuel type.                                                                                                                                              |
| Purpose of the data:   | Combined Margin Calculations                                                                                                                                                                                                                                                                           |
| Any comment:           | TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.                                                                                                                                                                         |

|                        |                                                                                                                                                                                                                                                                                                                |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | <b>FC<sub>i,y</sub></b>                                                                                                                                                                                                                                                                                        |
| Data unit:             | Mass or volume unit                                                                                                                                                                                                                                                                                            |
| Description:           | Fuels consumed for electricity generation in the years of 2006, 2007 and 2008                                                                                                                                                                                                                                  |
| Source of data:        | Annual Development of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See:<br><br><a href="http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/44.xls">http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/44.xls</a> |
| Value applied:         | See Validated VCS-PD                                                                                                                                                                                                                                                                                           |
| Purpose of the data:   | Combined Margin Calculations                                                                                                                                                                                                                                                                                   |
| Any comment:           | TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.                                                                                                                                                                                 |

|                        |                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | <b>NCV<sub>i,y</sub></b>                                                                                                   |
| Data unit:             | TJ/kton, TJ/million m <sup>3</sup>                                                                                         |
| Description:           | Net Calorific Value of fuel types in the years of 2006, 2007 and 2008                                                      |
| Source of data:        | Calculated by using HVi,y to FCi,y as Net Calorific Values of fuel types are not directly available in Turkey.             |
| Value applied:         | See Validated VCS-PD                                                                                                       |
| Purpose of the data:   | Combined Margin Calculations                                                                                               |
| Any comment:           | TEİAŞ is the national electricity transmission company, which makes available the official data of power plants in Turkey. |

## 3.2 Data and Parameters Monitored

|                        |                                |
|------------------------|--------------------------------|
| Data Unit / Parameter: | <b>EG<sub>facility,y</sub></b> |
| Data unit:             | MWh/yr                         |

|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description:                                                     | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Source of data:                                                  | The data from the Electricity Meters are the basis for the settlement notification of PMUM. Data are gathered electronically from the meters by TEIAS and stored in secured website of PMUM, which is accessible to project developer with a private password. For monitoring, the monthly settlement notification of PMUM shall be used as source of data.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Description of measurement methods and procedures to be applied: | <p>Two electricity meters is placed at the substation. One is the main meter (Elster A1500 model with serial number 368721) and the other one is the backup meter (Elster A1500 model with serial number 368720). The meters have the accuracy of 0.5s. These meters are sealed by distribution company and intervention by project proponent is not possible.</p> <p>Measured hourly and readings monthly. Monthly settlement notifications of PMUM consist hourly electricity production and withdrawn from the grid.</p> <p><i>Since the meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid will be calculated by electricity supplied minus electricity withdrawn which will be taken from monthly settlement notifications.</i></p> |
| Frequency of monitoring/recording:                               | <p>The primary and back-up measurement devices measure, read and record various data such as electricity generated and consumed, in real-time. The measurements and recordings are made continuously. The readings are performed in monthly intervals.</p> <p>There is no sampling involved.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Value monitored:                                                 | 43,591.46 MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Monitoring equipment:                                            | <b>Calibration frequency:</b> According to the Article 9 of the relevant regulation <sup>1</sup> , periodical inspections of “gauges for electric, water, coal gas, natural gas and, current and voltage measuring transformers will be made once in 10 years”. This                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

<sup>1</sup> See; Measurement and Measuring Tools Inspection Regulation”, Date: 24/07/1994, Official Gazette Number: 22000

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>is in line with the monitoring plan and national requirements. TEIAS will decide when to carry out the next calibration. The Project owner has no control over or access to the measurement devices and is not entitled to perform any type of maintenance or calibration..</p> <p><b>Date of last calibration:</b><br/>First calibration date is 19.06.2008 Which is performed by Alpha Zahler</p> <p><b>Responsible personnel:</b> TEIAS is responsible for monitoring and ensuring that the measurement devices satisfy the requirements. TEIAS is also responsible for the calibration of the measurement devices. In case of any detected problem (e.g. failure of one of the measurement devices, inconsistency between the readings of the primary and the back-up meter etc.), the plant manager in the name of the Project owner is responsible for coordinating the necessary maintenance and calibration procedure with TEIAS.</p> |
| QA/QC procedures to be applied: | Maintenance and calibration of the metering devices will be made by TEIAS periodically. If there is a significant difference between the readings of two devices, maintenance and tests of the metering devices and the associated equipment will be done before waiting for the periodical maintenance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Calculation method:             | The net electricity amount supplied to the grid will be calculated by electricity supplied minus electricity withdrawn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Any comment:                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

### 3.3 Description of the Monitoring Plan

As described above, the relevant data that has to be monitored is the electricity supplied to the grid ( $EG_y$ ) per year, the installed capacity of the hydro power plant and the area of the reservoir.

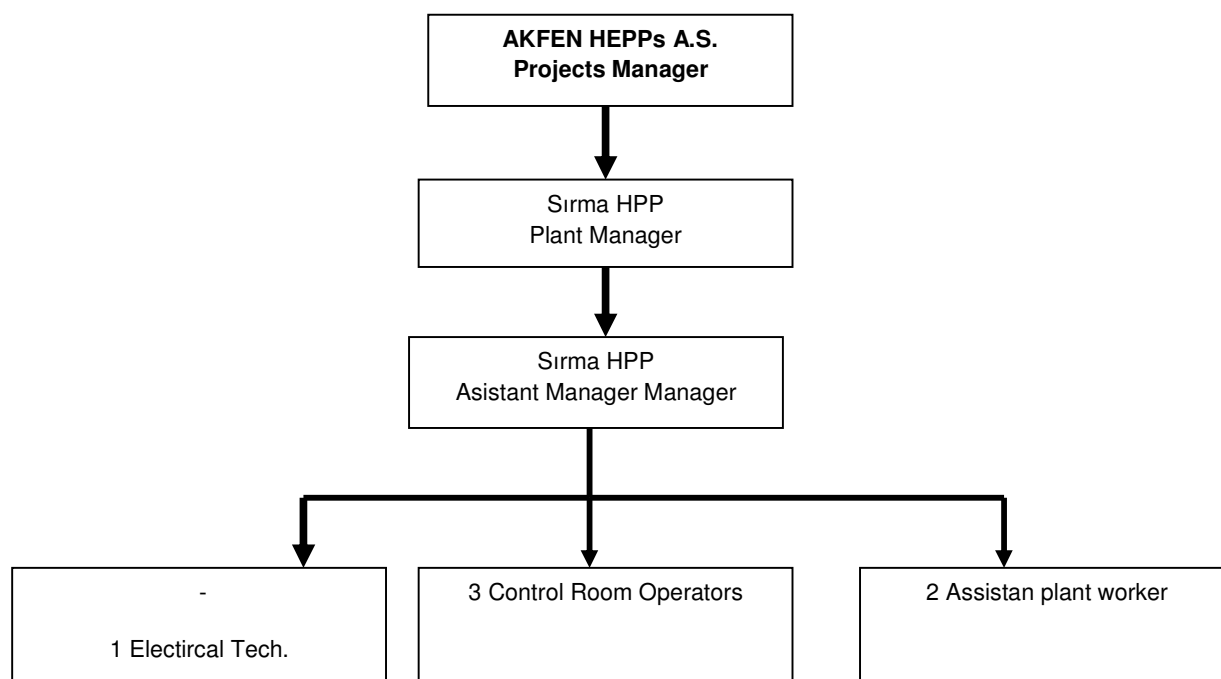
$EG_y$ :

These data are subject to the accounting quality systems of both parties to the power purchase agreement, TEIAS and Beyobası Elektrik Üretim A.Ş. With this, no additional structures or processes have to be implemented to insure the availability of necessary data for monitoring.

At the end of one monitoring period, which is planned to generally last one year, the data from the monthly meter reading records by PMUM (Market Financial Settlement Centre) will be added up to the yearly electricity generation and multiplied with the combined margin emission factor with the help of an excel spreadsheet that also contains the combined margin calculation. Thus, the complete baseline approach is always transparent and traceable.

Technicians in Sirma HPP daily reads meters and keeps record for electricity generation amount and reports to management. These records can be used for monitoring in case of any problem will arise in meters.

Currently the following information on staff and responsibilities at Sirma HPP can be seen below:



**Figure 2:** Organisation chart

All data monitored under the monitoring plan will be kept in electronic form and hard copy for 2 years after the end of the crediting period.

## 4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

### 4.1 Baseline Emissions

Baseline emissions are calculated as per AMS-I.D., formula 1:

$$BE_y = EG_y \times EF_{grid,CM,y} \quad (1)$$

Where:

$BE_y$  Baseline emissions in year  $y$  (tCO<sub>2</sub>/yr).

$EG_y$  Electricity supplied by the project activity to the grid (MWh).

$EF_{grid,CM,y}$  Combined margin CO<sub>2</sub> emission factor for grid connected power generation in year  $y$  calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"; validated value = **0.5502 tCO<sub>2</sub>/MWh**.

Emission reductions achieved by the project activity are calculated as per formula 13 of AMS-I.D.:

$$ER_y = BE_y - PE_y - LE_y \quad (13)$$

Where:

$ER_y$  Emission reductions in year  $y$  (tCO<sub>2</sub>/yr).

$BE_y$  Baseline emissions in year  $y$  (tCO<sub>2</sub>/yr).

$PE_y$  Project emissions in year  $y$  (tCO<sub>2</sub>/yr); validated value = 0.

$LE_y$  Leakage emissions in year  $y$  (tCO<sub>2</sub>/yr); validated value = 0.

$$BE_y = EG_{\text{facility},y} * EF_{\text{grid,CM}} = 43,591.46 \text{ MWh} * 0.5502 \text{ tCO}_2/\text{MWh} \\ = \mathbf{23,984 \text{ tCO}_2}$$

## 4.2 Project Emissions

Regarding project emissions of hydro power plants, AMS-I.D. (p.7) refers to ACM0002 where PD (power density) of the water reservoir is considered for determination of reservoir emissions. Thresholds and calculation procedures defined there (p.7) though are only applicable to projects with new reservoir capacity. As Sirma HPP does not include the construction of a new reservoir, such project emissions do not accrue.

Thus,

$$PE_{HP,y} \text{ (project emissions)} = 0$$

## 4.3 Leakage

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

## 4.4 Summary of GHG Emission Reductions and Removals

$PE_y$  is 0 (see 4.2 above), the emission reduction is equivalent to the determined baseline emissions. Thus emission reductions amount to **23,984 tCO<sub>2</sub>**.

**Table 4:** Summary of the Emission Reductions Yearly

|                                                      |                               |                               |                               |
|------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------|
| <b>Total Generation (Jan 2011-June 2013)</b>         | 43,591.46 MWh                 |                               |                               |
| <b>Total Emission reductions (May2011-July 2013)</b> | <b>2011 (tCO<sub>2</sub>)</b> | <b>2012 (tCO<sub>2</sub>)</b> | <b>2013 (tCO<sub>2</sub>)</b> |
|                                                      | 4,564.8                       | 12,804.2                      | 6,615.1                       |
| <b>Project Emissions</b>                             | 0                             | 0                             | 0                             |
| <b>Net Emission Reductions</b>                       | <b>23,984 tCO<sub>2</sub></b> |                               |                               |

**Table 5:** Summary of the Emission Reductions Monthly

| Month             | Electricity Production Fed into Grid [kWh]** | Electricity Withdrawn from Grid [kWh]*** | Net Electricity Production Fed into Grid [kWh] | Net Electricity Production Fed into Grid [MWh] | Emission Reductions [tCO <sub>2</sub> e] |
|-------------------|----------------------------------------------|------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------|
| January           | 54,734.4                                     | 2,504.3                                  | 52,230.1                                       | 52.2                                           | 28.7                                     |
| February          | 56,340.9                                     | 2,324.7                                  | 54,016.2                                       | 54.0                                           | 29.7                                     |
| March             | 0.0                                          | 2,211.3                                  | -2,211.3                                       | -2.2                                           | -1.2                                     |
| April             | 0.0                                          | 1,634.9                                  | -1,634.9                                       | -1.6                                           | -0.9                                     |
| May               | 634,624.2                                    | 1,030.1                                  | 633,594.1                                      | 633.6                                          | 348.6                                    |
| June              | 1,427,507.6                                  | 396.9                                    | 1,427,110.7                                    | 1,427.1                                        | 785.2                                    |
| July              | 2,181,844.4                                  | 737.1                                    | 2,181,107.3                                    | 2,181.1                                        | 1,200.0                                  |
| August            | 3,471,278.0                                  | 9.5                                      | 3,471,268.5                                    | 3,471.3                                        | 1,909.9                                  |
| September         | 273,218.4                                    | 1,540.4                                  | 271,678.0                                      | 271.7                                          | 149.5                                    |
| October           | 0.0                                          | 1,370.3                                  | -1,370.3                                       | -1.4                                           | -0.8                                     |
| November          | 0.0                                          | 1,549.8                                  | -1,549.8                                       | -1.5                                           | -0.9                                     |
| December          | 214,874.1                                    | 2,561.0                                  | 212,313.1                                      | 212.3                                          | 116.8                                    |
| <b>2011 TOTAL</b> | <b>8,314,422.0</b>                           | <b>17,870.3</b>                          | <b>8,296,551.0</b>                             | <b>8,296.6</b>                                 | <b>4,564.8</b>                           |
|                   |                                              |                                          |                                                |                                                |                                          |
| January           | 2,643,883.2                                  | 784.4                                    | 2,643,098.8                                    | 2,643.1                                        | 1,454.2                                  |
| February          | 3,450,299.0                                  | 37.8                                     | 3,450,261.2                                    | 3,450.3                                        | 1,898.3                                  |
| March             | 2,894,724.0                                  | 623.7                                    | 2,894,100.3                                    | 2,894.1                                        | 1,592.3                                  |
| April             | 2,484,083.7                                  | 151.2                                    | 2,483,932.5                                    | 2,483.9                                        | 1,366.7                                  |
| May               | 1,515,468.2                                  | 1,464.8                                  | 1,514,003.4                                    | 1,514.0                                        | 833.0                                    |
| June              | 1,922,593.1                                  | 595.4                                    | 1,921,997.7                                    | 1,922.0                                        | 1,057.5                                  |
| July              | 3,263,425.2                                  | 47.3                                     | 3,263,377.9                                    | 3,263.4                                        | 1,795.5                                  |
| August            | 2,897,870.9                                  | 113.4                                    | 2,897,757.5                                    | 2,897.8                                        | 1,594.3                                  |
| September         | 1,687,042.4                                  | 37.8                                     | 1,687,004.6                                    | 1,687.0                                        | 928.2                                    |
| October           | 517,888.4                                    | 1,285.2                                  | 516,603.2                                      | 516.6                                          | 284.2                                    |
| November          | 0.0                                          | 236.3                                    | -236.3                                         | -0.2                                           | -0.1                                     |
| December          | 0.0                                          | 0.0                                      | 0.0                                            | 0.0                                            | 0.0                                      |

|                                   |                     |                 |                     |                 |                 |
|-----------------------------------|---------------------|-----------------|---------------------|-----------------|-----------------|
| <b>2012 TOTAL</b>                 | <b>23,277,278.1</b> | <b>5,377.3</b>  | <b>23,271,900.8</b> | <b>23,271.9</b> | <b>12,804.2</b> |
| January                           | 25,808.0            | 170.1           | 25,637.9            | 25.6            | 14.1            |
| February                          | 3,057,916.1         | 349.7           | 3,057,566.4         | 3,057.6         | 1,682.3         |
| March                             | 2,370,702.6         | 397.0           | 2,370,305.6         | 2,370.3         | 1,304.1         |
| April                             | 1,447,040.7         | 18.9            | 1,447,021.8         | 1,447.0         | 796.2           |
| May                               | 2,507,207.9         | 207.9           | 2,507,000.0         | 2,507.0         | 1,379.4         |
| June                              | 2,615,599.4         | 122.9           | 2,615,476.5         | 2,615.5         | 1,439.0         |
| <b>2013 TOTAL</b>                 | <b>12,024,274.7</b> | <b>1,266.5</b>  | <b>12,023,008.2</b> | <b>12,023.0</b> | <b>6,615.1</b>  |
| <b>Total of Monitoring Period</b> | <b>43,615,974.8</b> | <b>24,514.1</b> | <b>43,591,460.0</b> | <b>43,591.5</b> | <b>23,984.0</b> |

Expected amount of emission reduction is calculated as 12,780 tCO<sub>2</sub> per year and 1065 tCO<sub>2</sub> per month in the validated VCS-PD. As the monitoring period of the project is selected as 30 months, total emission reduction should be 31,950 tCO<sub>2</sub> (30\*1065) according to the VCS-PD. However because of the changing rain regimes, total emission reduction of the project cannot achieve the figure stated in the VCS-PD. Project reduces 75.1% of the value stated in the VCS-PD.

## 5 ADDITIONAL INFORMATION