

# ALKUMRU HYDROELECTRIC POWER PLANT PROJECT



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|                      |                                                                                                                                                                                          |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Title</b> | Alkumru Hydroelectric Power Plant Project                                                                                                                                                |
| <b>Version</b>       | 2.1                                                                                                                                                                                      |
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## 1 PROJECT DETAILS

### 1.1 Summary Description of the Project

The Alkumru Hydroelectric Power Plant (Alkumru HPP from this point onward) project is to be constructed at the Eastern Anatolia Geographical district of Turkey over the Botan River that is one of the major tributaries of the Tigris.

The Alkumru HPP will be producing electricity by utilizing the energy of the Botan river, a major tributary to River Tigris. Energy will be produced using the head difference between the 647 m maximum water level and 541.80 m tail water levels. Based on the Electricity Studies Institution's report dated 1991, the Alkumru HPP is proposed to be developed with 222 MW capacity and with an annual energy production capacity of 812.48 GWh, and after completion of the upstream Çetin and Pervari Hydroelectric Power plants the annual electricity production was envisaged to be 817.26 GWh. The initial feasibility report submitted to State Hydraulic Works (DSI) of the Republic of Turkey proposed the project to be 240 MW with an annual electricity production of 822.13 GWh. The investment decision for the project activity considers these parameters.

Later, with a minor design change the and an adjustment in the turbines the project owner revealed that with the same amount of water flow, the project capacity can be increased to 261.27 MW and the annual electricity production is calculated to be 875.84 GWh. The design change is presented to the Electricity Market Regulatory Agency and the terms of the electricity production license have been amended.

With these conditions project owner also presented a fish passage project so that the fish populations are not effected from the dam blocking the river, and it is agreed to release 14m<sup>3</sup>/s of water at all times to the river bed to support aquatic life. However, the design of the project turbines are realized not to be suitable to release the required amount of water, therefore an other addition is made at the tail water part of the project and a new horizontal Francis turbine with 14.250 MWe capacity is added to the project. This turbine is expected to be operational by the beginning of year 2014. This way by the third year of the project activity the electricity production is estimated to increase to 881,210 MWh, with the total project capacity of 275.520 MWe.

The Alkumru HPP will have a reservoir area of 10.99 km<sup>2</sup> and a dam that is designed to be clay cored, sand, gravel rock filled. The project activity will be constructed between the 611.80 minimum operation elevation and 647 m maximum operation elevation. With the latest design updates the project is expected to produce an annual amount of 881,210 MWh of electricity. This accounts for 475,143 tonnes of VCUs per year.

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

Table 1: Major Milestones of Alkumru HPP Project

| Date                  | Milestones                                                                                                                             | Reference                                                                          |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>October-06</b>     | Feasibility Study Report                                                                                                               | Feasibility Study Report                                                           |
| <b>10 Sep. 2007</b>   | Water Usage Agreement signed with DSI                                                                                                  | Water Usage Agreement                                                              |
| <b>Sep. 27, 2007</b>  | Electricity Production License issued by Energy Market Regulatory Authority (EMRA) and the license modification                        | EMRA License                                                                       |
| <b>Jan., 2008</b>     | Project granted EIA Affirmative certification                                                                                          | EIA Affirmative certification                                                      |
| <b>Aug. 15, 2008</b>  | Construction Started                                                                                                                   | Memorandum by Limak Insaat (owner: Limak Hidroelektrik / contractor: Limak Insaat) |
| <b>Dec. 18, 2008</b>  | Signing of the E&M contract                                                                                                            | The E&M contract                                                                   |
| <b>June 19, 2009</b>  | TEIAS system connection agreements signed                                                                                              | TEIAS Connection agreement                                                         |
| <b>Aug. 19, 2009</b>  | The start of the construction of the TEIAS electricity transmission line                                                               | The subcontractor agreement for construction of the transmission line              |
| <b>April 13, 2010</b> | EMRA Approved capacity upgrade                                                                                                         | The updated special terms of license agreement                                     |
| <b>May 17, 2010</b>   | Water Usage Agreement Updated.                                                                                                         | DSI agreement amendment                                                            |
| <b>Dec. 14, 2010</b>  | TEIAS system agreements signed                                                                                                         | TEIAS system usage agreement                                                       |
| <b>16 Dec. 2010</b>   | Expropriation Moderation and Information Meeting 1 Held in the Project site                                                            | Summary of Expropriation by the Company Lawyers                                    |
| <b>Dec. 22, 2010</b>  | The completion of the construction of the TEIAS electricity transmission line and the preliminary acceptance by the Ministry of Energy | Substantial completion protocol-transmission line                                  |
| <b>Mar. 10, 2011</b>  | The preliminary acceptance of the Dam and the HEPP for two units and the start of the electricity generation                           | Alkumru Preliminary acceptance protocol for units 1 and 2                          |
| <b>April 12, 2011</b> | The preliminary acceptance of the Dam and the HEPP for the third unit                                                                  | Alkumru Preliminary acceptance protocol for unit 3                                 |
| <b>12 May 2011</b>    | Expropriation Moderation and Information Meeting 2 Held in the Project site                                                            | Summary of Expropriation by the Company Lawyers                                    |
| <b>Oct. 1, 2012</b>   | Feasibility report finalized                                                                                                           | FSR                                                                                |
| <b>Oct. 12, 2012</b>  | Ministry of Environment approved the design upgrade                                                                                    | Environment and Urban Planning Correspondence with Ministry of                     |

The Project Activity is a hydro power plant with a total installed capacity of 261.27 MW (3 x 87.09 MW), it is expected that the capacity increases to 275.52 MWe by early 2014.

The following figure (Figure 1) schematically summarizes how the project activity will be operating and what needs to be considered within the physical project boundary.

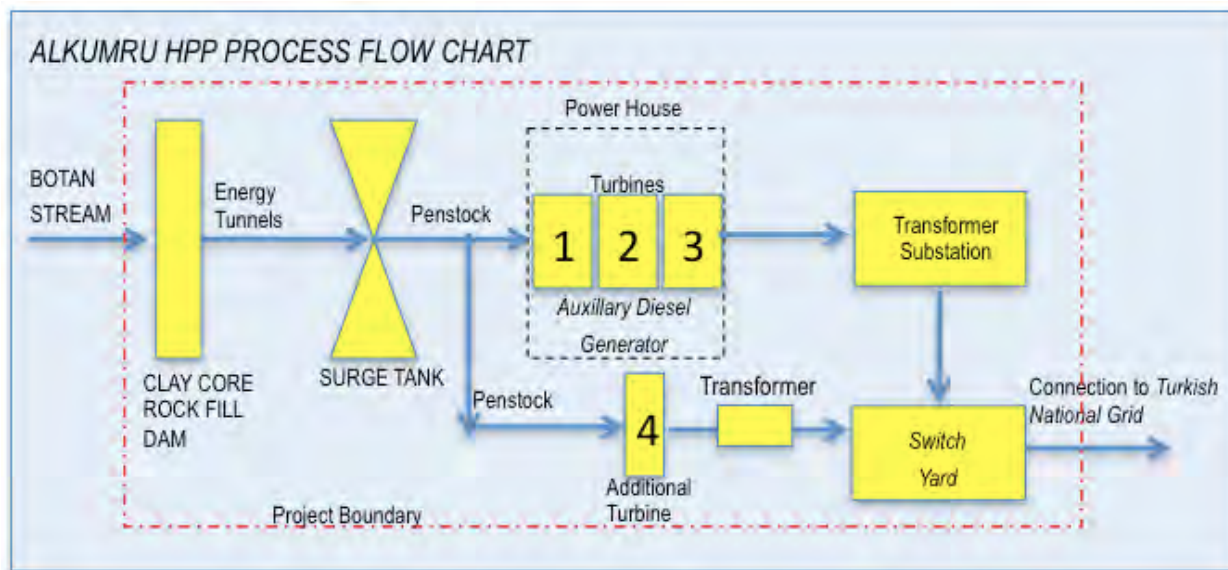


Figure 1: Flow chart showing the basic operational principles of the project activity.

## 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                                                                               |
|--------------------------------------------------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------|
| Limak Hidroelektrik Santral Yatırımları Anonim Şirketi | Project Owner – Implementation of the Project | Hafta Sokak No:9 G.O.P. Çankaya/Ankara-Turkey<br>Tel: +90 312 446 88 00<br>Fax: +90 312 437 38 46 |

## 1.4 Other Entities Involved in the Project

| Other Entities Involved                                        | Role and Responsibility                         | Contact Information                                                                                           |
|----------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Ekobil Environmental Services and Consulting Ltd. <sup>1</sup> | Preparation of the Project Description Document | Güneykent Sitesi 51. Cad. 1839. Sk. No: 56 Ahlatlıbel-ANKARA<br>T:+90 312 489 13 38<br>E-mail:info@ekobil.com |

<sup>1</sup>Registered to the Ankara Chamber of Trade, with the full name of "Ekobil Çevre Hizmetleri Danışmanlık Eğt.Tar. Hayv. Mad. İnş. İth. İhr.Tur. ve Tic. Ltd. Şti."

### 1.5 Project Start Date

Project start date is: 10<sup>th</sup> of March, 2011.

### 1.6 Project Crediting Period

The project crediting period is 10 years: 10.03.2011 to 09.03.2021 (both dates inclusive). The crediting period is renewable twice.

### 1.7 Project Scale and Estimated GHG Emission Reductions or Removals

|               |                                     |
|---------------|-------------------------------------|
| Project       | <input type="checkbox"/>            |
| Large project | <input checked="" type="checkbox"/> |

| Years                                    |                  |
|------------------------------------------|------------------|
| Year 0: 10.03.2011 to 31.12.2011         | 356,237          |
| Year 1: 2012                             | 472,824          |
| Year 2: 2013                             | 472,824          |
| Year 3: 2014                             | 475,723          |
| Year 4: 2015                             | 475,723          |
| Year 5: 2016                             | 475,723          |
| Year 6: 2017                             | 475,723          |
| Year 7: 2018                             | 475,723          |
| Year 8: 2019                             | 475,723          |
| Year 9: 2020                             | 475,723          |
| Year.10: 2021 (01.01.2021 to 09.03.2021) | 119,486          |
| <b>Total estimated ERs</b>               | <b>4,751,432</b> |
| <b>Total number of crediting years</b>   | <b>10</b>        |
| <b>Average annual ERs</b>                | <b>475,143</b>   |

### 1.8 Description of the Project Activity

The main technical characteristics obtained from the DSI Approved, final feasibility report are provided below (Table 3):

Table 2 : Technical characteristics of the Alkumru HPP (Based on the most up to date Feasibility Study Report, 2012, prepared by SuYapı).

| Technical characteristics of Alkumru HPP |   |                                                                                      |
|------------------------------------------|---|--------------------------------------------------------------------------------------|
| Characteristics of the Dam               |   |                                                                                      |
| Location                                 | : | Siirt Province, near Taşbalta village at the 542 m thalweg elevation of Botan River. |
| Purpose                                  | : | Energy Production                                                                    |
| Dam Type                                 | : | Clay core, rock filled                                                               |
| Drainage Area                            | : | 7,562.50km <sup>2</sup>                                                              |
| Annual average natural flow              | : | 4,067.81 hm <sup>3</sup>                                                             |
| Annual Average Flow Rate                 | : | 128.90m <sup>3</sup> /s                                                              |
| Thalweg elevation                        | : | 542 m                                                                                |
| Base elevation                           | : | 516 m                                                                                |
| Height from thalweg                      | : | 108 m                                                                                |

|                                                                |   |                                             |
|----------------------------------------------------------------|---|---------------------------------------------|
| Height from the base                                           | : | 134 m                                       |
| Maximum Flood Crest Water Level                                | : | 648.66 m                                    |
| Crest elevation                                                | : | 650 m                                       |
| Crest length                                                   | : | 909.05 m                                    |
| Minimum operational water level                                | : | 611.80 m                                    |
| Normal operational water level                                 | : | 636.96 m                                    |
| Maximum operational water level                                | : | 647.00 m                                    |
| Active reservoir volume                                        | : | 283.22 hm <sup>3</sup>                      |
| Maximum reservoir Area (at maximum operational level of 647 m) | : | 10.99 km <sup>2</sup>                       |
| <i>Characteristics of the Spillway</i>                         |   |                                             |
| Location                                                       | : | Right bank                                  |
| Type                                                           | : | frontal intake with radial gate             |
| Inlet sill elevation                                           | : | 633.00 m                                    |
| Approach canal elevation                                       | : | 629.00 m                                    |
| Width                                                          | : | 56 m (50.00 m net)                          |
| Number and dimensions of the gates                             | : | 4 gates; w:12.75m X h:16.50 m               |
| Discharge flow rate                                            | : | 7,119.00 m <sup>3</sup> /s                  |
| Total Gross Energy (Maximum)                                   | : |                                             |
| <i>Characteristics of the Derivation Tunnel</i>                |   |                                             |
| Tunnel location                                                | : | Right bank                                  |
| Type and radius                                                | : | 2 horse shoe type with 9.50 m radius        |
| Discharge flow rate                                            | : | 550.00 m <sup>3</sup> /s                    |
| Tunnel slop                                                    | : | 0.0041 and 0.00421                          |
| Tunnel entrance base elevation                                 | : | 546.75 m                                    |
| Total tunnel length                                            | : | (T1) 882.58 m and (T2) 935.07 m             |
| Q <sub>25</sub>                                                | : | 1,875.30 m <sup>3</sup> /s                  |
| Q <sub>50</sub>                                                | : | 2,081.70 m <sup>3</sup> /s                  |
| Q <sub>100</sub>                                               | : | 2,292.70 m <sup>3</sup> /s                  |
| <i>Bottom outlet</i>                                           |   |                                             |
| Entrance shaft elevation                                       | : | 578.00 m                                    |
| Penstock diameter                                              | : | 2.50 m                                      |
| Total Length                                                   | : | 337.84 m                                    |
| Total discharge rate                                           | : | 24.74 m <sup>3</sup> /s                     |
| <i>Energy Tunnel</i>                                           |   |                                             |
| Location                                                       | : | Left bank                                   |
| Tunnel type                                                    | : | Horse shoe type                             |
| Tunnel entrance base elevation                                 | : | 591.225 m                                   |
| Tunnel inner radius                                            | : | 8.40 m                                      |
| Tunnel capacity                                                | : | 295.00 m <sup>3</sup> /s                    |
| Total tunnel length                                            | : | 443.06 m                                    |
| Tunnel exit elevation                                          | : | 585 m                                       |
| <i>Surge Chamber</i>                                           |   |                                             |
| Type                                                           | : | circular                                    |
| Radius                                                         | : | 8.40 m at the bottom and 18.00 m at the top |
| Upper level                                                    | : | 663.50 m                                    |
| Base level                                                     | : | 586.05 m                                    |
| <i>Penstock</i>                                                |   |                                             |
| Number                                                         | : | 1 with bottom trifurcation                  |
| Inner radius                                                   | : | 4.70 m                                      |
| Total length                                                   | : | 124.00 m                                    |



|                               |                                          |
|-------------------------------|------------------------------------------|
| Average thickness             | : 19.20 mm                               |
| Emergency and control         | : Butterfly valve                        |
| <b>Power House</b>            |                                          |
| Length                        | : 57.20 m                                |
| Width                         | : 41.15 m                                |
| Project flow rate (3+1)       | : 295.00 m <sup>3</sup> /s               |
| Tail water elevation          | : 541.80 m                               |
| Turbine center line elevation | : 536.30 m                               |
| Total Capacity                | : 275.52 MW (after the design upgrade)   |
| Number of turbines            | : 3 +1                                   |
| Turbine type                  | : 3 Vertical axis francis + 1 horizontal |
| Gross head                    | : 105.20 m                               |
| Turbine unit capacity         | : 87.09 MW +14.25 MWe                    |
| Annual Electricity production | : 875,840 MWh Until end of 2013          |
|                               | : 881,220 MWh After 2014                 |

The project will be using three vertical Francis turbines and one additional horizontal francis turbine. The Francis type of turbine is a reaction type of turbine. In case of reaction turbines, the water approaches a set of curved blades mounted on a shaft and glides over them thereby changing direction and so imparting pressure on the blades due to centrifugal force, i.e. the force experienced by a passenger in a car when turning very fast. The water enters the blades nearly at a tangent and for the highest efficiency leaves the blades radially and at a reduced velocity. Francis turbines was invented by an English engineer J.B.Francis (1815 – 1892) water is delivered into a volute casing which completely surrounds the runner and is under pressure as well as velocity. The water is guided through both fixed and adjustable veins in the casing and glides onto the runner blades at an angle. The water then turns in the runner to exit parallel with the axis of rotation. The adjustable vanes cater for load changes. A bypass valve or a surge tank deals with sudden load changes. In a Francis turbine the entire wheel assembly is immersed in water and surrounded by a pressure casing. In a Francis turbine the pressure casing is spiral shaped and is tapered to distribute water uniformly around the entire perimeter of the runner. It uses guide vanes to ensure that water is fed into the runners at the correct angle. See the below Figure (Figure 2), for a schematic explanation of working principles of a Francis Turbine.

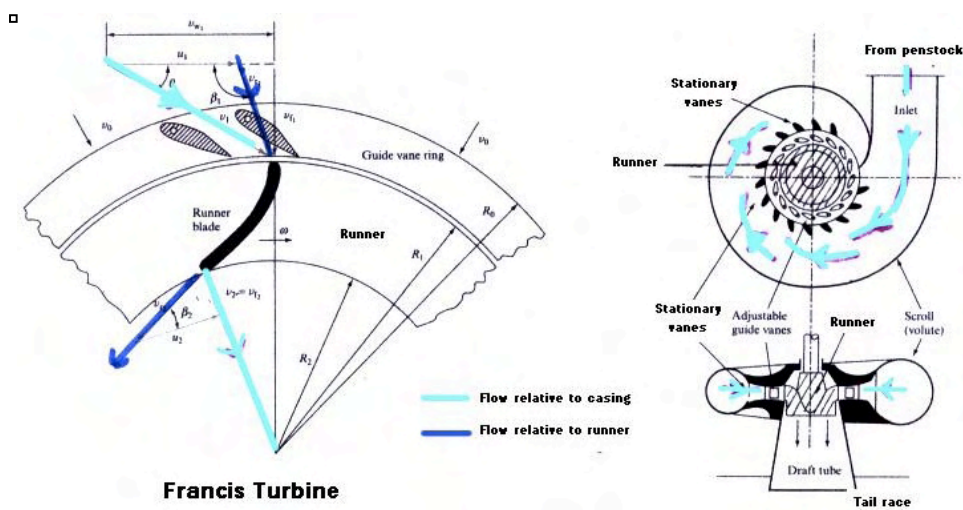




Figure 2: The working principle of a Francis type turbine, in case of the project activity the axis of the turbine will be vertical.

The project owner is granted a production license for 49 years<sup>2</sup> including the 52 months of project design and construction phase. The economic life time of a hydro power plant investment is assumed to be about 50 years, based on the experts' committee report<sup>3</sup> on energy under the 8<sup>th</sup> development plan published by the State planning organization. Even if the facility can last for 50 years the major equipment needs to be replaced every 20 years<sup>4</sup>.

The project is expected to produce an average of 875,840 MWh of electricity per year, for the first three years of the project life and by the addition of the tail water unit the production will increase to 881,210 MWh over the extent of the first crediting period. The annual electricity delivered to the grid by the project, would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. Based on this a combined margin emission reduction factor is calculated as detailed below in Chapter 3 of this document.

## 1.9 Project Location

The Project Activity is located on the Botan River in the Eastern Anatolia region of Turkey, within the Siirt city borders. It is located between the elevations of 647 m and 541.80 between 42°05'04"–42°05'54" east latitudes and 37°57'0"–37°57'46" North latitudes (Figure 3).

The Following (Table 3) gives the coordinates of the Alkumru HPP Dam location and Power house location.

Table 3: Coordinates of the Weir and Power house:

|            | Latitude      | Longitude     |
|------------|---------------|---------------|
| Dam        | 37°57'36.94"N | 42° 5'34.94"E |
| Powerhouse | 37°57'25.24"N | 42° 5'30.08"E |

Below figure indicates the project location.

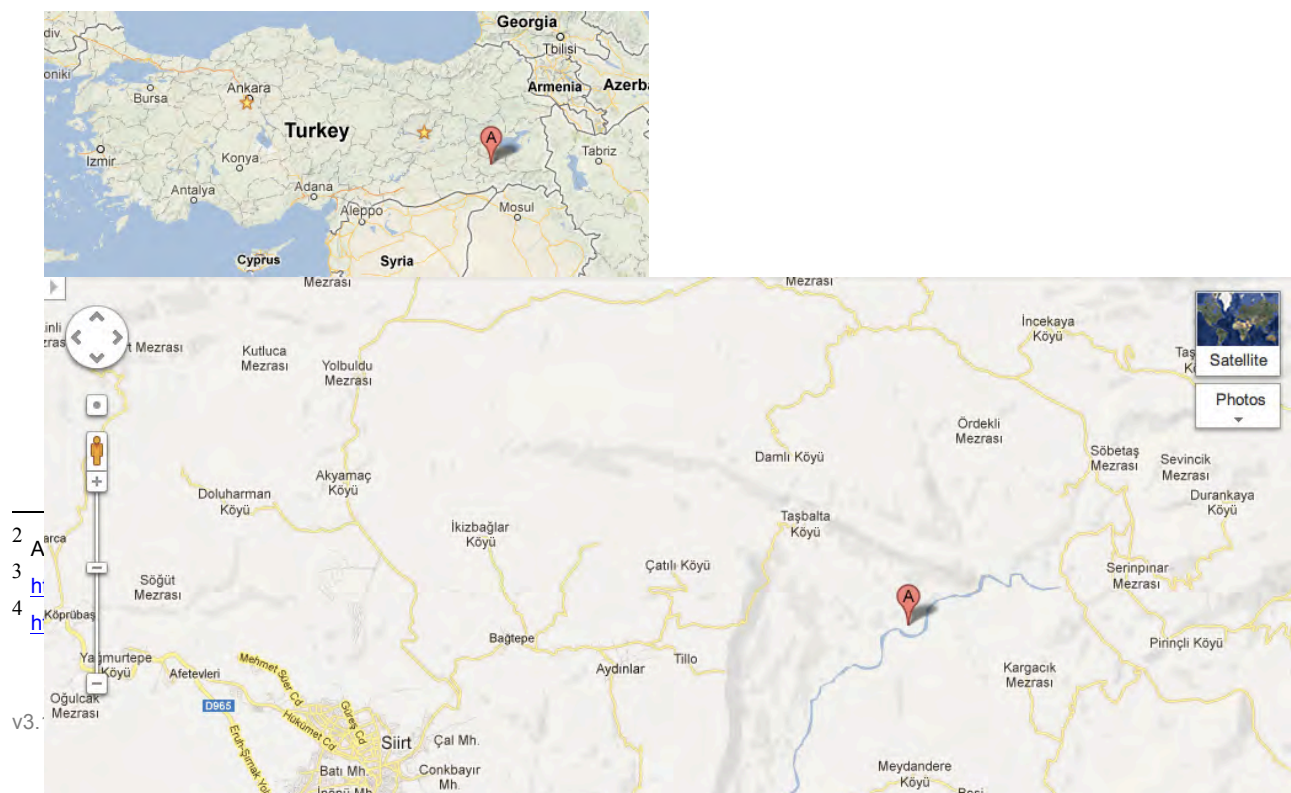


Figure 3: Map showing the location of Alkumru HPP on the Botan River, Siirt, Turkey (The project is indicated as a red balloon-<http://goo.gl/maps/6sAMS>).

### **1.10 Conditions Prior to Project Initiation**

There was no other hydroelectric power plant installation at the project location. The project activity does not generate greenhouse gas emissions, so it can be excluded that the implementation has been made only in order to generate GHG emissions with their subsequent reduction.

### **1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks**

Addition of a new power generation capacity to the grid is regulated by Energy Market Regulatory Authority (EMRA) who issues the licenses for electricity generation and is responsible for ensuring that new capacity additions are in compliance with its rules and regulations. The list of the rules and regulations of the host country that a new electricity generation project has to comply with is given in Annex 1..

### **1.12 Ownership and Other Programs**

#### **1.12.1 Proof of Title**

Ownership of the plant, equipment and electricity generation licence belongs to Limak Hidroelektrik Santral Yatırımları Anonim Şirketi and all emission reductions/removals are granted to the company. The production license and the operating certification of the company given by the Chamber of Commerce are provided to the validating DOE as proof of the Title.

#### **1.12.2 Emissions Trading Programs and Other Binding Limits**

Not applicable

The Project Activity is not embedded under any kind of Emission trading programs. Turkey is not an Annex-B country under Kyoto Protocol, neither has its set national emission reduction targets nor any related obligations.

## 1.12.3 Participation under Other GHG Programs

Not applicable

The project is a voluntary project and the host country, Turkey cannot host CDM or JI projects. The project has not been registered under any other voluntary GHG program.

## 1.12.4 Other Forms of Environmental Credit

Not applicable

The project will not generate other form of environmental credits such as Green Power Certificates.

## 1.12.5 Projects Rejected by Other GHG Programs

Not applicable

The project has not been rejected by any other Green House Gas programme.

## 1.13 Additional Information Relevant to the Project

### Eligibility Criteria

The Project is eligible to be a VCS Project because:

- VCS v.3.3 has taken effect on 04.10.2012, accordingly the Project is eligible to use this version.
- VCS v.3.3 requires project crediting period start date earliest to be 01.01.2002, besides, the Project must also complete the validation within two years of the Project Start Date, which is 10.March 2011. Both conditions are satisfied for the Project activity.
- VCS v.3.3 accepts all six Kyoto Protocol gases. The Project aims to reduce CO<sub>2</sub>, which is one of these six Kyoto Protocol gases.
- VCS v.3.3 accepts all technologies supported by a VCS approved GHG program. The Project is a hydropower plant, the technology of which is included in the UNFCCC- CDM sectoral scope 1.
- VCS v.3.3 requires the use of one of the VCS program approved project methodologies. The Project activity uses the tools and methodologies of approved by UNFCCC CDM executive board, which is a VCS approved program.
- The project does not benefit from any kind of Official Development Assistance.
- In addition to the above, the project is not a grouped project activity, nor de-bundled part of a grouped project activity

**Leakage Management**

Not Applicable as the project is a green field project.

**Commercially Sensitive Information**

A detailed excel workbook summarizing the financial analysis is provided to the validating DOE with relevant evidences that are commercially sensitive, these will not be disclosed to public.

**Further Information**

No further information to be added.

## 2 APPLICATION OF METHODOLOGY

### 2.1 Title and Reference of Methodology

The following UNFFCC methodology and its related tools are utilised:

Approved consolidated baseline and monitoring methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources.” Version 13.0.0.

The Approved Methodology refers to the following tools:

“Tool for the demonstration and assessment of additionality” (Version 06.0.0 )

“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).

### 2.2 Applicability of Methodology

The methodology ACM0002 (Version 13.0.0) is applicable to the proposed project activity because the proposed project meets all the applicability criteria stated in the methodology:

The methodology is applicable under the following conditions:

- “The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;
- In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2 on page 10 (of the ACM0002 (version 13.0.0)). to calculate the parameter EGPJ,y): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;”

The proposed project activity fits to first condition stated above as it is the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant).

“In case of hydro power plants:

- One of the following conditions must apply:

- The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or
- The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than  $4 \text{ W/m}^2$ ; or
- The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than  $4 \text{ W/m}^2$ .”

In case of Alkumru HPP, at the maximum operation level of 647.00 m water level the total extend of the area that is covered by the reservoir is  $10,990,000 \text{ m}^2$  therefore, as shown in the following calculation, the power density is calculated to be  $25.07 \text{ W/m}^2$ , which is greater than  $4 \text{ W/m}^2$ .

| Capacity (W) | Reservoir Area at Maximum Elevation ( $\text{m}^2$ ) | Power Density ( $\text{W/m}^2$ ):                                            |
|--------------|------------------------------------------------------|------------------------------------------------------------------------------|
| 275,520,000  | 10,990,000                                           | $\frac{275,520,000 \text{ W}}{10,990,000 \text{ m}^2} = 25.07 \text{ W/m}^2$ |

“In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than  $4 \text{ W/m}^2$  all the following conditions must apply:

- The power density calculated for the entire project activity using equation 5 (provided in the methodology) is greater than  $4 \text{ W/m}^2$ ;
- Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant;
- Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity;
- Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than  $4 \text{ W/m}^2$ , is lower than 15MW;
- Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than  $4 \text{ W/m}^2$ , is less than 10% of the total installed capacity of the project activity from multiple reservoirs.”

The proposed project activity does not have multiple reservoirs so the above conditions are not applicable and the project activity is eligible.

“The methodology is not applicable to the following:

- Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;
- Biomass fired power plants;
- A hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than  $4 \text{ W/m}^2$ . “

The proposed project activity does not involve switching from fossil fuels to renewable energy sources at the site of the project activity, is not a biomass fired plant, is not a hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than  $4 \text{ W/m}^2$ , therefore the project activity is eligible to implement the ACM0002 version 13.0.0

“In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.

The project is not a retrofit, replacement or capacity addition so the above condition is not applicable.

In addition, Alkumru HPP meets the applicability conditions included in “Tool for the demonstration and assessment of additionality” (Version 6.0.0) and “Tool to calculate the emission factor for an electricity system” (Version 2.2.1) referred below, the following reasons justify the applicability of the methodological tools:

- “Tool for the demonstration and assessment of additionality” (Version 6.0.0) is required to be applied for demonstrating and assessing the additionality of a project activity in ACM0002 (Version 13.0.0).

According to the “Tool to calculate the emission factor for an electricity system” (Version 2.2.1), “This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid.” Accordingly, Alkumru HPP will supply electricity to the Turkish National Grid, and therefore this tool can be used to estimate the OM, BM and CM of calculating baseline emissions.

## 2.3 Project Boundary

Table 5 exhibits the gases included in the project boundary. CO<sub>2</sub> emission is included in the baseline but the project activity does not emit any of the gases listed, in Table 5.

The project boundary includes net electricity generated and supplied to the Turkish national grid.



Table 4: Main gases included in the project boundary

| Source   |                                                     | Gas              | Included? | Justification/Explanation                                              |
|----------|-----------------------------------------------------|------------------|-----------|------------------------------------------------------------------------|
| Baseline | Electricity generation in baseline (Turkey's Grid)  | CO <sub>2</sub>  | Yes       | Main emission source                                                   |
|          |                                                     | CH <sub>4</sub>  | No        | Minor emission source                                                  |
|          |                                                     | N <sub>2</sub> O | No        | Minor emission source                                                  |
|          |                                                     | Other            | N.A.      | N.A.                                                                   |
| Project  | Emission from the reservoir of the proposed project | CO <sub>2</sub>  | No        | Minor emission source                                                  |
|          |                                                     | CH <sub>4</sub>  | No        | Minor emission source (Power density greater than 10W/m <sup>2</sup> ) |
|          |                                                     | N <sub>2</sub> O | No        | Minor emission source                                                  |
|          |                                                     | Other            | N.A.      | N.A.                                                                   |

## 2.4 Baseline Scenario

Since the proposed project activity is the installation of a new grid-connected hydroelectric, that is renewable power plant and therefore, the baseline scenario is defined as the following based on ACM0002 (Version 13.0.0):

“Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the. Tool to calculate the emission factor for an electricity system (v.02.2.1).”

Since the proposed project activity is going to be connected to the Turkish national grid, the baseline scenario of the proposed project is the supply of the equivalent amount of annual power output by the existing Turkish national grid which is the continued operation of existing power plants and the addition of new sources to meet electricity demand.

Based on ACM002, baseline emissions are equal to power generated by the project activity that is delivered to the Turkish national grid, multiplied by the baseline emissions factor. This baseline emissions factor (EF<sub>y</sub>) is calculated as the Combined Margin (CM), of which the breakdown and detailed description is given below in chapter 3.

## 2.5 Additionality

The proposed project activity reduces GHG emissions by substituting fossil fuel based electricity generation by renewable resources (hydro) based electricity generation.

This part refers to the “Tool for the Demonstration and Assessment of Additionality Version 6.0.0” and the numbering in this section reflects the Tool’s Guidelines provided at EB 65.

### **Step 1 - Identification of Alternatives to the project activity consistent with current laws and regulations**

#### **Sub-step 1a - Define alternatives to the project activity:**

The tool notifies that “Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity.”

The project alternative can be defined as follows:

Continuation of the current situation (No project activity or other alternatives undertaken). This alternative is the most likely scenario, since there are no legal obligation to implement such a project and without VCS support the project implementation is financially not attractive.

**Outcome of Step 1a:** The only realistic and credible alternative scenario to the project activity is Continuation of the current situation, without any project undertaken .

#### **Sub-step 1b. Consistency with mandatory laws and regulations:**

The project alternative, the baseline scenario, which is the continuation of the existing situation, is in compliance with all mandatory applicable and legal and regulatory requirements. Also the alternative scenario of addition of a new power generation capacity to the grid is regulated by Energy Market Regulatory Authority (EMRA) who issues the licenses for electricity generation and is responsible for ensuring that new capacity applies with its rules and regulations. The list of the rules and regulations of the host country that a new electricity generation project has to comply with is given in Annex 1.

**Outcome of Step 1b:** The alternative scenario to the project activity is the supply of electricity by the existing grid with additional capacity is in compliance with mandatory legislation and regulations.

### **Step 2 - Investment analysis**

At this step it will be demonstrated that “the proposed project activity is not the most economically and financially viable” option without the VER revenue. Please note that, at this step, the “Guidelines on the assessment of investment analysis” (EB 62 Report Annex 5) Version 05 is taken into account.

## **Sub-step 2a - Determine appropriate analysis method**

There are three options for investment analysis method:

- Simple Cost Analysis
- Investment Comparison Analysis and
- Benchmark Analysis

“Simple Cost Analysis” is not applicable for this project activity as the project generates economic benefits from sale of electricity to the Turkish national grid”. Investment Comparison Analysis is also eliminated since the baseline for the project is “the generation of electricity by the existing grid” and no similar investment alternatives exist. Therefore, Benchmark Analysis is the most appropriate approach for the evaluation of the project activity.

## **Sub-step 2b - Option III-Apply benchmark analysis**

Internal Rate of Return (IRR) on equity is taken for this project to be the financial indicator for assessing the financial viability of the project activity..

Equity IRR is the cash flow return to equity shareholders after debt repayments. And therefore also takes into account the debt repayments. Equity IRR takes into consideration that you use debt for the project, so the inflows are the cash flows required minus any debt that was raised for the project. The outflows are cash flows from the project minus any interest and debt repayments.

To be able to assess the financial viability of the project a benchmark to compare the equity IRR is needed.

The Tool for the Demonstration and Assessment of Additionality Version 6.0.0 and the Guidelines issued at EB 62 state that “...Discount rates and benchmarks shall be derived from: Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data”

The Guidelines issued at EB 62<sup>5</sup>, provides the default values for the expected return on equity as an appendix, and Moody’s index values of most of the CDM Countries. At the time of investment decision, Turkey’s Moody’s index (Ba2) was comparable to country’s with the same Moody’s index, and same default benchmark value from this point of view a reasonable and appropriate benchmark to compare the Equity IRR can be taken as 12.50 %.

## **Sub-step 2c - Calculation and comparison of financial indicators**

The following parameters are taken into account for the assessment of the investment (Table 5) and supplementary parameters are provided in the “AlkumruFinancialAnalysis” workbook and submitted to the validating DOE.

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<sup>5</sup> Annex 5 Guidelines on The Assessment of Investment Analysis (Version 05)

Table 5: Major parameters taken into account for the financial analysis and determination of the Equity IRR of the Alkumru HPP Project:

| Parameter                                      | Value           | Unit               | References                                                                                                                                                    |
|------------------------------------------------|-----------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Installed Capacity                             | 240.00          | MWe                | Initial Feasibility Report that makes the basis for Investment Decision                                                                                       |
| Expected Annual Electricity Generation         | 822,130         | MWh                | Initial Feasibility Report that makes the basis for Investment Decision                                                                                       |
| Expected Average Annual Emission Reduction(ER) | 475,143         | tCO <sub>2</sub> e | Calculated (see Chapter 3 for details) based on the post investment decision time electricity production values.                                              |
| Total Investment                               | 470,253,643     | USD                | Based on Cost values submitted to the crediting Banks                                                                                                         |
| Annual Operation Costs                         | \$10,439,915.89 | USD                | Based on FSR (2006, Table 9.2, maintenance & spare parts), EIA report (staff & labour) and 1% of the investment cost is chosen as the (insurance & security). |
| Loan                                           | Confidential    | USD                | Loan Agreement                                                                                                                                                |
| Loan Period                                    | 10              | years              | Loan Agreement                                                                                                                                                |
| Electricity Sales Price                        | 0.073           | USD/KWh            | Based on the guaranteed price by the "Renewable Energy Law" number 6094                                                                                       |
| VAT                                            | 18              | %                  | V.A.T. Law No:3065                                                                                                                                            |
| Income Tax                                     | 20              | %                  | Income Tax Law number 5281                                                                                                                                    |

The value of the investment has been depreciated on a reducing balance basis over 20 years, plus the four years of construction phase. 70 % of the long lasting assets are depreciated over 45 years and the residual book value of \$163,374,082.13 USD is added back to the cash flow. The economic life time of a hydro power plant investment is assumed to be about 50 years, based on the experts' committee report<sup>6</sup> on energy under the 8<sup>th</sup> development plan published by the State planning organization. Even if the facility can last for 50 years the major equipment needs to be replaced in every 20 years<sup>7</sup>. As a result the project lifetime is estimated to be about 20 years and the investment analysis is therefore done for a time frame of 20 years.

For the assessment of the viability of the project activity the Equity IRR is compared to the benchmark. The equity IRR is worked out as 9.04 %, which is below the benchmark of 12.50%.

### Sub-step 2d - Sensitivity Analysis

To be able to conclude if the investment decision is the financially the most attractive alternative, a sensitivity analysis is performed. Three parameters that affect the equity IRR are examined for the sensitivity analysis:

- Investment Cost
- Operating and Maintenance Cost
- Electricity Revenue

The sensitivity analysis is performed for a range of  $\pm 10\%$  fluctuations in the above parameters. The figures in the following table (Table 7) are obtained. Following the "Guidelines on the

<sup>6</sup> <http://ekutup.dpt.gov.tr/enerji/oik585.pdf> page 4.25 (Last visited on 3/3/2011)

<sup>7</sup> <http://ekutup.dpt.gov.tr/enerji/oik585.pdf> page 4.26 (Last visited on 3/3/2011)

assessment of investment analysis (Version 05)" of EB 62 Annex 5 when any of the key variables are increased or decreased by at least 10%, and the benchmark is not exceeded (also see Figure 7).

Table 6: Sensitivity analysis for the Equity IRR without carbon revenue for the project (Benchmark: 12.50%)

| Change              | -10%   | -5%    | 5%    | 10%    | Exceed Benchmark? |
|---------------------|--------|--------|-------|--------|-------------------|
| Investment Cost     | 12.24% | 10.42% | 7.94% | 7.02%  | No                |
| Operating Cost      | 9.28%  | 9.16%  | 8.91% | 8.79%  | No                |
| Electricity Revenue | 7.72%  | 8.39%  | 9.66% | 10.26% | No                |

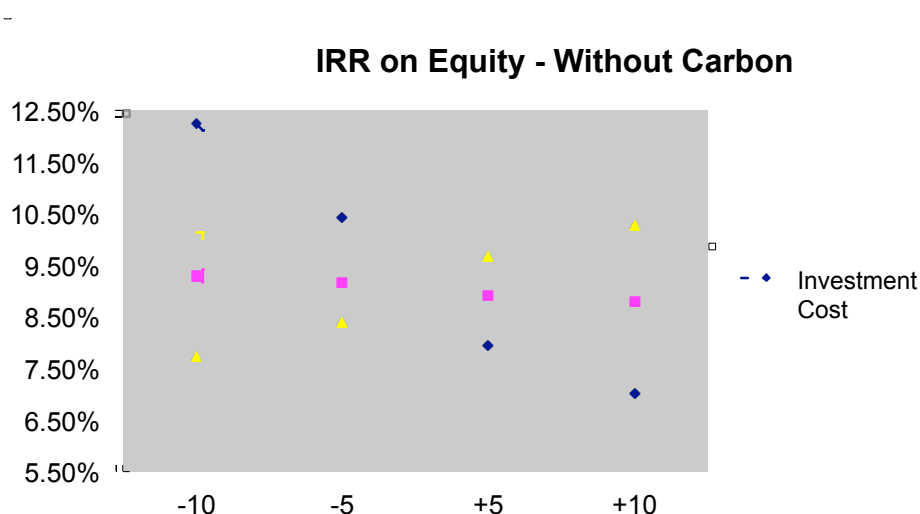


Figure 4: Sensitivity analysis: Fluctuation of the Equity IRR without the carbon revenue, by changing major parameters that effect the Equity IRR by  $\pm 10\%$

To exceed the benchmark, the electricity revenue must increase by about 30.30% over the life of the project, or the investment cost must be reduced by about 10.60%. As the Renewable energy law only guaranties a minimum price of USD 0.073 per kWh, and since the feasibility report and the design of the project is based on the maximum available capacity of the Botan river, and all our financial analysis is based on the maximum electricity output of the project, such an increase in increased amount of electricity generation is very unlikely. In addition to that as the availability of the water decreases due to the globally accepted results of global climate change, electricity production is very unlikely to reach to an increased generation amount of an additional 30.30%. In addition to this the climate change models indicate for the Mediterranean basin an increased drought and water scarcity that could even risk the project to reach the firm energy values.

The project involves particular design change decisions that are not considered at the investment decision stage when the above financial analysis was based on. Those changes improve the capacity and increase the amount of electricity production But the maximum amount of electricity expected to be produced after all of these changes are implemented is only 7.19% higher than the amount considered in the financial analysis. Besides, to be able to harvest that higher amount of electricity there needs to be an increase in the investment cost by about 20%.

The investment costs we have considered in our financial analysis are based on the numbers presented to the bank when the project developer was negotiating the terms of the bank loan. Therefore these numbers reasonable and reflect the average market conditions but are unlikely to go down, as the focus of the project developer is to secure and improve the electricity yield and therefore they will not be able to cut costs. Therefore it is very unlikely for the investment cost to finalize below the amounts estimated and shown in the financial analysis.

## **Outcome of Step 2:**

Without the VER revenue the Internal Rate of Return of the project cannot get close to the benchmark of 12.50 %, with an equity internal rate of return of 9.04%. A fluctuation of  $\pm 10\%$  in the key parameters also does not make the project exceed the benchmark.

## **Step 3 - Barrier Analysis**

As the investment analysis concludes that the proposed project activity is unlikely to be the most financially attractive option, the sub step 3- Barrier analysis is optional to be applied and barrier analysis is not considered for the Alkumru HPP.

## **Step 4: Common Practice Analysis**

### **Sub-step 4a. Analyse other activities similar to the proposed project activity**

As per “Tool for the Demonstration and Assessment of Additionality”, projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory frame-work, investment climate, access to technology, access to financing, etc. Although the tool does not consider the *Sectoral Scope 1: Energy industries (renewable-/non -renewable sources) projects* amongst the measures that can make use of the common practice guideline version 02, we preferred to utilise the same guideline to demonstrate that within the boundaries of the Tigris catchment there are no similar projects that are developed and operational without the assistance of the VER revenue. According to the Guidelines on Common Practice (version 02), common practice analysis is presented through the following 4 steps.

Common Practice tool Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity:

As a hydropower project, the installed capacity is chosen as an appropriate proxy for “similar scale”. The power generation capacity of 275.52 MW of the proposed project is selected as the design capacity. Therefore, the range from 137.76MW to 413.28 is considered as applicable capacity.

Common Practice tool Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number  $N_{all}$ . Registered VER project activities shall not be included in this step:

Checking all the power plants within the capacity range determined in Step 1, and looking projects that have started commercial operation before the start date of the project, it is revealed that there are 12 power plants operational in the Turkish grid with a capacity ranging between 137.76MW to 413.28 (See Table:7). Therefore the number of  $N_{all}$  is 12.

Table 7: Projects that are commissioned before the project activity that can be considered to be included in the count of  $N_{all}$ .

| Name                                | Developer        | Capacity (MW) | Mean Production (GWh) | Firm Production (GWh) | Location         | Basin Number and Name | DSİ District  | Year of Commissioning |
|-------------------------------------|------------------|---------------|-----------------------|-----------------------|------------------|-----------------------|---------------|-----------------------|
| Aslantaş                            | Government       | 138           | 569                   | 320                   | 80 Osmaniye      | 18 Seyhan             | 06 Adana      | 1984                  |
| Gezende                             | Government       | 159.4         | 528                   | 130                   | 33 İçel (Mersin) | 17 Doğu Akdeniz       | 06 Adana      | 1990                  |
| Obruk I-II                          | Government       | 212.4         | 473                   | 337                   | 19-Çorum         | 15 Kızılırmak         | 05 Ankara     | 2009                  |
| Borçka                              | Government       | 300.6         | 1039                  | 600                   | 08 Artvin        | 23 Çoruh              | 26 Artvin     | 2006                  |
| Yedigöze - Sanibey HPP <sup>8</sup> | Private Licencee | 320           | 1000                  | 1000                  | 01 Adana         | 20 Ceyhan             | 06 Adana      | 2011                  |
| Sarıyar-H.Polatkan                  | Government       | 160.00        | 400                   | 328                   | 06 Ankara        | 12 Sakarya            | 05 Ankara     | 1956                  |
| Çatalan                             | Government       | 168.90        | 596                   | 270                   | 01 Adana         | 18 Seyhan             | 06 Adana      | 1997                  |
| Özlüce-Peri                         | Government       | 170.00        | 413                   | 290                   | 12 Bingöl        | 21 Fırat              | 09 Elazığ     | 1999                  |
| Karkamış                            | Government       | 180.00        | 652                   | 462                   | 63 Urfa          | 21 Fırat              | 15 Urfa       | 1999                  |
| Batman                              | Government       | 198.00        | 483                   | 196                   | 21 Diyarbakır    | 26 Dicle              | 10 Diyarbakır | 2003                  |
| Gökçekaya                           | Government       | 278.40        | 562                   | 460                   | 26 Eskişehir     | 12 Sakarya            | 03 Eskişehir  | 1973                  |
| Sır                                 | Government       | 283.50        | 725                   | 408                   | 46 K. Maraş      | 20 Ceyhan             | 20 K.Maraş    | 1991                  |

Common Practice tool Step 3: identify the different technologies delivered the same output and differ by at least one of the following aspects, Note their number  $N_{diff}$  :

(i) Energy source/fuel;

(ii) Feed stock

(iii) Size of installation (power capacity):

- Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision3/CMP.6);
- Small (as defined in paragraph 28 of Decision 1/CMP.2);
- Large;

(iv) Investment climate in the date of the investment decision, inter alia:

- Access to technology;
- Subsidies or other financial flows;
- Promotional policies;
- Legal regulations

(v) Other features, inter alia:

- Unit cost of output (units costs are considered different if they differ by at least 20%);

<sup>8</sup> Upon our communication with the project owner we are informed that the project was under validation process to seek VCS certification.



Common Practice tool Sub-step 3a:

When we consider the project listed in Table 7, these projects are different from Alkumru HPP in the following aspects:

- All the projects except Yedigöze-Saniey HPP, were developed by government, and therefore since they were developed considering public benefit the conditions and economical motivations in developing them are very different than the project activity.
- Yedigöze-Saniey HPP is developed by the private sector, and it is not yet listed in the VCS Project database or in any of the VCS registries however, the project owner stated that it was under validation to seek VCS certification.
- In addition to that the project was developed on Ceyhan Basin, within the jurisdiction of DSI 6<sup>th</sup> District of Adana, and therefore has different water flow characteristics than the project activity, which is located in the Tigris catchment.

Conclusion of Common Practice tool Sub- Step 3b is  $N_{diff}=12$

Common Practice tool Step 4: Calculate factor  $F=1-N_{diff}/N_{all}$  representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

$$F=1-N_{diff}/N_{all}$$

$$F=1-(12/12)$$

$$F=0$$

Common Practice tool Step 5: Conclusion

The proposed project activity is a “common practice” within a sector in the applicable geographical area if the factor F is greater than 0.2 and  $N_{all}-N_{diff}$  is greater than 3

Factor F is calculated to be  $0 < 0.2$

$N_{all}-N_{diff}=12-12=0 < 3$  in that case the Alkumru HPP is not common practice.

**Conclusion of Step 4:** In conclusion the proposed project is deemed to be additional according to ACM0002 and the tool and guideline for the demonstration and assessment of additionality.

## 2.6 Methodology Deviations

The UNFCCC methodology of ACM0002/ Version 13.0.0 and its related tools have been applied without any deviations.

### 3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

#### 3.1 Baseline Emissions

According to the latest version (version 13.0.0) of ACM0002 and the tool to calculate the emission factor for electricity system, since the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

*Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system” (version 02.2.1 (EB63)).*

The Project therefore applies the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system” (version 02.2.1 (EB63)).

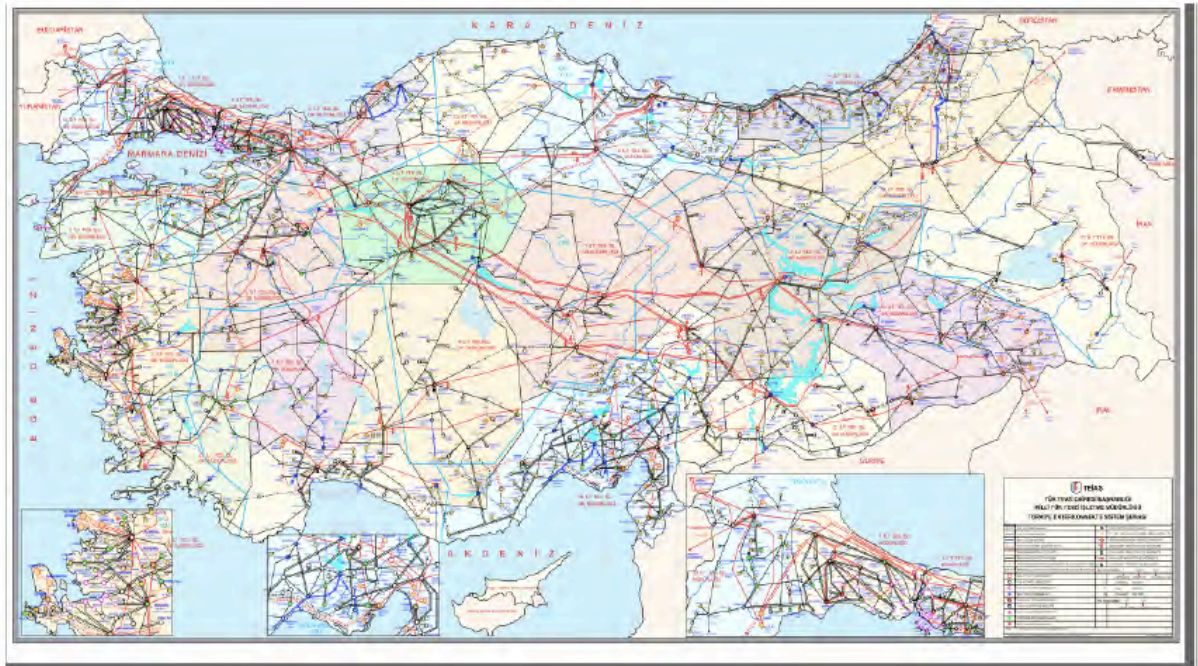
##### **Step 1 -Identify the relevant electric power system**

As the host country is not participating in the compliance markets hence does not have a DNA, a delineation of the project electricity system and connected electricity systems has not been published yet. For such cases, the tool suggests using the following criteria to determine the existence of significant transmission constraints:

1. *“In case of electricity systems with spot markets for electricity: there are differences in electricity prices (without transmission and distribution costs) of more than 5 percent between the systems during 60 percent or more of the hours of the year.”* This criteria is not applicable as there is no spot electricity market in the host country.
2. *“The transmission line is operated at 90% or more of its rated capacity during 90% percent or more of the hours of the year”:* The transmission line operator (TEIAS) or any other official source has not published the capacity usage figures for the Turkish grid, hence this criterion can not be proved.

According to the tool, where the application of these criteria does not result in a clear grid boundary, a regional grid definition in the case of large countries with layered dispatch systems (e.g. provincial / regional / national) shall be used. A provincial grid definition may indeed in many cases be too narrow given significant electricity trade among provinces that might be affected, directly or indirectly, by a CDM project activity. In other countries, the national (or other largest) grid definition should be used by default.

Therefore, for the case of the subject project activity “the project electricity system” and “the connected system” are same, and the Turkish National Grid is used as the “project electricity system”. It is also confirmed by TEIAS that the Turkish grid is interconnected. There isn’t any independent or regional grid system in any region of Turkey. The map of the Turkish Electricity Grid is given in the below figure (Figure 10):



**Figure 5:** The Map showing the boundaries of Turkish Electricity Grid (Source Electricity Market Report 2010, by Electricity Market Regulatory Authority  
<http://www.epdk.gov.tr/documents/10157/48dd12d4-74da-4dcf-9f48-86983146c0d8>)

All the calculations details of which are given below are made for the entire Turkish Grid.

For the purpose of determining the operating margin emission factor, the tool directs us to use one of the following options to determine the CO<sub>2</sub> emission factor(s) for net electricity imports from a connected electricity system:

0 tCO<sub>2</sub>/MWh; or (a) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in Step 4 (d) below; or (b) The simple operating margin emission rate of the exporting grid, determined as described in Step 4 (a), if the conditions for this method, as described in Step 3 below, apply to the exporting grid; or (c) The simple adjusted operating margin emission rate of the exporting grid, determined as described in Step 4 (b) below.

For imports from connected electricity systems located in Annex I country(ies), the emission factor is 0 tons CO<sub>2</sub> per MWh.

And the tool also notes that the ... "Electricity exports should not be subtracted from electricity generation data used for calculating and monitoring the electricity emission factors."

In our case the host country (imports electricity mainly from Annex -1 countries, so the emission factor related to imports is considered to be zero"0".

**Step 2 - Choose whether to include off-grid power plants in the project electricity system**

The tool requires Project participants to choose between the following two options to calculate the operating margin and build margin emission factor:

**Option I:** Only grid power plants are included in the calculation.

**Option II:** Both grid power plants and off-grid power plants are included in the calculation.

In our case, "Option I" has been selected for the calculation of grid emission factor, and only grid power plants are included in the calculation.

### **Step 3 – Select an operating margin (OM) method**

According to the "Tool to calculate the emission factor for an electricity system", version 02.2.1 in calculating the Operating Margin grid emission factor for a given year  $y$  ( $EF_{grid, OM, y}$ ), project developers have the option of selecting from four methods:

- (a) Simple OM,
- (b) Simple adjusted OM,
- (c) Dispatch Data Analysis OM, or
- (d) Average OM.

As the share of "low cost/must run" resources are below 50% for the five most recent years (Table 9), therefore, in accordance with the Tool, (a) Simple OM method will be used in the calculations.

Table 8: **Share of primary sources in electricity generation, 2006 – 2010<sup>9</sup>**

|                              | 2006    | 2007    | 2008    | 2009    | 2010    |
|------------------------------|---------|---------|---------|---------|---------|
| <i>Thermal</i>               | 74.78 % | 81.02 % | 82.72 % | 80.5 %  | 73.78 % |
| <i>Hydro</i>                 | 25.10 % | 18.72 % | 16.77 % | 18.46 % | 24.52 % |
| <i>Wind &amp; Geothermal</i> | 0.12 %  | 0.26 %  | 0.51 %  | 0.99 %  | 1.70 %  |
| <b>Total</b>                 | 100 %   | 100 %   | 100 %   | 100 %   | 100 %   |

Since the Simple OM calculation (option (A)) is selected, the emission factor is calculated by the generation-weighted average emissions per electricity unit ( $tCO_2/GWh$ ), and averaged over the past three years of all generating sources serving the system, not including low-cost / must run power plants. The tool gives two options for the calculation of  $EF_{grid, OM, y}$ :

- *Ex-ante* option

A 3-year generation-weighted average, based on the most recent data available at the time of submission of the VER-PDD to the DOE for validation, without the requirement to monitor and recalculate the emissions factor during the crediting period, or

<sup>9</sup> [Annual Development of Installed Capacity Generation in Turkey \(1970-2010\)](http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/kgucunkullanım(13-21)/13.xls)  
([http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/kgucunkullanım\(13-21\)/13.xls](http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/kgucunkullanım(13-21)/13.xls))

- *Ex-post* option

The year in which the project activity displaces grid electricity, with the requirement that the emission factor be updated annually during monitoring.

For the calculation of the Simple OM, the “**Ex-Ante**” option is selected, at the time of PDD submission to the DOE, the data vintages that were most recent at the start of validation, belongs to the years 2008, 2009 and 2010. All the data used in calculation of the Simple OM are taken from the TEIAS website, details of which are given below.

**Step 4 - Calculate the operating margin emission factor according to the selected method**

The Simple OM emission factor is calculated as the generation-weighted average CO<sub>2</sub> emissions per unit of net electricity generation (tCO<sub>2</sub>/MWh) for all generating power plants serving the system, not including low-cost / must run plants / units. It may be calculated:

- Option A: Based on the net electricity generation and a CO<sub>2</sub> emission factor of each power unit; or
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

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

- Annual fuel consumption by fuel type<sup>10</sup>,
- Annual heating values for fuels consumed for electricity generation<sup>11</sup>,
- Annual electricity generation by fuel type, import and export<sup>12</sup>

Taking into consideration the available data Simple OM method Option B is the applicable method for the project activity. Option A requires data on net electricity generation of each power plant / unit and a CO<sub>2</sub> emission factor of each power unit, both of which are not publicly available, for the Turkish electricity grid.

EF<sub>grid,OMsimple,y</sub>, using option B is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

<sup>10</sup> Fuel Consumed in thermal P.P.in Turkey by the Electric Utilities (2008-2010) (<http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/47.xls>)

<sup>11</sup> [Heating Values Of Fuels Consumed In Thermal P.P.s In Turkey By The Electric Utilities \(2008-2010\)](http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/49.xls), (<http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/49.xls>).

<sup>12</sup> Turkey's Gross Electricity Generation by Primary Energy Resources and The Electric Utilities (2008-2010) / (<http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/47.xls>) / Annual Development of Electricity Generation-Consumption and Losses in Turkey (1984-2009), ([http://www.teias.gov.tr/istatistik2009/30\(84-09\).xls](http://www.teias.gov.tr/istatistik2009/30(84-09).xls)).

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y})}{EG_{y,grid}} \quad (7)$$

Where:

$EF_{grid, OM simple,y}$  = Simple operating margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)

$FC_{i,y}$  = Amount of fossil fuel type  $i$  consumed in the project electricity system in year  $y$  (mass or volume unit)

$NCV_{i,y}$  = Net calorific value (energy content) of fossil fuel type  $i$  in year  $y$  (GJ/mass or volume unit)

$EF_{CO_2,i,y}$  = CO<sub>2</sub> emission factor of fossil fuel type  $i$  in year  $y$  (tCO<sub>2</sub>/GJ)

$EG_y$  = 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  $y$  (MWh)

$i$  = All fossil fuel types combusted in power sources in the project electricity system in year  $y$

$y$  = The relevant year as per the data vintage chosen in Step 3

#### **Step 5 - Calculate the build margin (BM) emission factor:**

The tool indicates that, in terms of vintage of data, project participants can choose between one of the following two options:

**Option 1:** For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group  $m$  at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

And ,

**Option 2:** For the first crediting period, the build margin emission factor shall be updated annually, *ex post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex ante*, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

We prefer the Option 1, calculating the Build Margin Emission factor, “*ex ante*”, for the first crediting period.



The sample group of power units  $m$  used to calculate the build margin are determined as per the following procedure, consistent with the data vintage selected above:

- Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ( $SET_{5-units}$ ) and determine their annual electricity generation ( $AEG_{SET-5-units}$ , in MWh);
- Determine the annual electricity generation of the project electricity system; excluding power units registered as CDM project activities ( $AEG_{total}$ , in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of  $AEG_{total}$  (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ( $SET_{\geq 20\%}$ ) and determine their annual electricity generation ( $AEG_{SET-\geq 20\%}$ , in MWh);
- From  $SET_{5-units}$  and  $SET_{\geq 20\%}$  select the set of power units that comprises the larger annual electricity generation ( $SET_{sample}$ ); Identify the date when the power units in  $SET_{sample}$  started to supply electricity to the grid. If none of the power units in  $SET_{sample}$  started to supply electricity to the grid more than 10 years ago, then use  $SET_{sample}$  to calculate the build margin.

According to the tool in terms of vintage of data, project participants can choose either the ex-ante option or the ex-post option. Between these two options, Option 1 is selected. For the first crediting period, the build margin emission factor is calculated ex-ante based on the most recent information available on units already built for sample group  $m$  at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period will be used. This option does not require monitoring the emission factor during the crediting period.

The build margin emissions factor is the generation-weighted average emission factor ( $tCO_2/MWh$ ) of all power units  $m$  during the most recent year  $y$  for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$  = Build margin CO2 emission factor in year  $y$  ( $tCO_2/MWh$ )

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

$EF_{EL,m,y}$  = CO2 emission factor of power unit  $m$  in year  $y$  ( $tCO_2/MWh$ )

$m$  = Power units included in the build margin



y = Most recent historical year for which electricity generation data is available

According to the tool, the CO<sub>2</sub> emission factor of each power unit m ( $EF_{EL,m,y}$ ) should be determined as per the guidance in step 4 (a) for the simple OM, using options A1, A2 or A3, using for y the most recent historical year for which power generation data is available, and using for m the power units included in the build margin. Taking into consideration the available data on the capacity additions, the formula given under Option A2 of the Simple OM option A is used to calculate  $EF_{EL,m,y}$ .

The CO<sub>2</sub> emissions from the most recent capacity additions are calculated by multiplying the  $EF_{EL,m,y}$  values calculated for each fuel source by the annual generation of that fuel source (Table 14). The emission factor has been taken as “zero” for the renewable and wastes and the generation efficiencies for the thermal power plants type of which are not known are taken as 60% which is generation efficiency for the combined cycle natural gas power plants. The Build Margin Emission Factor for each year is calculated by dividing the total CO<sub>2</sub> Emissions of the subject year by the total generation from the capacity additions of the same year.

The Build Margin Emission Factor of the grid is then calculated as an average for the years 2009 and 2010, as explained in the part where the actual calculations are shown, the assessed capacities added in these two years constitutes our  $SET_{sample}$ .

#### **Step 6 - Calculation of the combined margin emissions factor**

Finally, the combined margin grid emission factor ( $EF_{grid,CM,y}$ ) is expressed as the weighted average of the Operating Margin emission factor ( $EF_{grid,OM,y}$ ) and the Build Margin emission factor ( $EF_{grid,BM,y}$ ):

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

Where:

$EF_{grid,BM,y}$  Build margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/MWh)

$EF_{grid,OM,y}$  Operating margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/MWh)

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

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

Where weights  $w_{OM}$  and  $w_{BM}$  are by default 0.50 and 0.50 according to the selected methodology. And  $EF_{OM}$  and  $EF_{BM}$  are calculated as described in the previous steps.

Then baseline emissions ( $BE_y$ ) are obtained as:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

Where:

|                               |   |                                                                                                                                                                  |
|-------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $BE_y$                        | = | Baseline emissions in year $y$ (tCO <sub>2</sub> /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 <sub>2</sub> emissions factor in year $y$ (tCO <sub>2</sub> /MWh)                                                                             |
| And                           |   |                                                                                                                                                                  |
| $EG_{PJ,y} = EG_{facility,y}$ |   |                                                                                                                                                                  |
| $EG_{facility,y}$             | = | Quantity of net electricity generation supplied by the project plant to the grid in year $y$ (MWh/yr)                                                            |

The *ex-ante* emission reductions ( $ER_y$ ) are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

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

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

$PE_y$  = Project Emissions in year  $y$  (tCO<sub>2</sub>)

As methodology states the  $PE_y$  in case of a hydro power project with a power density > 10 W/m<sup>2</sup> (that is 25.07 W/m<sup>2</sup> for the Project Activity) to be zero hence  $ER_y = BE_y$

### 3.2 Project Emissions

As the methodology states the  $PE_y$  in case of a hydro power project will be calculated:

“Emissions from water reservoirs of hydro power plants ( $PE_{HP,y}$ )

*For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH<sub>4</sub> and CO<sub>2</sub> emissions from the reservoir, estimated as follows:”*

“...the power density of the project activity (PD) is greater than 4 W/m<sup>2</sup> and less than or equal to 10 W/m<sup>2</sup>:”

The project has a power density of 25.07 W/m<sup>2</sup> therefore

$$PE_{HP,y} = 0$$

Where:

$PE_{HP,y}$  Project emissions from water reservoirs (tCO<sub>2</sub>e/yr)

Although there will be auxiliary diesel generators installed within the project boundary, the emissions from these have been deemed negligible as per the ACM0002 (version 13.0.0) methodology.

### 3.3 Leakage

There are no leakage emissions related to project activity.

### 3.4 Summary of GHG Emission Reductions and Removals

Ex-ante calculation of emission reductions:

#### Simple Operating margin (OM)

As also explained above, for the computation of the Simple OM, the Ex-Ante option is selected, at the time of PD submission to the DOE, the data vintages that were most recent, belongs to the years 2008, 2009 and 2010. All the data used in calculation of the Simple OM are taken from the TEİAŞ website, details of which are given below. Taking into account the available data “Simple OM” method “Option B” is the appropriate method for the project activity. TEİAŞ publishes the annual heating values of the fuels consumed in the power plants, the heating values are directly related to fuel consumption and are used to calculate average Net Calorific Values (TJ/kt) (Table 9).

The heating values of fuels consumed in thermal power plants are announced by TEİAŞ, the unit of the heating values are Tcal. Tcal is converted to GJoule by using the conversion factor 1cal = 4.1868 Joule. Then the heating values in GJ are divided by Fuel Consumption ( $FC_{i,y}$ ) to get the Net Calorific Values of the fuels consumed in TJ/kt as follows:

Table 9: Net Calorific Values for each fuel type for Turkey

| Fuel Type                | NCV (TJ/kt)        |       |                    |
|--------------------------|--------------------|-------|--------------------|
|                          | 2008               | 2009  | 2010               |
| Hard Coal+ Imported Coal | 22.24              | 22.21 | 22.32              |
| Lignite                  | 6.83               | 6.43  | 7.13               |
| Fuel Oil                 | 39.70              | 39.81 | 40.23              |
| Diesel Oil               | 42.38              | 42.37 | 43.09              |
| LPG                      | 0.00 <sup>13</sup> | 46.47 | 0.00 <sup>13</sup> |
| Naphtha                  | 44.61              | 43.65 | 33.50              |
| Natural Gas              | 36.63              | 37.17 | 37.38              |

The emission factors of fuels required are taken from IPCC 2006 guidelines for GHG inventories<sup>14</sup>. All data used for the calculations can be found in Annex-2 (See Table 1 and Table 2 to in Annex -2). Table 10 shows total CO<sub>2</sub> emission by fuel types calculated using lower IPCC emission factors and available data from the TEİAŞ website.

<sup>13</sup> It is shown as zero as in year 2008 and 2010 there was no LPG consumption in the grid.

<sup>14</sup> Table 2.2.Default Emission Factors for Stationary Combustion in the Energy Industries, Vol.2. Energy, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, ([http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2\\_Volume2/V2\\_2\\_Ch2\\_Stationary\\_Combustion.pdf](http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf))

Table 10: Calculation of emission by electricity generation (2008-2010)

|                         | Default CO <sub>2</sub> Emissions (tCO <sub>2</sub> ) |                      |                      |
|-------------------------|-------------------------------------------------------|----------------------|----------------------|
|                         | 2008                                                  | 2009                 | 2010                 |
| Hard Coal+Imported Coal | 12,942,102.18                                         | 13,649,138.82        | 15,365,199.79        |
| Lignite                 | 41,189,044.65                                         | 37,164,240.90        | 36,745,389.26        |
| Fuel Oil                | 6,513,942.76                                          | 4,792,096.57         | 2,708,730.18         |
| Diesel Oil              | 403,661.11                                            | 556,318.57           | 63,674.50            |
| Lpg                     | 0.00                                                  | 0.00                 | 0.00                 |
| Naphtha                 | 32,786.41                                             | 24,429.94            | 30,502.68            |
| Natural Gas             | 42,980,830.92                                         | 42,346,272.06        | 44,215,362.69        |
| <b>TOTAL</b>            | <b>104,062,368.04</b>                                 | <b>98,532,496.86</b> | <b>99,128,859.11</b> |

Net electricity generated and supplied to the grid by thermal power plants has been calculated using data obtained from TEİAŞ web page. The ratio between total gross and total net generation (including low-cost/must run plants) has been calculated for each year. The same ratio is assumed to be valid for all thermal plants and total net generation by the plants has been calculated accordingly. Summing up total net generation with the imported electricity, total supply excluding low cost / must run sources for each year is determined and given in Table 11.

Table 11: Net Electricity Generation from thermal power plants (units in GWh)

|                               | 2008           | 2009           | 2010           |
|-------------------------------|----------------|----------------|----------------|
|                               | Unit: GWh      |                |                |
| <b>Net Generation</b>         | 189,761.90     | 186,619.30     | 203,046.10     |
| <b>Gross Generation</b>       | 198,418.00     | 194,812.90     | 211,207.70     |
| <b>Net/Gross Ratio</b>        | 0.9563744      | 0.9579412      | 0.9613575      |
| <b>Net Thermal Generation</b> | 156,978.63     | 150,323.43     | 149,806.03     |
| <b>Electricity Imports</b>    | 789.40         | 812.00         | 1,143.80       |
| <b>EG<sub>y</sub> (GWh)</b>   | 157,768.03     | 151,135.43     | 150,949.83     |
| <b>EG<sub>y</sub> (MWh)</b>   | 157,768,028.11 | 151,135,428.72 | 150,949,827.21 |

The OM Emission Factor for the years 2008, 2009 and 2010 are calculated by dividing the total CO<sub>2</sub> emissions for those years (Table 10) to the Net Electricity Generation (Table 11) for the subject year. The annual OM emission factors are calculated as follows (Table 12):

Table 12: Annual OM Emission Factors

| Year | OM Emission Factor |
|------|--------------------|
| 2008 | 0.65959            |
| 2009 | 0.65195            |
| 2010 | 0.65670            |

Finally, OM emission factor is calculated as a generation weighted average for the three most recent years. The resulting OM Emission Factor is;

$$EF_{\text{grid,OMsimple}} = 0.65613$$

### Build Margin (BM)

As mentioned above we have preferred the Option 1, calculating the Build Margin Emission factor, “ex ante”, for the first crediting period.

The sample group of power units  $m$  used to calculate the build margin are determined as per the following procedure, consistent with the data vintage selected above:

- a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ( $SET_{5-units}$ ) and determine their annual electricity generation ( $AEG_{SET-5-units}$ , in MWh);
- b) Determine the annual electricity generation of the project electricity system; excluding power units registered as CDM project activities ( $AEG_{total}$ , in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of  $AEG_{total}$  (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ( $SET_{\geq 20\%}$ ) and determine their annual electricity generation ( $AEG_{SET-\geq 20\%}$ , in MWh);
- c) From  $SET_{5-units}$  and  $SET_{\geq 20\%}$  select the set of power units that comprises the larger annual electricity generation ( $SET_{sample}$ ); Identify the date when the power units in  $SET_{sample}$  started to supply electricity to the grid. If none of the power units in  $SET_{sample}$  started to supply electricity to the grid more than 10 years ago, then use  $SET_{sample}$  to calculate the build margin.

Between the  $SET_{5-units}$  and  $SET_{\geq 20\%}$ , the sample group that comprises the larger annual generation is  $SET_{\geq 20\%}$ , hence the set of capacity additions in the electricity system that comprise 20% of the system generation is used.

The amount of electricity produced by the  $SET_{5-units}$  is calculated to be 4,288.65 GWh. (=  $AEG_{SET-5-units}$ ).

The gross electricity generation in year 2010 is taken as reference for determination of plants that comprise 20% of the system generation. Based on Turkey's Annual Electricity statistics published on the TEİAŞ web site ([www.teias.gov.tr](http://www.teias.gov.tr)), the gross generation in year 2010 was 211,207.70 GWh (See Table 12) in 2010, out of this amount 7,053.40 GWh was identified<sup>15</sup> to be produced by projects that claimed VERs, excluding this number from the gross generation we end up with 204,154.3 GWh of electricity which is our  $AEG_{TOTAL}$  and 20% of that amount is calculated as 40,830.86 GWh.

Comparing the  $AEG_{SET-5-units}$  and 20% of  $AEG_{TOTAL}$ , it is seen that 20% of  $AEG_{TOTAL}$ , is higher than  $AEG_{SET-5-units}$ .

<sup>15</sup> A list of units providing electricity to the year 2010 Turkish Electricity Grid is provided as an Annex 1 to the most recent Capacity Projection report published by TEİAŞ (<http://212.175.131.171/projeksiyon/KAPASITEPROJEKSIYONU2011.pdf>). We have checked and identified the ones that have claimed VERs by comparing the list to the Gold Standard registry (<https://gs2.apx.com/myModule/rpt/myrpt.asp?r=111>) and VCS Project Database (<http://www.vcsprojectdatabase.org>). This list is provided to the validating DOE.

Therefore the 20% of  $AEG_{TOTAL}$  with a value of 40,830.86 GWh is to be compared to the capacity additions in the recent years.

Summing up electricity the generations of all the plants added to the Turkish National Grid in 2010 and 2009, but excluding the projects that claimed VERs, their total generation is 47,745.76 GWh. The total generation by the power plants added in year 2010 is 26,256.04 GWh which is still less than the 20% of  $AEG_{TOTAL}$  value of 39,198.54 GWh, however we are unable to identify the date of addition of the units that are added to the Grid in year 2009 to complete the amount of electricity added to the Grid by year 2010 power plants. Therefore, with a conservative approach we are considering all the units added in year 2009 and the  $AEG_{SET\ Sample}$  value we are using in our BM calculation is 47,745.76 GWh and is greater than the 20% of the total generation, So only the power plants added in the last 2 years, excluding those claiming VER credits, are used in the calculations. As there is no power unit older than 10 years this number is being used for Build Margin Calculations.

The lists of most recent capacity additions to the grid by year and their average and firm generation capacities for the years 2010, and 2009 are available as Annex-2 to the capacity projection reports published in the TEİAŞ web page. Also the annual generation capacity data for each plant is not available on the statistics page of TEİAŞ. The data for the years 2009<sup>16</sup> and 2010<sup>17</sup> are taken from the TEİAŞ Capacity Projection Reports which are also available in another section of the TEİAŞ website. For the capacity additions, the firm generation capacities of the power plants are used. The units that are taken out of the grid are not taken into consideration. All the data used for calculations could be found in Annex-2 (see Table 8a and Table8b).

According to the tool in terms of vintage of data, a project participant can choose either the ex-ante option or the ex-post option. As explained above, out of these two options, as mentioned above, Option 1 is selected. For the first crediting period, the build margin emission factor is calculated ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period will be used. This option does not require monitoring the emission factor during the crediting period.

### Electric efficiency rates

There is no complete and up-to-date data regarding the electrical efficiency of thermal power plants that supply electricity to the Turkish National Grid system. Therefore the default values provided in Annex 1(Default efficiency factors for power plants) of the Methodological Tool to calculate the emission factor for an electricity system (Version 02.2.1) (EB 63 Report Annex 19) is utilised, in a very conservative manner, considering that we are unable to differentiate the units

<sup>16</sup> TEİAŞ Capacity Projection Report 20010-2019  
(<http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202010.pdf>)

<sup>17</sup> <http://www.teias.gov.tr/projeksiyon/KapasiteProjeksiyonu2011.doc>

that were commissioned before year 2000, and we cannot differentiate their technologies, all the coal and lignite fired thermal power plants are considered to operate with 50% efficiency, all the oil fired power plants are considered to operate with 46% efficiency, and all the Natural Gas fired power plants are considered to operate at 60 % efficiency. For the diesel powered thermal power plants the efficiency is considered to be 45%. Since the default values are not provided for Naphtha, it is considered to behave like oil and its efficiency is considered as 46%, and Bitumen is considered to behave like coal and its efficiency is considered to be 50%. The efficiency values considered in BM calculations can be summarized as follows (Table 13):

Table 13: Default Electric efficiency rates taken from Annex 1 of the Methodological Tool to calculate the emission factor for an electricity system (Version 02.2.1) (EB 63 Report Annex 19).

| Fuel Type   | Average Electric efficiency rate |
|-------------|----------------------------------|
| Coal        | 50.0%                            |
| Lignite     | 50.0%                            |
| Fuel Oil    | 46.0%                            |
| Diesel      | 46.0%                            |
| Naphtha     | 46.0%                            |
| Natural Gas | 60.0%                            |
| Bitumen     | 50.0%                            |

The parameters for the calculation of  $EF_{EL,m,y}$ , and its calculation is shown in Table 14 below:

Table 14: Calculation of  $EF_{EL}$  generation efficiency based on the default values provided in Annex 1 of the Methodological Tool to calculate the emission factor for an electricity system (Version 02.2.1) (EB 63 Report Annex 19)

| Calculation of $EF_{EL}$ using default generation efficiencies |                           |          |                         |                                     |
|----------------------------------------------------------------|---------------------------|----------|-------------------------|-------------------------------------|
|                                                                | EF (tCO <sub>2</sub> /TJ) | (EF*3.6) | Generation Efficiency % | $EF_{EL,m,y}$ tCO <sub>2</sub> /MWh |
| Coal                                                           | 92.80                     | 334.080  | 50.0%                   | 0.668                               |
| Lignite                                                        | 90.90                     | 327.240  | 50.0%                   | 0.654                               |
| Fuel Oil                                                       | 75.50                     | 271.800  | 46.0%                   | 0.591                               |
| Diesel                                                         | 72.60                     | 261.360  | 46.0%                   | 0.568                               |
| Naphtha                                                        | 69.30                     | 249.480  | 46.0%                   | 0.542                               |
| Natural Gas                                                    | 54.30                     | 195.480  | 60.0%                   | 0.326                               |
| Bitumen                                                        | 73.00                     | 262.800  | 50.0%                   | 0.526                               |

The CO<sub>2</sub> emissions from the most recent capacity additions are calculated by multiplying the  $EF_{EL,m,y}$  values calculated for each fuel source by the annual generation of that fuel source (Table 15). The emission factor has been taken as “zero” for the renewable and wastes and the generation efficiencies for the thermal power plants type (such as Bitumen) of which are not known are taken same as the best efficiency factor of the known units, which is generation



efficiency for the natural gas power plants. The Build Margin Emission Factor for each year is calculated by dividing the total CO<sub>2</sub> Emissions of the subject year by the total generation from the capacity additions of the same year.

Table 15 Annual CO<sub>2</sub> Emissions for Capacity Additions and Annual BM Emission Factors

| Capacity Additions in 2009 (GWh) | CO <sub>2</sub> Emissions | EF <sub>grid,BM,2009</sub> |
|----------------------------------|---------------------------|----------------------------|
| Asphaltite                       | 945.00                    | 496.69                     |
| Fuel Oil                         | 1,082.08                  | 639.37                     |
| Coal                             | 1,923.33                  | 1,285.09                   |
| Lignite                          | 7.00                      | 4.58                       |
| Natural Gas                      | 16,512.65                 | 5,379.82                   |
| Renewables and Wastes            | 1,019.66                  | 0.00                       |
| <b>TOTAL</b>                     | <b>21,489.72</b>          | <b>7,805.56</b>            |
| Capacity Additions in 2010 (GWh) | CO <sub>2</sub> Emissions | EF <sub>grid,BM,2008</sub> |
| Coal                             | 12017.6                   | 8,029.71                   |
| Lignite                          | 180.0                     | 117.81                     |
| Natural Gas                      | 13108.5                   | 4,270.76                   |
| Renewables and Wastes            | 949.9                     | 0.00                       |
| <b>TOTAL</b>                     | <b>12017.6</b>            | <b>8,029.71</b>            |

The Build Margin Emission Factor of the grid is then calculated as a generation weighted average for the years 2009 and 2010. The resulting BM Grid is:

$$EF_{\text{grid,BM}} = 0.42357 \text{ tCO}_{2e}/\text{MWh}$$

#### Combined margin emission factor

Where weights  $w_{\text{OM}}$  and  $w_{\text{BM}}$  are by default 0.50 and 0.50 according to the selected methodology. And  $EF_{\text{OM}}$  and  $EF_{\text{BM}}$  are calculated as described in the previous steps.

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

$$EF_y = 0.50 * 0.65613 \text{ tCO}_{2e}/\text{MWh} + 0.50 * 0.42357 \text{ tCO}_{2e}/\text{MWh} = 0.53985 \text{ tCO}_{2e}/\text{MWh}$$

#### Emission reductions

$$\begin{aligned}
 ER_y = BE_y &= EG_{\text{facility},y} * EF_y \\
 &= 875,840 \text{ MWh} * 0.53985 \text{ tCO}_{2e}/\text{MWh} = 472,824 \text{ tCO}_{2e} \text{ until the end of 2013} \\
 \text{and} \\
 &= 881,210 \text{ MWh} * 0.5711037 \text{ tCO}_{2e}/\text{MWh} = 475,723 \text{ tCO}_{2e} \text{ from 2014 onwards.}
 \end{aligned}$$

A summary of the GHG removals by the project activity is given as follows (Table 16):

Table 16: summary of the GHG removals by the project activity

| Years                                                              | Estimated baseline emissions or removals (tCO <sub>2e</sub> ) | Estimated project emissions or removals (tCO <sub>2e</sub> ) | Estimated leakage emissions (tCO <sub>2e</sub> ) | Estimated net GHG emission reductions or removals (tCO <sub>2e</sub> ) |
|--------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------|
| Year 0: 2011<br>(March 10 <sup>th</sup> to Dec. 31 <sup>st</sup> ) | 356,237                                                       | 0                                                            | 0                                                | 356,237                                                                |
| Year 1: 2012                                                       | 472,824                                                       | 0                                                            | 0                                                | 472,824                                                                |
| Year 2: 2013                                                       | 472,824                                                       | 0                                                            | 0                                                | 472,824                                                                |
| Year 3: 2014                                                       | 475,723                                                       | 0                                                            | 0                                                | 475,723                                                                |
| Year 4: 2015                                                       | 475,723                                                       | 0                                                            | 0                                                | 475,723                                                                |
| Year 5: 2016                                                       | 475,723                                                       | 0                                                            | 0                                                | 475,723                                                                |
| Year 6: 2017                                                       | 475,723                                                       | 0                                                            | 0                                                | 475,723                                                                |
| Year 7: 2018                                                       | 475,723                                                       | 0                                                            | 0                                                | 475,723                                                                |
| Year 8: 2019                                                       | 475,723                                                       | 0                                                            | 0                                                | 475,723                                                                |
| Year 9: 2020                                                       | 475,723                                                       | 0                                                            | 0                                                | 475,723                                                                |
| Year 10: 2021<br>(Jan. 1 <sup>st</sup> to March 9 <sup>th</sup> )  | 119,486                                                       | 0                                                            | 0                                                | 119,486                                                                |
| <b>Total</b>                                                       | <b>4,751,432</b>                                              | <b>0</b>                                                     | <b>0</b>                                         | <b>4,751,432</b>                                                       |

## 4 MONITORING

### 4.1 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, 2008, 2009, 2010.                                                                                                                                                                                                                                                                                 |
| Source of data:                                                                               | Official publications at the Turkish Electricity Transmission Company (TEİAŞ) Web Site ( <a href="http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2010/front%20page%202010-çiçek%20kitap/yakıt46-49/47.xls">http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2010/front%20page%202010-çiçek%20kitap/yakıt46-49/47.xls</a> ) <sup>18</sup> |
| 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                                                                                                                                                                                                                                                                                                                                               |
| 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, for the years 2008, 2009 and 2010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 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/istatistik2010/front%20page%202010-çiçek%20kitap/yakıt46-49/49.xls">http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/yakıt46-49/49.xls</a> <a href="http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/yakıt46-49/47.xls">http://www.teias.gov.tr/istatistik2010/front%20page%202010-çiçek%20kitap/yakıt46-49/47.xls</a> ) <sup>20</sup> |
| Measurement procedures (if any): | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Monitoring                       | For Simple OM : Once for each crediting period using the most recent three                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

<sup>18</sup> If the provided link does not work please try the following link and look for the title and number of the excel sheet referred in the reference. "<http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2010/İstatistik%202010.htm>"

|                                                                                               |                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| frequency:                                                                                    | 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 ex ante and for the second and third crediting period, only once ex ante at the start of the second crediting period |
| Value applied:                                                                                | Please see Annex-2-Table 5                                                                                                                                                                                                                                                                   |
| 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:                                                                             | $EF_{CO_2,i,y}$                                                                                                                                                                                                                                                                                                                                                                                                            |
| Data unit:                                                                                    | tCO <sub>2</sub> /GJ                                                                                                                                                                                                                                                                                                                                                                                                       |
| Description:                                                                                  | CO <sub>2</sub> emission factor of fossil fuel type i in year y                                                                                                                                                                                                                                                                                                                                                            |
| 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, ( <a href="http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf">http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf</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 ex ante and for the second and third crediting period, only once ex ante at the start of the second crediting period                                                    |
| QA/QC Procedures                                                                              | -                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Value applied:                                                                                | Please see Annex 2-Table-2.                                                                                                                                                                                                                                                                                                                                                                                                |
| 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 y |

|                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source of data:                                                                               | Turkish Electricity Transmission Company Web Site<br><a href="http://www.teias.gov.tr/istatistik2010/front%20page%202010-ççek%20kitap/uretim%20tuketim(22-45)/40(06-10).xls">http://www.teias.gov.tr/istatistik2010/front%20page%202010-ççek%20kitap/uretim%20tuketim(22-45)/40(06-10).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> <sup>19</sup> |
| 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 ex ante and for the second and third crediting period, only once ex ante at the start of the second crediting period (For BM VER projects are excluded).                      |
| QA/QC Procedures                                                                              | -                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Value applied:                                                                                | Please see Annex 2-Table 3 and Table 4.                                                                                                                                                                                                                                                                                                                                                                                          |
| 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> ). Data is extracted from the relevant annexes of the capacity projection reports for the years 2009 <sup>20</sup> and 2010 <sup>21</sup> , and the projects that are listed in Gold Standard Registry, VCS project Database, and Blue Registry (VER+ Standard) are deducted. |
| 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 ex ante and for the second and third crediting period, only once ex ante at the start of the second crediting period                  |
| QA/QC Procedures                                              | -                                                                                                                                                                                                                                                                                                                                                                                        |
| Value applied:                                                | Please see Annex 2-Table 8a and Table 8b.                                                                                                                                                                                                                                                                                                                                                |
| Justification of choice of data or description of measurement | 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.                                                                                                                                                        |

<sup>19</sup> If the provided link does not work please try the following link and look for the title and number of the excel sheet referred in the reference. "<http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2010/İstatistik%202010.htm>"

<sup>20</sup> <http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202010.pdf>

<sup>21</sup> <http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2011.pdf>

|                                 |                                                   |
|---------------------------------|---------------------------------------------------|
| methods and procedures applied: |                                                   |
| Any comment:                    | Data used for the calculation of $EF_{grid,BM,y}$ |

|                                                                                               |                                                                                                                                |
|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                                             | $\eta_{m,y}$                                                                                                                   |
| Data unit:                                                                                    | %                                                                                                                              |
| Description:                                                                                  | Specific electrical efficiency for all relevant energy sources (natural gas, lignite, coal/anthracite, fuel/motor oil).        |
| Source of data:                                                                               | Default values provided at the Annex 2 of the “Tool to calculate the emission factor for an electricity system” version 02.2.1 |
| 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:                                                                                | See Table 14                                                                                                                   |
| Justification of choice of data or description of measurement methods and procedures applied: | There is no up to date country specific data, and this is the most conservative approach.                                      |
| Any comment:                                                                                  | Data used for the calculation of $EF_{grid,BM,y}$                                                                              |

## 4.2 Data and Parameters Monitored

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

|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                | $EG_{PP-self\ consumption, y}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 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 (Recorded over the consumption related invoices)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Source of data:                                                  | The source of data will be the TEDAS <sup>22</sup> meters located at the Alkumru Construction site. The data read through these meters are recorded remotely by TEDAS and declared to the project owner in the form of a consumer's invoice. This invoice contains the amount of electricity consumed by the work site and by the power plant. The net amount consumed by the power plant is recorded by an other meter that belongs to the project owner and this meter is read and recorded by the Project Owner's technicians each month. |
| Description of measurement methods and procedures to be applied: | Measurements are to be made by electricity meters that belong to the grid distributor TEDAŞ, and by another meter that belong to the project owner. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid,                                                                                                                                                                                                                                                           |
| Frequency of                                                     | Recorded continuously, reported monthly on TEDAS Invoices and Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

<sup>22</sup> TEDAS: Türkiye Elektrik Dağıtım Şirketi-Turkish Electricity Distribution Company

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| monitoring/recording:           | Owner's meter records, Reported annually on the VCS Monitoring Report.                                                                                                                                                                                                                                                                                                                                                                            |
| Value applied:                  | Will be determined at the monitoring stage                                                                                                                                                                                                                                                                                                                                                                                                        |
| Monitoring equipment:           | All meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market <sup>23</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.                                                                                                                                                                                                                                                                                                                     |
| Calculation method:             | Direct continuous measurement                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Any comment:                    | Data will be used to calculate net electricity supplied to the grid.<br><i>The internal consumption will be recorded this way until the commissioning of the 4<sup>th</sup> turbine that will be constructed to utilize the energy of the water discharged to support life in the river. As soon as the construction site will be removed the internal consumption will be recorded by two of the meters that measure the electricity export.</i> |

|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |          |  |        |        |        |                       |          |          |          |                    |          |          |          |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|--|--------|--------|--------|-----------------------|----------|----------|----------|--------------------|----------|----------|----------|
| 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 meters located at the Alkumru Powerhouse. The data read trough these meters are recorded at the monthly reading protocols, the column related to electricity supplied to the Grid. There are two main meters, each record the generation of electricity from each line that transmit the electricity generated by each unit of generators, and there will be two back-up meters, for each one of these main meters. The secondary source of data will be the PMUM/MFRC web site screen shots, the column with the heading ISVM <sup>24</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:                                                   | Will be determined at the monitoring stage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |          |  |        |        |        |                       |          |          |          |                    |          |          |          |
| Monitoring equipment:                                            | All Meters will be Elster 1500, and their corresponding serial numbers will be as tabulated below: <table><tr><td></td><td>Unit 1</td><td>Unit 2</td><td>Unit 3</td></tr><tr><td>Main Meter Serial No:</td><td>00419607</td><td>00419609</td><td>00419611</td></tr><tr><td>Back Up Serial No:</td><td>00419608</td><td>00419610</td><td>00419612</td></tr></table> <p>All meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market<sup>25</sup>. They have an accuracy class of Class002 indicating an accuracy range of 0,2%.</p>                 |          |          |  | Unit 1 | Unit 2 | Unit 3 | Main Meter Serial No: | 00419607 | 00419609 | 00419611 | Back Up Serial No: | 00419608 | 00419610 | 00419612 |
|                                                                  | Unit 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Unit 2   | Unit 3   |  |        |        |        |                       |          |          |          |                    |          |          |          |
| Main Meter Serial No:                                            | 00419607                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 00419609 | 00419611 |  |        |        |        |                       |          |          |          |                    |          |          |          |
| Back Up Serial No:                                               | 00419608                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 00419610 | 00419612 |  |        |        |        |                       |          |          |          |                    |          |          |          |
| 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 Class002, that is to say should be within the ±0.2% (±0.002) range. The monthly reported meter readings by the unit 1 main meter with serial number 00419607, will be cross-checked against the unit 1 back up meter that                                                                                                                                                                                                   |          |          |  |        |        |        |                       |          |          |          |                    |          |          |          |

<sup>23</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>

<sup>24</sup> ISVM: İletim Sistemine Veriş Miktarı-Amount Supplied to the Grid

<sup>25</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>



|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | has the serial number 00419608, and the meter readings by the unit 2 main meter with serial number 00419609, will be cross-checked against the unit 2 back up meter that has the serial number 00419610, and similarly the meter readings by the unit 3 main meter with serial number 00419611, will be cross-checked against the unit 3 back up meter that has the serial number 00419612. 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 shots. The PMUM/MFRC data of electricity sales will also be a proof for quality and reliability of data. |
| Calculation method: | Direct continuous measurement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Any comment:        | Data will be used to calculate net electricity supplied to the grid.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                                                                  |                                                                                                                    |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                | <b>Cap<sub>PJ</sub></b>                                                                                            |
| Data unit:                                                       | W                                                                                                                  |
| Description:                                                     | Installed capacity of the hydropower plants after the implementation of the Project Activity.                      |
| Measured /Calculated /Default:                                   | Measured                                                                                                           |
| Source of data:                                                  | Project site                                                                                                       |
| Description of measurement methods and procedures to be applied: | Observed via the SCADA system of the Project Activity                                                              |
| Frequency of monitoring/recording:                               | Once for each monitoring period                                                                                    |
| Value applied:                                                   | 261,270,000 until the end of 2013 and 275,520,000                                                                  |
| Monitoring equipment:                                            | SCADA system of the Project Activity                                                                               |
| QA/QC procedures to be applied:                                  | Can be confirmed also by the parameter readings on the design plates of each turbine and by summing the two units. |
| Calculation method:                                              | N/A                                                                                                                |
| Any comment:                                                     | -                                                                                                                  |

|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter:                                                | <b>A<sub>PJ</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Data unit:                                                       | m <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Description:                                                     | Area of the reservoir measured in the surface of the water, after the implementation of the Project Activity, when the reservoir is full.                                                                                                                                                                                                                                                                                                                                                                                    |
| Measured /Calculated /Default:                                   | Indirectly measured based on depth readings from the SCADA system                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Source of data:                                                  | SCADA System of the project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Description of measurement methods and procedures to be applied: | The reservoir area corresponding to maximum operational level has been determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings will be taken and the corresponding reservoir area will be determined using the same graphic, Presented in Annex 4. |
| Frequency of                                                     | Once during each monitoring period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                                 |                                                                             |
|---------------------------------|-----------------------------------------------------------------------------|
| monitoring/recording:           |                                                                             |
| Value applied:                  | 10,990,000                                                                  |
| Monitoring equipment:           | SCADA system water level readings                                           |
| QA/QC procedures to be applied: | Can be checked and compared to satellite imagery available by Google Earth. |
| Calculation method:             | -                                                                           |
| Any comment:                    | -                                                                           |

### 4.3 Description of the Monitoring Plan

#### Objectives of the monitoring program

The Monitoring plan is developed to ensure that the Project Activity is well organized from the start in terms of the collection and archival of complete and reliable data that is needed to ensure reliable and accurate measurements of actual emission reductions.

#### Data to be monitored

Given that the emission factor is calculated on an ex-ante basis, the first data to be monitored is the electricity net supplied to the grid. This parameter is obtained indirectly as a subtraction of electricity imported from electricity exported to the grid.

The second data to be monitored is the installed capacity of the Project Activity. Using the SCADA system installed capacity will be measured automatically.

The third data to be monitored is the reservoir area of the Project Activity. The reservoir area corresponding to maximum operational level has been determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings will be taken and the corresponding reservoir area will be determined using the same graphic, Presented in Annex 4.

#### Monitoring procedures

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 17):

Table 17: Positions and responsibilities of the VER monitoring team members.

| Position                  | Responsibility                                                                                                                                                                                                 |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alkumru HPP Manager       | Day to day operation of the Alkumru HPP,<br>Compliance of the project activity with the host country rules and regulations<br>Coordination of the data collection and recording for the VCS monitoring report. |
| Chief Electrical Engineer | Day to day follow up of electrical equipment<br>Recording and monitoring of the electricity generation data                                                                                                    |
| Accounts Manager          | Data keeping for power sales<br>Keeping the track record of PMUM/MFRC data                                                                                                                                     |
| Chief Mechanical Engineer | Day to day operation of the power plant<br>Keeping records of malfunctions and repairs                                                                                                                         |
| Carbon Consultant         | Emission reduction calculations<br>Scripting of the periodic monitoring report<br>Follow up of the verification process                                                                                        |

The power generation meter readings are performed by using the main metering devices and the back-up metering devices that are used 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 three metering devices, generation data of the Alkumru 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 monthly screen shot print outs of the PMUM data will be available to the verifying DOE during the verification process for cross checking. 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.

The internal consumption data will be recorded by one TEDAS meter, and a meter that belongs to the project owner, The difference between this two gives the net internal consumption value which is then used to determine the net amount of electricity supplied to the grid. The internal consumption will be recorded this way until the commissioning of the 4<sup>th</sup> turbine that will be constructed to utilize the energy of the water discharged to support life in the river. As soon as the construction site will be removed the internal consumption will be recorded by two of the meters that measure the electricity export.

#### Monitoring equipment

#### Electricity meters

The main and back-up electricity meters are bi-directional for quantifying the electricity delivered by the Project Activity to the grid.

The meters are in compliance with the standards of the Turkish Standards Institute and will have obtained a “Type and System Approval” certificate from the Ministry of Trade and Industry. In case there are modifications to the standards, the modified standard shall be valid; and in case

a valid standard is cancelled or abolished, the new standard shall be valid. The standards that will be used are TS-620 EN 60044-1 and TS718 IEC60044.2 for main and back-up meters, respectively. The sensitivity of the main and secondary meters are  $CI = 0.2$  for active and reactive energy. The meters shall be factory calibrated by the manufacturer before installation. Records of the meter (type, made, model and calibration documentation) will be retained in the quality control system.

#### Data collecting and recording

*I. 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 three main meters and three Back-up meters:

Meters:

##### A. Main Electricity Meters:

- a. Unit 1 Main Meter: ELSTER A 1500: Serial Number: 00419607
- b. Unit 2 Main Meter: ELSTER A 1500: Serial Number: 00419609
- c. Unit 3 Main Meter: ELSTER A 1500: Serial Number: 00419611

##### B. Back-up Electricity Meters:

- a. Unit 1 Back-up Meter: ELSTER A 1500: Serial Number: 00419608
- b. Unit 2 Back-up Meter: ELSTER A 1500: Serial Number: 00419610
- c. Unit 3 Back-up Meter: ELSTER A 1500: Serial Number: 00419612

These meters are placed at the Alkumru powerhouse where the power plant gets connected to the Turkish national grid. Those meters provide official data, which are read and recorded monthly by TEİAŞ officers for invoicing. TEİAŞ also conducts 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.

At the end of each month, the monthly generation is read remotely and e-mailed to the project owner. In case of failure of the main meter, the control meter is used to determine the invoiced generation amount. These readings can be on site as well as remotely by the systems that will be put in place by the grid operator TEİAŞ.

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 Ex-ante Combined Margin Emission Factor calculated above.

### Measuring Installed Capacity

By means of the SCADA system established in the plant all kinds of technical parameters related with turbines and generators including installed capacity will be measured and stored in the system on real time basis. The installed capacity of the plant will be measured from SCADA once a year while the plant is operated with full load and the related data will be stored as per the monitoring program.

### Measuring Reservoir Area

The reservoir area corresponding to maximum operational level has been determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings will be taken and the corresponding reservoir area will be determined using the same graphic, Presented in Annex 4.

### Data management

At the end of each month, electricity supplied to the grid will be entered into an electronic spread sheet. The data to be measured for installed capacity and reservoir area will be entered into an electronic spread sheet at the end of each year. The electronic files will be backed up on both hard drives and on a Compact Disc (CD).

### Quality Control and Assurance (QC/QA)

All of the main and back-up meters are owned and installed by the grid operator, TEIAS. The Calibrations of the electricity meters are valid for the next 10 years after calibration,

The grid operator's Metering Officer should be notified of any failure of one of the meters. TEIAS is the only one entity, authorized to deal with fixing, calibrating, or changing the meters, which will be done either by the grid operator or by a company authorized by the grid operator. The Project Owner will keep electricity sale and purchase records, to which the recorded data will be compared.

All written documentation such as maps, drawings, the EIA and the Feasibility study, will be stored and will be made available to the verifier so that the reliability of the information may be checked.

All data records will be kept for at least 2 years from the last project credited year.

## 5 ENVIRONMENTAL IMPACT

In accordance with “Environmental Law” No. 2872 (Issued in 1983), Annex 2 of Environmental Impact Assessment (EIA) Regulation (issued in 1993 and revised in 2001), run-off river type Hydroelectric Power Plants with an installed capacity of 50 MW or more are subject to a full EIA process or report preparation. The project has gone through a full EIA process and was granted an EIA Affirmative certification presented in Annex-3;

The EIA report outlines the major design parameters of the project activity, and explains how the project is going to be producing its cement, and how it is going to be utilizing the rock, clay and sand quarries.

The report summarizes that the cement that is needed will be acquired from the Cement factory at Kurtalan, Siirt, and the steel is going to be supplied from the İskenderun province. The report also outlines how these quarries are going to be remedied at the end of the construction stage.

Although expropriation process and stake holder consultations related to expropriation is held separately the EIA report also summarizes the number of houses (13 house) and public buildings (1 school and 2 Gendarme posts) that are going to be flooded as a result of the formation of the reservoir lake of the project activity

Some of the environmental parameters discussed in this report can be summarized as follows:

### Impact to local Traffic:

The project is mainly located in a rural area, the traffic activity that will be increased during the construction phase is not expected to disturb the baseline conditions of the traffic. During the operation phase there will be shuttle service up to Aydınlar town and this activity is considered as an insignificant addition to the baseline traffic.

### Construction Waste

There will be a designated area to dump the construction waste. The dumped waste is to be compressed after the dumping will be completed and these parts will be forested. There will be no such waste during the operation phase.

### Air quality

Modeling of dust flow and emissions predict no significant effect on air quality of the nearest residential areas, and the levels are in accordance with the “Regulations for Control of Air Pollution Caused by Industrial Facilities”, announced in the Official Gazette No. 26236, on the 22/07/2006.

During the construction phase the operation of the concrete mixing stations, operational at the rock and clay quarries, excavation, backfilling, transportation, loading and unloading of the debris

will be causing dusting. The following are the preventive actions to avoid or minimize dust emissions:

- The work sites will be water sprayed periodically and will be kept damp to avoid dusting.
- At the sewing and grinding facilities, the material will be dampened pulverized water before the break up of the material. In addition to this the bunkers and the conveyor belts will be designed as closed systems and the emission permits of these facilities would be followed up.
- Dust holding filters would be installed at the bunkers of the concrete mixing stations.
- The work sites and the roads that are prone to dust formation will be regularly sprayed by water.
- Strict speed limits will be implemented at the work site, to avoid dusting

No dust emission is expected during the operation phase. There will be gas emissions due to the operation of the heaters during winter season. The emissions related to heaters will be below the emission limits allowed by the regulations.

#### Waste Waters:

It is estimated that there will be about 1000 people working at the project site, and during the operation phase this number will be down to 80. During the construction phase there will be a compacted waste water treatment facility to treat the household waste water that will be produced as a result of water that will be utilized by the workers for toiletry etc. For the operation stage there will be housings that will be built for the personnel and the waste water from these housings will also be discharged to the compacted waste water treatment facility. The waste water that will be discharged from the power house will be first collected in a sanitary tank and will then be transferred to the treatment facility nearby the housings.

#### Hazardous Substances and Wastes

The residue oils and fuels from the construction equipment, or the used batteries will be disposed of according to the Regulations for Control of Hazardous Wastes, announced in the Official Gazette No. 25755, on 14 of March 2005, and Regulations for Control of Waste Oils announced in the Official Gazette No. 25353, on 21 January 2004.

The explosive to be used in construction of the conveyance tunnel is ANFO. The explosives will be transported and used in accordance with the "Regulations of Measures to be Taken At Workplaces Operated Using Explosive, Combustive, Dangerous and Hazardous Substances" and the "Regulations Related to Procedures and Principles of Production, Import, Transportation, Preserving, Storing, Sales, Use, Disposal, Inspection of Explosive Substances, Hunting Materials and Similar Substances, Excluding Tekel", announced in the Official Gazette No. 19589 on 29 September 1987.



Hazardous waste such as rubber, batteries, cables, paints, barrels, contaminated ground by oil, oil binding filters, etc. shall be collected and sent to a licensed hazardous waste recycling or disposal plant, and treated according to the provisions given in the "Regulations for Control of Hazardous Wastes" announced in the Official Gazette No. 25755, dated 14 March 2005.

#### Solid Waste:

Both during the construction phase and operation phase there will be solid waste as a result of the presence of the workers that will be working at the project site. These wastes will be sorted and re-cycleable wastes will be collected separately and sent to the recycling facilities and the rest will be sent to the Aydınlar Towns waste disposal site.

#### Noise

The noise levels on Alkumru Regulator site, tunneling system and HES site, were modeled. It was predicted that day and night time noise levels around the nearest residential areas will be within the standards of the "Day and night noise limits for Rural Areas and Settlement Areas" in accordance with the Article 25 of the Regulations for Evaluation and Management of Environmental Noise announced in the Official Gazette No. 25862 on 01.07.2005.

#### Water flow and Lifeline Water

It is agreed by the water usage agreement between the project owner and the DSI that 14 m<sup>3</sup>/s water will be released from the dam for wildlife year-round. And if under circumstances when the natural water flow will be less than the above mentioned flow the entire water will be released to the river.

#### River Water quality

The Project is not expected to have a material effect on water quality. The power density of the project is greater than 10 W/m<sup>2</sup>, therefore, anaerobic conditions and decomposition are not expected to form and will not affect water quality and composition, or encourage methane production.

#### Ecology

The project area is not designated as an area for preservation. According to the available literature, there are no rare, endemic, endangered or protected species by national and/or international laws. Fauna and flora species, which are included in the Bern Convention or Red Data Book categories, were not found in the project area. A fish passage for fish species will be built, and once in operation, the project will not produce any air or water pollution to the surrounding environment. It is therefore concluded that the implementation of the project is expected to have only a minor impact on the surrounding environment and regional ecology.

The dam lake and its surrounding will be creating new habitat for waterfowl and other birds.

There will be some public buildings (2 security buildings and one school) and 13 houses that are be relocated.

## 6 STAKEHOLDER COMMENTS

For the project activity a local stake holders consultation meeting was held in Aydınlar town of Siirt Province, on October 25<sup>th</sup>, 2007, at 11:00 am, in the Public Educational Center Meeting Hall of Aydınlar Town, Siirt.

The meeting was announced at the bulletin boards of the governor house, municipality and at the village boards of Taşlı Village (via its muhtar Osman Çarp), Meydanderesi village (via its muhtar Ali Nur) Kılbasan Village (via its muhtar İzzettin Aygün), and Taşbalta Village (via Yılmaz Alanç). On the day of the meeting, Limak Hidroelektrik Santral Yatırımları A.Ş. has sent mini-busses to the villages and helped the stakeholders reach to the meeting hall.

The consultant company that prepared the EIA report, moderated the meeting and provided information about the project and its environmental impacts to the local stakeholders and answered their questions.

In general most of the questions were related to the expropriation process and the amount of compensation money. None of the attendants mentioned any doubts about the negative impacts of the project to the surrounding environment. Both the project owner company representatives and the environmental consultants answered these questions emphasizing that the expropriation process would be conducted in line with the host country rules and regulations.

The following is a translation of the meeting minutes:

### ***Minutes of the Local Stake holder Consultation Meeting***<sup>26</sup>

The stakeholder consultation meeting was realized on 25<sup>th</sup> of October, 2007, at 11:00 o'clock at the public education centre of the Aydınlar Town of Siirt, with the presence of the people listed attached to this document.

During the meeting the spokesman of Selin İnş. Müh. Müş Ltd. Mr. Orkun Sarıfakioğlu, have provided detailed information to the public about the planned project and its possible impacts to the environment. The information is provided in the form of a slide show and narration.

The contribution of the project to the economy of the country, to the province and town is explained and it is emphasized that the project implementers will keep their undertakings that are outlined within the context of the environmental impact assessment report. It is also mentioned that the possible environmental impacts were expected to occur mainly during the construction phase but no impact was expected for the operation phase.

Bedri Adar from Hürmüz village (An employee of the Park Elektrik) mentioned that there was work going on in their land, added that the village was stranded at the moment due to some sociological reasons, but the village inhabitants would come back and those that have their lands and those that does not have their lands registered due to zoning problems could find themselves downtrodden. He also mentioned lands tat belonged to their village was being used, and he added that he would like to see the employee to be chosen from the neighbouring villages during the construction and operation phases.

Orkun Sarıfakioğlu (Selin Ltd) explained that in such projects the cadastral survey officers of the government would be organizing the expropriation, and it would not be possible to occupy anybody's land without paying any compensation. HE also explained that it was Limak A.Ş.'s company policy and priority to recruit employees from the surrounding towns and villages as long as they could find the appropriate persons to satisfy the needs.

The Akyayla Village inhabitant M.Salih Akgün asked if there would be any water tunnel related work on-going prior to expropriation.

<sup>26</sup> Translated form the signed hand written originals.

Orkun Sarıfakioğlu explained that the expropriation would start after the construction and would be an on going process that would be advancing part by part.

Seydan Altunç from Siirt Special Provincial Authority (SPA) asked the amount of sediments that the water would carry to the reservoir and the impact of the dam 50 years later.

It is explained that DSI was planning precautions to extend the life span of the Dam, establishment of the upstream weirs were planned. Upon an other question by Seydan Altunç, related to the materials that would be collected at the end of the life of the project activity, it is explained that it would be under the command and control of the DSI.

Murat Özdemir asked about the debt of the reservoir, and he is answered that the depth of the reservoir lake was 134 m.

The village head (muhtar) of Şirvan Taşlı village, Osman Can, asked the extent of the project area and to what degree their village would be affected.

Orkun Sarıfakioğlu explained that all the relevant villagers and their inhabitants would be enlightened about the details of the expropriation, by the cadastral survey officers.

Aydınlar Mayor, Muhsin Çelebi, expressed his gratitude to those that are involved in this project and his wishes for the success of the project. He added that as the municipality they would do their best to support the project and their only request was that the project management would consider helping unemployed.

Taşbalta Village head (Muhtar) Yılmaz Alanç asked the extent of impact related to their village and he asked from where he could get information. It is explained to him that for the forested areas Forestry Management could provide information and about the expropriation it was possible to get information from the cadastral offices.

Upon the question from Yılmaz Alanç related to the possibility of explosions affecting the settlements, it is explained that the drillings and surveys related to potential rock quarries were performed 1200 m away from settlements and it was very likely that those quarries were not suitable. As soon as complete results would be obtained, more information of the exact place, capacity and possibility to affect settlements would be provided to the village heads.

The audience is also informed that any kind of explosion would be performed under the control of the gendarme forces, and public would be informed, by announcements.

M. Salih Aygün asked whether it was possible to make use of the earth movers that belonged to the villagers.

It is explained that, if Limak would need, it would be possible to lease these vehicles, but the situation would be better clarified when the construction would start.

The town's Gendarme Commander Yener Güvercin, asked the possibility of the project activity to affect the climate and the vegetation (especially impact to the agricultural products such as pistachio and hackberry).

It is explained that no harm to the existing vegetation and crop was expected, however, it was also possible that the reservoir lake would attract more wildlife and it would be possible to grow up crops that was not possible to grow in the area.

M.Salih Akgün asked if the project would affect the 50,000 young pistachio trees that were planted near the project area. It is explained that no negative impact was expected.

It is asked if there were new road constructions it is explained that a steel bridge would be constructed in addition to this the Dam crest would also be used as a road.

The National Education Town representation manager Mr. Sedat Özveren asked the life span of the project it is answered that it was 50 years.

Provincial Manager for Public Health Murat Özdemir asked about the studies done and allowed limits related to potential dust emissions that may happen due to explosions in the quarries and during the transportation of the materials. The impacts that are envisaged and the precautions to minimize dust is explained, and it is also mentioned that the mitigation measures could be reshaped based on the impacts.

Bedri Adar asked who would take part in the security of the construction worksite. It is explained that those recruitments would be coordinated by the town Gendarme Forces.

The minutes are signed by the following attendees:

|                |               |                    |
|----------------|---------------|--------------------|
| Yalçın Çabuk   | Mesut Batur   | Ahmet Barlak       |
| Seydan Altunç  | Şükrü Sevim   | Orkun Sarıfakioğlu |
| Yener Güvercin | Muhsin Çelebi | Murat Özdemir      |

|                  |         |                |
|------------------|---------|----------------|
| Yılmaz Alanç     | Ali Nur | İzzettin Aygün |
| Ercüment Köytaş. |         |                |

The List of the people that have actually attended the meeting.

| Name               | Position                                        | Signature |
|--------------------|-------------------------------------------------|-----------|
| Yalçın Çabuk       | Provincial Directorate of MoEF                  | Signed    |
| Mesut Batur        | Provincial Directorate of MoEF                  | Signed    |
| Ahmet Barlak       | Provincial Directorate of MoEF                  | Signed    |
| M.Adnan Sualp      | Provincial Director of National Education       | Signed    |
| Seydan Altunç      | Special Provincial Authority, General Secretary |           |
| M. Şükrü Sevim     | Limak-Project Manager                           |           |
| Orkun Sarıfakıoğlu | Env. Consultant Selin İnşaat Ltd.               |           |
| Yener Güverci      | Town Gendarme Commander                         | Signed    |
| Muhsin Çelebi      | Mayor of Aydınlar Town                          | Signed    |
| Murat Özdemir      | Provincial Manager for Health                   |           |
| Yılmaz Alanç       | Taşbalta Village head (muhtar)                  |           |
| Ali Nur            | Meydandere Village head (muhtar)                |           |
| İzzettin Aygün     | Akyayla Village Head (Muhtar)                   |           |
| Ercüment Köytaş    | DSI Manager for 10 <sup>th</sup> District       |           |
| Ömer Faruk Sualp   | Sualp Tarım inşaat Ltd. Şti.                    | Signed    |
| Sedat Özvural      | National Education district manager             | Signed    |
| Yılmaz Erhan       |                                                 | Signed    |
| Kemal Akın         | Taşbalta köyü Sakini                            |           |
| Ezdü Adar          |                                                 |           |
| Celalettin Alanç   |                                                 |           |
| İzzettin Aygün     |                                                 |           |
| Yasin Adar         |                                                 |           |
| Sabri Adar         |                                                 |           |
| Bedri Adar         |                                                 |           |
| Bedri Yanık        |                                                 |           |
| Vehbi Ayhan        |                                                 |           |
| M. Sami Aygün      |                                                 |           |
| M.Salih Adar       |                                                 |           |
| M. Şirin Adar      |                                                 |           |
| Sıtkı Alavlı       |                                                 |           |
| Mesut Alanç        |                                                 |           |
| Seracettin Akın    |                                                 |           |
| Metin Çelebi       |                                                 |           |
| Zeynel Abidin Öz   |                                                 |           |
| Ahmet Toprak       |                                                 |           |
| Osman Carav        |                                                 |           |
| Abdullah Ağ        |                                                 |           |
| Ercüment Köytaş    | DSİ                                             |           |
| Erhan Aktaş        | DSİ                                             |           |
| Selçuk Özbek       | DSİ                                             |           |
| Cengiz Kayra       | Town Public Education Center Manager            |           |
| Mahfur Pamukçu     | Town's special provincial manager               |           |
| Beşir Tutar        | Aydınlar Governor's house -Press                |           |
| Ahmet Güneş        | Town Director of Education                      |           |
| Cemal Sual         | Town Director of Education                      |           |
| Seydan Altunç      | Siirt Special Provincial Authority              |           |
| İsmet Kavun        |                                                 |           |

|                   |                                |  |
|-------------------|--------------------------------|--|
| Nusret Güler      |                                |  |
| Celalettin Yanık  |                                |  |
| Celal Kanburoğlu  | Town Population manager        |  |
| Hacı Karayel      | Town Estate Office             |  |
| Hayrettin Türkan  | Officer                        |  |
| Yasin İlhan       | Officer                        |  |
| Yusuf Danış       | Cook                           |  |
| Zeki Şen          |                                |  |
| Sabri Şen         |                                |  |
| Selahattin Adirt  |                                |  |
| Cevher Kaçar      |                                |  |
| Musa Adirt        | Worker                         |  |
| Beşir Şen         | Worker                         |  |
| Necmettin Baykara | Driver (Meydandere inhabitant) |  |
| Kemal Baykara     | Foremen                        |  |

The questions asked can be grouped as expropriation related questions, employment opportunity related questions and environmental impact assessment related questions. The expropriation issues are followed up by an other series of meetings And one to one interaction with stakeholders. Regarding the employment issues there was temporary jobs created for the local inhabitants and the environmental impacts are studied and the project was granted all of its environmental permits.

## ANNEX-1: THE LEGAL FRAMEWORK OF THE HOST COUNTRY THAT BINDS THE PROJECT

### Turkish Environmental Legislation

The Environmental Law (No. 2872), which was published in Turkish Official Gazette No. 18132 dated August 11, 1983 and revised in Turkish Official Gazette No. 26167 dated May 13, 2006 (Law No. 5491) provides the legislative framework for the regulation of industries and their potential impact on the environment. Industrial projects are subject to varying levels of review that begin while projects are in the development and pre-operation phases. Additional regulations apply to facilities once they are in operation.

The Environmental Law authorized the promulgation of a number of regulations. Those that pertain to development and operation of renewable energy projects are the following:

- Environmental Impact Assessment Regulation, Official Gazette No. 26939 dated July 17, 2008.
- Water Pollution Control Regulation, Official Gazette No. 25687 dated December 31, 2004 and revised in Official Gazette No. 26786 dated February 13, 2008;
- Regulation on Construction of Cesspits where there is no Wastewater Collection System, Official Gazette No. 13783 dated March 13, 1971;
- Hazardous Chemicals Regulation, Official Gazette No. 21634 dated July 11, 1993 and revised in Official Gazette No. 27092 dated December 26, 2008;
- Regulation on General Principles of Waste Management, Official Gazette No. 26927 dated July 5, 2008;
- Hazardous Wastes Control Regulation, Official Gazette No. 25755 dated March 14, 2005;
- Waste Oil Control Regulation, Official Gazette No. 26952 dated July 30, 2008 and revised Official Gazette No. 27304 dated July 31, 2009;
- Vegetative Waste Oil Control Regulation, Official Gazette No. 25791 dated April 19, 2005; and revised Official Gazette No. 27305 dated July 31, 2009
- Solid Waste Control Regulation, Official Gazette No. 20814 dated March 14, 1991 and revised in Official Gazette No. 25777 dated April 5, 2005;
- Medical Waste Control Regulation, Official Gazette No. 25883 dated July 22, 2005;
- Environmental Audit Regulation, Official Gazette No. 27061 dated November 21, 2008;
- Packaging Waste Control Regulation, Official Gazette No. 26562 dated June 24, 2007 and revised in Official Gazette No. 27046 dated November 6, 2008; and
- Waste Batteries and Accumulators Control Regulation, Official Gazette No. 25569 dated August 31, 2004 and revised in Official Gazette No. 25744 dated March 03, 2005;
- The Excavation, Construction and Demolition Waste Control Regulation, Official Gazette No. 25406 dated March 18, 2004;
- Soil Pollution Control Regulation, Official Gazette No. 25831 dated May 31, 2005;

- Regulation Related to Workplace Opening and Operation Permits, Official Gazette No. 25902 dated August 10, 2005 and revised in Official Gazette No. 26492 dated April 13, 2007;
- Industrial Air Pollution Control Regulation, Official Gazette No. 27277 dated July 3, 2009
- Air Quality Assessment and Management Regulation, Official Gazette No. 26898 dated June 6, 2008 and revised in Official Gazette No. 27219 and dated May 5, 2009;
- Air Pollution Control Regulation For Heating Sources, Official Gazette No. 25699 dated January 13, 2005 and revised in Official Gazette No. 27134 dated February 07, 2009;
- Exhaust Gases Emission Control Regulation, Official Gazette No. 27190 dated April 04, 2009; and
- Regulation on Protection of Wetlands, Official Gazette No. 25818 dated May 17, 2005.
- In addition to the Environmental Law and its associated regulations, there are several other laws that directly or indirectly include environmental review, and thus, are applicable to the proposed project. The project will comply with the 4857 numbered Labour Law and its regulations stated below:
- Occupational Health and Safety Statute, Official Gazette No. 14765 dated April 11, 1974;
- Health and Safety Regulation for Construction Works, Official Gazette No. 25325 dated December 23, 2003;
- Regulation on Health and Safety Regarding Temporary Works, Official Gazette No. 25463 dated May 15, 2004.

Other regulations that the project will comply with can be listed as follows:

- 5346 numbered Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy;
- Regulation on Protection and Usage of Agricultural Lands, Official Gazette No. 25766 dated March 25, 2005;
- 2863 numbered Law on Protection of Cultural and Natural Heritage (revised by 5226 numbered Law);
- 4342 numbered Pasture Law;
- 6831 numbered Forestry Law (amended by 5192 numbered Revision in Forestry Law);
- Regulation on Buildings located on the Disaster Areas, Official Gazette No. 26582 dated July 14, 2007;



## Annex-2: Baseline Information

Table 1

<http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/47.xls>

**TÜRKİYE TERMİK SANTRALLARINDA KULLANILAN YAKIT MİKTARLARININ ÜRETİCİ KURULUŞLARA DAĞILIMI**  
(BİRLEŞİK ISI-ELEKTRİK SANTRALLARINDA ISI ÜRETİMİ İÇİN KULLANILAN YAKITLAR DAHİL)  
FUELS CONSUMED IN THERMAL POWER PLANTS IN TURKEY BY THE ELECTRIC UTILITIES  
(FUELS USED FOR HEAT PRODUCTION IN CHP PLANTS INCLUDED)

|                                                                                                                             |                      |                         | Birim(Unit):Ton/Gaz(gas) 10 <sup>3</sup> m <sup>3</sup> |            |            |
|-----------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------|---------------------------------------------------------|------------|------------|
|                                                                                                                             |                      |                         | 2008                                                    | 2009       | 2010       |
| EÜAŞ VE BAĞLI<br>ORTAKLIKLARI<br><br>EÜAŞ AND<br>AFFILIATED<br>PARTNERSHIPS OF EÜAŞ                                         | Taşkömürü            | Hard Coal               | 1,636,566                                               | 1,664,859  | 1,563,792  |
|                                                                                                                             | Linyit               | Lignite                 | 60,284,929                                              | 57,850,129 | 50,123,941 |
|                                                                                                                             | TOPLAM               | TOTAL                   | 61,921,495                                              | 59,514,988 | 51,687,733 |
|                                                                                                                             | Fuel-Öl              | Fuel Oil                | 832,635                                                 | 239,410    | 16,664     |
|                                                                                                                             | Yrd. Yakıt           | Auxiliary Fuel          | 154,307                                                 | 134,007    | 105,073    |
|                                                                                                                             | TOPLAM               | TOTAL                   | 986,942                                                 | 373,417    | 121,937    |
| MOBİL SANTRALLAR<br>MOBILE POWER PLANTS                                                                                     | Motorin              | Diesel Oil              | 83,041                                                  | 72,956     | 18,901     |
|                                                                                                                             | TOPLAM               | TOTAL                   | 83,041                                                  | 118,320    | 18,905     |
|                                                                                                                             | Doğal Gaz            | Natural Gas             | 5,789,269                                               | 5,091,011  | 4,493,275  |
|                                                                                                                             | TOPLAM               | TOTAL                   | 1,069,983                                               | 491,737    | 140,842    |
| OTOPRODÜKTÖRLER<br>ÜRETİM ŞİRKETLERİ<br>İŞLETME HAKKI DEVİR<br>ADÜAŞ*<br>AUTOPRODUCERS<br>PRODUCTION COMP.<br>TOOR<br>ADÜAŞ | Taşkömür-İthal kömür | Hard Coal+Imported Coal | 4,633,442                                               | 4,956,318  | 5,855,911  |
|                                                                                                                             | Linyit               | Lignite                 | 6,089,191                                               | 5,770,389  | 6,565,451  |
|                                                                                                                             | TOPLAM               | TOTAL                   | 10,722,633                                              | 10,726,707 | 12,421,362 |
|                                                                                                                             | Fuel-Öl              | Fuel Oil                | 1,118,667                                               | 1,220,504  | 769,645    |
|                                                                                                                             | Motorin              | Diesel Oil              | 48,165                                                  | 62,537     | 1,449      |
|                                                                                                                             | LPG                  | LPG                     | 0                                                       | 111        | 0          |
| TÜRKİYE<br>TURKEY                                                                                                           | Nafta                | Naphta                  | 10,606                                                  | 8,077      | 13,140     |
|                                                                                                                             | TOPLAM               | TOTAL                   | 1,177,438                                               | 1,291,629  | 784,434    |
|                                                                                                                             | Doğal Gaz            | Natural Gas             | 15,816,366                                              | 15,887,029 | 17,290,139 |
|                                                                                                                             | Taşkömür-İthal kömür | Hard Coal+Imported Coal | 6,270,008                                               | 6,621,177  | 7,419,703  |
|                                                                                                                             | Linyit               | Lignite                 | 66,374,120                                              | 63,620,518 | 56,689,392 |
|                                                                                                                             | TOPLAM               | TOTAL                   | 72,644,128                                              | 70,241,695 | 64,109,095 |
| TÜRKİYE<br>TURKEY                                                                                                           | Fuel-Öl              | Fuel Oil                | 2,173,371                                               | 1,594,321  | 891,782    |
|                                                                                                                             | Motorin              | Diesel Oil              | 131,206                                                 | 180,857    | 20,354     |
|                                                                                                                             | LPG                  | LPG                     | 0                                                       | 111        | 0          |
|                                                                                                                             | Nafta                | Naphta                  | 10,606                                                  | 8,077      | 13,140     |
|                                                                                                                             | TOPLAM               | TOTAL                   | 2,315,183                                               | 1,783,366  | 925,276    |
|                                                                                                                             | Doğal Gaz            | Natural Gas             | 21,607,635                                              | 20,976,040 | 21,783,414 |

Not:Ayrıca Otoprodüktör santrallerinde kullanılan Ağaç Kabuğu, Talaş, Sıvı Kükürt, Siyah Likör, Katran, Kükürt keki, Kok Gazı, YF Gazı, Rafineri gazı, Biogaz ve Endüstriyel atık ile ilgili miktarlar tabloda yer almamaktadır.

Note: Quantities of Wood Wastes, Liquid Sulphur, Black Liquor, Bitumen Pyrite, Sulphur Cake etc. and Natural Gas, Coke Oven Gas, Blast Furnace Gas and Refinery Gas values used by autoproducers are not included in the table.

<http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/47.xls>

Table-2: IPCC Default CO<sub>2</sub> Emission Factors

| Fuel Type:  | EF (tCO <sub>2</sub> /TJ) |
|-------------|---------------------------|
| Coal        | 92.80                     |
| Lignite     | 90.90                     |
| Fuel Oil    | 75.50                     |
| Diesel      | 72.60                     |
| LPG         | 61.60                     |
| Naphta      | 69.30                     |
| Natural Gas | 54.30                     |
| Bitumen     | 73.00                     |

Table-3

<http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/49.xls>

**TÜRKİYE TERMİK SANTRALLARINDA TÜKETİLEN YAKITLARIN KURULUŞLARA GÖRE ISI DEĞERLERİ**  
(BİRLEŞİK ISI-ELEKTRİK SANTRALLARINDA ISI ÜRETİMİ İÇİN KULLANILAN YAKITLAR DAHİL)  
HEATING VALUES OF FUELS CONSUMED IN THERMAL POWER PLANTS IN TURKEY BY THE ELECTRIC UTILITIES  
(FUELS USED FOR HEAT PRODUCTION IN CHP PLANTS INCLUDED)

|                                                                                                                            |                               |                               | Birim(Unit): Tcal |                |                |
|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------|-------------------|----------------|----------------|
| EÜAŞ<br>VE<br>BAĞLI<br>ORTAKLIKLARI                                                                                        | Taşkömürü<br>Linyit<br>TOPLAM | Hard Coal<br>Lignite<br>Total | 2008              | 2009           | 2010           |
|                                                                                                                            |                               |                               | 5,514             | 5,452          | 4,990          |
|                                                                                                                            |                               |                               | 94,045            | 83,356         | 80,967         |
|                                                                                                                            |                               |                               | <b>99,559</b>     | <b>88,809</b>  | <b>85,957</b>  |
| EÜAŞ<br>AND<br>AFFILIATED<br>PARTNERSHIPS OF EÜAŞ                                                                          | Fuel-Oil Fuel Oil             | Asıl Yakıt Main Fuel          | 7,993             | 2,301          | 162            |
|                                                                                                                            |                               | Yrd. Yakıt Auxiliary Fuel     | 1,481             | 1,286          | 1,009          |
|                                                                                                                            |                               | TOPLAM TOTAL                  | <b>9,474</b>      | <b>3,587</b>   | <b>1,171</b>   |
|                                                                                                                            | Motorin Diesel Oil            | Asıl Yakıt Main Fuel          | 0                 | 467            | 0              |
|                                                                                                                            |                               | Yrd. Yakıt Auxiliary Fuel     | 855               | 751            | 195            |
|                                                                                                                            |                               | TOPLAM TOTAL                  | <b>855</b>        | <b>1,219</b>   | <b>195</b>     |
|                                                                                                                            | TOPLAM                        | TOTAL                         | <b>10,329</b>     | <b>4,806</b>   | <b>1,366</b>   |
|                                                                                                                            | Doğal Gaz                     | Natural Gas                   | <b>47,744</b>     | <b>42,335</b>  | <b>37,354</b>  |
|                                                                                                                            | TOPLAM                        | TOTAL                         | <b>157,632</b>    | <b>135,949</b> | <b>124,676</b> |
| MOBİL SANTRALLAR<br>MOBİL POWER<br>PLANTS                                                                                  | Fuel-Oil                      | Fuel Oil                      | 649               | 0              | 0              |
|                                                                                                                            | Motorin                       | Diesel Oil                    |                   |                |                |
|                                                                                                                            | TOPLAM                        | TOTAL                         | <b>649</b>        | <b>0</b>       | <b>0</b>       |
| OTOPRODÜKTÖRLER<br>ÜRETİM ŞİRKETLERİ<br>İŞLETME HAKKI DEVİR<br>ADÜAŞ<br>AUTOPRODUCERS<br>PRODUCTION COMP.<br>TOOR<br>ADÜAŞ | Taşkömür+İthal kömür          | Hard Coal+Imported Coal       | 27,796            | 29,677         | 34,556         |
|                                                                                                                            | Linyit                        | Lignite                       | 14,182            | 14,295         | 15,584         |
|                                                                                                                            | TOPLAM                        | Total                         | <b>41,978</b>     | <b>43,973</b>  | <b>50,141</b>  |
|                                                                                                                            | Fuel-Oil                      | Fuel Oil                      | 10,484            | 11,573         | 7,398          |
|                                                                                                                            | Motorin                       | Diesel Oil                    | 473               | 612            | 15             |
|                                                                                                                            | Lpg                           | Lpg                           | 0                 | 1              | 0              |
|                                                                                                                            | Nafta                         | Naphta                        | 113               | 84             | 105            |
|                                                                                                                            | TOPLAM                        | TOTAL                         | <b>11,070</b>     | <b>12,270</b>  | <b>7,518</b>   |
|                                                                                                                            | Doğal Gaz                     | Natural Gas                   | <b>141,313</b>    | <b>143,931</b> | <b>157,134</b> |
|                                                                                                                            | TOPLAM                        | TOTAL                         | <b>183,291</b>    | <b>187,904</b> | <b>207,275</b> |
| TÜRKİYE<br>TURKEY                                                                                                          | Taşkömür+İthal kömür          | Hard Coal+Imported Coal       | 33,310            | 35,130         | 39,546         |
|                                                                                                                            | Linyit                        | Lignite                       | 108,227           | 97,652         | 95,551         |
|                                                                                                                            | TOPLAM                        | Total                         | <b>141,537</b>    | <b>132,781</b> | <b>136,097</b> |
|                                                                                                                            | Fuel-Oil                      | Fuel Oil                      | 20,607            | 15,160         | 8,569          |
|                                                                                                                            | Motorin                       | Diesel Oil                    | 1,328             | 1,830          | 209            |
|                                                                                                                            | Lpg                           | Lpg                           | 0                 | 1              | 0              |
|                                                                                                                            | Nafta                         | Naphta                        | 113               | 84             | 105            |
|                                                                                                                            | TOPLAM                        | TOTAL                         | <b>22,048</b>     | <b>17,076</b>  | <b>8,884</b>   |
|                                                                                                                            | Doğal Gaz                     | Natural Gas                   | <b>189,057</b>    | <b>186,266</b> | <b>194,487</b> |
|                                                                                                                            | TOPLAM                        | TOTAL                         | <b>352,642</b>    | <b>336,123</b> | <b>339,468</b> |

Not 1 :Ayrıca Ağaç kabuğu,talaş,sıvı kükürt,siyah likör,katran,kok gazı,YF gazı,rafineri gazı v.b otoprodüktör santrallarda kullanılan yakıtların ısı değerleri tabloda yer almamaktadır.

Note 1: Heating values of wood wastes,liquid sulphur,black liquor,bitumen,coke oven gas,blast furnace gas,refinery gas used by outproducers are not included in the table.

Source: <http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/49.xls>

Table 4:

| TÜRKİYE TERMİK SANTRALLARINDA TÜKETİLEN YAKITLARIN KURULUŞLARA GÖRE ISI DEĞERLERİ<br>(BİRLEŞİK ISI-ELEKTRİK SANTRALLARINDA ISI ÜRETİMİ İÇİN KULLANILAN YAKITLAR DAHİL)<br>HEATING VALUES OF FUELS CONSUMED IN THERMAL POWER PLANTS IN TURKEY BY THE ELECTRIC UTILITIES<br>(FUELS USED FOR HEAT PRODUCTION IN CHP PLANTS INCLUDED)<br>1cal = 4,1868 Joule |                      |                           |               |               |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------|---------------|---------------|---------------|
| Birim(Unit): Gjoule                                                                                                                                                                                                                                                                                                                                      |                      |                           |               |               |               |
| EÜAŞ<br>VE<br>BAĞLI<br>ORTAKLIKLARI                                                                                                                                                                                                                                                                                                                      |                      |                           | 2008          | 2009          | 2010          |
|                                                                                                                                                                                                                                                                                                                                                          | Taşkömürü            | Hard Coal                 | 23,086,015    | 22,828,163    | 20,892,383    |
|                                                                                                                                                                                                                                                                                                                                                          | Linyit               | Lignite                   | 393,747,606   | 348,995,433   | 338,990,622   |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | Total                     | 416,833,621   | 371,823,595   | 359,883,005   |
|                                                                                                                                                                                                                                                                                                                                                          | Fuel-Oil             | Fuel Oil                  | 33,465,092    | 9,632,696     | 679,656       |
|                                                                                                                                                                                                                                                                                                                                                          |                      | Asıl Yakıt Main Fuel      | 6,200,651     | 5,386,180     | 4,223,229     |
|                                                                                                                                                                                                                                                                                                                                                          |                      | Yrd. Yakıt Auxiliary Fuel | 39,665,743    | 15,018,876    | 4,902,885     |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | TOTAL                     |               |               |               |
| EÜAŞ<br>AND<br>AFFILIATED<br>PARTNERSHIPS OF EÜAŞ                                                                                                                                                                                                                                                                                                        | Motorin              | Diesel Oil                | 0             | 1,956,278     | 159           |
|                                                                                                                                                                                                                                                                                                                                                          |                      | Asıl Yakıt Main Fuel      | 3,579,714     | 3,146,162     | 815,082       |
|                                                                                                                                                                                                                                                                                                                                                          |                      | Yrd. Yakıt Auxiliary Fuel | 3,579,714     | 5,102,441     | 815,241       |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | TOTAL                     | 43,245,457    | 20,121,317    | 5,718,126     |
|                                                                                                                                                                                                                                                                                                                                                          | Doğal Gaz            | Natural Gas               | 199,894,579   | 177,247,713   | 156,392,061   |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | TOTAL                     | 659,973,658   | 569,192,626   | 521,993,192   |
| MOBİL SANTRALLAR<br>MOBIL POWER<br>PLANTS                                                                                                                                                                                                                                                                                                                | Fuel-Oil             | Fuel Oil                  | 2,717,233     | 0             | 0             |
|                                                                                                                                                                                                                                                                                                                                                          | Motorin              | Diesel Oil                | 0             | 0             | 0             |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | TOTAL                     | 2,717,233     | 0             | 0             |
| OTOPRODÜKTÖRLER<br>ÜRETİM ŞİRKETLERİ<br>İŞLETME HAKKI DEVİR<br>ADÜAŞ<br>AUTOPRODUCERS<br>PRODUCTION COMP.<br>TOOR<br>ADÜAŞ                                                                                                                                                                                                                               | Taşkömür+İthal kömür | Hard Coal+Imported Coal   | 116,376,293   | 124,253,075   | 144,680,890   |
|                                                                                                                                                                                                                                                                                                                                                          | Linyit               | Lignite                   | 59,377,198    | 59,852,102    | 65,249,084    |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | Total                     | 175,753,490   | 184,105,177   | 209,929,975   |
|                                                                                                                                                                                                                                                                                                                                                          | Fuel-Oil             | Fuel Oil                  | 43,894,411    | 48,452,601    | 30,974,336    |
|                                                                                                                                                                                                                                                                                                                                                          | Motorin              | Diesel Oil                | 1,980,356     | 2,560,350     | 61,818        |
|                                                                                                                                                                                                                                                                                                                                                          | Lpg                  | Lpg                       | 0             | 5,158         | 0             |
|                                                                                                                                                                                                                                                                                                                                                          | Nafta                | Naphta                    | 473,108       | 352,524       | 440,154       |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | TOTAL                     | 46,347,876    | 51,370,633    | 31,476,308    |
|                                                                                                                                                                                                                                                                                                                                                          | Doğal Gaz            | Natural Gas               | 591,649,268   | 602,609,967   | 657,887,178   |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | TOTAL                     | 767,402,759   | 786,715,144   | 867,817,153   |
| TÜRKİYE<br>TURKEY                                                                                                                                                                                                                                                                                                                                        | Taşkömür+İthal kömür | Hard Coal+Imported Coal   | 139,462,308   | 147,081,237   | 165,573,274   |
|                                                                                                                                                                                                                                                                                                                                                          | Linyit               | Lignite                   | 453,124,804   | 408,847,535   | 404,239,706   |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | Total                     | 592,587,112   | 555,928,772   | 569,812,980   |
|                                                                                                                                                                                                                                                                                                                                                          | Fuel-Oil             | Fuel Oil                  | 86,277,388    | 63,471,478    | 35,877,221    |
|                                                                                                                                                                                                                                                                                                                                                          | Motorin              | Diesel Oil                | 5,560,070     | 7,662,790     | 877,059       |
|                                                                                                                                                                                                                                                                                                                                                          | Lpg                  | Lpg                       | 0             | 5,158         | 0             |
|                                                                                                                                                                                                                                                                                                                                                          | Nafta                | Naphta                    | 473,108       | 352,524       | 440,154       |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | TOTAL                     | 92,310,566    | 71,491,950    | 37,194,434    |
|                                                                                                                                                                                                                                                                                                                                                          | Doğal Gaz            | Natural Gas               | 791,543,848   | 779,857,681   | 814,279,239   |
|                                                                                                                                                                                                                                                                                                                                                          | TOPLAM               | TOTAL                     | 1,476,441,526 | 1,407,278,403 | 1,421,286,653 |

Source: Computed based on the data in p. 44.

Table-5

| NET CALORIFIC VALUES OF FUELS CONSUMED IN THE THERMAL POWER PLANTS                                                          |                      |                           |       |       |       |
|-----------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------|-------|-------|-------|
| Unit: TJ/KT                                                                                                                 |                      |                           |       |       |       |
|                                                                                                                             |                      |                           | 2008  | 2009  | 2010  |
| EÜAŞ VE BAĞLI<br>ORTAKLIKLARI<br><br>EÜAŞ AND<br>AFFILIATED<br>PARTNERSHIPS OF EÜAŞ                                         | Taşkömürü            | Hard Coal                 | 14.11 | 13.71 | 13.36 |
|                                                                                                                             | Linyit               | Lignite                   | 6.53  | 6.03  | 6.76  |
|                                                                                                                             | TOPLAM               | TOTAL                     | 6.73  | 6.25  | 6.96  |
|                                                                                                                             | Fuel-Oil             | Fuel Oil                  | 40.19 | 40.24 | 40.30 |
|                                                                                                                             |                      | Asıl Yakıt Main Fuel      | 40.19 | 40.24 | 40.30 |
|                                                                                                                             |                      | Yrd. Yakıt Auxiliary Fuel | 40.18 | 40.19 | 40.19 |
|                                                                                                                             |                      | TOPLAM TOTAL              | 40.19 | 40.22 | 40.21 |
|                                                                                                                             | Motorin              | Diesel Oil                | 0.00  | 0.00  | 1.00  |
|                                                                                                                             |                      | Asıl Yakıt Main Fuel      | 0.00  | 0.00  | 1.00  |
|                                                                                                                             |                      | Yrd. Yakıt Auxiliary Fuel | 43.11 | 43.12 | 43.12 |
| MOBİL SANTRALLAR<br>MOBILE POWER PLANTS                                                                                     | TOPLAM               | TOTAL                     | 40.42 | 40.92 | 40.60 |
|                                                                                                                             | Doğal Gaz            | Natural Gas               | 34.53 | 34.82 | 34.81 |
|                                                                                                                             | Fuel-Oil             | Fuel Oil                  | 40.10 | 0.00  | 0.00  |
|                                                                                                                             | Motorin              | Diesel Oil                | 0.00  | 0.00  | 0.00  |
| OTOPRODÜKTÖRLER<br>ÜRETİM ŞİRKETLERİ<br>İŞLETME HAKKI DEVİR<br>ADÜAŞ*<br>AUTOPRODUCERS<br>PRODUCTION COMP.<br>TOOR<br>ADÜAŞ | Taşkömür+İthal kömür | Hard Coal+Imported Coal   | 25.12 | 25.07 | 24.71 |
|                                                                                                                             | Linyit               | Lignite                   | 9.75  | 10.37 | 9.94  |
|                                                                                                                             | TOPLAM               | TOTAL                     | 16.39 | 17.16 | 16.90 |
|                                                                                                                             | Fuel-Oil             | Fuel Oil                  | 39.24 | 39.69 | 40.23 |
|                                                                                                                             | Motorin              | Diesel Oil                | 41.12 | 40.94 | 42.66 |
|                                                                                                                             | LPG                  | LPG                       | 0.00  | 0.00  | 1.00  |
|                                                                                                                             | Nafta                | Naphta                    | 44.61 | 43.65 | 33.50 |
|                                                                                                                             | TOPLAM               | TOTAL                     | 39.36 | 39.77 | 40.13 |
|                                                                                                                             | Doğal Gaz            | Natural Gas               | 37.40 | 37.93 | 38.05 |
|                                                                                                                             |                      |                           |       |       |       |
| TÜRKİYE<br>TURKEY                                                                                                           | Taşkömür+İthal kömür | Hard Coal+Imported Coal   | 22.24 | 22.21 | 22.32 |
|                                                                                                                             | Linyit               | Lignite                   | 6.83  | 6.43  | 7.13  |
|                                                                                                                             | TOPLAM               | TOTAL                     | 8.16  | 7.91  | 8.89  |
|                                                                                                                             | Fuel-Oil             | Fuel Oil                  | 39.70 | 39.81 | 40.23 |
|                                                                                                                             | Motorin              | Diesel Oil                | 42.38 | 42.37 | 43.09 |
|                                                                                                                             | LPG                  | LPG                       | 0.00  | 0.00  | 1.00  |
|                                                                                                                             | Nafta                | Naphta                    | 44.61 | 43.65 | 33.50 |
|                                                                                                                             | TOPLAM               | TOTAL                     | 39.87 | 40.09 | 40.20 |
|                                                                                                                             | Doğal Gaz            | Natural Gas               | 36.63 | 37.17 | 37.38 |
|                                                                                                                             |                      |                           |       |       |       |

Computed based on the data in page 45



# PROJECT DESCRIPTION: VCS Version 3

Table-6:

Data Source: <http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B146-49/47.xls>

| TÜRKİYE BRÜT ELEKTRİK ENERJİSİ ÜRETİMİNİN ÜRETİCİ KURULUŞLAR VE BİRİNCİL ENERJİ KAYNAKLARINA DAĞILIMI<br>TURKEY'S GROSS ELECTRICITY GENERATION BY PRIMARY ENERGY RESOURCES AND THE ELECTRIC UTILITIES |                                   |                             | Birim(Unit) : GWh |           |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------|-------------------|-----------|-----------|
| ÜRETİM KARAKTERİSTİĞİ<br>Generation Characteristics                                                                                                                                                   |                                   |                             | 2008              | 2009      | 2010      |
| E<br>Ü<br>A<br>Ş                                                                                                                                                                                      | TAŞKÖMÜRÜ                         | Hard Coal                   | 1,882.4           | 1,851.1   | 1,882.7   |
|                                                                                                                                                                                                       | LİNYİT                            | Lignite                     | 22,433.3          | 22,395.3  | 20,646.7  |
|                                                                                                                                                                                                       | KÖMÜR TOPLAMI                     | Coal Total                  | 24,315.7          | 24,246.4  | 22,529.4  |
|                                                                                                                                                                                                       | FUEL-OİL                          | Fuel Oil                    | 3,365.1           | 974.4     | 62.2      |
|                                                                                                                                                                                                       | MOTORİN                           | Diesel oil                  | 0.4               | 0.2       | 0.0       |
|                                                                                                                                                                                                       | SIVI TOPLAMI                      | Liquid Total                | 3,365.5           | 974.6     | 62.2      |
|                                                                                                                                                                                                       | DOĞAL GAZ                         | Natural Gas                 | 18,818.5          | 17,225.5  | 15,289.4  |
|                                                                                                                                                                                                       | TERMİK TOPLAM                     | Thermal Total               | 46,499.7          | 42,446.5  | 37,881.0  |
|                                                                                                                                                                                                       | HİDROLİK +JEOTERMAL+RÜZGAR TOPLAM | Hydro+Geothermal+Wind Total | 28,419.4          | 28,338.2  | 41,377.4  |
|                                                                                                                                                                                                       | TOPLAM                            | Total                       | 74,919.1          | 70,784.8  | 79,258.3  |
| BAĞLI ORTAKLIKLAR<br>Affiliated partnerships Of EÜAŞ                                                                                                                                                  | LİNYİT                            | Lignite                     | 14,802.7          | 11,974.5  | 10,524.2  |
|                                                                                                                                                                                                       | DOĞAL GAZ                         | Natural Gas                 | 7,995.1           | 6,694.4   | 5,749.9   |
|                                                                                                                                                                                                       | TERMİK TOPLAM                     | Thermal Total               | 22,797.8          | 18,668.9  | 16,274.1  |
| MOBİL SANTRALLAR<br>MOBILE P.P.                                                                                                                                                                       | FUEL-OİL                          | Fuel Oil                    | 330.5             | 0.0       | 0.0       |
|                                                                                                                                                                                                       | MOTORİN                           | Diesel oil                  |                   |           | 0.0       |
|                                                                                                                                                                                                       | TERMİK TOPLAM                     | Thermal Total               | 330.5             | 0.0       | 0.0       |
| OTOPRODÜKTÖRLER<br>ÜRETİM ŞRK.<br>İŞLETME HAKKI DEV.<br>Autoproducers<br>Production Comp.<br>TOOR                                                                                                     | TAŞKÖMÜRÜ+İTHAL KÖMÜR             | Hard Coal+Imported Coal     | 13,975.1          | 14,744.5  | 17,221.6  |
|                                                                                                                                                                                                       | LİNYİT                            | Lignite                     | 4,622.1           | 4,719.6   | 4,771.2   |
|                                                                                                                                                                                                       | KÖMÜR TOPLAMI                     | Coal Total                  | 18,597.2          | 19,464.1  | 21,992.8  |
|                                                                                                                                                                                                       | FUEL-OİL                          | Fuel Oil                    | 3,513.0           | 3,465.4   | 2,081.6   |
|                                                                                                                                                                                                       | MOTORİN                           | Diesel oil                  | 265.9             | 345.6     | 4.3       |
|                                                                                                                                                                                                       | LPG                               | LPG                         | 0.0               | 0.4       | 0.0       |
|                                                                                                                                                                                                       | NAFTA                             | Naphtha                     | 43.6              | 17.6      | 31.9      |
|                                                                                                                                                                                                       | SIVI TOPLAMI                      | Liquid Total                | 3,822.5           | 3,829.0   | 2,117.8   |
|                                                                                                                                                                                                       | DOĞAL GAZ                         | Natural Gas                 | 71,871.7          | 72,174.8  | 77,104.5  |
|                                                                                                                                                                                                       | YENİLENEBİLİR+ATIK                | Renewables and wastes       | 219.9             | 340.1     | 457.0     |
|                                                                                                                                                                                                       | TERMİK TOPLAM                     | Thermal Total               | 94,511.3          | 95,808.0  | 101,672.5 |
|                                                                                                                                                                                                       | HİDROLİK +JEOTERMAL+RÜZGAR TOPLAM | Hydro+Geothermal+Wind Total | 5,859.3           | 9,551.2   | 14,002.8  |
|                                                                                                                                                                                                       | TOPLAM                            | Total                       | 100,370.6         | 105,359.2 | 115,675.3 |
| TÜRKİYE<br>TURKEY                                                                                                                                                                                     | TAŞKÖMÜRÜ+İTHAL KÖMÜR             | Hard Coal+Imported Coal     | 15,857.5          | 16,595.6  | 19,104.3  |
|                                                                                                                                                                                                       | LİNYİT                            | Lignite                     | 41,858.1          | 39,089.5  | 35,942.1  |
|                                                                                                                                                                                                       | KÖMÜR TOPLAMI                     | Coal Total                  | 57,715.6          | 55,685.1  | 55,046.4  |
|                                                                                                                                                                                                       | FUEL-OİL                          | Fuel Oil                    | 7,208.6           | 4,439.8   | 2,143.8   |
|                                                                                                                                                                                                       | MOTORİN                           | Diesel oil                  | 266.3             | 345.8     | 4.3       |
|                                                                                                                                                                                                       | LPG                               | LPG                         | 0.0               | 0.4       | 0.0       |
|                                                                                                                                                                                                       | NAFTA                             | Naphtha                     | 43.6              | 17.6      | 31.9      |
|                                                                                                                                                                                                       | SIVI TOPLAMI                      | Liquid Total                | 7,518.5           | 4,803.5   | 2,180.0   |
|                                                                                                                                                                                                       | DOĞAL GAZ                         | Natural Gas                 | 98,685.3          | 96,094.7  | 98,143.7  |
|                                                                                                                                                                                                       | YENİLENEBİLİR+ATIK                | Renewables and wastes       | 219.9             | 340.1     | 457.5     |
|                                                                                                                                                                                                       | TERMİK TOPLAM                     | Thermal Total               | 164,139.3         | 156,923.4 | 155,827.6 |
|                                                                                                                                                                                                       | HİDROLİK +JEOTERMAL+RÜZGAR TOPLAM | Hydro+Geothermal+Wind Total | 34,278.7          | 37,889.5  | 55,380.1  |
|                                                                                                                                                                                                       | TÜRKİYE TOPLAMI                   | TURKEY'S TOTAL              | 198,418.0         | 194,812.9 | 211,207.7 |

Table 7

[http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2010/front%20page%202010-çiçek%20kitap/uretim%20tuketim\(22-45\)/33\(84-10\).xls](http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2010/front%20page%202010-çiçek%20kitap/uretim%20tuketim(22-45)/33(84-10).xls)

| TÜRKİYE ELEKTRİK ENERJİSİ ÜRETİM - TÜKETİM VE KAYIPLARININ YILLAR İTİBARIYLA GELİŞİMİ<br>ANNUAL DEVELOPMENT OF ELECTRICITY GENERATION- CONSUMPTION AND LOSSES IN TURKEY<br>(1984-2010) |                              |                     |                                       |     |                           |                    |                                                                               |                        |     |                         |      |                 |      |                                                |                             |                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------|---------------------------------------|-----|---------------------------|--------------------|-------------------------------------------------------------------------------|------------------------|-----|-------------------------|------|-----------------|------|------------------------------------------------|-----------------------------|---------------------|
| ŞEBEKE KAYBI — NETWORK LOSSES                                                                                                                                                          |                              |                     |                                       |     |                           |                    |                                                                               |                        |     |                         |      |                 |      |                                                |                             |                     |
| YILLAR<br>YEARS                                                                                                                                                                        | BRÜT<br>ÜRETİM<br>GROSS GEN. | ARTIŞ %<br>INCREASE | İç İhtiyaç<br>INTERNAL<br>CONSUMPTION | %   | NET<br>ÜRETİM<br>NET GEN. | İTHALAT<br>IMPORTS | ŞEBEKEYE<br>VERİLEN <sup>1)</sup><br>SUPPLIED TO<br>THE NETWORK <sup>2)</sup> | İLETİM<br>TRANSMISSION | %   | DAĞITIM<br>DISTRIBUTION | %    | TOPLAM<br>TOTAL | %    | İHRACAT <sup>3)</sup><br>EXPORTS <sup>3)</sup> | NET<br>TÜKETİM<br>NET CONS. | ARTIŞ %<br>INCREASE |
| 1984                                                                                                                                                                                   | 30613.5                      | 11.9                | 1890.7                                | 6.2 | 28722.8                   | 2853.0             | 31375.8                                                                       | 1577.4                 | 5.0 | 2183.2                  | 6.9  | 3740.6          | 11.9 |                                                | 27835.2                     | 13.0                |
| 1985                                                                                                                                                                                   | 34216.9                      | 11.8                | 2306.8                                | 6.7 | 31912.1                   | 2142.4             | 34054.5                                                                       | 1811.4                 | 4.7 | 2734.5                  | 8.0  | 4345.9          | 12.8 |                                                | 29708.6                     | 7.5                 |
| 1986                                                                                                                                                                                   | 38694.8                      | 16.0                | 2815.0                                | 7.1 | 36879.8                   | 776.6              | 37656.4                                                                       | 1344.3                 | 3.6 | 4102.4                  | 10.9 | 5446.7          | 14.5 |                                                | 32209.7                     | 8.4                 |
| 1987                                                                                                                                                                                   | 44352.9                      | 11.7                | 2807.7                                | 5.9 | 41745.2                   | 572.1              | 42317.3                                                                       | 1627.4                 | 3.8 | 3982.6                  | 9.4  | 5620.0          | 13.3 |                                                | 36697.3                     | 13.9                |
| 1988                                                                                                                                                                                   | 48048.8                      | 8.3                 | 2400.0                                | 5.0 | 45648.8                   | 381.2              | 46030.0                                                                       | 2016.6                 | 4.4 | 4291.9                  | 9.3  | 6308.5          | 13.7 |                                                | 39721.5                     | 8.2                 |
| 1989                                                                                                                                                                                   | 52043.2                      | 8.3                 | 3234.5                                | 6.2 | 48808.7                   | 558.5              | 49367.2                                                                       | 1544.0                 | 3.1 | 4703.2                  | 9.5  | 6247.2          | 12.7 |                                                | 43120.0                     | 8.6                 |
| 1990                                                                                                                                                                                   | 57543.0                      | 10.6                | 3311.4                                | 5.8 | 54231.6                   | 175.5              | 54407.1                                                                       | 1787.2                 | 3.3 | 4882.1                  | 9.0  | 6680.3          | 12.3 | 908.8                                          | 48820.0                     | 8.6                 |
| 1991                                                                                                                                                                                   | 60246.3                      | 4.7                 | 3656.2                                | 6.1 | 56590.1                   | 759.4              | 57350.5                                                                       | 1437.8                 | 2.5 | 6123.4                  | 10.7 | 7581.2          | 13.2 | 508.4                                          | 49282.9                     | 5.3                 |
| 1992                                                                                                                                                                                   | 67342.2                      | 11.8                | 4237.3                                | 6.3 | 63104.9                   | 188.8              | 63293.7                                                                       | 1342.9                 | 2.1 | 7851.9                  | 12.1 | 8694.8          | 14.2 | 314.2                                          | 53984.7                     | 9.5                 |
| 1993                                                                                                                                                                                   | 73807.5                      | 9.6                 | 3943.1                                | 5.3 | 69864.4                   | 212.9              | 70077.3                                                                       | 1634.9                 | 2.3 | 8816.7                  | 12.3 | 10251.6         | 14.6 | 588.7                                          | 59237.0                     | 9.7                 |
| 1994                                                                                                                                                                                   | 78321.7                      | 6.1                 | 4539.1                                | 5.8 | 73782.6                   | 31.4               | 73814.0                                                                       | 1800.3                 | 2.4 | 10042.7                 | 13.6 | 11843.0         | 16.0 | 570.1                                          | 61400.9                     | 3.7                 |
| 1995                                                                                                                                                                                   | 86247.4                      | 10.1                | 4388.8                                | 5.1 | 81858.6                   | 0                  | 81858.6                                                                       | 2034.9                 | 2.5 | 11733.9                 | 14.3 | 13768.8         | 16.6 | 685.9                                          | 67363.9                     | 9.8                 |
| 1996                                                                                                                                                                                   | 94881.7                      | 10.0                | 4777.3                                | 5.0 | 90084.4                   | 270.1              | 90354.5                                                                       | 2461.7                 | 2.7 | 13383.1                 | 14.8 | 15854.8         | 17.5 | 343.1                                          | 74156.8                     | 10.0                |
| 1997                                                                                                                                                                                   | 103295.8                     | 8.9                 | 5050.2                                | 4.9 | 98245.6                   | 2492.3             | 100737.9                                                                      | 2935.5                 | 2.9 | 15948.4                 | 15.5 | 18581.9         | 18.4 | 271.0                                          | 81885.0                     | 10.4                |
| 1998                                                                                                                                                                                   | 111022.4                     | 7.5                 | 5523.2                                | 5.0 | 105499.2                  | 3296.5             | 108795.7                                                                      | 3337.1                 | 3.1 | 17457.8                 | 16.0 | 20794.9         | 19.1 | 288.2                                          | 87704.8                     | 7.1                 |
| 1999                                                                                                                                                                                   | 118438.9                     | 4.9                 | 5738.0                                | 4.9 | 112700.9                  | 2330.3             | 113032.2                                                                      | 2985.1                 | 2.6 | 18559.9                 | 16.4 | 21545.0         | 18.1 | 285.3                                          | 91201.9                     | 4.0                 |
| 2000                                                                                                                                                                                   | 124821.6                     | 7.3                 | 6224.0                                | 5.0 | 118697.6                  | 3791.3             | 122488.9                                                                      | 3181.8                 | 2.6 | 20574.1                 | 16.8 | 23755.9         | 19.4 | 437.3                                          | 98295.7                     | 7.8                 |
| 2001                                                                                                                                                                                   | 122724.7                     | -1.8                | 6472.6                                | 5.3 | 116252.1                  | 4579.4             | 120831.5                                                                      | 3374.4                 | 2.8 | 19954.3                 | 16.5 | 23328.7         | 19.3 | 432.8                                          | 97070.0                     | -1.2                |
| 2002                                                                                                                                                                                   | 129389.5                     | 5.4                 | 5672.7                                | 4.4 | 123716.8                  | 3586.2             | 127315.0                                                                      | 3440.7                 | 2.7 | 20491.2                 | 16.1 | 23831.9         | 18.6 | 435.1                                          | 102948.0                    | 6.1                 |
| 2003                                                                                                                                                                                   | 140580.5                     | 8.6                 | 5332.2                                | 3.8 | 135248.3                  | 1158.0             | 136406.3                                                                      | 3330.7                 | 2.4 | 20722.0                 | 15.2 | 24052.7         | 17.6 | 587.6                                          | 111786.0                    | 8.6                 |
| 2004                                                                                                                                                                                   | 150888.3                     | 7.2                 | 5632.6                                | 3.7 | 145255.7                  | 463.5              | 145719.2                                                                      | 3422.8                 | 2.4 | 19820.2                 | 13.6 | 23243.0         | 16.0 | 1144.3                                         | 121141.9                    | 8.4                 |
| 2005                                                                                                                                                                                   | 161956.2                     | 7.5                 | 6487.1                                | 4.0 | 155469.1                  | 835.9              | 156305.0                                                                      | 3895.3                 | 2.4 | 20348.7                 | 13.0 | 24044.0         | 15.4 | 1788.1                                         | 130262.9                    | 7.5                 |
| 2006                                                                                                                                                                                   | 176289.8                     | 8.9                 | 6756.7                                | 3.8 | 169533.1                  | 573.2              | 170106.3                                                                      | 4543.8                 | 2.7 | 19245.4                 | 11.3 | 23789.2         | 14.0 | 2235.7                                         | 144091.4                    | 10.6                |
| 2007                                                                                                                                                                                   | 191558.1                     | 8.7                 | 8218.4                                | 4.3 | 183339.7                  | 864.3              | 184204.0                                                                      | 4523.0                 | 2.5 | 22123.6                 | 12.0 | 28646.8         | 14.5 | 2422.2                                         | 155135.2                    | 7.7                 |
| 2008                                                                                                                                                                                   | 198418.0                     | 3.6                 | 8656.1                                | 4.4 | 189761.9                  | 789.4              | 190551.3                                                                      | 4368.4                 | 2.3 | 23093.1                 | 12.1 | 27481.5         | 14.4 | 1122.2                                         | 161947.6                    | 4.4                 |
| 2009                                                                                                                                                                                   | 194812.9                     | -1.8                | 8193.6                                | 4.2 | 186619.3                  | 812.0              | 187431.3                                                                      | 3873.4                 | 2.1 | 25018.0                 | 13.3 | 28691.4         | 15.5 | 1545.8                                         | 158894.1                    | -3.1                |
| 2010                                                                                                                                                                                   | 211207.7                     | 8.4                 | 8181.6                                | 3.9 | 203026.1                  | 1143.8             | 204169.9                                                                      | 5690.5                 | 2.8 | 24531.2                 | 12.0 | 30221.7         | 14.8 | 1917.8                                         | 172050.6                    | 9.7                 |

1) Şebekeye Verilen = Net Üretim İthalat

2) İhracat, sınırda teslim edilmesi göre yapıldığından, ihracat ile ilgili şebeke kayıtları, iletim kayıtlarında yer almazlar.

\* Kaynak : Türkiye Elektrik Dağıtım ve Tüketim İstatistikleri, 1984-2010

1) Supplied to the Network = Net Generation Import

2) As the export is made on delivery at border basis, its issues are included in the section for transmission network losses.

\* Source : Electricity Distribution and Consumption Statistics of Turkey, 1984-2010

Source: [http://www.teias.gov.tr/istatistik2009/30\(84-09\).xls](http://www.teias.gov.tr/istatistik2009/30(84-09).xls)

Table-8a:

Source: <http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202010.pdf>

| Plant Name                                 | Electricity Utilities | Fuel Type     | Installed Capacity (Mw) | Firm Generation Capacity (GWh) | VER Status |
|--------------------------------------------|-----------------------|---------------|-------------------------|--------------------------------|------------|
| Silopi Elektrik Üretim A.Ş.                | Prod.Comp.            | Bitumen       | 135                     | 945.00                         |            |
| Habaş (Bilecik)(Paşalar)                   | Prod.Comp.            | Fuel Oil      | 18                      | 144.00                         |            |
| Habaş (İzmir)(Habaş)                       | Prod.Comp.            | Fuel Oil      | 36                      | 288.00                         |            |
| Hayat Kağıt                                | Prod.Comp.            | Fuel Oil      | 7.5                     | 56.30                          |            |
| Silopi Elektrik Üretim A.Ş.(Esenboğa)      | Prod.Comp.            | Fuel Oil      | 44.8                    | 315.00                         |            |
| Tire- Kutsan (Tire)                        | AutoProducer          | Fuel Oil      | 8                       | 37.00                          |            |
| TUPRAŞ O.A.RAFİNERİ(Kırıkkale)(Düzeltilme) | AutoProducer          | Fuel Oil      | 10                      | 70.00                          |            |
| Tüpraş Rafineri(Aliağa/İzmir)              | AutoProducer          | Fuel Oil      | 24.7                    | 171.78                         |            |
| İçdaş Çelik (İlave)                        | Prod.Comp.            | Imported Coal | 270                     | 1,923.33                       |            |
| Alkim Alkali Kimya (Cihanbeyli/Konya)      | Autoproducer          | Lignite       | 0.4                     | 3.00                           |            |
| Konya Şeker San. Tic. A.Ş.                 | Autoproducer          | Lignite       | 1.6                     | 4.00                           |            |
| Ak Gıda San. Ve Tic. A.Ş. (Pamukova)       | Autoproducer          | Natural Gas   | 7.5                     | 61.00                          |            |
| Aksa Akrilik Kimya Sn. A.Ş. (Yalova)       | Prod.Comp.            | Natural Gas   | 70                      | 539.00                         |            |
| Aksa Enerji (Antalya) (Güç Değişikliği)    | Prod.Comp.            | Natural Gas   | 16.2                    | 127.72                         |            |
| Aksa Enerji (Antalya) (İlave)              | Prod.Comp.            | Natural Gas   | 300                     | 2310.00                        |            |
| Aksa Enerji (Antalya) (İlave)              | Prod.Comp.            | Natural Gas   | 300                     | 2310.00                        |            |
| Aksa Enerji (Manisa) (İlave)               | Prod.Comp.            | Natural Gas   | 52.4                    | 414.93                         |            |
| Aksa Enerji (Manisa) (İlave)               | Prod.Comp.            | Natural Gas   | 10.5                    | 83.14                          |            |
| Anadolu Elektrik (Çakırlar Hes)            | Prod.Comp.            | Natural Gas   | 16.2                    | 28.00                          |            |
| Antalya Enerji (İlave)                     | Prod.Comp.            | Natural Gas   | 41.8                    | 302.10                         |            |
| Arenko Elektrik Üretim A.Ş. (Denizli)      | Prod.Comp.            | Natural Gas   | 12                      | 84.00                          |            |
| Bil Enerji (Dg+M) (Balgat)                 | Prod.Comp.            | Natural Gas   | 36.6                    | 255.00                         |            |
| Cam İş Elektrik (Mersin) (İlave)           | Prod.Comp.            | Natural Gas   | 126.1                   | 1008.00                        |            |
| Çelikler Taah. İnş. (Rixox Grand)          | Autoproducer          | Natural Gas   | 2                       | 16.00                          |            |
| Dalsan Alçı San. Ve Tic. A.Ş.              | Autoproducer          | Natural Gas   | 1.2                     | 9.00                           |            |
| Delta Enerji Üretim Ve Tic.A.Ş.            | Prod.Comp.            | Natural Gas   | 47                      | 365.82                         |            |
| DELTA ENERJİ ÜRETİM VE TİC.A.Ş. (İlave)    | Prod.Comp.            | Natural Gas   | 13                      | 101.18                         |            |
| DESA ENERJİ ELEKTRİK ÜRETİM A.Ş.           | Prod.Comp.            | Natural Gas   | 9.8                     | 70.00                          |            |
| E.Şehir End. Enerji (Dg+M)(Eskişehir-2)    | Prod.Comp.            | Natural Gas   | 59                      | 451.80                         |            |
| Ege Birleşik Enerji (Lpg+Dg+M)(Aliağa)     | Prod.Comp.            | Natural Gas   | 12.8                    | 107.00                         |            |
| Entek Köseköy(İztek) (Düzeltilme)          | Prod.Comp.            | Natural Gas   | 36.3                    | 288.87                         |            |
| Entek Köseköy(İztek) (Düzeltilme)          | Prod.Comp.            | Natural Gas   | 0.8                     | 6.37                           |            |
| Erdemir(Ereğli-Zonguldak)                  | Prod.Comp.            | Natural Gas   | 39.2                    | 237.88                         |            |
| Falez Elektrik Üretimi A. Ş.               | Prod.Comp.            | Natural Gas   | 11.7                    | 88.00                          |            |
| Global Enerji (Pelitlik)                   | Prod.Comp.            | Natural Gas   | 8.6                     | 155.00                         |            |
| Gül Enerji Elkt. Üret. Sn. Ve Tic. A.Ş.    | Prod.Comp.            | Natural Gas   | 24.3                    | 170.00                         |            |
| Habaş Aliağa                               | Prod.Comp.            | Natural Gas   | 224.5                   | 1796.00                        |            |
| Kasar Dual Tekstil San. A.Ş. (Çorlu)       | Autoproducer          | Natural Gas   | 5.7                     | 38.00                          |            |



| Plant Name                                        | Electricity Utilities | Fuel Type    | Installed Capacity (Mw) | Firm Generation Capacity (GWh) | VER Status |
|---------------------------------------------------|-----------------------|--------------|-------------------------|--------------------------------|------------|
| Ken Kipaş Elektrik Üretim (Karen)                 | Prod.Comp.            | Natural Gas  | 41.8                    | 180.00                         |            |
| Ken Kipaş Elektrik Üretim (Karen) (Kahramanmaraş) | Prod.Comp.            | Natural Gas  | 17.5                    | 75.36                          |            |
| Maksi Enerji Elektrik Üretim A.Ş.                 | Prod.Comp.            | Natural Gas  | 7.7                     | 55.00                          |            |
| Marmara Pamuklu Mens. Sn.Tic.A.Ş.                 | Prod.Comp.            | Natural Gas  | 34.9                    | 275.15                         |            |
| Mauri Maya San. A.Ş.                              | Autoproducer          | Natural Gas  | 2.3                     | 20.00                          |            |
| Modern Enerji (B.Karıştıran)                      | Prod.Comp.            | Natural Gas  | 96.8                    | 680.00                         |            |
| Mosb Enerji Elektrik Üretim Ltd. Şti.             | Prod.Comp.            | Natural Gas  | 84.8                    | 434.00                         |            |
| Nuh Çimento San. Tic. A.G.(Nuh Çim.) (İlave)      | Prod.Comp.            | Natural Gas  | 47                      | 329.00                         |            |
| Petkim Aliğa (Aliğa)                              | Autoproducer          | Natural Gas  | 222                     | 1188.00                        |            |
| Petkim Aliğa (Aliğa)(Düzeltilme-İlave)            | Autoproducer          | Natural Gas  | 52                      | 278.27                         |            |
| Rasa Enerji (Van)                                 | Prod.Comp.            | Natural Gas  | 78.6                    | 500.00                         |            |
| Şahinler Enerji (Çorlu/Tekirdağ)                  | Prod.Comp.            | Natural Gas  | 26                      | 185.00                         |            |
| Selkasan Kağıt Paketleme Malz. İm.                | Autoproducer          | Natural Gas  | 9.9                     | 73.00                          |            |
| Sönmez Elektrik(Uşak) (İlave)                     | Prod.Comp.            | Natural Gas  | 8.7                     | 67.06                          |            |
| Süperfilm (Gaziantep)                             | AutoProducer          | Natural Gas  | 25.3                    | 203.00                         |            |
| Tav İstanbul Terminal İşletme. A.Ş.               | Autoproducer          | Natural Gas  | 3.3                     | 27.61                          |            |
| Tav İstanbul Terminal İşletme. A.Ş.               | Autoproducer          | Natural Gas  | 6.5                     | 54.39                          |            |
| Tesko Kipa Kitle Paz. Tic. Ve Gıda A.G.           | Autoproducer          | Natural Gas  | 2.3                     | 18.00                          |            |
| Yurtbay Elektrik Üretim A.Ş. (D.G.+M)             | Prod.Comp.            | Natural Gas  | 6.9                     | 50.00                          |            |
| Zorlu Enerji (B.Karıştıran) (İlave)               | Prod.Comp.            | Natural Gas  | 49.5                    | 396.00                         |            |
| Cargill Tarım Ve Gıda San. Tic. A.Ş.              | AutoProducer          | R-Biogas     | 0.1                     | 0.70                           |            |
| Gürmat Elekt. (Gürmat Jeotermal)                  | Prod.Comp.            | R-Geothermal | 47.4                    | 313.00                         |            |
| Akçay Hes Elektrik Ur. (Akçay Hes)                | Prod.Comp.            | R-HPP        | 28.8                    | 45.00                          |            |
| Akua Enerji (Kayalık Reg. Ve Hes)                 | Prod.Comp.            | R-HPP        | 5.8                     | 20.00                          |            |
| Bağışli Reg. Ve Hes (Ceykar Elekt.)               | Prod.Comp.            | R-HPP        | 0                       | 0.00                           | VCS 657    |
| Bağışli Reg. Ve Hes (Ceykar Elekt.)               | Prod.Comp.            | R-HPP        | 0                       | 0.00                           | VCS 658    |
| Bereket Enerji (Koyulhisar Hes)                   | Prod.Comp.            | R-HPP        | 0                       | 0.00                           | VCS 713    |
| Beyobasi En. Ur. A.Ş. (Sirma Hes)                 | Prod.Comp.            | R-HPP        | 0                       | 0.00                           | VCS 603    |
| Cindere Hes (Denizli)                             | Prod.Comp.            | R-HPP        | 19.1                    | 30.00                          |            |
| Değirmenüstü En. (Kahramanmaraş)                  | Prod.Comp.            | R-HPP        | 12.9                    | 17.38                          |            |
| Denizli Elektrik (Ege I Hes)                      | Prod.Comp.            | R-HPP        | 0.9                     | 2.00                           |            |
| Elestaş Elektrik (Yaylabel Hes)                   | Prod.Comp.            | R-HPP        | 0                       | 0.00                           | VCS 582    |
| Elestaş Elektrik (Yazi Hes)                       | Prod.Comp.            | R-HPP        | 0                       | 0.00                           | VCS 583    |
| Erva Enerji (Kabaca Reg. Ve Hes)                  | Prod.Comp.            | R-HPP        | 4.2                     | 7.50                           |            |
| Erva Enerji (Kabaca Reg. Ve Hes)                  | Prod.Comp.            | R-HPP        | 4.2                     | 7.50                           |            |
| Filyos Enerji (Yalınızca Reg. Ve Hes)             | Prod.Comp.            | R-HPP        | 0                       | 0.00                           | GS 618     |
| Kalen Enerji (Kalen I - li Hes)                   | Prod.Comp.            | R-HPP        | 15.7                    | 23.58                          |            |
| Karel Enerji (Pamukova)                           | Prod.Comp.            | R-HPP        | 0                       | 0.00                           | GS 1073    |
| Kayen Alfa Enerji (Kaletepe Hes)                  | Prod.Comp.            | R-HPP        | 10.2                    | 17.00                          |            |
| Kisik                                             | EUAS                  | R-HPP        | 9.6                     | 20.00                          |            |

| Plant Name                              | Electricity Utilities | Fuel Type | Installed Capacity (Mw) | Firm Generation Capacity (GWh) | VER Status |
|-----------------------------------------|-----------------------|-----------|-------------------------|--------------------------------|------------|
| Lamas Iii - Iv Hes (Tgt Enerji Üretim)  | Prod.Comp.            | R-HPP     | 35.7                    | 71.00                          |            |
| Obruk Hes                               | EUAŞ                  | R-HPP     | 212.4                   | 337.00                         |            |
| Ozgür Elektrik (Azmak Ii Reg.Ve Hes)    | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | VCS554     |
| OZTAY ENERJİ (Günayge REG.VE HES)       | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | GS636      |
| Ozyakut Elek. Ur.A.Ş. (Güneşli Hes)     | Prod.Comp.            | R-HPP     | 1.8                     | 4.00                           |            |
| Reşadiye 3 Hes (Turkon Mng Elekt.)      | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | GS645      |
| Sarıtepe Hes (Genel Dinamik Sis.El.)    | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | ?          |
| Sarıtepe Hes (Genel Dinamik Sis.El.)    | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | ?          |
| Şirikçioğlu El.(Kozak Bendi Ve Hes)     | Prod.Comp.            | R-HPP     | 4.4                     | 7.00                           |            |
| Taşova Yenidereköy Hes (Hameka A.Ş.)    | Prod.Comp.            | R-HPP     | 2                       | 6.00                           |            |
| Tektuğ (Erkenek)                        | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | VCS 693    |
| Tektuğ (Erkenek) (Ilave)                | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | VCS 694    |
| Tocak I Hes (Yurt Enerji Uretim Sn.)    | Prod.Comp.            | R-HPP     | 4.8                     | 6.00                           |            |
| Tüm Enerji (Pinar Reg. Ve Hes)          | Prod.Comp.            | R-HPP     | 30.1                    | 65.00                          |            |
| Uzunçayır Hes (Tunceli)                 | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | VCS 762    |
| Yapisan (Karica Reg. Ve Darica I Hes)   | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | VCS 506    |
| Yapisan (Karica Reg. Ve Darica I Hes)   | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | VCS 506    |
| Yeşilbaş Enerji (Yeşilbaş Hes)          | Prod.Comp.            | R-HPP     | 0                       | 0.00                           | VCS 806    |
| Ypm Gölova Hes (Suşehri/Sivas)          | Prod.Comp.            | R-HPP     | 1.1                     | 2.00                           |            |
| Ypm Sevindik Hes (Suşehri/Sivas)        | Prod.Comp.            | R-HPP     | 5.7                     | 18.00                          |            |
| İtc-Ka Enerji (Sincan)                  | Prod.Comp.            | R-Waste   | 0                       | 0.00                           | GS 765     |
| İtc-Ka Enerji Mamak Kati Atik Top.Merk. | Prod.Comp.            | R-Waste   | 0                       | 0                              | GS 440     |
| Ortadoğu Enerji (Kömürcüoda)            | Prod.Comp.            | R-Waste   | 0                       | 0.00                           | GS 707     |
| Ortadoğu Enerji (Oda Yeri) (Ilave)      | Prod.Comp.            | R-Waste   | 0                       | 0                              | GS 707     |
| Ortadoğu Enerji (Oda Yeri) (Ilave)      | Prod.Comp.            | R-Waste   | 0                       | 0                              | GS 707     |
| Ak Enerji (Ayyıldız Res)                | Prod.Comp.            | R-WPP     | 0                       | 0                              | GS 634     |
| Alize Enerji (Çamseki Res)              | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 399     |
| Alize Enerji (Keltepe Res)              | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 437     |
| Alize Enerji (Sarıkaya Res) (Şarköy)    | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 577     |
| Ayen Enerji A.Ş. Akbük Rüzgar           | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 436     |
| AYEN ENERJİ A.Ş. AKBÜK RÜZGAR (Ilave)   | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 437     |
| Baki Elektrik Şamli Rüzgar              | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS?        |
| Baki Elektrik Şamli Rüzgar              | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS?        |
| Belen Elektrik Belen Rüzgar-Hatay       | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 390     |
| Belen Elektrik Belen Rüzgar-Hatay       | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 390     |
| Borasko Enerji (Bandırma Res)           | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 744?    |
| Borasko Enerji (Bandırma Res)           | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 744?    |
| Datça Res (Datça)                       | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 428     |
| Datça Res (Datça)                       | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 428     |
| Datça Res (Datça) (Ilave)               | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 428     |

| Plant Name                             | Electricity Utilities | Fuel Type | Installed Capacity (Mw) | Firm Generation Capacity (GWh) | VER Status |
|----------------------------------------|-----------------------|-----------|-------------------------|--------------------------------|------------|
| Kores Kocadağ Res (Urla/Izmir)         | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 601     |
| Mazi-3 Res Elekt.Ur. A.G. (Mazi-3 Res) | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 388     |
| Mazi-3 Res Elekt.Ur. A.G. (Mazi-3 Res) | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 388     |
| Rotor Elektrik (Osmaniye Res)          | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 474     |
| Rotor Elektrik (Osmaniye Res)          | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 474     |
| Rotor Elektrik (Osmaniye Res)          | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 474     |
| Sayalar Rüzgar (Doğal Enerji)          | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 1090    |
| Soma Enerji Uretim (Soma Res)          | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 398     |
| Soma Enerji Uretim (Soma Res)          | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 398     |
| Soma Enerji Uretim (Soma Res)          | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 398     |
| Utopya Elektrik (Düzova Res)           | Prod.Comp.            | R-WPP     | 0                       | 0.00                           | GS 672     |
| Total 2009                             |                       |           | 2,765.90                | 21,489.72                      |            |

Table- 8b

Source: <http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2011.pdf>

| Unit Name                                          | Capacity (MW) | Project Production Potential (GWh) | Firm Production (GWh) | Type         | Fuel        | Date of Commissioning | VCS Status |
|----------------------------------------------------|---------------|------------------------------------|-----------------------|--------------|-------------|-----------------------|------------|
| SELİMOĞLU REG. VE HES                              | 0.00          | 0.00                               | 0.00                  | Private      | Hydro       | 7-Jan-10              | GS 635     |
| KULP IV HES (YILDIZLAR EN.ELK.ÜR.AŞ.)              | 12.30         | 41.00                              | 23.00                 | Private      | Hydro       | 13-Jan-10             |            |
| TUZLA JEOTERMAL                                    | 0.00          | 0.00                               | 0.00                  | Private      | Jeothermal  | 13-Jan-10             | GS 353     |
| ROTOR ELEKTRİK (OSMANİYE RES)                      | 0.00          | 0.00                               | 0.00                  | Private      | Wind        | 14-Jan-10             | GS 474     |
| CİNDERE HES (İlave)                                | 9.07          | 28.29                              | 16.07                 | Private      | Hydro       | 21-Jan-10             |            |
| ETİ SODA ÜRE.PAZ.NAK.VE ELK.ÜRE.SAN.               | 24.00         | 144.00                             | 144.00                | Autoproducer | Lignite     | 22-Jan-10             |            |
| BAYBURT HES (BAYBURT ENERJİ ÜRET.)                 | 14,6          | 51.00                              | 24.00                 | Private      | Hydro       | 28-Jan-10             |            |
| UZUNÇAYIR HES (Tunceli) (İlave)                    | 0.00          | 0.00                               | 0.00                  | Private      | Hydro       | 28-Jan-10             | VCS 762    |
| ALTINMARKA                                         | 4.60          | 37.02                              | 37.02                 | Autoproducer | Natural Gas | 28-Jan-10             |            |
| CAN TEKSTİL (Çorlu/TEKİRDAĞ)                       | 7.83          | 60.25                              | 60.25                 | Autoproducer | Natural Gas | 28-Jan-10             |            |
| ALAKIR HES (YURT ENERJİ ÜRETİM)                    | 2.06          | 6.00                               | 4.00                  | Private      | Hydro       | 29-Jan-10             |            |
| CEV ENERJİ ÜRETİM (GAZİANTEP ÇÖP Biogası)          | 0.00          | 0.00                               | 0.00                  | Private      | Biogas      | 1-Feb-10              | GS 745     |
| AKBAŞLAR (İlave)                                   | 1.54          | 1.54                               | 12.08                 | Autoproducer | Natural Gas | 18-Feb-10             |            |
| ASA ENERJİ (KALE REG.ve HES)                       | 9,6           | 0.00                               | 0.00                  | Private      | Hydro       | 19-Feb-10             | GS 637     |
| PETA MÜHENDİSLİK EN. (MURSAL II HES)               | 4.50          | 19.00                              | 11.00                 | Private      | Hydro       | 19-Feb-10             |            |
| HETAŞ HACISALİHOĞLU (YILDIZLI HES)                 | 1.20          | 5.00                               | 3.00                  | Private      | Hydro       | 23-Feb-10             |            |
| ORTADOĞU ENERJİ (ODA YERİ) (Eyüp/İST.)             | 0.00          | 0.00                               | 0.00                  | Private      | LFG         | 24-Feb-10             | GS 707     |
| KONYA ŞEKER SAN. VE TİC. A.Ş.1                     | 6.00          | 36.00                              | 36.00                 | Autoproducer | Lignite     | 26-Feb-10             |            |
| GLOBAL ENERJİ (PELİTLİK)                           | 3.54          | 27.06                              | 27.06                 | Private      | Natural Gas | 26-Feb-10             |            |
| ASMAKİNSAN (BANDIRMA 3 RES)                        | 20.00         | 0.00                               | 0.00                  | Private      | Wind        | 26-Feb-10             | GS 683     |
| FLOKSER Tekstil (Çatalça-İstanbul)(Süetser tesisi) | -2.13         | 0.00                               | 0.00                  | Autoproducer | Natural Gas | 28-Feb-10             |            |
| RASA ENERJİ (VAN)                                  | 26.19         | 166.62                             | 166.62                | Private      | Natural Gas | 3-Mar-10              |            |
| ROTOR ELEKTRİK (OSMANİYE RES)                      | 17.50         | 0.00                               | 0.00                  | Private      | Wind        | 10-Mar-10             | GS 474     |
| SOMA ENERJİ ÜRETİM (SOMA RES)                      | 4.50          | 0.00                               | 0.00                  | Private      | Wind        | 10-Mar-10             | GS 655     |
| DOĞUBAY ELEKTRİK (SARİMEHMET HES)                  | 3.10          | 10.00                              | 6.00                  | Private      | Hydro       | 11-Mar-10             |            |
| DENİZ ELEKTRİK (SEBENOBA RES)                      | 10.00         | 0.00                               | 0.00                  | Private      | Wind        | 12-Mar-10             | VCS 553    |
| AKDENİZ ELEKTRİK (MERSİN RES)                      | 33,0          | 0.00                               | 0.00                  | Private      | Wind        | 19-Mar-10             | GS 753     |
| AKSA ENERJİ (ANTALYA)                              | 25.00         | 192.50                             | 192.50                | Private      | Natural Gas | 20-Mar-10             |            |
| NURYOL ENERJİ (DEFNE REG. VE HES)                  | 7.23          | 22.00                              | 13.00                 | Private      | Hydro       | 26-Mar-10             |            |
| MENDERES GEOTERMAL DORA-2                          | 0.00          | 0.00                               | 0.00                  | Private      | Jeothermal  | 26-Mar-10             | GS 445     |
| ASMAKİNSAN (BANDIRMA 3 RES)                        | 4.00          | 0.00                               | 0.00                  | Private      | Wind        | 26-Mar-10             | GS 683     |
| ÖZGÜR ELEKTRİK (AZMAK I REG.VE HES)                | 5.91          | 0.00                               | 0.00                  | Private      | Hydro       | 1-Apr-10              | VCS 544    |
| BİRİM HİDR. ÜRETİM AŞ. (ERFELEK HES)               | 3.23          | 9.50                               | 5.50                  | Private      | Hydro       | 3-Apr-10              |            |
| BEYTEK EL. ÜR. A.Ş. (ÇATALOLUK HES)                | 9,5           | 0.00                               | 0.00                  | Private      | Hydro       | 7-Apr-10              | GS 872     |
| NİSAN E.MEKANİK EN. (BAŞAK REG. HES)               | 6.85          | 22.00                              | 12.00                 | Private      | Hydro       | 9-Apr-10              |            |
| BOREAS ENERJİ (BOREAS I ENEZ RES)                  | 15,0          | 0.00                               | 0.00                  | Private      | Wind        | 9-Apr-10              | GS 702     |
| UZUNÇAYIR HES (Tunceli) (İlave)                    | 27.33         | 0.00                               | 0.00                  | Private      | Hydro       | 11-Apr-10             | VCS 762    |
| FIRTINA ELEKTRİK ÜR. A.Ş. (SÜMER HES)              | 21.60         | 59.41                              | 33.27                 | Private      | Hydro       | 16-Apr-10             |            |
| FRİTOLAY GIDA SAN.VE TİC A.Ş.                      | 0.07          | 4.00                               | 4.00                  | Autoproducer | Biogas      | 21-Apr-10             |            |

| Unit Name                                  | Capacity (MW) | Project Production Potential (GWh) | Firm Production (GWh) | Type         | Fuel        | Date of Commissioning | VCS Status |
|--------------------------------------------|---------------|------------------------------------|-----------------------|--------------|-------------|-----------------------|------------|
| YILDIZ ENTEGRE AĞAÇ (Kocaeli)              | 12.37         | 79.79                              | 79.79                 | Autoproducer | Natural Gas | 22-Apr-10             |            |
| BAKRAS EN. ELKT.ÜR. A.Ş. ŞENBÜK RES        | 15.0          | 0.00                               | 0.00                  | Private      | Wind        | 22-Apr-10             | GS 733     |
| ALİZE ENERJİ (KELTEPE RES)                 | 1.80          | 0.00                               | 0.00                  | Private      | Wind        | 28-Apr-10             | GS 437     |
| KAR-EN KARADENİZ EL.A.Ş. ARALIK HES        | 12.41         | 56.00                              | 32.00                 | Private      | Hydro       | 30-Apr-10             |            |
| ITC-KA ENERJİ (SİNCAN)                     | 0.00          | 0.00                               | 0.00                  | Private      | LFG         | 30-Apr-10             | GS765      |
| ATAER ENERJİ ELEKTRİK ÜRETİM A.Ş.          | 49.00         | 277.89                             | 277.89                | Private      | Natural Gas | 5-May-10              |            |
| BİRİM HİDR. ÜRETİM AŞ. (ERFELEK HES)       | 3.23          | 9.50                               | 5.50                  | Private      | Hydro       | 14-May-10             |            |
| CENGİZ ENERJİ SAN. VE TİC. A.Ş. (Tekkeköy) | 101.95        | 802.00                             | 802.00                | Private      | Natural Gas | 22-May-10             |            |
| KARADENİZ EL.ÜRET. (UZUNDERE-1 HES)        | 31.08         | 82.44                              | 46.46                 | Private      | Hydro       | 27-May-10             |            |
| SİMKO(Kartal)                              | -2.05         | 0.00                               | 0.00                  | Autoproducer | Natural Gas | 27-May-10             |            |
| AKIM ENERJİ (CEVİZLİK REG. VE HES)         | 91.4          | 0.00                               | 0.00                  | Private      | Hydro       | 28-May-10             | VCS 753    |
| CEYHAN HES (OŞKAN HES) (ENOVA EN.)         | 23.89         | 0.00                               | 0.00                  | Private      | Hydro       | 3-Jun-10              | VCS 810    |
| ERENLER REG. ve HES (BME BİR.MÜT.EN.)      | 45.00         | 85.00                              | 48.00                 | Private      | Hydro       | 4-Jun-10              |            |
| ROTOR ELEKTRİK (GÖKÇEDAĞ RES)              | 20.00         | 0.00                               | 0.00                  | Private      | Wind        | 5-Jun-10              | GS 474     |
| ÇAKIT HES (ÇAKIT ENERJİ A.Ş.)              | 20.18         | 0.00                               | 0.00                  | Private      | Hydro       | 10-Jun-10             | VCS 685    |
| SOMA ENERJİ ÜRETİM (SOMA RES)              | 7.20          | 0.00                               | 0.00                  | Private      | Wind        | 10-Jun-10             | GS 655     |
| PAŞA REG. VE HES (ÖZGÜR ELEKTRİK)          | 8.68          | 0.00                               | 0.00                  | Private      | Hydro       | 11-Jun-10             | GS 681     |
| GÜZELÇAY-I HES (İLK ELEKTRİK ENERJİ)       | 3.14          | 16.67                              | 9.30                  | Private      | Hydro       | 15-Jun-10             |            |
| KALE REG. VE HES (KALE ENERJİ ÜR.)         | 34.14         | 0.00                               | 0.00                  | Private      | Hydro       | 16-Jun-10             | VCS 893    |
| BERGAMA RES EN. ÜR. A.Ş. ALİAĞA RES        | 37.50         | 0.00                               | 0.00                  | Private      | Wind        | 16-Jun-10             | GS 735     |
| MAZI-3 RES ELEKTRİK (MAZI-3 RES)           | 7.50          | 0.00                               | 0.00                  | Private      | Wind        | 18-Jun-10             | GS 388     |
| UĞUR ENERJİ ÜRETİM TİC. VE SAN. A.Ş.       | 48.20         | 405.14                             | 405.14                | Private      | Natural Gas | 21-Jun-10             |            |
| SÖKTAŞ (N+LPG)(Aydın)                      | -4.50         |                                    |                       | Autoproducer | NAFTA       | 23-Jun-10             |            |
| ÇAMLIKAYA REG. VE HES                      | 5.65          | 19.00                              | 11.00                 | Private      | Hydro       | 30-Jun-10             |            |
| ERİKLİ-AKOC AK REG. ve AKOC AK HES         | 41.25         | 0.00                               | 0.00                  | Private      | Hydro       | 30-Jun-10             | VCS 535    |
| BORASKO ENERJİ (BANDIRMA RES)              | 12.00         | 0.00                               | 0.00                  | Private      | Wind        | 30-Jun-10             | GS 744     |
| AKSA ENERJİ (ANTALYA)                      | 25.00         | 192.50                             | 192.50                | Private      | Natural Gas | 1-Jul-10              |            |
| DİNAR HES (ELDA ELEKTRİK ÜRETİM)           | 4.44          | 15.00                              | 9.00                  | Private      | Hydro       | 3-Jul-10              |            |
| DAMLAPINAR HES (CENAY ELEKTRİK ÜR.)        | 16.42         | 92.00                              | 0.00                  | Private      | Hydro       | 8-Jul-10              | VCS        |
| DİM HES (DİLER ELEKTRİK ÜRETİM)            | 38.25         | 123.00                             | 70.00                 | Private      | Hydro       | 8-Jul-10              |            |
| ÖZGÜR ELEKTRİK (AZMAK I REG.VE HES)        | 5.91          | 0.00                               | 0.00                  | Private      | Hydro       | 10-Jul-10             | VCS 544    |
| ALTEK ALARKO ELEKTRİK SANTRALLARI          | 60.10         | 415.57                             | 415.57                | Private      | Natural Gas | 10-Jul-10             |            |
| KİRPİLİK REG. VE HES (ÖZGÜR ELEKTRİK)      | 6.24          | 22.00                              | 13.00                 | Private      | Hydro       | 11-Jul-10             |            |
| YAVUZ REG. VE HES (MASAT ENERJİ)           | 22.50         | 0.00                               | 0.00                  | Private      | Hydro       | 14-Jul-10             | GS 651     |
| EREN ENERJİ ELEKTRİK ÜRETİM A.Ş.           | 160.00        | 4,005.88                           | 4,005.88              | Private      | Coal        | 15-Jul-10             |            |
| ZİYARET RES (ZİYARET RES ELEKTRİK)         | 12.50         | 0.00                               | 0.00                  | Private      | Wind        | 15-Jul-10             | GS 617     |
| FLOKSER TEKSTİL (Çerkezköy/TEKİRDAĞ)       | 5.17          | 42.00                              | 42.00                 | Autoproducer | Natural Gas | 17-Jul-10             |            |
| KAYABÜKÜ REG. VE HES (ELİTE ELEKT.)        | 14.58         | 0.00                               | 0.00                  | Private      | Hydro       | 21-Jul-10             | GS 726     |
| RB KARESİ İTHALAT İHRACAT TEKSTİL          | 8.60          | 65.00                              | 65.00                 | Autoproducer | Natural Gas | 23-Jul-10             |            |
| SOMA ENERJİ ÜRETİM (SOMA RES)              | 7.20          | 0.00                               | 0.00                  | Private      | Wind        | 28-Jul-10             | GS 655     |
| ERİKLİ-AKOC AK REG. ve AKOC AK HES         | 41.25         | 0.00                               | 0.00                  | Private      | Hydro       | 29-Jul-10             | VCS 535    |

| Unit Name                                    | Capacity (MW) | Project Production Potential (GWh) | Firm Production (GWh) | Type         | Fuel        | Date of Commissioning | VCS Status |
|----------------------------------------------|---------------|------------------------------------|-----------------------|--------------|-------------|-----------------------|------------|
| CENGİZ ENERJİ SAN. VE TİC. A.Ş. (Tekkeköy)   | 101.95        | 802.00                             | 802.00                | Private      | Natural Gas | 31-Jul-10             |            |
| GÖK REG. ve HES (GÖK ENERJİ EL. SAN.)        | 10.01         | 43.00                              | 24.00                 | Private      | Hydro       | 6-Aug-10              |            |
| BULAM REG. VE HES (MEM ENERJİ ELK.)          | 7.03          | 0.00                               | 0.00                  | Private      | Hydro       | 10-Aug-10             | GS 707     |
| KESKİNOĞLU TAVUKÇULUK VE DAM. İŞL.           | 3.50          | 25.00                              | 25.00                 | Autoproducer | Natural Gas | 11-Aug-10             |            |
| SOMA RES (BİLGİN Wind SAN. EN.ÜR.)           | 32.50         | 0.00                               | 0.00                  | Private      | Wind        | 13-Aug-10             | GS 398     |
| BİNATOM ELEKTRİK ÜRETİM A.Ş.                 | 2.00          | 13.00                              | 13.00                 | Private      | Natural Gas | 17-Aug-10             |            |
| KURTOĞLU BAKIR KURŞUN SAN. A.Ş.              | 1.59          | 12.00                              | 12.00                 | Autoproducer | Natural Gas | 19-Aug-10             |            |
| CAN ENERJİ ELEKTRİK ÜR. A.Ş. (Tekirdağ)      | 29.10         | 203.00                             | 203.00                | Private      | Natural Gas | 19-Aug-10             |            |
| CEYHAN HES (BERKMAN HES)(ENOVA EN.)          | 12.61         | 0.00                               | 0.00                  | Private      | Hydro       | 20-Aug-10             | VCS 810    |
| SOMA ENERJİ ÜRETİM (SOMA RES)                | 6.30          | 0.00                               | 0.00                  | Private      | Wind        | 20-Aug-10             | GS 655     |
| GÜDÜL I REG. VE HES (YAŞAM ENERJİ)           | 2.36          | 14.00                              | 8.00                  | Private      | Hydro       | 25-Aug-10             |            |
| SÖNMEZ ENERJİ ÜRETİM (UŞAK)                  | 33.24         | 248.59                             | 248.59                | Private      | Natural Gas | 26-Aug-10             |            |
| CEYHAN HES (BERKMAN HES)(ENOVA EN.)          | 12.61         | 0.00                               | 0.00                  | Private      | Hydro       | 28-Aug-10             | VCS 810    |
| KARŞIYAKA HES (AKUA ENERJİ ÜRET.)            | 1.59          | 0.00                               | 5.00                  | Private      | Hydro       | 28-Aug-10             | GS 637     |
| ITC ADANA BİOKÜTLE SANT.                     | 0.00          | 0.00                               | 0.00                  | Private      | LFG         | 2-Sep-10              | GS 715     |
| BELEN ELEKTRİK (BELEN RES) (İlave)           | 6.00          | 0.00                               | 0.00                  | Private      | Wind        | 2-Sep-10              | GS 390     |
| TEKTUĞ ELEKTRİK (ANDIRIN HES)                | 40.50         | 106.00                             | 60.00                 | Private      | Hydro       | 3-Sep-10              |            |
| ÜTOPIYA ELEKTRİK (DÜZOVA RES) (İlave)        | 15.00         | 0.00                               | 0.00                  | Private      | Wind        | 3-Sep-10              | GS 672     |
| BERGAMA RES EN. ÜR. A.Ş. ALİAĞA RES          | 52.50         | 0.00                               | 0.00                  | Private      | Wind        | 4-Sep-10              | GS 735     |
| ROTOR ELEKTRİK (OSMANİYE RES)                | 17.50         | 0.00                               | 0.00                  | Private      | Wind        | 4-Sep-10              | GS 474     |
| SELEN ELEKTRİK (KEPEZKAYA HES)               | 28.00         | 0.00                               | 0.00                  | Private      | Hydro       | 6-Sep-10              | VCS        |
| REŞADİYE 2 HES (TURKON MNG ELEKT.)           | 26.14         | 0.00                               | 0.00                  | Private      | Hydro       | 17-Sep-10             | GS 644     |
| KOZAN HES (SER-ER ENERJİ)                    | 4.00          | 9.00                               | 5.00                  | Private      | Hydro       | 21-Sep-10             |            |
| SOMA RES (BİLGİN Wind SAN) (İlave)           | 27.50         | 0.00                               | 0.00                  | Private      | Wind        | 23-Sep-10             | GS 400     |
| KIRKA BORAKS(Kırka) (Eti Maden İşl.) (İlave) | 10.00         | 65.93                              | 65.93                 | Autoproducer | Natural Gas | 29-Sep-10             |            |
| KAHRAMAN REG. VE HES (KATIRCIOĞLU)           | 1.42          | 6.00                               | 3.00                  | Private      | Hydro       | 30-Sep-10             |            |
| NARINKALE REG. VE HES (EBD ENERJİ)           | 3.10          | 10.00                              | 6.00                  | Private      | Hydro       | 30-Sep-10             |            |
| SOMA ENERJİ ÜRETİM (SOMA RES) (İlave)        | 9.00          | 0.00                               | 0.00                  | Private      | Wind        | 1-Oct-10              | GS 655     |
| ERENKÖY REG. VE HES (TÜRKERLER)              | 21.46         | 87.00                              | 49.00                 | Private      | Hydro       | 7-Oct-10              |            |
| ENERJİ-SA (BANDIRMA)                         | 1,000.00      | 7,540.00                           | 7,540.00              | Private      | Natural Gas | 7-Oct-10              |            |
| UĞUR ENERJİ ÜR. TİC.VE SAN. A.Ş. (İlave)     | 12.00         | 100.86                             | 100.86                | Private      | Natural Gas | 7-Oct-10              |            |
| ZİYARET RES (ZİYARET RES ELEK.)(İlave)       | 22.50         | 0.00                               | 0.00                  | Private      | Wind        | 13-Oct-10             | GS 617     |
| KAHTA I HES (ERDEMYILDIZ ELEK. ÜRT.)         | 7.12          | 0.00                               | 0.00                  | Private      | Hydro       | 14-Oct-10             | GS 675     |
| ROTOR ELEKTRİK (GÖKÇEDAĞ RES) (İlave)        | 2.50          | 0.00                               | 0.00                  | Private      | Wind        | 15-Oct-10             | GS 474     |
| AZMAK-II REG. VE HES (Düzeltilme)            | -18.07        | 0.00                               | 0.00                  | Private      | Hydro       | 25-Oct-10             | GS 745     |
| ITC ADANA BİOKÜTLE SANT. (Düzeltilme)        | 0.00          | 0.00                               | 0.00                  | Private      | LFG         | 25-Oct-10             | GS 715     |
| ENERJİ-SA (BANDIRMA) (Düzeltilme)            | -69.20        | 0.00                               | 0.00                  | Private      | Natural Gas | 25-Oct-10             |            |
| ULUABAT KUVVET TÜNELİ VE HES                 | 48.51         | 0.00                               | 0.00                  | Private      | Hydro       | 27-Oct-10             | VCS 536    |
| SABUNSUYU II HES (ANG ENERJİ ELK.)           | 7.35          | 21.00                              | 12.00                 | Private      | Hydro       | 28-Oct-10             |            |
| EREN ENERJİ ELEKTRİK ÜR. A.Ş. (İlave)        | 600.00        | 4,005.88                           | 4,005.88              | Private      | Coal        | 1-Nov-10              |            |
| BURÇ BENDİ VE HES (AKKUR ENERJİ)             | 27.33         | 0.00                               | 0.00                  | Private      | Hydro       | 4-Nov-10              | VCS 419    |

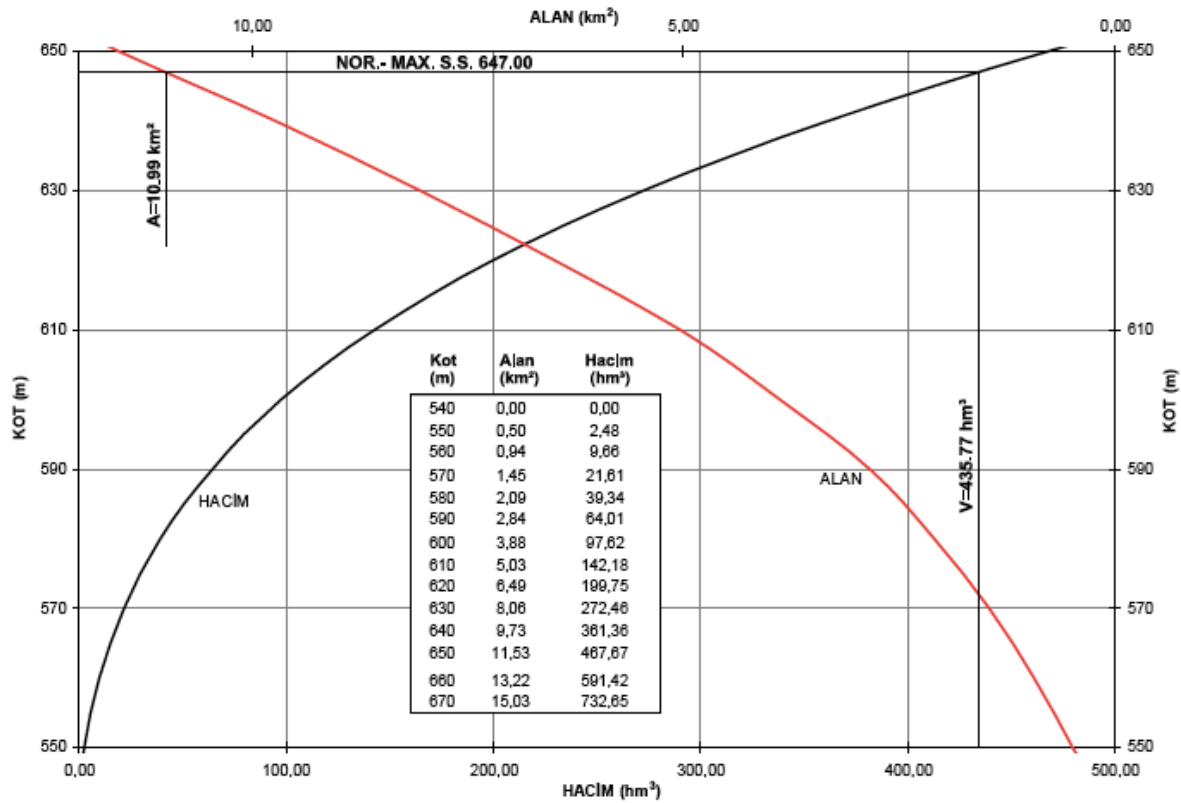
| Unit Name                              | Capacity (MW) | Project Production Potential (GWh) | Firm Production (GWh) | Type         | Fuel        | Date of Commissioning | VCS Status |
|----------------------------------------|---------------|------------------------------------|-----------------------|--------------|-------------|-----------------------|------------|
| KARADENİZ EL. (UZUNDERE-1 HES)(İlave)  | 31.08         | 82.44                              | 46.46                 | Private      | Hydro       | 7-Nov-10              |            |
| GÜZELÇAY-II HES (İLK ELEKTRİK ENERJİ)  | 4.96          | 26.33                              | 14.70                 | Private      | Hydro       | 11-Nov-10             |            |
| MURGUL BAKIR (Ç.Kaya) (İlave)          | 19.60         | 40.50                              | 31.59                 | Private      | Hydro       | 11-Nov-10             |            |
| KUYUCAK RES (ALİZE ENERJİ ÜRET.)       | 8.00          | 0.00                               | 0.00                  | Private      | Wind        | 11-Nov-10             | GS 576     |
| SOMA RES (BİLGİN Wind SAN.)(İlave)     | 30.00         | 0.00                               | 0.00                  | Private      | Wind        | 11-Nov-10             | GS 399     |
| ULUABAT KUVVET TÜNELİ VE HES (İlave)   | 48.51         | 0.00                               | 0.00                  | Private      | Hydro       | 25-Nov-10             | VCS 536    |
| MARMARA PAMUKLU MENSUCAT (İlave)       | 26.19         | 203.45                             | 203.45                | Autoproducer | Natural Gas | 25-Nov-10             |            |
| FRITOLAY GIDA SAN.VE TİC A.Ş. (İlave)  | 0.33          | 3.00                               | 3.00                  | Autoproducer | Biogas      | 26-Nov-10             |            |
| EGEMEN 1 HES (ENERSİS ELEKTRİK)        | 8.82          | 0.00                               | 0.00                  | Private      | Hydro       | 26-Nov-10             | GS 755     |
| REŞADİYE 1 HES (TURKON MNG ELEKT.)     | 15.68         | 0.00                               | 0.00                  | Private      | Hydro       | 26-Nov-10             | GS 643     |
| ALİAĞA ÇAKMAKTEPE ENERJİ (İlave)       | 69.84         | 557.92                             | 557.92                | Private      | Natural Gas | 26-Nov-10             |            |
| YEDİGÖZE HES (YEDİGÖZE ELEKTRİK)       | 155.33        | 474.00                             | 268.00                | Private      | Hydro       | 2-Dec-10              |            |
| SÖNMEZ ENERJİ ÜRETİM (UŞAK) (İlave)    | 2.56          | 19.77                              | 19.77                 | Private      | Natural Gas | 7-Dec-10              |            |
| AK-ENERJİ (UŞAK OSB)(Uşak-Ak.en.)      | -15.24        | 0.00                               | 0.00                  | Private      | Natural Gas | 9-Dec-10              |            |
| AK-ENERJİ(DG+N) (Deba-Denizli)         | -15.60        | 0.00                               | 0.00                  | Private      | Natural Gas | 9-Dec-10              |            |
| KUYUCAK RES (ALİZE ENERJİ ÜR.) (İlave) | 17.60         | 0.00                               | 0.00                  | Private      | Wind        | 9-Dec-10              | GS 576     |
| UMUT III REG. VE HES (NİSAN ELEKTR.)   | 12.00         | 26.00                              | 15.00                 | Private      | Hydro       | 13-Dec-10             |            |
| TÜPRAŞ RAFİNERİ (İZMİT) (İlave)        | 40.00         | 258.82                             | 258.82                | Autoproducer | Natural Gas | 15-Dec-10             |            |
| POLYPLEX EUROPA POLYESTER FİLM         | 7.81          | 61.00                              | 61.00                 | Autoproducer | Natural Gas | 16-Dec-10             |            |
| ALTEK ALARKO ELEKTRİK SANTRALLARI      | 21.89         | 151.36                             | 151.36                | Private      | Natural Gas | 18-Dec-10             |            |
| AKSA ENERJİ (Demirtaş/BURSA)           | -1.40         | 0.00                               | 0.00                  | Private      | Waste       | 21-Dec-10             | GS 1068    |
| SARES RES (GARET ENERJİ ÜRETİM)        | 15.00         | 0.00                               | 0.00                  | Private      | Wind        | 22-Dec-10             | GS 963     |
| FEKE 2 BARAJI VE HES (AKKUR ENERJİ)    | 69.34         | 0.00                               | 0.00                  | Private      | Hydro       | 24-Dec-10             | VCS 534    |
| EGEMEN 1B HES (ENERSİS ELEKTRİK)       | 11.10         | 0.00                               | 0.00                  | Private      | Hydro       | 28-Dec-10             | GS 755     |
| EREN ENERJİ ELEKTRİK ÜR. A.Ş. (İlave)  | 600.00        | 4,005.88                           | 4,005.88              | Private      | Coal        | 29-Dec-10             |            |
| RASA ENERJİ (VAN) (İlave)              | 10.12         | 64.41                              | 64.41                 | Private      | Natural Gas | 29-Dec-10             |            |
| KALKANDERE REG. VE YOKUŞLU HES         | 14.54         | 0.00                               | 0.00                  | Private      | Hydro       | 30-Dec-10             | VCS 905    |
| TURGUTTEPE RES (SABAŞ ELEKTRİK ÜR.)    | 22.00         | 0.00                               | 0.00                  | Private      | Wind        | 30-Dec-10             | GS 610     |
| AK TEKSTİL-1 (G.antep)                 | -13.04        | 0.00                               | 0.00                  | Autoproducer | FUEL-OIL    | 31-Dec-10             |            |
| SİLOPİ ELEKTRİK ÜR. A.Ş. (ESENBOĞA)    | -44.78        | 0.00                               | 0.00                  | Private      | FUEL-OIL    | 31-Dec-10             |            |
| INTERNATIONAL HOSPITAL İSTANBUL AŞ.    | 0.77          | 6.00                               | 6.00                  | Autoproducer | Natural Gas | 31-Dec-10             |            |
| TÜPRAŞ RAFİNERİ (İZMİT) (Düzeltilme)   | -39.14        | 0.00                               | 0.00                  | Autoproducer | Natural Gas | 31-Dec-10             |            |
| YALOVA ELYAF                           | -12.30        | 0.00                               | 0.00                  | Autoproducer | Natural Gas | 31-Dec-10             |            |



## Annex-3: Certificate of EIA Affirmative

|                                                                                                                                                                                                                                                                                                   |                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                  | <p><b>T.C.</b><br/><b>ÇEVRE ve ORMAN BAKANLIĞI</b><br/>Çevresel Etki Değerlendirmesi ve Planlama Genel Müdürlüğü</p>                                |
|                                                                                                                                                                                                                                                                                                   | <p><b>Karar Tarihi:</b> 15.10/2008<br/><b>Karar No</b> : 1417</p>                                                                                   |
| <h3>ÇED OLUMLU BELGESİ</h3>                                                                                                                                                                                                                                                                       |                                                                                                                                                     |
| <p>16.12.2003 tarih ve 25318 sayılı Resmi Gazete’de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği’nin 14.maddesi gereğince; “Alkumru Barajı, Hidroelektrik Santrali ve Malzeme Ocakları” projesi hakkında “Çevresel Etki Değerlendirmesi Olumlu Kararı” verilmiştir.</p> |                                                                                                                                                     |
|                                                                                                                                                                                                                                                                                                   | <p><br/><b>Fevzi İŞBİLİR</b><br/>Bakan a.<br/>Genel Müdür V.</p> |
| <b>Proje Sahibi</b>                                                                                                                                                                                                                                                                               | : Limak Hidroelektrik Santral Yatırımları A.Ş.                                                                                                      |
| <b>Projenin Yeri</b>                                                                                                                                                                                                                                                                              | : Siirt İli, Aydınlar İlçesi, Taşbalta Köyü Mevkii, Botan Çayı                                                                                      |

## Annex-4: Volume vs Area Curve



This curve is taken from the uptodate feasibility report prepared by SuYapı Ltd. It is given as Figure 4.6.1 in the fourth chapter of the report.

It is a correlation curve between water depth, reervoir volume and reservoir area.

The areal extend that corresponds to the maximu operation level of 647 m is 10.99 km<sup>2</sup>.

## Annex-5: Electricity Generation License of the project



The image shows a formal document titled "ÜRETİM LİSANSI" (Production License) issued by the T.C. ENERJİ PİYASASI DÜZENLEME KURUMU (T.C. Energy Market Regulation Authority). The document is framed by a decorative border of small stars. At the top left is the EPDK logo, which consists of a stylized mountain and the letters "EPDK". The title "ÜRETİM LİSANSI" is centered in a large, bold font. Below the title, a subtitle states: "Bu Lisans kapsamındaki üretim tesisi Yenilenebilir Enerji Kaynağı kullanmaktadır." (The production facility within the scope of this license uses a Renewable Energy Source). The license number "Lisans No : EÜ/1325-5/964" and the date "Tarih : 27/09/2007" are listed. The main body of the text describes the license holder as "Limak Hidroelektrik Santral Yatırımları Anonim Şirketi" and mentions the "Alkumru Barajı ve Hidroelektrik Santrali" (Alkumru Dam and Hydroelectric Power Plant). It states that the license is valid for 49 years from the date of issuance (27/09/2007) and is based on the 4628 numbered Electricity Market Law and the 1325-5 numbered Decision of the Energy Market Regulation Authority. The document is signed by Yusuf GÜNAY, Chairman, with a handwritten signature above the printed name. At the bottom, a small note reads: "Bu lisans, genel ve özel hükümleri ile ayrılmaz bir bütündür." (This license is an inseparable whole with its general and special provisions).

T.C.  
ENERJİ PİYASASI DÜZENLEME  
KURUMU

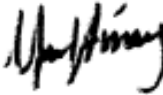
EPDK

**ÜRETİM LİSANSI**

*Bu Lisans kapsamındaki üretim tesisi  
Yenilenebilir Enerji Kaynağı kullanmaktadır.*

Lisans No : EÜ/1325-5/964  
Tarih : 27/09/2007

Bu Lisans, Limak Hidroelektrik Santral Yatırımları Anonim Şirketi'ne, Siirt ili'nde kurulacak olan Alkumru Barajı ve Hidroelektrik Santrali üretim tesisinde 27/09/2007 tarihinden itibaren 49 yıl süreyle, üretim faaliyeti göstermek üzere 4628 sayılı Elektrik Piyasası Kanunu ve ilgili mevzuat uyarınca Enerji Piyasası Düzenleme Kurulu'nun 27/09/2007 tarihli ve 1325-5 sayılı Kararı ile verilmiştir.

  
Yusuf GÜNAY  
Başkan

Bu lisans, genel ve özel hükümleri ile ayrılmaz bir bütündür.