# DERELİ HYDROELECTRIC POWER PLANT

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|---|---|
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# 1 PROJECT DETAILS

## 1.1 Summary Description of the Project

Karhes Elektrik Üretim A.Ş.is planning to construct Dereli Regulator and Hydroelectric Power Plant (HPP) on the Aksu River, within the jurisdiction of Dereli Town of Giresun Province. The purpose of the project is electricity production using the potential energy of Aksu River as a renewable resource. Therefore, the electricity is going to be produced without causing airborne pollutants or Green House Gas (GHG) emissions. The construction and operation of the Dereli Hydro Electric Power Plant (HEPP) will be delaying the addition of conventional thermal power plants to the Turkish National Electricity Grid.

*As shown on the EMRA approved electricity production license*[1] *the established* capacity of Dereli HEPP is 49.2 MW. The project is expected to produce a total of 157,500.00 MWh of electricity per year[1] ., therefore the plant load factor of the project calculates to be, 38.59 %, as shown in the below calculation:

$$\frac{157{,}500\ MWh}{49.2\ MWX365X24h} = \frac{157{,}500}{430{,}992} = 0.3859 = 36.54\%$$

Based on Turkey's Combined Margin Emission Factor of 0.5332 $CO_{2e}$ tonnes /MWh, the project activity is expected to produce 83,983 tonnes of $CO_{2e}$ GHG reductions each year.

The environmental impacts of the project will be kept at a minimum level and all the regulations that are in act in the host country, Turkey, will be obeyed during the construction and operation stages of the Dereli HEPP project. At the planning stage these impacts have been investigated and were presented to the Giresun Provincial Directorate of the Ministry of Environment and Forestry (MoEF), in the form of a project description report. The report was examined by the Provincial Directorate of the MoEF and it was decided that a detailed Environmental Impact Assessment study was not needed for the project. Considering that the project will be using the water resource that is also essential for the aquatic life in the area, there will be a fish ladder (fish passage way) within the regulator for the downstream and upstream movement of the fish, to facilitate fish migration. Since the project is designed as a run off river type power plant, the minimum water necessary for the sustainability of the aquatic life in the river will always be released.

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

[1] Dereli Electricity Production Licence Dated 06/12/2004 numbered EÜ/391-1/500 pdf page 10

Table 1: The Major Milestones of the Project Activity

| Date | Milestone | Reference |
|---|---|---|
| 05/11/04 | Water usage agreement signed with DSI | Water usage agreement |
| 06/12/04 | The Electricity Production License is granted for the project activity | License number EÜ/391-1/500 |
| 21/03/06 | Local Stake holder Consultation is announced | Announcement documents |
| 09/04/06 | Local Stake holder Consultation meeting is held | Meeting Minutes |
| 27/04/06 | EIA Exemption certification issued | Certificate |
| 04/09/06 | Grid connection agreement signed | Agreement |
| 01/12/06 | Board decision to take VER revenues into account. | Board Decision |
| 01/02/07 | Construction Started | NHS Records |
| 29/08/07 | The Loan agreement is signed between Karhes and the crediting banks | Loan agreement |
| 12/01/11 | DOE Contracted for Validation | Contract |
| 02/08/11 | The project site is visited with the DOE | DOE Testimonial |
| 10/01/14 | Project Start Date | The Provisional acceptance protocol |

The Dereli HEPP is going to be made up of one hydro power plant. There will be one controlled weir through which the water will be taken up from the 778 m elevation level and will be transferred to a derivation tunnel of 8113m . From there the water will arrive to the valve chamber and will be fed to a penstock of 630 m where it will be pressurized and will arrive to the power plant that will be built at a level of 495 m. The potential energy of water at approximate gross head level of 263 m will be utilized and the electricity will be produced by the power plant.

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

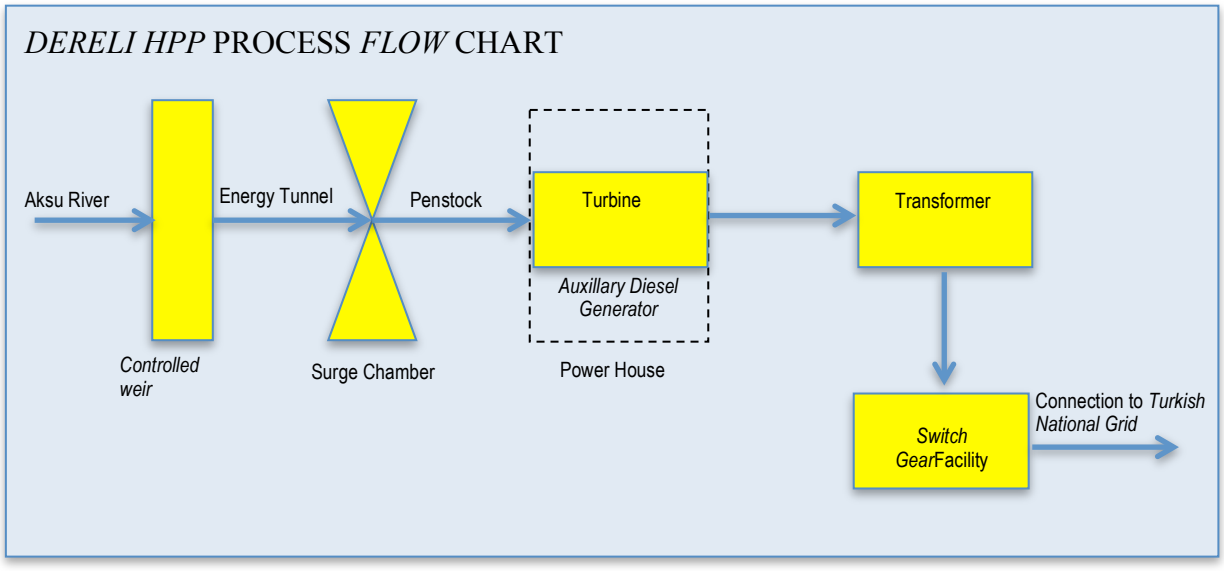


**Figure 1: Flow chart showing the basic operational principles of the project activity.**

## 1.2 Sectoral Scope and Project Type

The project category is Sectoral Scope 1: Energy industries (renewable-/non -renewable sources). The project is a non-grouped, stand alone project.

## 1.3 Project Proponent

| | |
|---|---|
| Organization name | Karhes Elektrik Üretim A.Ş. |
| Contact person | Özgün Gül Koparan |
| Title | Environmental Affairs Manager |
| Address | Gazi Mustafa Kemal Bulvarı 15 Mayıs Mah.<br>832 Sok. No:2 75.Yıl Esnaf Sarayı K:2 Denizli-Turkey |
| Telephone | +90 258 242 27 76 |
| Email | ogul@bereketenerji.com.tr |

## 1.4 Other Entities Involved in the Project

| | |
|---|---|
| Organization name | Turkuaz Karbon Varlık Yönetimi Enerji Proje ve Dan. San. İth. İhr. Ltd. Şti. |
| Role in the project | Preparation of the Project Description Document |
| Contact person | Dr. Aslı Sezer Özçelik |
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## 1.5 Project Start Date

10.01.2014, is the date when the project started to supply electricity to the Turkish grid as substantiated by the partial acceptance letter sent to the Governance of Giresun Province, Giresun-Turkey.

## 1.6 Project Crediting Period

The project crediting period is 10 years: 10/01/2014 to 09/01/2024 (both days inclusive). Renewable twice.

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

| Project Scale | |
|---|---|
| Project | Y |
| Large project | N |

| Years | Estimated GHG emission reductions or removals (tCO2e) |
|---|---|
| Year 0: 2014 (10/01/2014 to 31/12/2014) | 81,682 |
| Year 1: 2015 | 83,983 |
| Year 2: 2016 | 83,983 |
| Year 3: 2017 | 83,983 |
| Year 4: 2018 | 83,983 |
| Year 5: 2019 | 83,983 |
| Year 6: 2020 | 83,983 |
| Year 7: 2021 | 83,983 |
| Year 8: 2022 | 83,983 |
| Year 9: 2023 | 83,983 |
| Year.10: 2024 (01/01 to 09/01/2024) | 2,301 |
| **Total estimated ERs** | 839,830 |
| **Total number of crediting years** | 10 |
| **Average annual ERs** | 83,983 |

## 1.8 Description of the Project Activity

Dereli HEPP, that will be built on Aksu River. The Tyrolean type weir will be approximately at the elevation of 778.75 m. Dereli HEPP will be utilizing approximately (gross) 263 m of potential energy difference to produce electricity.

Dereli HEPP with 49.20 MW installed capacity, will be connecting to the Turkish National Power Grid over the Çırakdamı Hydroelectric Power Plant via one of Transformer Substations by 5,5 km long transmission line and then both power plants will be connected via 25 km long 154 kV Giresun transmission line. As the project will be operational, a reliable, continuous, independent from imported fossil fuels, and an uninterrupted high quality power at 154 kV voltage level will be supplied to consumers in Turkey. Thus, the implementation of the project will positively affect both Turkey's and the region's economy.

The project will involve collecting of water, at the 778,6 m level, by the help of a controlled weir. After that the water will be transferred to a diversion tunnel of 8,109.5 m. This tunnel will be carrying the water to the surge chamber from which it will enter into the penstock and will be transferred to two turbine units, each with 24.6 MW capacity. The two Francis type vertical axis turbines will be housed within the Hydroelectricity Power Plant (HPP) building. The water that will hit these two turbines, will then leave the turbines via the tail water canal and a spillway which is going to be located at a level of 492 m.

The following are the facilities to be constructed:

- Dereli weir to be constructed at approximately 778 m elevation level
- Water intake body and the settling tank
- Conveyor tunnel
- Penstock
- Surge Chamber
- Hydro Electricity Power Plant building
- Tail water canal and spillway
- The switch gear area and the transformer

General technical characteristics of Dereli HEPP are given in Table 2.

Table 2 : General technical characteristics of Dereli HEPP[2]

| The Weir | |
|---|---|
| Place | The controlled weir will be located on the Aksu River, at the close proximity of the Dereli Town of Giresun Province. |
| Purpose | According to water flow direction, diverting the Aksu River's water to water intake structure. |
| Elevation of the river bed | 778.60 m |
| Elevation of the foundation | 778.60 m |
| Type | Controlled Weir |
| Height from the foundation of the regulator | 5.00 m (Approximately) |
| Height of the regulator from the River Bed | 5.00 m |
| Crest level | 783 m |
| Maximum Water Level | 781.62 m |
| Minimum Water Level | 781 m |
| Tail Water Level | 492 m |
| Energy Tunnel | |
| Shape | Circular, concrete covered, pressurized |
| Length | 8,109.50 m |
| Slope | 0.0007 |
| Penstock | |
| Penstock Length | 550 m |
| Penstock section thickness | 15 mm |
| Turbines | |
| Turbine Type | Vertical Axis Francis |
| Unit numbers | 2 |
| Unit Powers | 24.6 MWe each |
| Transmission Line | |
| Length | 5.53 km |
| Section | 1X 795 MCM |
| Power House | |
| Power Plant Type | Over the surface |
| Gross fall | 289 m |
| Net fall | 281.19 m |
| Total Installed Capacity (Bar) | 49.2 MW |
| Project Flow Rate | 20.42 m³/s |
| Annual Energy Production: | |

[2] The characteristics presented in this table are taken from the Revised Feasibility Study of Dereli HPP-January 2013.

| | |
|---|---|
| Primary Energy | 12,345 GWh/year |
| Secondary Energy | 139,782 GWh/year |
| Total Energy | 152,13 GWh/year[3] |

The project will be using Vertical Francis type turbines. 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. Load changes are catered for by the adjustable vanes. Sudden load changes are dealt with by a bypass valve or a surge tank. 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 3), for a schematic explanation of working principles of a Francis Turbine.

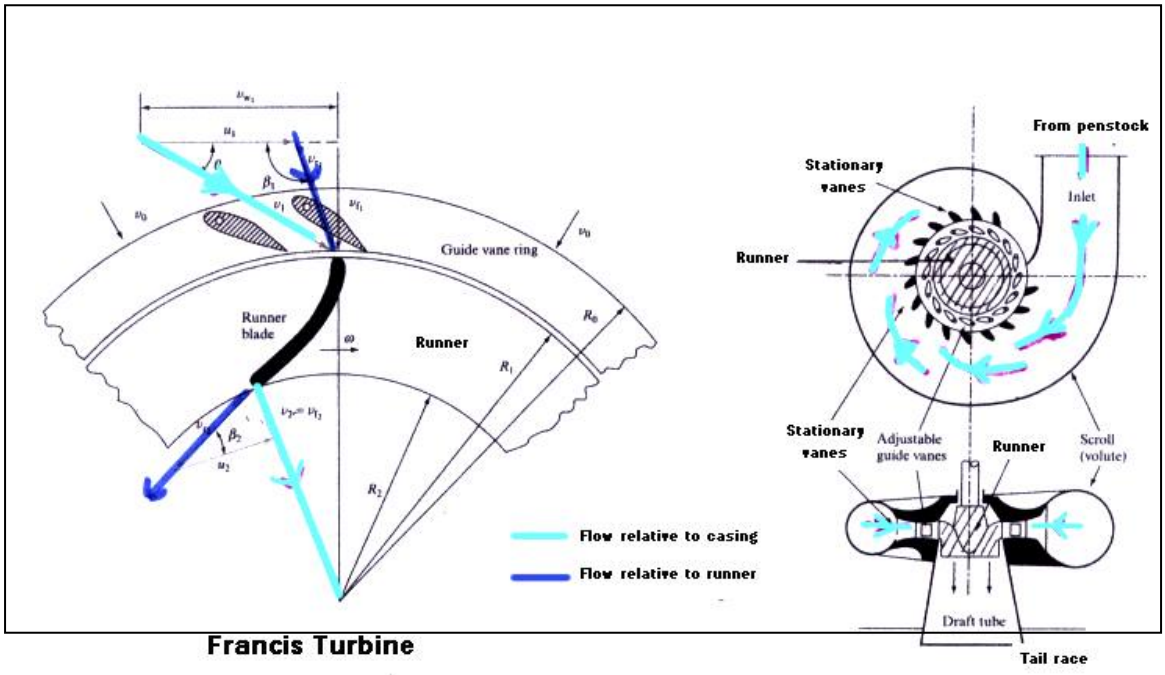



Figure 2: The working principle of a Vertical Axis Francis type turbine.

[3] Please note that annual electricity production is indicated as 157.50 GWh at the Dereli electricity production license pdf page 10 and to be conservative this larger number is considered in financial analysis and other parts of this PDD.

The project owner is granted a production license for 49 years. The economic life time of a hydro power plant investment is assumed to be about 50 years, based on the experts' committee report[4] on energy under the 8th 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[5]. As a result the project life time is estimated to be about 20 years.

The project will be producing 157,500 MWh[5] of electricity per year. This is 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 is located at the Northern Black Sea region of Turkey at the Giresun Province as shown in the location Map below (Figure 3):

The coordinates of the major project structures are as follows:

| | Latitude | Longitude |
|---|---|---|
| Power House | 40°41'20.42"N | 38°26'17.57"E |
| Spill Weir | 40°41'15.00"N | 38°26'27.58"E |

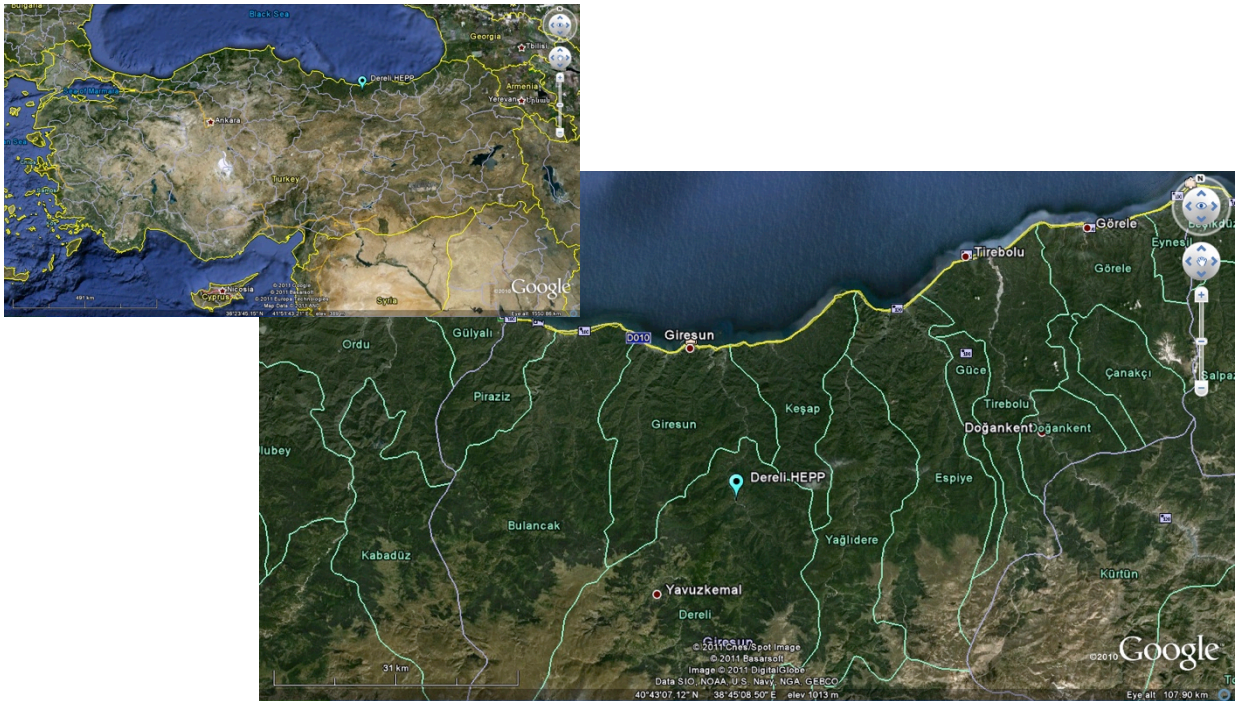



Figure 3: Google Earth Satellite imagery showing the location of the project area.

[4] Devlet Planlama Teşkilatı (DPT), 8. Beş Yıllık Kalkınma Planı, Elektrik Enerjisi Özel İhtisas Komisyonu Paporu, Ankara, 2001. (http://www.kalkinma.gov.tr/Lists/zel%20htisas%20Komisyonu%20Raporlar/Attachments/72/oik585.pdf Last visited on 12/07/2015)
[5] Dereli electricity production license pdf page 10

## 1.10 Conditions Prior to Project Initiation

The project is a renewable energy project, prior the project initiation, there was no other hydro electric power plant installation at the project site.

## 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 applies with its rules and regulations. The list of the rules and regulations of the host country that a new electricity generation project has o comply is given in Annex 1.

## 1.12 Ownership and Other Programs

### 1.12.1 Right of Use

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.

### 1.12.2 Emissions Trading Programs and Other Binding Limits

Not applicable

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

### 1.12.3 Other Forms of Environmental Credit

Not applicable

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

### 1.12.4 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.

### 1.12.5 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 not 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.

### Further Information

No Further information to be added.

# 2 APPLICATION OF METHODOLOGY

## 2.1 Title and Reference of Methodology

Approved consolidated baseline and monitoring methodology ACM0002 “Large-scale Consolidated Methodology; Grid-connected electricity generation from renewable sources.” Version 16.0.0.

The Approved Methodology refers to the following tools:

“Tool for the demonstration and assessment of additionality” (Version 07.0.0; EB 70 -Annex 8)

“Tool to calculate the emission factor for an electricity system”. (Version 04.0.0;EB 75-Annex 15)

"Methodological tool Investment analysis” (Version 06.0; EB85-Annex 12)

In addition to this as the Tool for the demonstration and assessment of additionality refers to common practice analysis we have also made use of the following methodological tool:

“Methodological tool: Common practice” (Version 03.1; EB 84 - Annex 7).

## 2.2 Applicability of Methodology

The ACM0002 (version 16.0.0) methodology is applicable to grid-connected renewable power generation project activities that: (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

The choice of methodology ACM0002, Version 16.0.0, is justified as the project activity meets the following applicability criteria:

| **Reference page in ACM0002 (version 16.0.0)** | Applicability Criteria | Justification |
|---|---|---|
| **4 paragraph 4** | ((a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;<br>(b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference | The Dereli HEPP project activity is the Installation of a new hydro power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant) |

| | | |
|---|---|---|
| | baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity. | |
| **5 paragraph 5** | In case of hydro power plants:<br>One of the following conditions shall apply:<br>(a) The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or<br>(b) 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 is increased and the power density calculated using equation (3), is greater than 4 $W/m^2$; or<br>(c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 $W/m^2$; or<br>(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 $W/m^2$, all of the following conditions shall apply:<br>(i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 $W/m^2$;<br>(ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;<br>(iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 $W/m^2$ shall be:<br>a. Lower than or equal to 15 MW; and<br>b. Less than 10 per cent of the total installed capacity of integrated hydro power project. | The project activity satisfies condition (c), as it results in a new reservoir and the power density of the project activity is 12,634 $W/m^2$ which is greater than 4 $W/m^2$ as shown in the following calculation:<br>Installed Capacity/ Reservoir Area[6]=Power Density<br>49,200,000 W/3,894 $m^2$= 12,634 $W/m^2$ |
| **5 paragraphs 6 to 8** | In the case of integrated hydro power projects, project proponent shall:<br>Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or<br>Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. | Not Applicable as the project activity is the addition of a new hydro power plant with only a single reservoir. |

| | | |
|---|---|---|
| | This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity. | |
| **5-6 paragraph 9** | The methodology is not applicable to:<br>(e) 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;<br>(f) Biomass fired power plants/units. | The Project activity is eligible as :<br>It does not involve switching from fossil fuels<br>It is not a biomass fired power plant<br>Although it is the creation of a hydro power plant with a new reservoir it's power density is greater than 4 $W/m^2$ (the power density of the project activity is 12,634 $W/m^2$). |
| **6 paragraph 10** | In the case of retrofits, rehabilitations, 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, that is 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". | Not Applicable as the project activity is the addition of a new hydro power plant thus a new reservoir, and it is not a retrofit, replacement or capacity addition project. |
| **6 paragraph 11** | In addition, the applicability conditions included in the tools referred to below apply[7]. | Not applicable as the tools referred does not have additional requirements is not used in the case of the project activity. |

## 2.3 Project Boundary

Table 4 exhibits the gases included in the project boundary. $CO_2$ emission is included in the baseline but the project activity does not emit any of the gases listed, in Table 4.

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

Table 3: Main gases included in the project boundary

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Electricity generation in baseline (Turkey's Grid) | $CO_2$ | Yes | Main emission source |
| | | $CH_4$ | No | Minor emission source |
| | | $N_2O$ | No | Minor emission source |
| | | Other | N.A. | N.A. |
| Project | Emission from the reservoir of the proposed project | $CO_2$ | No | Minor emission source |
| | | $CH_4$ | No | Minor emission source (Power density (12,634 $W/m^2$) greater than 10$W/m^2$) |
| | | $N_2O$ | No | Minor emission source |
| | | Other | N.A. | N.A. |

[7] The condition in the "Combined tool to identify the baseline scenario and demonstrate additionality" that all potential alternative scenarios to the proposed project activity must be available options to project participants; does not apply to this methodology, as this

## 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 16.0.0):

> *"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.04.0.0; EB 75-Annex 15)."*

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 (EFy) 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 7.0.0*" and the numbering in this section reflects the Tool's Guidelines provided at EB 70, Annex 8.

**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 (version 16.0.0), 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 or financially attractive" option*. Please note that, at this step, the "Guidelines on the assessment of investment analysis" (EB 62 Report Annex 5) Version 05 is followed.

**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 equity IRR of the project activity is determined on post-tax basis inline with the Tool for the Demonstration and Assessment of Additionality Version 7.0.0 (EB 70, Annex 8) and the Guidelines issued at EB 62.

The Tool for the Demonstration and Assessment of Additionality Version 7.0.0 (EB 70, Annex

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[8], provides a list of the default values for the expected return on equity alongside with the Moody's index values of most of the CDM Countries, as an appendix. Therefore if the host country is not listed in the appendix, it is possible to choose a benchmark by correlating the Moody's index of the host country at the time of investment decision. At the time of investment decision (01/02/2007[9] to 29.08.2007), Turkey's Moody's index was (Ba3[10] between 14 December 2005 to 08 January 2010). When we check the appendix of the guidelines issued at EB 62[15], the corresponding Equity IRR benchmark is given as 12.75 for countries with Ba3 Moody's rating (see Bangladesh, Montenegro, Philippines, Uruguay, and Viet Nam) therefore we have taken the bench mark as 12.75 %.

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

The following parameters are taken into account for the assessment of the investment (Table 4) and supplementary parameters are provided in the "DereliHPPFinancialAnalysis" workbook and submitted to the validating DOE.

Table 4: Major parameters taken into account for the financial analysis and determination of the Equity IRR of the Dereli HPP Project:

| Parameter | Value | Unit | References |
|---|---|---|---|
| Installed Capacity | 49.2 | MWe | Dereli Electricity Production Licence Dated 06/12/2004 numbered EÜ/391-1/500 pdf page 10 |
| Expected Annual Electricity Generation | 157,500 | MWh | Dereli Electricity Production Licence Dated 06/12/2004 numbered EÜ/391-1/500 pdf page 10 |
| Expected Average Annual Emission Reduction (ER) | 83,983 | $tCO_2e$ | Calculated (see Chapter 3 for details) based on the electricity production values. |
| Total Investment | 52, 700.00 | USD | Based on assumptions presented on table 8.1 (pdf page 276) of the FSR (February 2004) prepared according to DSI rules and presented to the government authorities |
| Annual Operation Costs | 404,415.80 | USD | Based on page Based on pdf page 286 of the FSR (February 2004) Chapter 9 and table 9.1 |
| Loan | 36,890,000 | USD | Credit Agreement signed on 29/08/2007 |
| Loan Period | 9 | years | Credit Agreement signed on 29/08/2007 |
| Electricity Sales Price | 0.073 | USD/KWh | Price guaranteed by the renewable energy law no: 5346 |
| 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, 13 % of the assets are depreciated over 15 years and 87 % of the long lasting assets are depreciated over 40 years and the residual book value of 20,184,416.46 USD is added back to the cash flow. The economic life time of a hydro power plant investment is assumed to be about 50

[8] Methodological Tool: Investment Analysis (Version 06;EB 85 Annex 12)

[9] On February 2007, the project owner started the construction workcamp as they were close to financial closure and signed the loan agreement on 29th of August, 2007, therefore the investment decision process is dated within this interval

years, based on the experts' committee report[11] on energy under the 8th 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[12]. But still the "Methodological Tool to determine the remaining lifetime of equipment Version 01 (EB 50 Report Annex 15)" determines the default lifetime of "Electric generators, -hydrogen cooled or water cooled-" as 30 years. Taking this into account and considering the investment analysis guidelines the investment analysis is done for a time frame of 20 years, after the estimated project start date.

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 10.77 %, which is below the benchmark of 12.75%.

**Sub-step 2d - Sensitivity Analysis**

To be able to conclude if the investment decision is the financially the most attractive alternative or not, 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 ±10% fluctuations in the above parameters. The figures in the following table (Table 6) are obtained. Following the "Guidelines on the 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 5).

Table 5: Sensitivity analysis for the Equity IRR without carbon revenue for the project (Benchmark: 12.75%)

| Change | -10% | -5% | 5% | 10% | Exceed Benchmark? |
|---|---|---|---|---|---|
| Investment Cost | 12.36% | 11.51% | 10.12% | 9.54% | No |
| Operating Cost | 10.80% | 10.79% | 10.75% | 10.74% | No |
| Electricity Revenue | 9.79% | 10.29% | 11.23% | 11.68% | No |

[11] Devlet Planlama Teşkilatı (DPT), 8. Beş Yıllık Kalkınma Planı, Elektrik Enerjisi Özel İhtisas Komisyonu Paporu, Ankara, 2001. (http://www.kalkinma.gov.tr/Lists/zel%20htisas%20Komisyonu%20Raporlar/Attachments/72/oik585.pdf, Last visited on

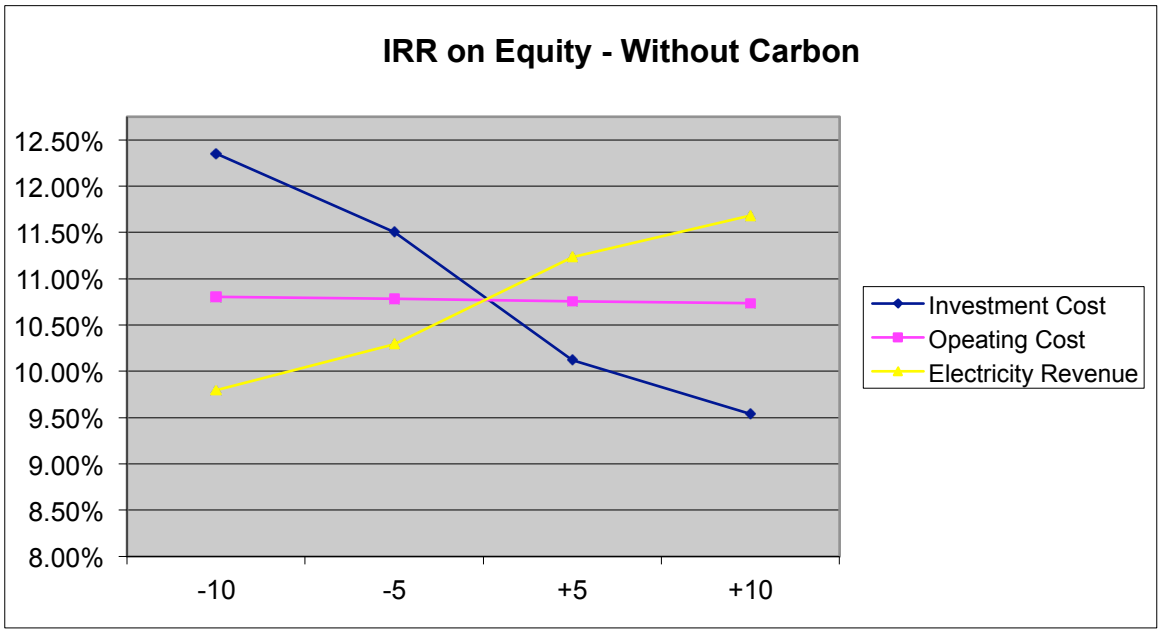



Figure 4: Sensitivity analysis: Fluctuation of the Equity IRR without the carbon revenue, by changing major parameters that effect the Equity IRR by ±10%

To exceed the benchmark, the electricity revenue must increase by about 22.50 % over the life of the project, or the investment cost must be reduced by about 12.05 %. The Financial analysis performed for the project have selected the electricity selling price as the "Renewable Energy Law" guarantied price of USD 0.073 per kWh for renewable energy. Compared to the publically announced electricity price of 0.0913 TL/KWh[12] (converts as 0.055 USD/KWh). The guaranteed price is a conservative estimation. In addition to this the last couple of years exhibited severe drops at the flow rates of the rivers due to the lack of winter precipitations that feed the rivers. As a result, we do not expect an increase in the electricity revenue related to a price increase and since the feasibility report and the design of the project is based on the maximum available capacity of the Aksu river, and since our entire financial analysis is based on the maximum net electricity output of the project, such an increase based on an 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 22.50 %. 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 investment costs we have considered in our financial analysis was based on the project owners assumptions at the investment decision time as can be substantiated by the loan agreement. Later the project owner re-visited the feasibility report and the investment cost in that later report (dated 2013) was estimated to be about 24 % more than the amount that was considered during investment decision time. Therefore these numbers are not only reasonable and reflect the average market conditions but are also very conservative and are very 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 12.75 %, with an equity internal rate of return of 10.77%. A fluctuation of ± 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 Dereli 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. According to the Methodological tool on Common practice (Version 03.1, EB 84 Annex 7), common practice analysis is presented through the following 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 49.20 MW of the proposed project is selected as the design capacity. Therefore, the range from 24.60 MW to 73.80 MW is considered as applicable capacity.

Common Practice tool Step 2: identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The projects are located in the applicable geographical area;

(b) The projects apply the same measure as the proposed project activity;

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

The project activity is located within the borders of the 22nd water catchment that is designated as the Eastern Black Sea Catchment (See Figure 5). The investment conditions and the water regimes are similar in this area that this is considered to be the applicable geographic area. The hydroelectric power plant projects that are within the determined capacity range of 24.60 to 73.80 MW, operational within the borders of the Eastern Black Sea Catchment are given below in Table 6:

Table 6: The list of all the hydroelectric power plants that are within the capacity range[13].

| Name of Power Plant | Capacity (MW) | Production (GWh) | Firm Production GWh | Investment Type | Province | NOTES |
|---|---|---|---|---|---|---|
| Kalen I-II HEPP | 31.3 | 104 | 47 | Private | Giresun | VCS 952 |
| Muratli HEPP | 26.7 | 94 | 55 | Private | Giresun | |
| İncirli Weir & HEPP | 25.2 | 126 | 71 | Private | Rize | |
| Kalkandere-Yokuşlu HEPP | 37.9 | 178 | 100 | Private | Rize | VCS 905 |
| Uzundere I HEPP | 62.2 | 165 | 93 | Private | Rize | VCS 964 |


Figure 5: The map showing the catchment boundaries within Turkey. The project is located within the borders of the ***Eastern Black Sea* Catchment**.

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number $N_{all}$.

Looking at the above table (Table 6) Kalen I-II HEPP, Kalkandere HEPP, and Uzundere I HEPP are observed to be registered VER project activities. Therefore excluding them we get the following 2 projects listed in Table 7, as the projects that will be considered within $N_{all.}$

[13] Source: A list of units providing electricity to the year 2011 Turkish Electricity Grid is provided as an Annex 1 to the most recent Capacity Projection report published by TEIAS at the time of PDD Submission

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

| Name of HPP | Capacity (MW) | Production (GWh) | Firm Production GWh | Investment Type | Province |
|---|---|---|---|---|---|
| Muratli HEPP | 26.7 | 94 | 55 | Private | Giresun |
| İncirli Weir & HEPP | 25.2 | 126 | 71 | Private | Rize |

As explained above, considering the Eastern Black Sea Catchment and checking all the power plants within the capacity range determined in Step 2, and looking projects that have started commercial operation before the start date of the project, it is revealed that there are only 2 power plants operational in the Turkish grid with a capacity ranging between 24.60 and 73.80 MW (See Table:7). Therefore the number of $N_{all}$ is 2.

Common Practice tool Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number Ndiff.

Common Practice tool Sub-step 4a:
When we consider the project listed in Table 8, these projects are different from Dereli HPP in the following aspects:

- İncirli Project was developed in an other province namely Rize, and not on the same river system as the project activity. Similarly, Muratlı project is also on another river although within the borders of the same province and same catchment.
- Muratlı project was developed on an other river and thus the flow regime can be considered different .

However, with a conservative approach we consider these projects to be similar to the project activity and we take $N_{diff}=0$

Conclusion of Common Practice tool Sub- Step 4b is $N_{diff}=0$

Common Practice tool Step 5: 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.

$F=1-N_{diff}/N_{all}$
$F=1-(0/2)$
$F=1-0$
$F=1$

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 1 > 0.2, however
$N_{all}-N_{diff}=2-0=2<3$ in that case the Dereli HPP is not common practice.

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

**Outcome:** The Dereli Hydroelectric Power Plant project is additional for the following main reasons:

1. The Dereli HPP project faces significant investment barriers. As shown by the benchmark analysis it is not the financially most viable option. Furthermore, the financial analysis may prove to be optimistic over time due to the negative effects of climate change.
2. The Dereli HPP project is not common practice.

*Carbon finance is essential to bring the project activity closer to the benchmark values and is essential for the implementation of the project activity by supplying a further stream of revenue, over and above the electricity revenue, to cover the difficulties that the project will face at investment and operation phases. The carbon revenue reduces the risk to the project investor by providing increased revenue to pay back the increased amount of equity required to fund the project costs*

## 2.6 Methodology Deviations

*The UNFCCC methodology of ACM0002 (v16.0.0 ) and its related tools are applied as they are and without any deviation.*

# 3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

## 3.1 Baseline Emissions

Explanation of methodological choices:

Based on the version 16.0.0 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".

The Project therefore applies the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" (*version 04.0.0 (*EB 75, Annex 15*))* as follows:

Step 1 -Identify the relevant electric power system

Turkey, the host country is not participating in the compliance markets, therefore, although it has a focal point to UNFCCC it does not have a structured DNA, a description of the project electricity system and connected electricity systems has not been published. 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 (TEİAŞ) or any other official source has not published the capacity usage figures for the Turkish grid, hence this criterion can not be proved.

Based on 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 TEİAŞ that the Turkish grid is interconnected. There is no independent or regional grid system in any region of Turkey. The map of the Turkish Electricity Grid is as shown in the below figure (Figure 8):

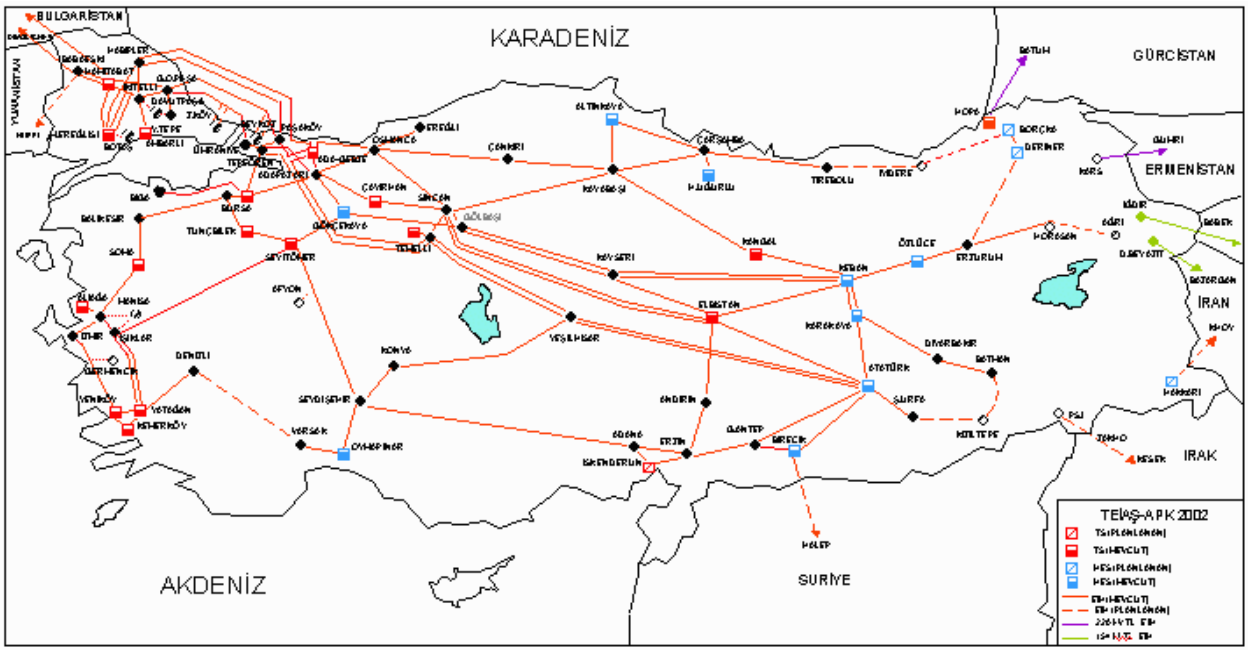



**Figure 6:** The Map showing the boundaries of Turkish Electricity Grid (http://geni.org/globalenergy/library/national_energy_grid/turkey/turkishnationalelectricitygrid.shtml)

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 CO2 emission factor(s) for net electricity imports from a connected electricity system:
>
> 0 tCO2/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 $CO_2$ 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 (optional)

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 a method to determine the operating margin (OM);

According to the "Tool to calculate the emission factor for an electricity system", version 4.0.0 in calculating the Operating Margin grid emission factor for a given year y (EFgrid,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, 2007 – 2011[14]

| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Thermal | 81.02 % | 82.72 % | 80.5 % | 73.78 % | 74.82% |
| Hydro | 18.72 % | 16.77 % | 18.46 % | 24.52 % | 22.81% |
| Wind & Geothermal | 0.26 % | 0.51 % | 0.99 % | 1.70 % | 2.36% |
| Total | 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 (tCO2/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 EFgrid, 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

- *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 2009, 2010 and 2011. 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

[14] Annual Development of Installed Capacity Generation in Turkey (1970-2011)
http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/kgucunkullanim(13-21)/13.xls

The Simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit of net electricity generation ($tCO_2/MWh$) 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 $CO_2$ 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[15],
- Annual heating values for fuels consumed for electricity generation[16],
- Annual electricity generation by fuel type, import and export[17]

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 $CO_2$ emission factor of each power unit, both of which are not publicly available, for the Turkish electricity grid.

$EF_{grid,OMsimple,y}$, 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:

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}\right)}{EG_{y,grid}} \qquad (7)$$

Where:

$EF_{grid,OM\ simple,y}$ = Simple operating margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$)

$FCi_{,y}$ = 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)

$EF_{CO2,i,y}$ = $CO_2$ emission factor of fossil fuel type *i* in year *y* ($tCO_2/GJ$)

$EG_y$ = 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:

[15] Fuel Consumed in thermal P.P.in Turkey by the Electric Utilities (2007-2011) (http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/yakıt46-49/47.xls

[16] Heating Values Of Fuels Consumed In Thermal P.Ps In Turkey By The Electric Utilities (2007-2011), (http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/yakıt46-49/49.xls).

[17] Turkey's Gross Electricity Generation by Primary Energy Resources and The Electric Utilities (2007-2011) / (http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/uretim%20tuketim(22-45)/40(06-11).xls)/ Annual Development of Electricity Generation

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:

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 ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, 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 ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

c) From $SET_{5\text{-units}}$ 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:

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

Where:

$EF_{grid,BM,y}$ = Build margin $CO_2$ 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)

$EF_{EL,m,y}$ = $CO_2$ 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 $CO_2$ 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 $EF_{EL,m,y}$. For this calculation the generation efficiencies are taken from Annex 1 of the Tool.

The $CO_2$ 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 (see 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 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 $CO_2$ 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, 2010 and 2011, 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 -** Calculate the combined margin (CM) emission 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 ($EF_{grid,BM,y}$):

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

Where:

$EF_{grid,BM,y}$ Build margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$)

$EF_{grid,OM,y}$ Operating margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$)

$w_{OM}$ 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**:

BEy = Baseline emissions in year y (tCO2/yr)
EGPJ,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)
EFgrid,CM,y = Combined margin CO2 emissions factor in year y (tCO2/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:

$$ER_y = BE_y - PE_y - L_y$$

Where:

$ER_y$ = Emission reductions in year y (tCO2)
$BE_y$ = Baseline emissions in year y (tCO2)
$PE_{,y}$ = Project Emissions in year y (tCO2)
$L_y$ = Leakage emissions in year y (tCO2)

As methodology states the Ly in case of a hydro power project to be zero hence ERy = BEy - PEy.

## 3.2 Project Emissions

As methodology states the PEy 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 $CH_4$ and $CO_2$ emissions from the reservoir, estimated as follows:"

"...the power density of the project activity (PD) is greater than 4 W/m$^2$ and less than or equal to 10 W/m$^2$:"

As shown by the following calculation, The project has a power density of 12,634 W/m$^2$, this is greater than 10 W/m$^2$,

| Project Activity | Installed Capacity | / | Reservoir Area[18] | = | Power Density |
|---|---|---|---|---|---|
| Dereli HEPP | 49,200,000 W | / | 3,894 m$^2$ | = | 12,634 W/m$^2$ |

therefore:

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

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs ($tCO_{2e}$/yr)

There may be one diesel generator installed within the project boundary. This is only going to be utilized as a back-up or emergency generator, therefore, the emissions from this back up generator have been deemed negligible as per the ACM0002 (version 16.0.0) methodology.

## 3.3 Leakage

There are no leakage emissions related to project activity

## 3.4 Net GHG Emission Reductions and Removals

As also explained above, for the computation 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, belongs to the years 2009, 2010 and 2011. 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 10).

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/kton as follows:

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

| Fuel Type | NCV (TJ/KT) | | |
|---|---|---|---|
| | 2009 | 2010 | 2011 |
| Hard Coal+ Imported Coal | 22.21 | 22.32 | 22.79 |
| Lignite | 6.43 | 7.13 | 7.30 |
| Fuel Oil | 39.81 | 40.23 | 41.58 |
| Diesel Oil | 42.37 | 33.09 | 43.15 |
| LPG | 46.47 | 0.00[13] | 0 |
| Naphtha | 43.65 | 33.50 | 0 |
| Natural Gas | 43.65 | 33.50 | 37.10 |

The emission factors of fuels required are taken from IPCC 2006 guidelines for GHG inventories[19]. All data used for the calculations can be found in Annex-2. (See Table 1 and Table 2 to in Annex-2). Table 11 shows total $CO_2$ emission by fuel types calculated using lower IPCC emission factors and available data from the TEİAŞ website.

[19] 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

Table 10: Calculation of emission by electricity generation (2009-2011)

| | Default $CO_2$ Emissions ($tCO_2$ | | |
|---|---|---|---|
| | 2009 | 2010 | 2011 |
| Hard Coal+Imported Coal | 13,649,138.82 | 15,365,199.79 | 22,366,901.55 |
| Lignite | 37,164,240.90 | 36,745,389.26 | 40,801,815.79 |
| Fuel Oil | 4,792,096.57 | 2,708,730.18 | 52,086,506.72 |
| Diesel Oil | 556,318.57 | 63,674.50 | 1,604,878.16 |
| Lpg | 317.74 | 0.00 | 39,996.20 |
| Naphta | 24,429.94 | 30,502.68 | 0.00 |
| Natural Gas | 42,346,272.06 | 44,215,362.69 | 0.00 |
| TOTAL | 98,532,496.86 | 99,128,859.11 | 110,822,747.76 |

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 12.

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

| | **2009** | **2010** | **2011** |
|---|---|---|---|
| **Unit:** | | **GWh** | |
| **Net Generation** | 186,619.30 | 203,046.10 | 217,557.70 |
| **Gross Generation** | 194,812.90 | 211,207.70 | 229,395.10 |
| **Net/Gross Ratio** | 0.9579412 | 0.9613575 | 0.9483973 |
| **Net Thermal Generation** | 150,323.43 | 149,806.03 | 162,781.31 |
| **Electricity Imports** | 812.00 | 734.26 | 4,555.80 |
| **EGy (GWh)** | 151,135.43 | 150,949.83 | 167,337.11 |
| **EGy (MWh)** | 151,135,428.72 | 150,949,827.21 | 167,337,105.18 |

The OM Emission Factor for the years 2009, 2010 and 2011 are calculated by dividing the total $CO_2$ emissions for those years (Table10) 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 |
|---|---|
| 2009 | 0.65195 |
| 2010 | 0.65670 |
| 2011 | 0.66227 |

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

$$EF_{grid,OMsimple} = 0.65716$$

Build margin

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 ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, 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 ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

c) From $SET_{5\text{-units}}$ 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.

Since TEIAŞ didn't announce the commissioning dates of the power plants added to the grid in 2011, it is not possible to identify the amount of electricity produced by the newly added 5 units or the $SET_{5\text{-units}}$ .

The net electricity generation in year 2011 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 TEIAŞ web site (www.teias.gov.tr) , the net generation in year 2011 was 217,557.7GWh (See Table 12, in 2011, out of this amount 9,646.71 GWh was identified[20] to be produced by projects that claimed VERs, excluding this number from the net generation we end up with 207,910.99 GWh of electricity which is our $AEG_{TOTAL}$ and 20% of that amount is calculated as 41,582.198 GWh.

As we are unable to determine the $AEG_{SET\text{-}5\text{-}units}$ and the entire added capacity in year 2011 was 15,454.53 GWh, a number which is less than 20% of $AEG_{TOTAL}$, it is therefore obvious that 20% of $AEG_{TOTAL}$, is higher than $AEG_{SET\text{-}5\text{-}units}$.

Therefore the 20% of $AEG_{TOTAL}$ with a value of 41,582.198 GWh is to be compared to the capacity additions in the recent years, and used as $AEG_{SAMPLE}$ to calculate Build Margin Emission Factor.

Summing up the electricity generations of all the plants added to the Turkish National Grid in 2010 and 2011, but excluding the projects that claimed VERs, the total generation in this two years sums up to 41,710.56 GWh.

The total generation by the power plants added in year 2011 is 15,454.53 GWh. This number is still smaller than the $AEG_{SET\ 20\%}$ value of 41,582198 GWh. Therefore, to reach the $AEG_{SE}$ 20% all the units added in year 2010 are also added. As a result, the $AEG_{SET\ Sample}$ value we

[20] A list of units providing electricty to the year 2011 Turkish Electricity Grid is provided as an Annex 1 to the most recent Capacity Projection report published by TEIAS (http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2012.pdf). We have checked and identified the units 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

are using in our BM calculation is 47,710.56 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 2011, and 2010 are available as Annex-2 to the capacity projection reports published in the TEIAS web page. Although the annual generation capacity data for each plant is not available on the statistics page of TEİAŞ. The data for the years 2011[21] and 2010[22] 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 can 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 3.0.0) (EB 70, Annex 22) is utilised, in a very conservative manner, considering that we are unable to differentiate the units 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 14):

[21] TEİAŞ Capacity Projection Report 20010-2019
(http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202010.pdf)

Table 13: Default Electric efficiency rates taken from Annex 1 of the Methodological Tool to calculate the emission factor for an electricity system (Version 4.0.0) (EB 75, Annex 15).

| 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 calculation of $EF_{EL,m,y}$ is shown in Table 14 below:

Table 14: Calculation of $EF_{EL}$ using default generation efficiencies based on the default values provided in Annex 1 of the Methodological Tool to calculate the emission factor for an electricity system (Version 04.0.0) (EB 75 Report Annex 15)

| Fuel Type | EF ($tCO_2/TJ$) | (EF*3.6) | Generation Efficiency % | $EF_{EL,m,y}$ $tCO_2/MWh$ |
|---|---|---|---|---|
| **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 $CO_2$ 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 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 $CO_2$ Emissions of the subject year by the total generation from the capacity additions of the same year.

Table 15 Annual $CO_2$ Emissions for Capacity Additions and Annual BM Emission Factors

| | Capacity Additions in 2010 (GWh) | $CO_2$ Emissions | $EF_{grid,BM,2010}$ |
|---|---|---|---|
| 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 | |
| **TOTAL** | **26,256.04** | **12,418.28** | **0.47297** |
| | Capacity Additions in 2011 (GWh) | $CO_2$ Emissions | $EF_{grid,BM,2011}$ |
| Fuel Oil | 922.67 | 545.18 | |
| Coal | 4.32 | 2.89 | |
| Lignite | 180.78 | 98.05 | |
| Naphtha | - | 0.00 | |
| Natural Gas | 12,301.75 | 4,007.91 | |
| Renewables and Wastes | 2,045.00 | 0.00 | |
| **TOTAL** | **15,454.53** | **4,654.02** | **0.30114** |

The Build Margin Emission Factor of the grid is then calculated as a generation weighted average for the years 2010 and 2011. The resulting BM Grid is:

$$EF_{grid,BM} = 0.40930\ tCO_{2e}/MWh$$

Combined margin emission 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.

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

$EF_y = 0.50 * 0.65716 + 0.50 * 0.40930 = 0.53323\ tCO_{2e}/MWh$

$ER_y = BE_y = EG_{facility,y} * EF_y$

$= 157{,}500\ MWh * 0.53523 tCO_{2e}/MWh = 83{,}983\ tCO_{2e}$

A summary of the GHG removals by the project activity is given below in Table 16, as follows:

Table 16: Summary of GHG reductions by the project activity

| Years | Estimated baseline emissions or removals($tCO_2$) | Estimated project emissions or removals ($tCO_{2e}$) | Estimated leakage emissions ($tCO_{2e}$) | Estimated net GHG emission reductions or removals ($tCO_{2e}$) |
|---|---|---|---|---|
| 2014 (10 January to 31 Dec.) | 81,682 | 0 | 0 | 81,682 |
| 2015 | 83,983 | 0 | 0 | 83,983 |
| 2016 | 83,983 | 0 | 0 | 83,983 |
| 2017 | 83,983 | 0 | 0 | 83,983 |
| 2018 | 83,983 | 0 | 0 | 83,983 |
| 2019 | 83,983 | 0 | 0 | 83,983 |
| 2020 | 83,983 | 0 | 0 | 83,983 |
| 2021 | 83,983 | 0 | 0 | 83,983 |
| 2022 | 83,983 | 0 | 0 | 83,983 |
| 2023 | 83,983 | 0 | 0 | 83,983 |
| 2024 (1 Jan - 09 Jan) | 2,301 | 0 | 0 | 2,301 |
| **Total** | 839,830 | 0 | 0 | 839,830 |

# 4 MONITORING

## 4.1 Data and Parameters Available at Validation

Following are the data that was available at the time of 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, 2011, 2012, 2013. |
| Source of data | Official publications at the Turkish Electricity Transmission Company (TEIAŞ) Web Site (http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2013/yakıt48-53/49.xls) |
| Value applied: | - |
| Justification of choice of data or description of measurement methods and procedures applied | 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 |
| Purpose of Data | Please see Annex 2-Table-1 |
| Comments | - |
| | 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. |
| | 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 2010, 2011 and 2012 |
| 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 (http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2013/yakıt48-53/49.xls http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2013/yakıt48-53/51.xls) |
| 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 |
| 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 Unit / Parameter | $EF_{CO2,i,y}$ |
| Data unit | $tCO_2/GJ$ |
| Description | $CO_2$ 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 |
| 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 2, 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. |
| Purpose of Data | Data used both for the calculation of $EF_{grid,OM,Simple,y}$ and $EF_{EL,m,y}$ |
| Comments | |

| | |
|---|---|
| Data Unit / Parameter | $EG_y$ |
| Data unit | MWh |
| Description | 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 http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/uretim%20tuketim(22-45)/33(84-11).xls |
| 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. |
| Purpose of Data | Data used for the calculation of $EF_{grid,OM,Simple,y}$ |
| Comments | |

| | |
|---|---|
| Data Unit / Parameter | $EG_{m,y}$ |
| Data unit | MWh |
| Description | Net quantity of electricity generated and delivered to the grid by power unit m in year y |
| Source of data | Turkish Electricity Transmission Company Web |

| | |
|---|---|
| | Site (www.teias.gov.tr). Data is extracted from the relevant annexes of the capacity projection reports for the years 2011[23] and 2012[24]. |
| Value applied | Please see Annex 2-Table 8 |
| 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. |
| Purpose of Data | Data used for the calculation of $EF_{grid,BM,y}$ |
| Comments | |

| | |
|---|---|
| Data Unit / Parameter | $\eta_{m,y}$ |
| Data unit | - |
| Description | Average net energy conversion efficiency of power unit m in year y |
| Source of data | The default values provided at the annex 1 of the "Tool to calculate emission factor for an electricity sector (version 4.0.0)" are used |
| Value applied | Please see Annex 2 |
| Justification of choice of data or description of measurement methods and procedures applied | According to the "tool to calculate emission factor for an electricity system if documented manufacturer's specifications or data from the utility, the dispatch centre or official records are not available then the default values given in annex 1 of the tool shall be used. The first two options are not available for the power plants supplying the Turkish grid, therefore the default values are used. |
| Purpose of Data | Data used for the calculation of $EF_{grid,BM,y}$ |
| Comments | |

## 4.2 Data and Parameters Monitored

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

| | |
|---|---|
| Data Unit / Parameter | $EG_y$ |
| Data unit | MWh |
| Description | Electricity |
| Source of data | Net Amount of Electricity supplied to the "Turkish National Grid" by the proposed project |
| Description of measurement methods and procedures to be applied | *Data will be measured directly from meters and records on TEIAS readings protocol papers.* |
| Frequency of monitoring/recording | *Annually* |
| Value applied | Will be determined at he monitoring stage |
| Monitoring equipment | Data will be monitored continuously by redundant metering devices, which will provide the data for |

[23] http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2011.pdf
[24] http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2012.pdf

| | |
|---|---|
| | the monthly invoicing to TEİAŞ. All meters will be in compliance with the communiqué for Metering Devices to be used in the Electricity Market[25]. |
| QA/QC procedures to be applied | There will be meters that will backup each other. Generated electricity will also be monitored by the operator via the SCADA software for internal monitoring and QA/QC purposes. |
| Purpose of data | Data to be used for the calculation of Baseline Emissions. |
| Calculation method: | Direct Continuous Measurement |
| Comments | The collected data will be kept by Karhes Elektrik Üretim A.Ş. During the crediting period and until two years after the last issuance of VERs for the "Dereli Hydro Electricity Power Plant" project activity for that crediting period. |

| | |
|---|---|
| Data / Parameter: | CapPJ |
| 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 computers with SCADA system and the turbine name plates. |
| 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: | 49,200,000 |
| 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: | $\mathbf{A_{PJ}}$ |
| Data unit: | $m^2$ |
| Description: | Area of the reservoir measured in the surface of the water, after the implementation of the Project Activity, when the reservoir is at its maximum fullness. |
| Measured /Calculated /Default: | Indirectly measured based on the reservoir area map provided in Annex-4 |
| Source of data: | Surface area determined using the lake surface area map provided in Annex-4 of this PD. |
| Description of measurement methods and procedures to be applied: | The reservoir area corresponding to maximum operational level has been determined via the topographic map showing the lake area, presented in Annex-4 |
| Frequency of monitoring/recording: | Once during each monitoring period |

[25] 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

| | |
|---|---|
| Value applied: | 3,894 $m^2$ |
| Monitoring equipment: | - |
| QA/QC procedures to be applied: | Can be checked and compared to satellite imagery available by Google Earth. |
| Calculation method: | N/A |
| Any comment: | - |

## 4.3 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 archiving 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 net electricity supplied 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. In order to make verification of the reservoir area, the reservoir lake can be visited during the verification site visit and be compared to the reservoir area map, presented in Annex-4.

The electricity produced will be sold to TEİAŞ. Therefore, TEİAŞ measures the electricity produced by meters. Those TEIAŞ meters will provide official data which will be 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.

The net electricity produced is calculated by subtracting the total electricity consumed by the hydroelectric power plant, from the gross electricity generation. After obtaining the net electricity production value, the emission reductions will be calculated by multiplying the net electricity with the Combined Margin calculated above.

The monitoring will be conducted by the Verified Emission Reduction (VER) Monitoring Team. The VER Team Members, and their position and duties for the monitoring is outlined in the following table (Table 17):

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

| Position | Responsibility |
|---|---|
| Dereli HPP Manager | Day to day operation of the Dereli 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>Data entry to PMUM system |
| 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 will be performed by using the main metering devices and the auxiliary metering devices for accuracy checks only. Data from metering devices will be recorded by TEİAŞ and will form the basis for the electricity production data. In addition to the readings of the main and auxiliary (back-up) metering devices, generation data of the Dereli 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 (in the case of project activity the project owner has this capacity). The electricity generation data at the Market Financial Reconciliation Centre (MFRC/PMUM) web page will exhibit the net electricity generated less transmission loss, to be able to produce comparable numbers , the figures taken from PMUM web site needs to be multiplied by the transmission loss factor of the grid. This data will be the main QA/QC data for the project activity.

# 5 ENVIRONMENTAL IMPACT

According to the rules and regulations at the time of licence application for electricity production the project was given a certificate of Exemption for the EIA process, by the Giresun Provincial Directorate of Environment and Forestry. Because, at the time of licence application the Hydro Power Plants that had installed capacity lower than 50 MW was considered to be out of scope according to EIA regulation that was active during the period of application. This letter is attached in Annex 3.

Although there was no significant environmental impacts determined, the following is the summary of the impacts and the mitigation actions outlined in the Project Presentation Report submitted to the authorities:

Air Quality: Necessary precautions, such as watering roads, careful loading and unloading and covering the top of loaded trucks by tarpaulin; will be taken in order to minimize the dust formed during excavation.

Water & Wastewater Management: Water for domestic use will be supplied by tankers to the site and wastewater will be collected in septic tanks which will be emptied regularly. The wastewater will be discharged in accordance with Water Pollution Control Regulations.

The waste oil: Any kind of waste oil that may result during construction or operation stages, will be collected in impermeable containers and transferred to recycling centres in accordance with Hazardous Waste Control Regulations and Waste Oil Control Regulations.

Solid Waste: Solid waste will be collected and recyclables will be separated to be sent to recycling centres. The rest will be disposed to the nearest landfill site in coordination with Dereli Municipality.

Biodiversity: The region is defined to include some of species under conservation by international conventions. Necessary precautions will be taken if any seen on the site. Also a fish passage will be constructed to ease up and down stream movements of the fish living in Aksu river.

# 6 STAKEHOLDER COMMENTS

The project owner have organized a local stake holders meeting on 09/04/2006 in the Muhtarship room of the Kuşluhan Sub district which is a close settlement near the project site.

The meeting was announced by announcements placed at the Muhtarship board and several places at the nearby settlements. These announcements were given to the Muhtar on 20/03/2006 and announced the meeting time and place.

The meeting was held in the afternoon at 14:00 and the Muhtar coordinated the meeting. Here is a translation summary of the meeting minutes that is provided to the validating DOE:

Muhtar Ç. Aydoğan: Made an introduction and explained that the meeting was held upon written request sent by the project owner on March 20, 2006, and the purpose of the meeting was to provide information about the project that would be constructed within the borders of their neighbourhood.

Company Representor Mr. Karaduman: Mr. Karaduman explained the characteristics of the project in detail but with a plain language, and explained that 60% of the project area was forestry land, 20 % would be on Private land that was acquired by the project owner in accordance with their owners and 20% of the project land was over the land that would be expropriated. Mr. Karaduman also provided numeric information about how much energy would be produced by the project activity, he then added that the project will be operating without creating any waste, dirt or noise and would be environmentally friendly.

Mr. Saray: asked if there would be any job opportunities and how many people would have a chance to work for the project.

The company HR answered and explained that it was planned to start by employing 50 people than the number would increase towards 200 and taking into account the subcontractors it would increase up to 250 people throughout the course of the construction period.

Mr. H. Aksu asked if there was any agricultural land in the area where reservoir was planned to be constructed. The project owner representors answered and explained that the reservoir would only cover a small area in a narrow part of the valley and there were no agreeable land in that area, except 5 lots of high sloped, rocky lands that have some barns. They have also added that the owners of these barns were informed and their lands were acquired with their consignment.

Based on this explanation Mr. Aksu raised and added that they were very happy about the situation and he expressed his gratitude. On this topic, Mr. Mustafa Yenidede and Mr. Hayati Yenidede who have also sold their lands to support the project, also raised and explained that they were very happy to sell their lands to the project owner, and they have also expressed their gratitude.

In addition to this Muhtar Ç.Aydogan also added that both him and the board of elderly were involved in these land acquisition agreements and they have also witnessed, and the sales were made upon agreed protocols that the landowners were happy with the results.

Mr. Aksu mentioned that the local inhabitants were familiar with this type of constructions and some of them had worked in similar constructions, and asked if the local inhabitants would be considered if the employment opportunities will arise. Mr. Karaduman answered that especially for the security positions and for other suitable positions their intention was to prefer 70% of the employees from the local area.

Mr. Yılmaz Gürses asked if there would be any noise herd from the power house building during the operation stage. The project owner representor explained that there would be no noise from the power house building and all the necessary precautions to eliminate noise would be taken and this would also be checked by the Ministry of Energy representors at the stage of commissioning and approval of the power house.

The Muhtar Mr. Aydoğan asked if there were other citizens who would like to ask questions. Seeing that there were no more questions he thanked the project owners for organizing this meeting and he mentioned that they were informed and happy to have the project in their neighbourhood.

The project representor raised and thanked to the citizens for attending the meeting and thank to the muhtar for moderating the meeting.

Finally The Muhtar Mr. Aydoğan mentioned that as far has he knows al the local citizens were happy to have the project and they had no complaints about the project, that they were supporting it. And he announced the closure of the meeting as of 09/04/2006 at 17:30.

Then the Muhtar, the board of elderly and the representors of the Project owner have signed the written minutes of the meeting. These minutes and the list of the attendees are provided to the validating DOE.

## ANNEX-1 :THE LEGAL FRAMEWORK OF THE HOST COUNTRY

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/TürkiyeElektrikİstatistikleri/istatistik2011/yakıt46-49/47.xls

TÜRKİYE TERMİK SANTRALLARINDA TÜKETİLEN YAKIT MİKTARLARININ ÜRETİCİ KURULUŞLARA DAĞILIMININ YILLAR İTİBARİYLE GELİŞİMİ
(BİRLEŞİK ISI-ELEKTRİK SANTRALLARINDA ISI ÜRETİMİ İÇİN KULLANILAN YAKITLAR DAHİL)
*ANNUAL DEVELOPMENT OF 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) $10^3$ $m^3$

| | | | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| EÜAŞ VE BAĞLI ORTAKLIKLARI *EÜAŞ AND AFFILIATED PARTNERSHIPS OF EÜAŞ* | Taşkömürü | *Hard Coal* | 1,664,859 | 1,563,792 | 1,700,458 |
| | Linyit | *Lignite* | 57,850,129 | 50,123,941 | 54,558,282 |
| | TOPLAM | *TOTAL* | **59,514,988** | **51,687,733** | 56,258,740 |
| | Fuel-Oil *Fuel Oil* | Asıl Yakıt *Main Fuel* | 239,410 | 16,864 | 27,098 |
| | | Yrd. Yakıt *Auxiliary Fuel* | 134,007 | 105,073 | 118,439 |
| | | TOPLAM *TOTAL* | **373,417** | **121,937** | 145,537 |
| | Motorin *Diesel Oil* | Asıl Yakıt *Main Fuel* | 45,364 | 4 | 0 |
| | | Yrd. Yakıt *Auxiliary Fuel* | 72,956 | 18,901 | 13,984 |
| | | TOPLAM *TOTAL* | **118,320** | **18,905** | 13,984 |
| | TOPLAM | *TOTAL* | **491,737** | **140,842** | 159,521 |
| | Doğal Gaz | *Natural Gas* | 5,091,011 | 4,493,275 | 4,173,420 |
| MOBİL SANTRALLAR *MOBILE POWER PLANTS* | Fuel-Oil | *Fuel Oil* | 0 | 0 | 0 |
| | Motorin | *Diesel Oil* | 0 | 0 | 0 |
| | TOPLAM | *TOTAL* | **0** | **0** | 0 |
| OTOPRODÜKTÖRLER ÜRETİM ŞİRKETLERİ İŞLETME HAKKI DEVİR ADÜAŞ* *AUTOPRODUCERS PRODUCTION COMP. TOOR ADÜAŞ* | Taşkömür+İthal kömür | *Hard Coal+Imported Coal* | 4,956,318 | 5,855,911 | 8,873,976 |
| | Linyit | *Lignite* | 5,770,389 | 6,565,451 | 6,949,028 |
| | TOPLAM | *TOTAL* | **10,726,707** | **12,421,362** | 15,823,004 |
| | Fuel-Oil | *Fuel Oil* | 1,220,904 | 769,845 | 386,071 |
| | Motorin | *Diesel Oil* | 62,537 | 1,449 | 1,063 |
| | LPG | *LPG* | 111 | 0 | 0 |
| | Nafta | *Naphta* | 8,077 | 13,140 | 0 |
| | TOPLAM | *TOTAL* | **1,291,629** | **784,434** | 387,134 |
| | Doğal Gaz | *Natural Gas* | 15,887,029 | 17,290,139 | 18,631,167 |
| TÜRKİYE *TURKEY* | Taşkömür+İthal kömür | *Hard Coal+Imported Coal* | 6,621,177 | 7,419,703 | 10,574,434 |
| | Linyit | *Lignite* | 63,620,518 | 56,689,392 | 61,507,310 |
| | TOPLAM | *TOTAL* | **70,241,695** | **64,109,095** | **72,081,744** |
| | Fuel-Oil | *Fuel Oil* | 1,594,321 | 891,782 | 531,608 |
| | Motorin | *Diesel Oil* | 180,857 | 20,354 | 15,047 |
| | LPG | *LPG* | 111 | 0 | 0 |
| | Nafta | *Naphta* | 8,077 | 13,140 | 0 |
| | TOPLAM | *TOTAL* | **1,783,366** | **925,276** | **546,655** |
| | Doğal Gaz | *Natural Gas* | **20,978,040** | **21,783,414** | **22,804,587** |

Not:Ayrıca Otoprodüktör santrallarda 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.*

* ADÜAŞ'ın lisansı Eylül 2008 tarihinde serbest üretim lisansına dönüştürülmüştür.
*ADÜAŞ's license has been turned into the IPP license in September 2008*

Table-2: IPCC Default $CO_2$ Emission Factors

| Fuel Type: | EF (tCO2/TJ) |
|---|---|
| Coal | 92.80 |
| Lignite | 90.90 |
| Fuel Oil | 75.50 |
| Diesel | 72.60 |
| LPG | 61.60 |
| Naphtha | 69.30 |
| Natural Gas | 54.30 |
| Bitumen | 73.00 |

Table 3:
Source: http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/yakıt46-49/49.xls

http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/yakıt46-49/49.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**

| | | | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| **EÜAŞ VE BAĞLI ORTAKLIKLARI** *EÜAŞ AND AFFILIATED PARTNERSHIPS OF EÜAŞ* | **Taşkömürü** | *Hard Coal* | 5,452 | 4,990 | 5,511 |
| | **Linyit** | *Lignite* | 83,356 | 80,967 | 91,352 |
| | **TOPLAM** | *Total* | **88,809** | **85,957** | **96,863** |
| | **Fuel-Oil** *Fuel Oil* | **Asıl Yakıt** *Main Fuel* | 2,301 | 162 | 261 |
| | | **Yrd. Yakıt** *Auxiliary Fuel* | 1,286 | 1,009 | 1,137 |
| | | **TOPLAM** *TOTAL* | **3,587** | **1,171** | **1,398** |
| | **Motorin** *Diesel Oil* | **Asıl Yakıt** *Main Fuel* | 467 | 0 | 0 |
| | | **Yrd. Yakıt** *Auxiliary Fuel* | 751 | 195 | 144 |
| | | **TOPLAM** *TOTAL* | **1,219** | **195** | **144** |
| | **TOPLAM** | *TOTAL* | **4,806** | **1,366** | **1,542** |
| | **Doğal Gaz** | *Natural Gas* | **42,335** | **37,354** | **34,621** |
| | **TOPLAM** | *TOTAL* | **135,949** | **124,676** | **133,026** |
| **MOBİL SANTRALLAR** *MOBIL POWER PLANTS* | **Fuel-Oil** | ***Fuel Oil*** | 0 | 0 | 0 |
| | **Motorin** | ***Diesel Oil*** | | | |
| | **TOPLAM** | ***TOTAL*** | **0** | **0** | **0** |
| **OTOPRODÜKTÖRLER ÜRETİM ŞİRKETLERİ İŞLETME HAKKI DEVİR ADÜAŞ** *AUTOPRODUCERS PRODUCTION COMP. TOOR ADÜAŞ* | **Taşkömür+İthal kömür** | *Hard Coal+Imported Coal* | 29,677 | 34,556 | 52,056 |
| | **Linyit** | *Lignite* | 14,295 | 15,584 | 15,857 |
| | **TOPLAM** | *Total* | **43,973** | **50,141** | **67,914** |
| | **Fuel-Oil** | *Fuel Oil* | 11,573 | 7,398 | 3,882 |
| | **Motorin** | *Diesel Oil* | 612 | 15 | 11 |
| | **Lpg** | *Lpg* | 1 | 0 | 0 |
| | **Nafta** | *Naphta* | 84 | 105 | 0 |
| | **TOPLAM** | *TOTAL* | **12,270** | **7,518** | **3,893** |
| | **Doğal Gaz** | *Natural Gas* | **143,931** | **157,134** | **167,443** |
| | **TOPLAM** | *TOTAL* | **187,904** | **207,275** | **235,357** |
| **TÜRKİYE** *TURKEY* | **Taşkömür+İthal kömür** | *Hard Coal+Imported Coal* | 35,130 | 39,546 | 57,567 |
| | **Linyit** | *Lignite* | 97,652 | 96,551 | 107,210 |
| | **TOPLAM** | *Total* | **132,781** | **136,097** | **164,777** |
| | **Fuel-Oil** | *Fuel Oil* | 15,160 | 8,569 | 5,280 |
| | **Motorin** | *Diesel Oil* | 1,830 | 209 | 155 |
| | **Lpg** | *Lpg* | 1 | 0 | 0 |
| | **Nafta** | *Naphta* | 84 | 105 | 0 |
| | **TOPLAM** | *TOTAL* | **17,076** | **8,884** | **5,435** |
| | **Doğal Gaz** | *Natural Gas* | **186,266** | **194,487** | **202,064** |
| | **TOPLAM** | *TOTAL* | **336,123** | **339,468** | **372,276** |

**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 autoproducers are not included in the table.*

Table 4:
Source: Computation based on Table 3 (in Annex-2) provided above.

**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)*
1cal = 4,1868 Joule

**Birim(Unit): Gjoule**

| | | | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| **EÜAŞ VE BAĞLI ORTAKLIKLARI** *EÜAŞ AND AFFILIATED PARTNERSHIPS OF EÜAŞ* | **Taşkömürü** | *Hard Coal* | 22,828,163 | 20,892,383 | 23,074,208 |
| | **Linyit** | *Lignite* | 348,995,433 | 338,990,622 | 382,472,805 |
| | **TOPLAM** | *Total* | **371,823,595** | **359,883,005** | 405,547,013 |
| | **Fuel-Oil** *Fuel Oil* | **Asıl Yakıt** *Main Fuel* | 9,632,696 | 679,656 | 1,091,289 |
| | | **Yrd. Yakıt** *Auxiliary Fuel* | 5,386,180 | 4,223,229 | 4,760,433 |
| | | **TOPLAM** *TOTAL* | **15,018,876** | **4,902,885** | 5,851,723 |
| | **Motorin** *Diesel Oil* | **Asıl Yakıt** *Main Fuel* | 1,956,278 | 159 | 0 |
| | | **Yrd. Yakıt** *Auxiliary Fuel* | 3,146,162 | 815,082 | 603,737 |
| | | **TOPLAM** *TOTAL* | **5,102,441** | **815,241** | 603,737 |
| | **TOPLAM** | *TOTAL* | **20,121,317** | **5,718,126** | 6,455,459 |
| | **Doğal Gaz** | *Natural Gas* | **177,247,713** | **156,392,061** | 144,950,365 |
| | **TOPLAM** | *TOTAL* | **569,192,626** | **521,993,192** | 556,952,838 |
| **MOBİL SANTRALLAR** *MOBIL POWER PLANTS* | **Fuel-Oil** | ***Fuel Oil*** | 0 | 0 | 0 |
| | **Motorin** | ***Diesel Oil*** | 0 | 0 | 0 |
| | **TOPLAM** | ***TOTAL*** | **0** | **0** | 0 |
| **OTOPRODÜKTÖRLER ÜRETİM ŞİRKETLERİ İŞLETME HAKKI DEVİR ADÜAŞ** *AUTOPRODUCERS PRODUCTION COMP. TOOR ADÜAŞ* | **Taşkömür+İthal kömür** | *Hard Coal+Imported Coal* | 124,253,075 | 144,680,890 | 217,948,438 |
| | **Linyit** | *Lignite* | 59,852,102 | 65,249,084 | 66,392,055 |
| | **TOPLAM** | *Total* | **184,105,177** | **209,929,975** | 284,340,493 |
| | **Fuel-Oil** | *Fuel Oil* | 48,452,601 | 30,974,336 | 16,254,037 |
| | **Motorin** | *Diesel Oil* | 2,560,350 | 61,818 | 45,552 |
| | **Lpg** | *Lpg* | 5,158 | 0 | 0 |
| | **Nafta** | *Naphta* | 352,524 | 440,154 | 0 |
| | **TOPLAM** | *TOTAL* | **51,370,633** | **31,476,308** | 16,299,589 |
| | **Doğal Gaz** | *Natural Gas* | **602,609,967** | **657,887,178** | 701,051,608 |
| | **TOPLAM** | *TOTAL* | **786,715,144** | **867,817,153** | 985,392,101 |
| **TÜRKİYE** *TURKEY* | **Taşkömür+İthal kömür** | *Hard Coal+Imported Coal* | 147,081,237 | 165,573,274 | 241,022,646 |
| | **Linyit** | *Lignite* | 408,847,535 | 404,239,706 | 448,864,860 |
| | **TOPLAM** | *Total* | **555,928,772** | **569,812,980** | **689,887,506** |
| | **Fuel-Oil** | *Fuel Oil* | 63,471,478 | 35,877,221 | 22,105,760 |
| | **Motorin** | *Diesel Oil* | 7,662,790 | 877,059 | 649,289 |
| | **Lpg** | *Lpg* | 5,158 | 0 | 0 |
| | **Nafta** | *Naphta* | 352,524 | 440,154 | 0 |
| | **TOPLAM** | *TOTAL* | **71,491,950** | **37,194,434** | **22,755,049** |
| | **Doğal Gaz** | *Natural Gas* | **779,857,681** | **814,279,239** | **846,001,974** |
| | **TOPLAM** | *TOTAL* | **1,407,278,403** | **1,421,286,653** | **1,558,644,529** |

Table 5:
Source: Computation based on Table 3 (in Annex-2) provided above.

**NET CALORIFIC VALUES OF FUELS CONSUMED IN THE THERMAL POWER PLANTS**

Unit: TJ/KT

| | | | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| **EÜAŞ VE BAĞLI ORTAKLIKLARI** *EÜAŞ AND AFFILIATED PARTNERSHIPS OF EÜAŞ* | **Taşkömürü** | *Hard Coal* | 13.71 | 13.36 | 13.57 |
| | **Linyit** | *Lignite* | 6.03 | 6.76 | 7.01 |
| | **TOPLAM** | *TOTAL* | **6.25** | **6.96** | 7.21 |
| | **Fuel-Oil** *Fuel Oil* | **Asıl Yakıt** *Main Fuel* | 40.24 | 40.30 | 40.27 |
| | | **Yrd. Yakıt** *Auxiliary Fuel* | 40.19 | 40.19 | 40.19 |
| | | **TOPLAM** *TOTAL* | **40.22** | **40.21** | 40.21 |
| | **Motorin** *Diesel Oil* | **Asıl Yakıt** *Main Fuel* | 0.00 | 1.00 | 0.00 |
| | | **Yrd. Yakıt** *Auxiliary Fuel* | 43.12 | 43.12 | 43.17 |
| | | **TOPLAM** *TOTAL* | **43.12** | **43.12** | 43.17 |
| | **TOPLAM** | *TOTAL* | **40.92** | **40.60** | 40.47 |
| | **Doğal Gaz** | *Natural Gas* | 34.82 | 34.81 | 34.73 |
| **MOBİL SANTRALLAR** *MOBILE POWER PLANTS* | **Fuel-Oil** | *Fuel Oil* | 0.00 | 0.00 | 0.00 |
| | **Motorin** | *Diesel Oil* | 0.00 | 0.00 | 0.00 |
| | **TOPLAM** | *TOTAL* | **0.00** | **0.00** | **0.00** |
| **OTOPRODÜKTÖRLER ÜRETİM ŞİRKETLERİ İŞLETME HAKKI DEVİR ADÜAŞ*** *AUTOPRODUCERS PRODUCTION COMP. TOOR ADÜAŞ* | **Taşkömür+İthal kömür** | *Hard Coal+Imported Coal* | 25.07 | 24.71 | 24.56 |
| | **Linyit** | *Lignite* | 10.37 | 9.94 | 9.55 |
| | **TOPLAM** | *TOTAL* | **17.16** | **16.90** | **17.97** |
| | **Fuel-Oil** | *Fuel Oil* | 39.69 | 40.23 | 42.10 |
| | **Motorin** | *Diesel Oil* | 40.94 | 42.66 | 42.85 |
| | **LPG** | *LPG* | 0.00 | 1.00 | 0.00 |
| | **Nafta** | *Naphta* | 43.65 | 33.50 | 0.00 |
| | **TOPLAM** | *TOTAL* | **39.77** | **40.13** | 42.10 |
| | **Doğal Gaz** | *Natural Gas* | 37.93 | 38.05 | 37.63 |
| **TÜRKİYE** *TURKEY* | **Taşkömür+İthal kömür** | *Hard Coal+Imported Coal* | 22.21 | 22.32 | 22.79 |
| | **Linyit** | *Lignite* | 6.43 | 7.13 | 7.30 |
| | **TOPLAM** | *TOTAL* | **7.91** | **8.89** | **9.57** |
| | **Fuel-Oil** | *Fuel Oil* | 39.81 | 40.23 | 41.58 |
| | **Motorin** | *Diesel Oil* | 42.37 | 43.09 | 43.15 |
| | **LPG** | *LPG* | 46.47 | 0.00 | 0.00 |
| | **Nafta** | *Naphta* | 43.65 | 33.50 | 0.00 |
| | **TOPLAM** | *TOTAL* | **40.09** | **40.20** | **41.63** |
| | **Doğal Gaz** | *Natural Gas* | 37.17 | 37.38 | 37.10 |

Table 6:
Source: http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/uretim%20tuketim(22-45)/40(06-11).xls

**TÜRKİYE BRÜT ELEKTRİK ENERJİSİ ÜRETİMİNİN ÜRETİCİ KURULUŞLAR VE BİRİNCİL ENERJİ KAYNAKLARINA DAĞILIMI**
*TURKEY'S GROSS ELECTRICITY GENERATION BY PRIMARY ENERGY RESOURCES AND THE ELECTRIC UTILITIES*

Birim(Unit) : GWh

| ÜRETİM KARAKTERİSTİĞİ / *Generation Characteristics* | | | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| E | TAŞKÖMÜRÜ | *Hard Coal* | 1,851.1 | 1,882.7 | 2,004.2 |
| | LİNYİT | *Lignite* | 22,395.3 | 20,646.7 | 20,588.7 |
| | KÖMÜR TOPLAMI | *Coal Total* | **24,246.4** | **22,529.4** | **22,592.9** |
| Ü | FUEL-OİL | *Fuel Oil* | 974.4 | 62.2 | 103.0 |
| | MOTORİN | *Diesel oil* | 0.2 | 0.0 | 0.0 |
| A | SIVI TOPLAMI | *Liquid Total* | **974.6** | **62.2** | **103.0** |
| | DOĞAL GAZ | *Natural Gas* | **17,225.5** | **15,289.4** | **13,939.9** |
| Ş | TERMİK TOPLAM | *Thermal Total* | **42,446.5** | **37,881.0** | **36,635.9** |
| | HİDROLİK +JEOTERMAL+RÜZGAR TOPLAM | *Hydro+Jeothermal+Wind Total* | **28,338.2** | **41,377.4** | **36,888.2** |
| | TOPLAM | *Total* | **70,784.8** | **79,258.3** | **73,524.1** |
| BAĞLI ORTAKLIKLAR | LİNYİT | *Lignite* | 11,974.5 | 10,524.2 | 13,407.6 |
| *Affiliated partnerships Of EÜAŞ* | DOĞAL GAZ | *Natural Gas* | 6,694.4 | 5,749.9 | 5,419.0 |
| | TERMİK TOPLAM | *Thermal Total* | **18,668.9** | **16,274.1** | **18,826.5** |
| MOBİL SANTRALLAR | FUEL-OİL | *Fuel Oil* | **0.0** | **0.0** | **0.0** |
| *MOBILE P.P.* | MOTORİN | *Diesel oil* | | **0.0** | |
| | TERMİK TOPLAM | *Thermal Total* | **0.0** | **0.0** | **0.0** |
| | TAŞKÖMÜRÜ+İTHAL KÖMÜR | *Hard Coal+Imported Coal* | 14,744.5 | 17,221.6 | 25,343.3 |
| | LİNYİT | *Lignite* | 4,719.6 | 4,771.2 | 4,874.1 |
| | KÖMÜR TOPLAMI | *Coal Total* | **19,464.1** | **21,992.8** | **30,217.4** |
| | FUEL-OİL | *Fuel Oil* | 3,465.4 | 2,081.6 | 797.5 |
| OTOPRODÜKTÖRLER | MOTORİN | *Diesel oil* | 345.6 | 4.3 | 3.1 |
| ÜRETİM ŞRK. | LPG | *LPG* | 0.4 | 0.0 | 0.0 |
| İŞLETME HAKKI DEV. | NAFTA | *Naphtha* | 17.6 | 31.9 | 0.0 |
| | SIVI TOPLAMI | *Liquid Total* | **3,829.0** | **2,117.8** | **800.6** |
| *Autoproducers* | DOĞAL GAZ | *Natural Gas* | **72,174.8** | **77,104.5** | **84,688.7** |
| *Production Comp.* | YENİLENEBİLİR+ATIK | *Renewables and wastes* | **340.1** | **457.0** | **340.1** |
| *TOOR* | TERMİK TOPLAM | *Thermal Total* | **95,808.0** | **101,672.5** | **116,046.8** |
| | HİDROLİK +JEOTERMAL+RÜZGAR TOPLAM | *Hydro+Jeothermal+Wind Total* | **9,551.2** | **14,002.8** | **20,868.6** |
| | TOPLAM | *Total* | **105,359.2** | **115,675.3** | **136,915.4** |
| | TAŞKÖMÜRÜ+İTHAL KÖMÜR | *Hard Coal+Imported Coal* | 16,595.6 | 19,104.3 | 27,347.5 |
| | LİNYİT | *Lignite* | 39,089.5 | 35,942.1 | 38,870.4 |
| | KÖMÜR TOPLAMI | *Coal Total* | **55,685.1** | **55,046.4** | **66,217.9** |
| | FUEL-OİL | *Fuel Oil* | 4,439.8 | 2,143.8 | 900.5 |
| | MOTORİN | *Diesel oil* | 345.8 | 4.3 | 3.1 |
| TÜRKİYE | LPG | *LPG* | 0.4 | 0.0 | 0.0 |
| | NAFTA | *Naphtha* | 17.6 | 31.9 | 0.0 |
| *TURKEY* | SIVI TOPLAMI | *Liquid Total* | **4,803.5** | **2,180.0** | **903.6** |
| | DOĞAL GAZ | *Natural Gas* | **96,094.7** | **98,143.7** | **104,047.6** |
| | YENİLENEBİLİR+ATIK | *Renewables and wastes* | **340.1** | **457.5** | **469.2** |
| | TERMİK TOPLAM | *Thermal Total* | **156,923.4** | **155,827.6** | **171,638.3** |
| | HİDROLİK +JEOTERMAL+RÜZGAR TOPLAM | *Hydro+Jeothermal+Wind Total* | **37,889.5** | **55,380.1** | **57,756.8** |
| | TÜRKİYE TOPLAMI | *TURKEY'S TOTAL* | **194,812.9** | **211,207.7** | **229,395.1** |

Table 7: (Source: http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/uretim%20tuketim(22-45)/33(84-11).xls)

**TÜRKİYE ELEKTRİK ENERJİSİ ÜRETİM - TÜKETİM VE KAYIPLARININ YILLAR İTİBARİYLE GELİŞİMİ**

*ANNUAL DEVELOPMENT OF ELECTRICITY GENERATION- CONSUMPTION AND LOSSES IN TURKEY*

(1984-2011)

Source: http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2011/uretim%20tuketim(22-45)/33(84-11).xls

| YILLAR *YEARS* | BRÜT ÜRETİM *GROSS GEN.* | ARTIŞ % *INCREASE* | İÇ İHTİYAÇ *INTER. CONSUMPTION* | % | NET ÜRETİM *NET GEN.* | İTHALAT *IMPORTS* | ŞEBEKEYE VERİLEN[1] *SUPPLIED TO THE NETWORK* [1] | ŞEBEKE KAYBI / NETWORK LOSSES İLETİM *TRANSMISSION* | % | DAĞITIM *DISTRIBUTION* | | TOPLAM *TOTAL* | % | IRACAT[2] *EXPORTS*[2] | | NET TÜKETİM *NET CONS.* | | ARTIŞ % *INCREASE* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1984** | 30613.5 | 11.9 | 1890.7 | 6.2 | 28722.8 | 2653.0 | 31375.8 | 1577.4 | 5.0 | 2163.2 | | 3740.6 | 11.9 | | | 27635.2 | | 13.0 |
| **1985** | 34218.9 | 11.8 | 2306.8 | 6.7 | 31912.1 | 2142.4 | 34054.5 | 1611.4 | 4.7 | 2734.5 | | 4345.9 | 12.8 | | | 29708.6 | | 7.5 |
| **1986** | 39694.8 | 16.0 | 2815.0 | 7.1 | 36879.8 | 776.6 | 37656.4 | 1344.3 | 3.6 | 4102.4 | | 5446.7 | 14.5 | | | 32209.7 | | 8.4 |
| **1987** | 44352.9 | 11.7 | 2607.7 | 5.9 | 41745.2 | 572.1 | 42317.3 | 1627.4 | 3.8 | 3992.6 | | 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 | | 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 | | 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 | 4893.1 | | 6680.3 | 12.3 | 907 | | 46820.0 | | 8.6 |
| **1991** | 60246.3 | 4.7 | 3655.2 | 6.1 | 56591.1 | 759.4 | 57350.5 | 1437.8 | 2.5 | 6123.4 | | 7561.2 | 13.2 | 506 | | 49282.9 | | 5.3 |
| **1992** | 67342.2 | 11.8 | 4237.3 | 6.3 | 63104.9 | 188.8 | 63293.7 | 1342.9 | 2.1 | 7651.9 | | 8994.8 | 14.2 | 314 | | 53984.7 | | 9.5 |
| **1993** | 73807.5 | 9.6 | 3943.1 | 5.3 | 69864.4 | 212.9 | 70077.3 | 1634.9 | 2.3 | 8616.7 | | 10251.6 | 14.6 | 589 | | 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 | * | 11843.0 | 16.0 | 570 | | 61400.9 | * | 3.7 |
| **1995** | 86247.4 | 10.1 | 4388.8 | 5.1 | 81858.6 | 0 | 81858.6 | * 2034.9 | 2.5 | 11733.9 | * | 13768.8 | 16.8 | 696 | | 67393.9 | * | 9.8 |
| **1996** | 94861.7 | 10.0 | 4777.3 | 5.0 | 90084.4 | 270.1 | 90354.5 | * 2461.7 | 2.7 | 13393.1 | * | 15854.8 | 17.5 | 343 | | 74156.6 | * | 10.0 |
| **1997** | 103295.8 | 8.9 | 5050.2 | 4.9 | 98245.6 | 2492.3 | 100737.9 | * 2935.5 | 2.9 | 15646.4 | * | 18581.9 | 18.4 | ### | | 81885.0 | * | 10.4 |
| **1998** | 111022.4 | 7.5 | 5523.2 | 5.0 | 105499.2 | 3298.5 | 108797.7 | * 3337.1 | 3.1 | 17457.8 | * | 20794.9 | 19.1 | ### | | 87704.6 | * | 7.1 |
| **1999** | 116439.9 | 4.9 | 5738.0 | 4.9 | 110701.9 | 2330.3 | 113032.2 | * 2985.1 | 2.6 | 18559.9 | * | 21545.0 | 19.1 | ### | | 91201.9 | * | 4.0 |
| **2000** | 124921.6 | 7.3 | 6224.0 | 5.0 | 118697.6 | 3791.3 | 122488.9 | 3181.8 | 2.6 | 20574.1 | * | 23755.9 | 19.4 | ### | | 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 | * | 23328.7 ** | 19.3 | ### | | 97070.0 | * | -1.2 |
| **2002** | 129399.5 | 5.4 | 5672.7 | 4.4 | 123726.8 | 3588.2 | 127315.0 | 3440.7 | 2.7 | 20491.2 | * | 23931.9 | 18.8 | ### | | 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 | * | 24052.7 | 17.6 | ### | | 111766.0 | * | 8.6 |
| **2004** | 150698.3 | 7.2 | 5632.6 | 3.7 | 145065.7 | 463.5 | 145529.2 | 3422.8 | 2.4 | 19820.2 | * | 23243.0 | 16.0 | ### | | 121141.9 | * | 8.4 |
| **2005** | 161956.2 | 7.5 | 6487.1 | 4.0 | 155469.1 | 635.9 | 156105.0 | 3695.3 | 2.4 | 20348.7 | * | 24044.0 | 15.4 | ### | | 130262.9 | * | 7.5 |
| **2006** | 176299.8 | 8.9 | 6756.7 | 3.8 | 169543.1 | 573.2 | 170116.3 | 4543.8 | 2.7 | 19245.4 | * | 23789.2 | 14.0 | ### | | 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 | * | 26646.6 | 14.5 | ### | | 155135.2 | * | 7.7 |
| **2008** | 198418.0 | 3.6 | 8656.1 | 4.4 | 189761.9 | 789.4 | 190551.3 | 4388.4 | 2.3 | 23093.1 | * | 27481.5 | 14.4 | ### | | 161947.6 | * | 4.4 |
| **2009** | 194812.9 | -1.8 | 8193.6 | 4.2 | 186619.3 | 812.0 | 187431.3 | 3973.4 | 2.1 | 25018.0 | * | 28991.4 | 15.5 | ### | | 156894.1 | * | -3.1 |
| **2010** | 211207.7 | 8.4 | 8161.6 | 3.9 | 203046.1 | 1143.8 | 204189.9 | 5690.5 | 2.8 | 24531.2 | * | 30221.7 | 14.8 | ### | | 172050.6 | * | 9.7 |
| **2011** | 229395.1 | 8.6 | 11837.4 | 5.2 | 217557.7 | 4555.8 | 222113.5 | 4189.3 | 1.9 | 28180.0 | * | 32369.3 | 14.6 | ### | | 186099.6 | | 8.2 |

**1)Şebekeye Verilen = Net Üretim+İthalat**

**2) İhracat,Sınırda teslim esasına göre yapıldığından,ihracat ile ilgili şebeke kaybı,iletim kaybının içinde yer almaktadır.**

*** Kaynak : Türkiye Elektrik Dağıtım ve Tüketim İstatistikleri ,1994-2010 (2011 Geçici)**

*1)Supplied to the Network = Net Generation+Import*

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

** Source : Electricity Distribution and Consumption Statistics of Turkey ,1994-2010*

Table 8a:
Source: http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2011.pdf

| Unit Name | Capacity (MW) | Project Production Potential (GWh) | Firm Production (GWh) | Type | Fuel | Date of Commissioning |
|---|---|---|---|---|---|---|
| SELİMOĞLU REG. VE HES | 0.00 | 0.00 | 0.00 | Private | Hydro | 7-Jan-10 |
| 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 | Geothermal | 13-Jan-10 |
| ROTOR ELEKTRİK (OSMANİYE RES) | 0.00 | 0.00 | 0.00 | Private | Wind | 14-Jan-10 |
| 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 | Auto producer | 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 |
| ALTINMARKA | 4.60 | 37.02 | 37.02 | Auto producer | Natural Gas | 28-Jan-10 |
| CAN TEKSTİL (Çorlu/TEKİRDAĞ) | 7.83 | 60.25 | 60.25 | Auto producer | 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 Biogas) | 0.00 | 0.00 | 0.00 | Private | Biogas | 1-Feb-10 |
| AKBAŞLAR (İlave) | 1.54 | 1.54 | 12.08 | Auto producer | Natural Gas | 18-Feb-10 |
| ASA ENERJİ (KALE REG.ve HES) | 9,6 | 0.00 | 0.00 | Private | Hydro | 19-Feb-10 |
| 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 |
| KONYA ŞEKER SAN. VE TİC. A.Ş.1 | 6.00 | 36.00 | 36.00 | Auto producer | 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 |
| FLOKSER Tekstil (Çatalça-İstanbul)(Süetser tesisi) | -2.13 | 0.00 | 0.00 | Auto producer | 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 |
| SOMA ENERJİ ÜRETİM (SOMA RES) | 4.50 | 0.00 | 0.00 | Private | Wind | 10-Mar-10 |
| DOĞUBAY ELEKTRİK (SARIMEHMET 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 |
| AKDENİZ ELEKTRİK (MERSİN RES) | 33,0 | 0.00 | 0.00 | Private | Wind | 19-Mar-10 |
| 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 |
| ASMAKİNSAN (BANDIRMA 3 RES) | 4.00 | 0.00 | 0.00 | Private | Wind | 26-Mar-10 |
| ÖZGÜR ELEKTRİK (AZMAK I REG.VE HES) | 5.91 | 0.00 | 0.00 | Private | Hydro | 1-Apr-10 |
| 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 |
| NİSAN E.MEKANİK EN. (BAŞAK REG. HES) | 6.85 | 22.00 | 12.00 | Private | Hydro | 9-Apr-10 |

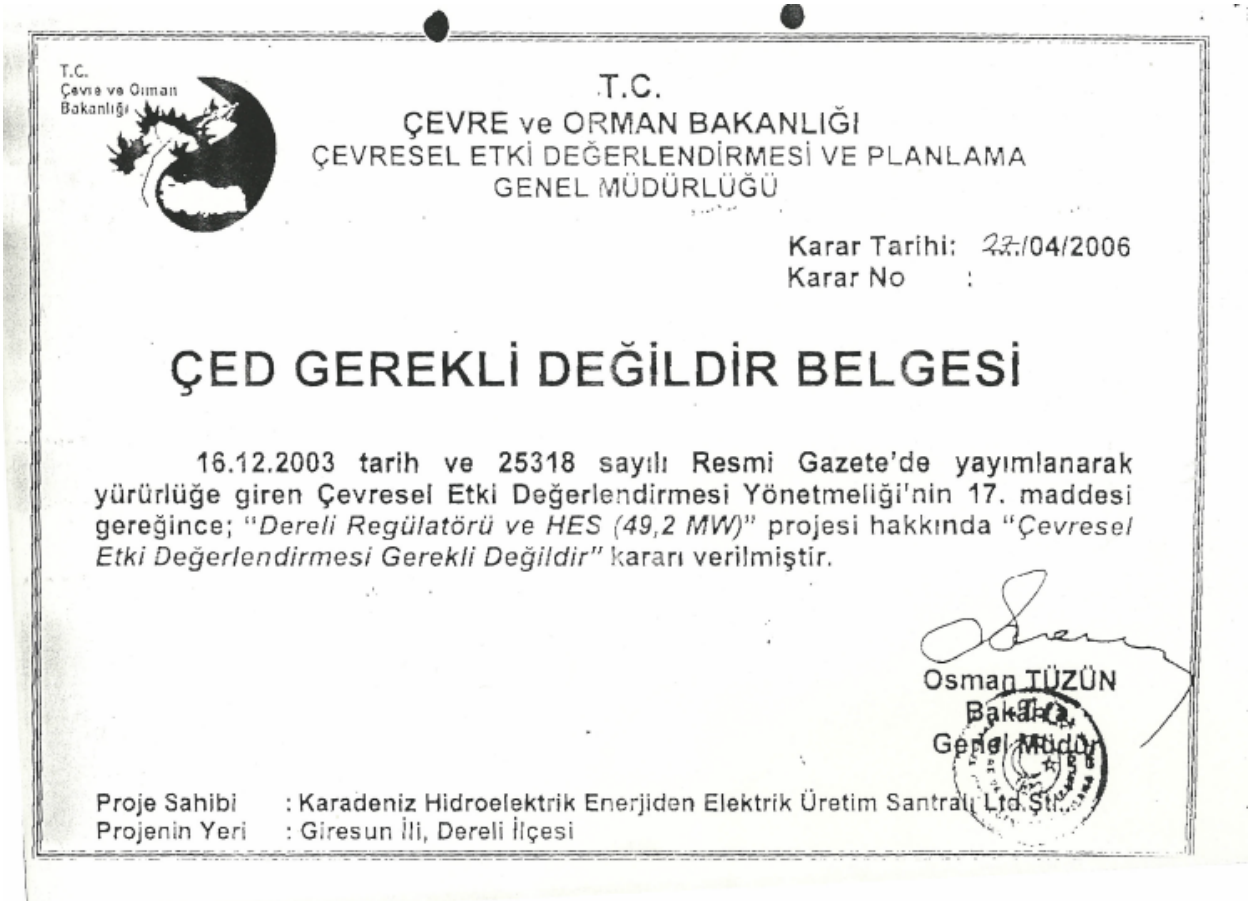
| Unit Name | Capacity (MW) | Project Production Potential (GWh) | Firm Production (GWh) | Type | Fuel | Date of Commissioning |
|---|---|---|---|---|---|---|
| BOREAS ENERJİ (BOREAS I ENEZ RES) | 15,0 | 0.00 | 0.00 | Private | Wind | 9-Apr-10 |
| UZUNÇAYIR HES (Tunceli) (İlave) | 27.33 | 0.00 | 0.00 | Private | Hydro | 11-Apr-10 |
| 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 | Auto producer | Biogas | 21-Apr-10 |
| YILDIZ ENTEGRE AĞAÇ (Kocaeli) | 12.37 | 79.79 | 79.79 | Auto producer | Natural Gas | 22-Apr-10 |
| BAKRAS EN. ELKT.ÜR. A.Ş. ŞENBÜK RES | 15,0 | 0.00 | 0.00 | Private | Wind | 22-Apr-10 |
| ALİZE ENERJİ (KELTEPE RES) | 1.80 | 0.00 | 0.00 | Private | Wind | 28-Apr-10 |
| 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 |
| 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 | Auto producer | Natural Gas | 27-May-10 |
| AKIM ENERJİ (CEVİZLİK REG. VE HES) | 91,4 | 0.00 | 0.00 | Private | Hydro | 28-May-10 |
| CEYHAN HES (OŞKAN HES) (ENOVA EN.) | 23.89 | 0.00 | 0.00 | Private | Hydro | 3-Jun-10 |
| 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 |
| ÇAKIT HES (ÇAKIT ENERJİ A.Ş.) | 20.18 | 0.00 | 0.00 | Private | Hydro | 10-Jun-10 |
| SOMA ENERJİ ÜRETİM (SOMA RES) | 7.20 | 0.00 | 0.00 | Private | Wind | 10-Jun-10 |
| PAŞA REG. VE HES (ÖZGÜR ELEKTRİK) | 8.68 | 0.00 | 0.00 | Private | Hydro | 11-Jun-10 |
| 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 |
| BERGAMA RES EN. ÜR. A.Ş. ALİAĞA RES | 37.50 | 0.00 | 0.00 | Private | Wind | 16-Jun-10 |
| MAZI-3 RES ELEKTRİK (MAZI-3 RES) | 7.50 | 0.00 | 0.00 | Private | Wind | 18-Jun-10 |
| 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 | | | Auto producer | NAFTA | 23-Jun-10 |
| ÇAMLIKAYA REG. VE HES | 5.65 | 19.00 | 11.00 | Private | Hydro | 30-Jun-10 |
| ERİKLİ-AKOCAK REG. ve AKOCAK HES | 41.25 | 0.00 | 0.00 | Private | Hydro | 30-Jun-10 |
| BORASKO ENERJİ (BANDIRMA RES) | 12.00 | 0.00 | 0.00 | Private | Wind | 30-Jun-10 |
| 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 |
| 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 |
| 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 |

| Unit Name | Capacity (MW) | Project Production Potential (GWh) | Firm Production (GWh) | Type | Fuel | Date of Commissioning |
|---|---|---|---|---|---|---|
| YAVUZ REG. VE HES (MASAT ENERJİ) | 22.50 | 0.00 | 0.00 | Private | Hydro | 14-Jul-10 |
| 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 |
| 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 |
| 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 |
| ERİKLİ-AKOCAK REG. ve AKOCAK HES | 41.25 | 0.00 | 0.00 | Private | Hydro | 29-Jul-10 |
| 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 |
| 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 |
| 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 |
| SOMA ENERJİ ÜRETİM (SOMA RES) | 6.30 | 0.00 | 0.00 | Private | Wind | 20-Aug-10 |
| 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 |
| KARŞIYAKA HES (AKUA ENERJİ ÜRET.) | 1.59 | 0.00 | 5.00 | Private | Hydro | 28-Aug-10 |
| ITC ADANA BİOKÜTLE SANT. | 0.00 | 0.00 | 0.00 | Private | LFG | 2-Sep-10 |
| BELEN ELEKTRİK (BELEN RES) (İlave) | 6.00 | 0.00 | 0.00 | Private | Wind | 2-Sep-10 |
| TEKTUĞ ELEKTRİK (ANDIRIN HES) | 40.50 | 106.00 | 60.00 | Private | Hydro | 3-Sep-10 |
| ÜTOPYA ELEKTRİK (DÜZOVA RES) (İlave) | 15.00 | 0.00 | 0.00 | Private | Wind | 3-Sep-10 |
| BERGAMA RES EN. ÜR. A.Ş. ALİAĞA RES | 52.50 | 0.00 | 0.00 | Private | Wind | 4-Sep-10 |
| ROTOR ELEKTRİK (OSMANİYE RES) | 17.50 | 0.00 | 0.00 | Private | Wind | 4-Sep-10 |
| SELEN ELEKTRİK (KEPEZKAYA HES) | 28.00 | 0.00 | 0.00 | Private | Hydro | 6-Sep-10 |
| REŞADİYE 2 HES (TURKON MNG ELEKT.) | 26.14 | 0.00 | 0.00 | Private | Hydro | 17-Sep-10 |
| 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 |
| 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 |
| NARİNKALE 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 |
| ERENKÖY REG. VE HES (TÜRKERLER) | 21.46 | 87.00 | 49.00 | Private | Hydro | 7-Oct-10 |

| Unit Name | Capacity (MW) | Project Production Potential (GWh) | Firm Production (GWh) | Type | Fuel | Date of Commissioning |
|---|---|---|---|---|---|---|
| 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 |
| KAHTA I HES (ERDEMYILDIZ ELEK. ÜRT.) | 7.12 | 0.00 | 0.00 | Private | Hydro | 14-Oct-10 |
| ROTOR ELEKTRİK (GÖKÇEDAĞ RES) (İlave) | 2.50 | 0.00 | 0.00 | Private | Wind | 15-Oct-10 |
| AZMAK-II REG. VE HES (Düzeltme) | -18.07 | 0.00 | 0.00 | Private | Hydro | 25-Oct-10 |
| ITC ADANA BİOKÜTLE SANT. (Düzeltme) | 0.00 | 0.00 | 0.00 | Private | LFG | 25-Oct-10 |
| ENERJİ-SA (BANDIRMA) (Düzeltme) | -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 |
| 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 |
| 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 |
| SOMA RES (BİLGİN Wind SAN.)(İlave) | 30.00 | 0.00 | 0.00 | Private | Wind | 11-Nov-10 |
| ULUABAT KUVVET TÜNELİ VE HES (İlave) | 48.51 | 0.00 | 0.00 | Private | Hydro | 25-Nov-10 |
| MARMARA PAMUKLU MENSUCAT (İlave) | 26.19 | 203.45 | 203.45 | Autoproducer | Natural Gas | 25-Nov-10 |
| FRİTOLAY 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 |
| REŞADİYE 1 HES (TURKON MNG ELEKT.) | 15.68 | 0.00 | 0.00 | Private | Hydro | 26-Nov-10 |
| 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 |
| 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 |
| SARES RES (GARET ENERJİ ÜRETİM) | 15.00 | 0.00 | 0.00 | Private | Wind | 22-Dec-10 |
| FEKE 2 BARAJI VE HES (AKKUR ENERJİ) | 69.34 | 0.00 | 0.00 | Private | Hydro | 24-Dec-10 |
| EGEMEN 1B HES (ENERSİS ELEKTRİK) | 11.10 | 0.00 | 0.00 | Private | Hydro | 28-Dec-10 |
| EREN ENERJİ ELEKTRİK ÜR. A.Ş. (İlave) | 600.00 | 4,005.88 | 4,005.88 | Private | Coal | 29-Dec-10 |

| Unit Name | Capacity (MW) | Project Production Potential (GWh) | Firm Production (GWh) | Type | Fuel | Date of Commissioning |
|---|---|---|---|---|---|---|
| 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 |
| TURGUTTEPE RES (SABAŞ ELEKTRİK ÜR.) | 22.00 | 0.00 | 0.00 | Private | Wind | 30-Dec-10 |
| AK TEKSTİL-1 (G.antep) | -13.04 | 0.00 | 0.00 | Autoproducer | FUEL-OİL | 31-Dec-10 |
| SİLOPİ ELEKTRİK ÜR. A.Ş. (ESENBOĞA) | -44.78 | 0.00 | 0.00 | Private | FUEL-OİL | 31-Dec-10 |
| INTERNATIONAL HOSPITAL İSTANBUL AŞ. | 0.77 | 6.00 | 6.00 | Autoproducer | Natural Gas | 31-Dec-10 |
| TÜPRAŞ RAFİNERİ (İZMİT) (Düzeltme) | -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 :The EIA Exemption Certificate of the Project Activity



T.C.
Çevre ve Orman Bakanlığı

T.C.
ÇEVRE ve ORMAN BAKANLIĞI
ÇEVRESEL ETKİ DEĞERLENDİRMESİ VE PLANLAMA
GENEL MÜDÜRLÜĞÜ

Karar Tarihi: 23/04/2006
Karar No :

# ÇED GEREKLİ DEĞİLDİR BELGESİ

16.12.2003 tarih ve 25318 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği'nin 17. maddesi gereğince; "*Dereli Regülatörü ve HES (49,2 MW)*" projesi hakkında "*Çevresel Etki Değerlendirmesi Gerekli Değildir*" kararı verilmiştir.

Osman TÜZÜN
Bakan a.
Genel Müdür

Proje Sahibi : Karadeniz Hidroelektrik Enerjiden Elektrik Üretim Santralı Ltd. Şti.
Projenin Yeri : Giresun İli, Dereli İlçesi

## ANNEX-4 :The Topographic Map Showing The Reservoir Lake Area