



Voluntary Carbon Standard
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

**Grid-connected electricity generation from
renewable sources:**
DARICA-1 99 MW Hydro Power Plant Project, Turkey

CONTENTS

- A. General description of project activity
- B. Application of a baseline and monitoring methodology.
- C. Duration of the Project activity / crediting period
- D. Environmental impacts
- E. Stakeholders' comments

Annexes

- Annex 1: Contact information on participants in the Project activity
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring plan
- Annex.5: EIA Affirmative Certificate
- Annex 6: VCS 2007 Specific Requirements
- Annex 7: Information in Generation
- Annex 8: Generation Licence

**SECTION A. General description of project activity****A.1. Title of the Project activity:**

Title: DARICA-1 99 MW Hydro Power Plant

Version:04 / 18

Date:18th April 2009**A.2. Description of the Project activity:**

Darica-1 Hydroelectric Power Plant (HPP) is designed by the YAPISAN Elektrik Üretimi Anonim Şirketi (YAPISAN Power Generation Company Incorporated) which is a private company set up by Bilgin Energy Holding. The Power plant will be constructed on the Melet River in the Mesudiye district, Ordu Province, 4 km Northeast of Topçam District, on the tail water downstream of the Topçam Hydroelectric Power Plant.

Darica-1 HPP will be fed by the Karica Diversion Regulator which will divert the water used by Topçam HPP upstream to Darica-1 HPP. The water will be taken from the Karica Regulator to the plant site by means of the transmission tunnel and penstock. The power generated will be transmitted to the switchgear area upstream approximately 1.3 km away by transformers and then will be fed to the national grid. The process flow chart has been given in Figure 1.

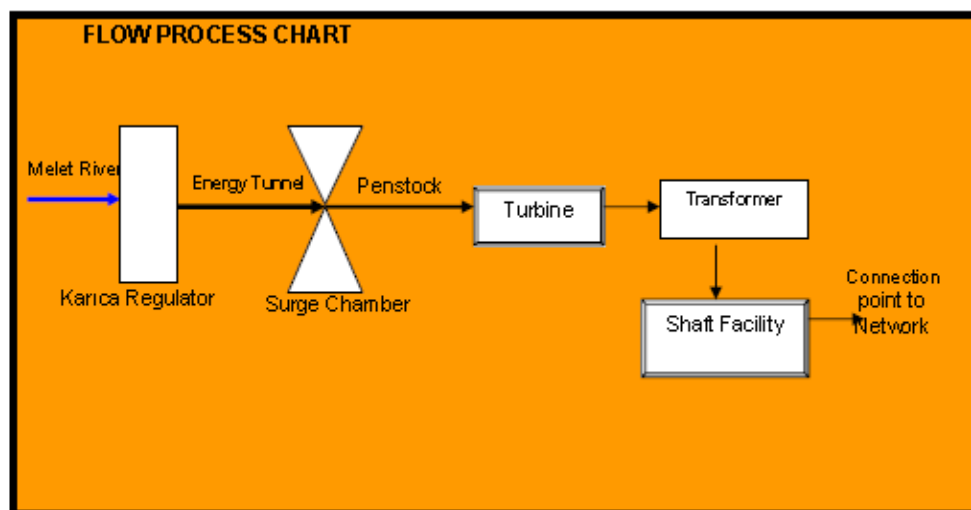


Figure 1. Process flow chart

The Melet River flows in a Northerly direction with a length of 165 kms. The annual mean flow rate, fed by snow and rain water, is 27 m³/sec. The region has steep topography and the altitude of the catchment area extends to 1,469 metres. The river itself falls from 650 meters to 335 meters at the Project site.

The Project will start with the construction of a derivation tunnel of 124 meters long on Western bank of the river in order to dry the construction site where the regulator will be placed. Then, an energy tunnel which will feed the regulator with water and a channel which will allow the stream flow to downstream will be constructed on the Eastern bank. In order allow the construction of the energy tunnel, four access tunnels will be built along its length and will be



closed by concrete when construction is completed. A stabilizer stack will be located inside the energy tunnel and a valve room will be built at the exit. A penstock will carry the water flow to the turbines where electricity is generated and then carried to the switchgear area via transformers. The connection to the grid will be provided by the transmission line to be constructed for Topçam HPP.

The objective of the Project activity is to supply about 99 MW of renewable electricity to the rapidly growing Turkish electricity market. The Project is expected to generate about 327,690 MWh of electricity annually and to reduce 209,722 tonnes of CO₂ emissions per year.

The Darıca-1 HPP project will also help in reducing the poverty in the area and contribute to the sustainable development goals. Regarding the socio-economic development and electricity consumption per capita, Ordu Province, where the Project is located, ranks 62nd and 59th respectively, among 81 provinces of Turkey. Although the population density is high, about 73.55% of the population is employed in agriculture whereas only 4.22% is employed in industry¹. From this point of view, the Project is expected to contribute to the development of the region significantly.

The Project will provide employment opportunities for local people. Unskilled workers will be hired temporarily during the construction phase whereas technicians and other professionals, along with the people for security and auxiliary operations, will be employed permanently during operation. The Turkish Electricity Transmission Company (TEİAŞ) will train those permanent employees for operational purposes in accordance with the local regulations. Then those technicians and professionals will be qualified to be eligible to work with high voltage equipment. YAPISAN prefers to recruit people from the local communities whenever possible to contribute to the local economy and keep logistics to a minimum.

Specific benefits of the Project regarding the sustainable development of the region and country can be summarized as follows:

- Increasing supply of electricity from sustainable resources: The Project will generate electricity from renewable resources and will contribute to greenhouse gas emission reduction. Creating direct and indirect employment opportunities for the local people during construction and operation phases.
- Reducing the demand for new thermal power plants using fossil fuels and the dependency on imported energy sources.
- Ensuring sufficient, reliable and clean energy in order to support social and economic development.
- Encouraging investment in renewable energy sources to meet growing energy demand.
- Providing easier access to villages in the region through newly built roads.

A.3. Project participants:

Name of Party involved (*) (Host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
TURKEY(Host)	JP Morgan Ventures Energy Corporation YAPISAN Elektrik Üretimi Anonim Şirketi	No

¹ State Planning Organisation, Regional Development Index. (<http://www.dpt.gov.tr/bgyu/ipg/karadeniz/orduPER.pdf>)

**A.4. Technical description of the Project activity:****A.4.1. Location of the Project activity:**

The Power Plant will be constructed on Melet River in the Mesudiye District of Ordu Province in the Northern Black Sea region of Turkey. (Figure 2 &3)



Figure 2. Location of project activities



Figure 3. Location of project activities

**A.4.1.1. Host Party(ies):**

The Host country is Republic of TURKEY. She does not have a quantitative reduction target under the Kyoto Protocol. Therefore the Project is eligible for the VER application.

A.4.1.2. Region/State/Province etc.:

The Project will be implemented in the Black Sea region, ORDU Province and Mesudiye District.

A.4.1.3. City/Town/Community etc.:

The Location of the plant will be on Melet River in Mesudiye District and 12 km Northeast of Topçam district.

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

The Turbine House is located at 40° 42' 39 N 35° 51' 10 E.

A.4.2. Category(ies) of project activity:

Energy Industry – Renewable Resources

A.4.3. Technology to be employed by the Project activity:

DARICA-I Hydroelectric Power Plant, which is a run of river type HPP, is planned to be established on the tail water of TOPÇAM HPP, constructed upstream from the Project. The main structures in the Project are the KARICA regulator, a diversion tunnel of 124 m in length between regulator and penstock, power generation turbines, office buildings and switchgear area. The regulator will be built in order to regulate and divert water downstream from TOPÇAM HPP. Through regulator and diversion tunnel, 315 meters of altitude drop will be obtained. Power generated by the turbines will be transmitted to the switchgear area and then connected to the main electricity grid of Turkey. The power plant will consist of 2x 49.5 MW turbines and 2x54 MVA generators.

**A.4.4. Estimated amount of emission reductions over the chosen crediting period:****Table.1.** Estimated amount of emission reductions over the chosen crediting period

Years	Annual estimation of emission reductions (tonnes of CO₂ e)
2009	104,861
2010	209,722
2011	209,722
2012	209,722
2013	209,722
2014	209,722
2015	209,722
2016	209,722
2017	209,722
2018	104,861
Total emission reductions (tonnes of CO₂ e)	2,097,220
Total number of crediting years	10 Years
Annual average over the crediting period of estimated reductions (tonnes of CO ₂ e)	209,722

A.4.5. Public funding of the Project activity:

No public funding is provided for the Project activity during its preparation, construction or implementation phases. There is no agreement to transfer the Project to the government and no agreement for the government to purchase electricity from the Project.

A.4.6. Demonstration to confirm that the Project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction:

The primary purpose of the Project activity is to generate electricity from renewable sources. The Project has no greenhouse gas emissions and therefore is not creating them in order to remove or destroy them.

A.4.7. Demonstration that the Project has not created another form of environmental credit (for example renewable energy certificates).

There is no mechanism in Turkey for this project to create any other form of environmental credit; this project does not produce any other form of environmental credits other than VERs.

A.4.8. Project Rejected under other GHG programs(if applicable):

The Project has not applied to nor been rejected by other GHG programs.

A.4.9. List of commercially sensitive information (if applicable):

Investment cost is commercially sensitive information and therefore is not included in PDD but is made available to the validator during the validation process.

**A.4.10. Ownership****A.4.10.1. Proof of Title**

A copy of licence issued by Energy Market Regulating Authority (EMRA) of Turkey the Project developer has been submitted to the DOE as a proof of title.

A.4.10.2. Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

Since Turkey does not have a quantitative reduction target under the Kyoto Protocol to the United Nations Framework Convention on Climate Change, she can only participate in the voluntary carbon market.

A.4.11. Implementation Schedule

Construction started in April 2007 with the building of ancillary facilities, office buildings etc. Construction of the power generating units started in July 2007. Table 2 shows the milestones of the works. Darica I HPP is planned to be completed by end of May 2009 and will become operational by July 2009. However, commissioning date depends on the completion of the Topçam HPP upstream since the stream flow from that HPP will be diverted to feed Darica I HPP. After the flow regime is regulated and filtering of impurities is completed in Topçam HPP, Darica-1 HPP will be able to operate efficiently.

Table 2. Implementation Schedule for Darica-I HPP

#	DESCRIPTION	COMPLETION DATE
1	DERIVATION TUNNEL	Sep-07
2	SURGE TANK	Jul-08
3	CONSTRUCTION OF CENTRAL BUILDING	Aug-08
4	ENERGY TUNNEL	Sep-08
5	TRANSMISSION LINE & SWITCHGEAR STATION	Sep-08
6	154 kV SWITCHGEAR CONSTRUCTION AND ASSEMBLY	Oct-08
7	REGULATOR	Oct-08
8	PRODUCTION AND ASSEMBLY OF PENSTOCK&MECHANICAL PARTS	Dec-08
9	WATER INTAKE	Dec-08
10	ASSEMBLY OF ELECTROMECHANICAL PARTS	May-09
11	TESTS	May-09

**SECTION B. Application of a baseline and monitoring methodology****B.1. Title and reference of the approved baseline and monitoring methodology applied to the Project activity:**

“Consolidated baseline methodology for grid connected electricity generation from renewable sources (ACM0002 version 7)”

The above methodology is hereafter referred to as the “Baseline Methodology”. The Baseline Methodology will be used in conjunction with the approved monitoring methodology ACM0002 version 7 (“Monitoring Methodology”).

The PDD also draws upon:

- Tool for assessment and demonstration of additionality, ver 5.2
- Tool to calculate the emission factor for an electricity system, ver 01

B.2. Justification of the choice of the methodology and why it is applicable to the Project activity:

The choice of methodology ACM0002, Version 7, is justified as the Project activity meets its applicability criteria:

- The DARICA-1 HPP Project activity is the installation of a 99 MW hydro power plant.
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.

There is a further requirement in the Methodology for Hydro power plants that create new reservoirs that the methodology is applicable:

- “[where] The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m².”

Power Density is calculated as: Capacity of turbine (w) / Area of reservoir surface (m²)

The maximum surface area of the lake created by the regulator will be 0.104 km² (104,000 m²) (see EIA paper page 11 / PDF page 12) and the capacity of the turbine is 99,000,000 watts. Therefore:

$$\text{Power density} = 99,000,000 / 104,000 = 951.9 \text{ W/m}^2$$

The project therefore fulfils the power density criteria and the methodology is applicable.

There is a further requirement that projects with a power density of between 4 and 10 W/m² must take account of the emissions from the reservoir. As the power density of the Project exceeds the threshold, the project does not have to take account of this potential source of emissions.

B.3. Description of the sources and gases included in the Project boundary:

Table 3. Gases included in the Project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity generation in baseline (Turkey Grid)	CO ₂	Yes	Main Emission Source
		CH ₄	No	Minor emission source.
				Excluded for simplification



Project Activity	Emission from the reservoir of the proposed project (inside project boundary)	N ₂ O	No	Minor emission source. Excluded for simplification
		CO ₂	No	Zero-emission electricity generation
		CH ₄	No	Minor emission source since power density is very high. Excluded for simplification
		N ₂ O	No	Zero-emission electricity generation

The Project boundary is limited by the National Electricity Grid of Turkey. The geographical and physical boundaries of the Turkish grid and location of the power plants are clear. All the data about power generation including imported electricity is obtained from TEİAŞ and have been included in the calculations of the combined margin emissions.

**B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

ACM0002, version 7 requires the application of the following tools which have been applied for this project as explained below:

- Tool to calculate the emission factor for an electricity system, ver 01
- Tool for assessment and demonstration of additionality, ver 5.2

The baseline scenario has been identified as: *“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, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”*

The baseline methodology has been applied in a conservative manner in a way that the expected increase in the use of fossil fuels for electricity generation has been ignored although it is well-known that new domestic coal reserves will be utilised in future and are likely to form a higher proportion of the electricity generated in Turkey. Therefore, the basic assumptions are:

- Weight of thermal power plants (and thus the emission factor) will remain same over the crediting period.
- When there is no data about the emission factor of fuels sources, it has been accepted as “0” or the lowest value of IPCC Guidelines for National Greenhouse Gas Inventories has been used.

In addition, the lowest values have been taken into consideration in the Build Margin Emission factor calculations in accordance with the applied methodology. The emission factors for fuels have been taken as the IPCC values at the lower limit of the uncertainty at 95% interval. Net calorific values of the fuels, on the other hand, have been calculated by the country specific data.

The additionality of the Project activity has been demonstrated using the latest version (version 5.2) of the Tool for assessment and demonstration of additionality obtained from the UNFCCC website.

The main gases included in the Project boundary are summarised in Table 3 above while the other key data and parameters used in the calculations are given in Annex 3.

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):**

This section refers to the Tool to for the Demonstration and Assessment of Additionality Version 5.2 and the numbering in this section reflect the Tool's guidelines provided at EB 39.

Step 1. Identification of Alternatives to the Project activity consistent with current laws and regulations**Sub-step 1a. Define alternatives to the Project activity:**

(1) The most realistic and reliable alternatives to the Project activity that provide outputs or services comparable with the proposed project activity are:

- a) Implementation of the proposed project activity undertaken without being registered as a VER project activity
- b) The supply of an equal amount of electricity by the grid by other sources
- c) Continuation of the current situation with no project activity or other alternatives undertaken.

Alternative a) The case set out in this Section B5 demonstrates why the Project proceeding without receiving carbon income is not a credible alternative. In summary:

- *This project faces significant investment barriers which the carbon finance helps to overcome*

These are detailed in Sub-step 3a 1a below

- *The Project faces a significant number of physical barriers being located in a remote and mountainous area which are likely to lead to the escalation of construction costs*

These are detailed Sub-step 3a 1b below.

- *This is the only run of river hydro project over 50MW to be developed by the private sector in Turkey.*

The next largest capacity is Ere-Birkepili with 48.5 MW. This is detailed in Substep 4a below

- *Private Sector investment in hydro is not common practice*

This is detailed in Sub-step 4b below

Alternative b) where electricity is provided by the grid is the most feasible alternative and is identified in Section B.5 as being the baseline scenario. The grid is and will continue to be dominated by fossil fuel based electricity generation as outlined in more detail below.

Alternative c) continuation of the current situation without the Project or other alternatives. This is not a realistic scenario because electricity demand in Turkey is forecast to rise by 7.7% per annum during 2003 to 2020, in line with the growth of the Turkish economy². It is unrealistic to assert that no new capacity will be added to the grid over this period to meet this demand.

² Chapter.5.Projections and Mitigations Scenarios, First National Communication of Turkey on Climate Change, January 2007, (pg. 123) (<http://unfccc.int/resource/docs/natc/turnc1.pdf>)



Outcome of Sub-step 1a: The outcome of Step 1a is that the only realistic alternative to the proposed scenario is that a similar amount of electricity will be added by the grid which is dominated by fossil fuel generating plant. The Project scenario will therefore reduce greenhouse gas emissions and the Project is therefore additional.

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

(2) The alternative scenario in 1(b) in Substep 1(a) above is in compliance with all mandatory applicable and legal and regulatory requirements. New power generation capacity is regulated by Electricity Market Regulation Authority (EMRA) who issues the licenses for electricity generation and is responsible for ensuring that new capacity applies with its rules and regulations.

(3) N/A

(4) The Project activity is not the only alternative, as supply of electricity from the grid is the most likely scenario. The Project is therefore additional.

Outcome of Sub-step 1b: The most realistic and credible scenario (which is that electricity is supplied by the grid which is having new capacity added to it) is in compliance with the necessary laws of Turkey.

Step 2. Investment analysis

As per the "Tool for assessment of additionality", Sub Step 3 is chosen

Step 3: Barrier Analysis

This step is to determine whether the proposed project activity faces barriers that would prevent the implementation of the proposed VER project activity.

Sub-step 3a: Identify barriers that would prevent the implementation of type of the proposed VER project activity

The main barriers that the project has to overcome are Investment Barriers and Technological barriers. We focus on the key ones below.

1 (a) Investment Barriers

This project faces numerous investment barriers:

- Due to the perceived risks of the project, the developer has only been able to raise 64% debt finance for the project. Other renewable energy technologies such as wind are routinely able to raise 85% debt as they are seen as less risky³. Not only does the developer have to raise more equity, his returns on that equity are lower as the gearing is lower – which in turn makes it harder to raise the equity finance proportion. Furthermore, any cost overruns will have to be borne by the equity investors rather than the banks. In working in such challenging terrain (see below) cost overruns are very likely to occur.
- The Project is seen as risky to the banks for two main reasons: risks during Construction and risks during Operation. The former are discussed in Technological Barriers below. In Operation the main risk is perceived

³ Evidence for discussions on financing terms for this and other projects are confidential and provided to the validator on request.

to be insecurity of electricity generation. This fluctuates with the amount of water available. There are two compounding factors which make this less attractive than other power investment opportunities:

- Firstly, as this is a Run of River project the flow is not regulated by a dam. Hydro projects with a dam can regulate their flow to much more of an extent by saving water in wet periods so they can run at a greater capacity in dry periods.
- Secondly, it is predicted that the effects of climate change in the future will have a negative impact on water flow.

The First National Communication on Climate Change Report⁴ for Turkey states that major changes may occur in the stream flow for the river basins in Turkey due to the reduction in snow water equivalent. The reduction is found to be significantly high over the high plains of Eastern Anatolia and the Eastern part of the Black Sea Mountains where the Project is located (Figure 4). The Project relies on such snow melt for its efficient and economic operation.

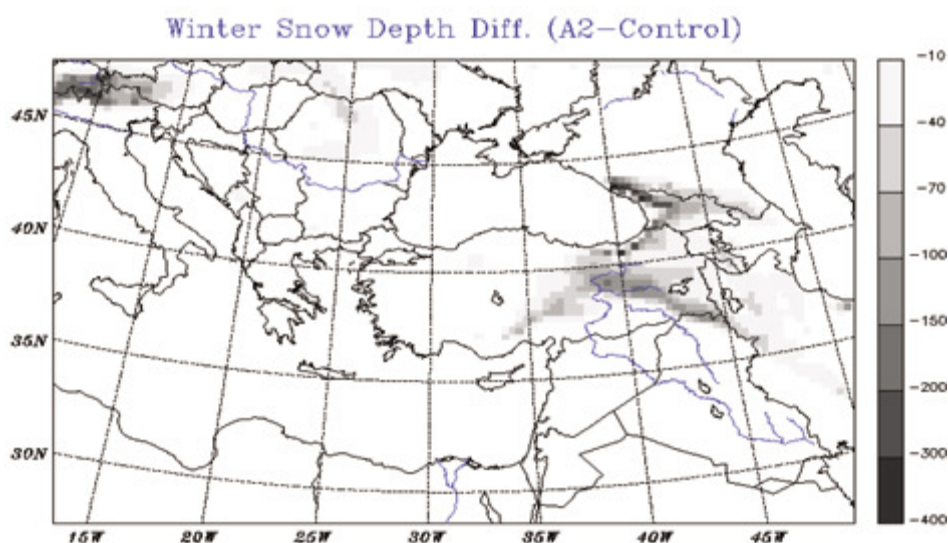


Figure 4. Climate Change Projections for Turkey: Changes in Snow Water Equivalent(in mm)

In case the stream flow for the river basins reduces, this may change River Basin Plans provided by Government. Plan revisions are common activities for river basins and a project that at one time seems to be profitable, can become financially loss making. This is acknowledged in the report about Turkey's hydropower potential published by EIE⁵. The report also underlines that those plans should be revised in accordance with the changes in cost/benefit ratios for alternative energy generation facilities and therefore a hydropower plant may become financially unviable for

⁴ Chapter.5.Projections and Mitigations Scenarios, First National Communication of Turkey on Climate Change, January 2007, (pg. 165) (<http://unfccc.int/resource/docs/natc/turnc1.pdf>)

⁵ Hydroelectricity Power Potential of Turkey, EUAS, http://www.eie.gov.tr/turkce/HESProje/HESProje10_istik.html



operates in future years. Thus the change in water regime is a real and major risk for investors in the Project which has an investment horizon of 50 years.

Table 4 Demonstrates the systematic underperformance of private sector hydro projects in Turkey compared to design.

Table.4. List of commissioned hydro power plants in Turkey owned by the private sector in 2007, their Installed Capacity and Performance relative to Design⁶.

NO	Name of the Plant	Installed Capacity (MW)	Generation Capacity(GWh)		Shortfall (-%) Excess (+%)
			Designed	2007 Actual ⁷	
1	Bereket (Dalaman)	37.5	179	81.8	-54%
2	Bereket (Denizli)	3.7	12	11.2	-7%
3	Bereket (Feslek)	9.5	41	14.1	-66%
4	Bereket (Gökyar)	11.6	43	23.6	-45%
5	Bereket (Mentaş)	39.9	163	72.9	-55%
6	Ekin Enerji(Başaran HES)	0.6	5	0.37	-93%
7	Elta (Dodurga)	4.1	12	6.3	-48%
8	Ere- Aksu-Şahmallar	14	45	16.5	-63%
9	Ere-Birkepili	48.5	171	4.1	-98%
10	Ere-Sugözü-Kızıldüz	15.4	55	21.9	-60%
11	Eşen-II (Göltaş)	43.4	170	78.6	-54%
12	İçtaş Yukarı Mercan	14.2	44	46.0	+5%
13	İskur (Süleymanlı HES)	4.6	18	4.9	-73%
14	Kurteks Karasu Andırın HES	2.4	19	0.9	-95%
15	Molu Enerji (Bahçelik HES)	4.2	30	16.4	-45%
16	Özgür Elek. K. Maraş Tahta HES	12.5	54	14.25	-74%
17	Pamuk (Toroslar)	23.3	112	42.4	-62%
18	Su Enerji (ÇayGören HES)	4.6	19	2.8	-85%
19	Tektuğ- Kalealtı HES	15	52	35.6	-32%
20	Tektuğ- Kebanderesi	5	32	23.1	-28%
21	Tektuğ-Kargılık	23.9	83	46.1	-45%
22	Yapısan Hacılar	13.3	90	68.6	-24%
23	YPM Altıntepe HES	4	18	unknown	N/A

⁶ 10 years Projection of Generation and Installed Capacity for Turkey, 2008-2017, TEİAŞ,

(http://www.epdk.gov.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu2008_2017.pdf)

⁷ Acquired from TEİAŞ (Turkish Electricity Transmission Company)



24	YPM Beypınar HES	3.6	18	unknown	N/A
25	YPM Konak HES	4	19	unknown	N/A

This means that banks believe that cash flow from sales of electricity for private sector hydro projects available to repay debt is likely to be much lower than projected and therefore lend less money – making such projects harder to finance. Reduced electricity revenue also reduces returns.

The main alternative to the project is the construction of fossil fuel power plants. Such plants are more straightforward to commission because the build times are shorter, they start supplying a revenue stream more quickly and in a more predictable manner. They are therefore more attractive than such run of river hydro projects

(b) Technological Barriers

Tunnel: A derivation tunnel with a length of 124 m and an energy tunnel with a length of 8,471 m will be constructed for diversion of water to feed the flow to the plant. The energy tunnel is long and hard to construct due to the geological characteristics of the field. Four extra approaching tunnels will be built for the construction of the energy tunnel which increases the cost in turn. It was estimated that 15% of the excavation work would be done through C Class geological ground which has the highest unit cost per meter cube. However; it is discovered that 60% of the ground was C Class which has added significantly to the technical difficulty of constructing the Tunnel. This has added an extra excavation cost for the project.

Terrain: The terrain is in the form of a plateau which has been formed by the rivers cleaving deeply through the structure. On the hillsides, mass movements such as falling of stone blocks, avalanche, and erosion due to flooding are being observed. The Project site is very steep and surrounding hillsides unstable (Figure 5).

The facilities will be located nearby the river and the construction activities will take place between the altitudes of 650 meters and 335 meters. As most of the structures will be located on that steep valley, a lot of excavation work will be done. However, the geologic structure of the site includes volcanic rocks which will be cut for excavation works. Several extra structures such as transport roads, regulator for stabilizing the water flow and tunnels will be constructed due to the topography; which will increase the cost of the Project. In addition, new roads which will provide access to the Project site will be approximately 8,500 meters long.



Figure.5. The high gradient of the site.



This terrain means that the likelihood of having unforeseen cost overruns during the construction phase is high. Since the project started development, this has turned to reality. One example is that of the height of the regulator. Originally it was planned to 20 m from the base. However, it has been recognised that the structure of the soil is not strong enough to support the regulator body during construction and deeper excavation is required. The height of the regulator from the base has risen to 36.8 m. Overall project construction costs have increased by some 27% compared to the original analysis. The increased revenue to the project from carbon income will go some way to offsetting these and other cost increases.

Outcome of Sub-step 3a: The above analysis shows that the Project faces significant Investment and Technological barriers. The increased revenue from carbon finance helps to overcome these barriers by increasing income, demonstrating that the Project is additional.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

(2) The Barriers analysed above don't prevent the baseline alternative which is *"Provision of equivalent amount of annual power output by the grid where the proposed project is connected"*, from implementation.

Outcome of Sub-step 3b: The barriers identified in 3a above would not prevent the alternatives to the Project occurring as they are not faced by the majority of plant supplying the grid.

Outcome of Sub-step 3: As both Sub-Steps 3a – 3b are satisfied, proceed to Step 4.

Step 4. Common Practice Analysis

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

According to the *Tool for the demonstration and assessment of additionality*, projects are taken to be similar if they are in "the same country . . . are of a broadly similar technology , are of a similar scale . . . and a comparable investment climate."

Turkey has an installed generation capacity of 40,834 MW in 2007 of which 32.8% is hydro, as shown in the blue section in Figure.6. below⁸.

⁸ Annual Report 2007, Electricity Generation Company (EUAS)
(http://www.euas.gov.tr/_EUAS/Images/Birimler/apk/2007_yillikrapor.pdf)

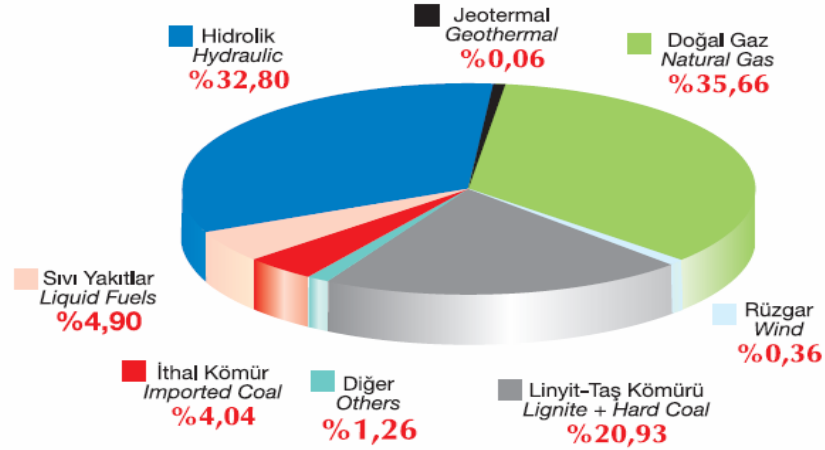


Figure 6. Share of Resources in Turkey's Installed Capacity.

However, there are clear distinctions between the hydro projects that make up this 32.8% and the Darica-I Project:

- Firstly, the government is the predominant investor. The list of current hydro power plants classified with ownership and their capacities can be found in the report, "10 years Projection of Generation and Installed Capacity for Turkey, 2008-2017" by TEİAŞ. The majority of the hydro power capacity is owned and operated by the government, i.e. 84.6% percent of total installed hydro power capacity is still owned by government in 2007⁹. This trend has changed little during the last two decades. The share of the state on installed capacity of hydro power plants has slightly dropped from 94% in 1984 to 84.6% in 2007, whereas the share of thermal power plants has dropped significantly from 77.3% to 45.7% in the same period¹⁰.

By multiplying hydro's share of the total installed electricity capacity in Turkey (32.8%) by the private sector's share of this capacity (15.4%) we can see that just 5% of the country's installed electricity generation capacity is privately held hydro. The annual electricity generated by privately held hydro plants was 668.5 GWh which is only 0.35% of the total generation 191,558 GWh¹¹ in 2007.

Government has very different reasons for investing in electricity generation capacity than the private sector (such as energy security and economic growth) and therefore the two "investment climates" (government and private sector) are not comparable. While there are other hydro projects in private ownership, these only constitute 5% of Turkey's total capacity and so therefore are not common practice

⁹ Annual Development of Turkey's Installed Capacity by the Electric Utilities (1984-2006), <http://www.teias.gov.tr/ist2006/5.xls>

¹⁰ 10 years Projection of Generation and Installed Capacity for Turkey, 2008-2017, TEİAŞ,

(http://www.epdk.gov.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu2008_2017.pdf)

¹¹ TEİAŞ web page <http://www.teias.gov.tr/yukdagitim/YILLIK/kurulus.XLS> -->Tab:Say54 Cell H20
P.S.:(SERBEST ÜRETİM ŞİRKETLERİ meaning Private Generation Companies)



- Secondly, in this 5% of hydro in Turkey under private ownership the maximum capacity of any plant is 48.5MW. The Darica-1 project will have an installed capacity of 99MW, the largest privately owned run of river hydro project in the country by some margin.

So therefore, although the technology of Darica-1 is similar (in that it is hydro), it is not of a similar scale and so is therefore once again different from other activities and is not common practice.

Outcome of Sub-step 4a: Whilst there are other hydro projects in Turkey, the majority of these are owned by the state, which is seen to have materially different motivations for investment and therefore not comparable to the Project. In addition, the Project is twice the size of any other private sector hydro project. For both these reasons, the Project is not Common Practice.

Sub-step 4b. Discuss any similar options that are occurring:

Following the guidelines in *The tool for the demonstration and assessment of additionality*, “similar options” are taken to be investment in electricity generation. In this section we look at:

- **Public vs Private sector investment in electricity generation** (Outcome: private sector is not dominant)
- **Private Sector investment in Thermal and Hydro generation sources** (Outcome: In terms of installed capacity, Private hydro is 9.8% of total Private capacity added in last three years (2004-2007))
- **Private sector energy investment in 2007** (Outcome: Hydro accounted for just 8% of private sector energy development in 2007)

Public vs Private sector investment in electricity generation

Figure 7 shows the split between State Sector and Private Sector cumulative installed capacity in Turkey.

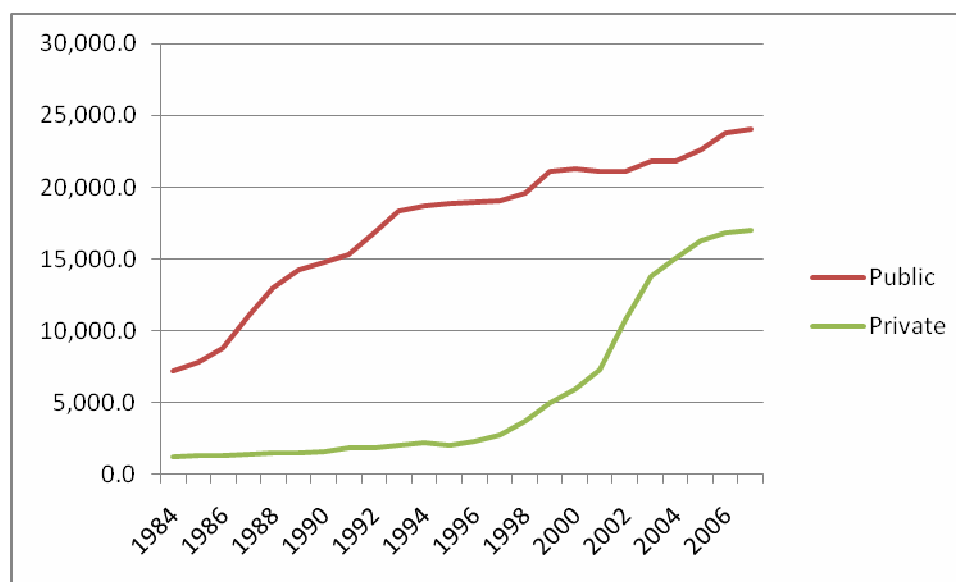


Figure 7. Development of installed capacity by public and private sectors (MW) (1984-2007)

This shows a number of trends:

- Installed Capacity under state control continues to dominate that under the private sector



- There was significant growth in private sector capacity during the period 1998 to 2004. The increase in private investment during this period is mainly due to the implementation of Build and Operate (BO) and Build, Operate and Transfer (BOT) models from the government's policy for privatisation of electricity generation¹². These models provided financial incentives to the private sector:
 - Firstly an Energy Fund was established by the government in order to subsidise the financial difficulties faced by the companies.
 - Secondly, a Guarantee Contract was signed between the Under-secretariat of Treasury and the investment companies on the terms that the electricity will be purchased by Treasury in case the producer could not sell it to any governmental institution.
 - Thirdly, the purchase contracts may be up to 99 years for BOTs and 20 years for BOs¹³.
- Under the new Energy Law in 2001, the investment models were removed and the Energy Fund was ended . Since then, the growth of private sector investment has slowed dramatically, as shown in the Figure above.

It can be seen that growth in private sector investment in the energy sector is slowing, at a time when government incentives have been reduced while government investment continues at a steady rate.

Private Sector investment in Thermal and Hydro generation sources

Now we will turn to the detail of private sector energy investment. Figure 8. below shows the development of the cumulative installed capacity by private sector during the period 1984-2007. 4,160.3 MW of installed capacity has been added during 2004-2007. The private sector has added 1,523.4 MW thermal power and only 410 MW hydropower capacities during that period, reflecting the recent preference for thermal investment¹⁴. Hydro power is therefore in the minority when it comes to private sector investment.

¹² 10 years Projection of Generation and Installed Capacity for Turkey, 2008-2017, TEİAŞ,

(http://www.epdk.gov.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu2008_2017.pdf)

¹³ Türkiye'de Yap İşlet Devret Modeli, Dr. Erol İmre (http://www.ydk.gov.tr/seminerler/turkiyede_yid_modeli.htm)

¹⁴ 10 years Projection of Generation and Installed Capacity for Turkey, 2008-2017, TEİAŞ,

(http://www.epdk.gov.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu2008_2017.pdf)

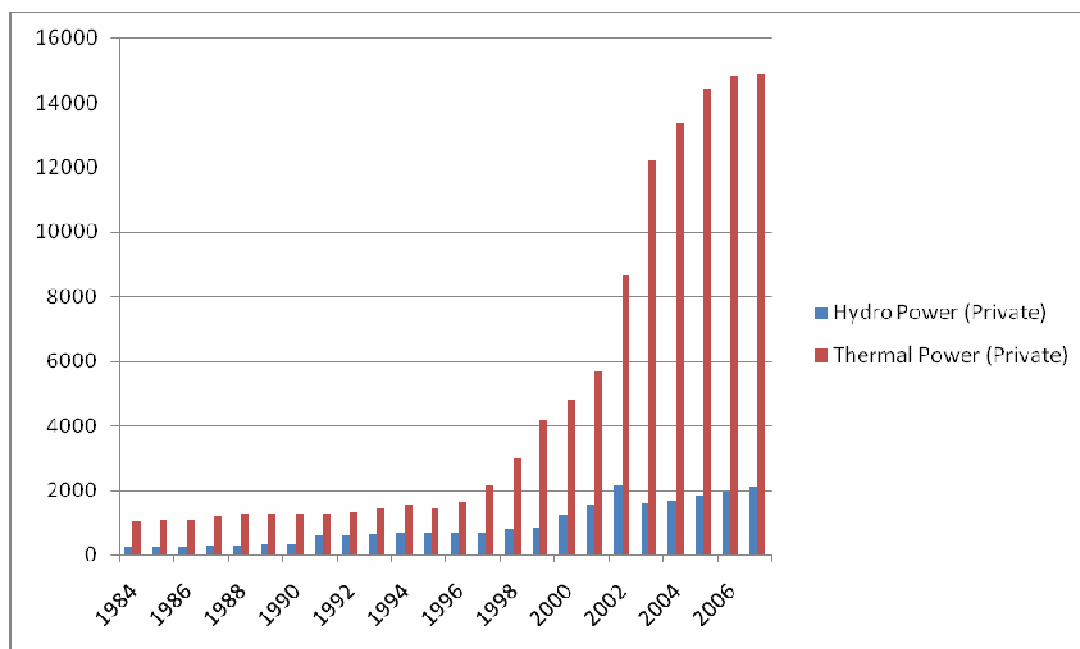


Figure 8. Development of the shares of public and private sector in installed capacity (MW)

Therefore, although there is investment by the private sector in electricity generation, the majority of it is in thermal sources. Private investment in hydro power is therefore not Common Practice.

Private sector energy investment in 2007

Now we will turn to more detailed data on investment in renewable sources for 2007, which is the most recent available:

- The private sector installed a total of 346.4 MW of generation capacity
- 241 MW of this was thermal, a total of 21 plants
- 76.4 MW of this was wind
- Just 29 MW was hydro, accounting for 5 plants which were all small scale¹⁵.

Therefore, within the private sector, it can be seen that hydro investment is in the minority and is not Common Practice.

Outcome of Sub-step 4b: When we compare Similar Options that are occurring, the project is always in the minority:

- Private sector investment in energy is less than public sector and its rate of growth has slowed significantly since the removal of incentives in 2001
- Private sector investment in total hydro capacity is just 9.8% of that in total added capacity in last 3 years.

¹⁵ Speech of the Minister of Energy and Natural Resources, (pg.4), (http://www.enerji.gov.tr/belge/2008_Butce_GK_Konusma.pdf)



- In 2007, private sector hydro development accounted for just 8% of private sector renewable energy investment.

Therefore the Project is not Common Practice.

Outcome of Section B5: This project is additional for two main reasons:

- Firstly it faces significant investment barriers. Banks will lend a much lower proportion of the investment cost than to other renewable energy projects. This is because it is perceived that electricity supply is insecure – as demonstrated in practice in Table 4. Furthermore, this insecurity is likely to increase over time due to the effects of climate change.
- Secondly, this project is not common practice. Only 5% of Turkey's current electricity supply capacity is run of river hydro in private ownership. Private sector investment in hydro is only 9.8% of that in total power added in last three years. Furthermore, the project itself is double the capacity of the next largest such project.

Carbon finance is key to overcoming these barriers to implementation by providing a further stream of revenue, over and above the electricity revenue. This reduces the risk to the project investor by providing increased revenue to pay back the increased amount of equity required to fund the project and increased construction costs. The carbon funds also give the bank greater assurance that the loan can be repaid.

**B.6. Emission reductions:****B.6.1. Explanation of methodological choices:**

According to ACM0002, version 7 requires that the emission factor for the grid system is calculated in accordance with the “Tool to calculate the emission factor for an electricity system”, ver 01. According to the tool, the following four methods may be used to calculate the operating margin:

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

Table 5 shows the share of primary sources in electricity generation for the five most recent years. Hydro and other renewable energy sources are accepted as low cost/must run sources and their share is below 50%, therefore, in accordance with the Tool, (a) Simple OM method will be used in the calculations. Other methods are not applicable due to data constraints.

Table.5. Share of primary sources in electricity generation, 2002 – 2006¹⁶

YEAR	THERMAL		HYDRO		GEOTHERM.WIND		TOTAL
	MW	%	MW	%	MW	%	
2002	19,569	73.8	12,241	26.8	36.4	0.2	31,846
2003	22,974	74.8	12,579	25.1	33.9	0.1	35,587
2004	24,145	69.2	12,645	30.6	33.9	0.2	36,824
2005	25,902	75.4	12,906	24.4	35.1	0.2	38,844
2006	27,420	74.8	13,063	25.1	81.9	0.2	40,565

The following steps explain show the Simple Operating Margin approach provided in the “Tool to calculate the emission factor for an electricity system”, Version 01 has been used to calculate the combined margin emission factor for Turkey.

Step 1. Identify the relevant electric power system

The spatial extent of the Project boundary includes the Project power plants and all power plants that are connected physically to the Turkish national electricity grid system. The total installed capacity of the Turkish electricity grid system has reached to 40,565 MW in 2006 and the total annual generation has become 176,299.8 GWh^{17,18}

Step 2. Select an operating margin method

The Simple Operating Margin (OM) emission factor ($EF_{grid, OMsimple, y}$) is calculated as the generation-weighted average CO₂ emissions per unit of net electricity generation (tCO₂/MWh) of all the generating plants serving the system, not including low-cost/must-run power plants. The electricity generation from solar and low cost biomass a facility are

¹⁶Annual Development of Turkey's Gross Electricity Generation by Share of Primary Energy Resources (1970-2006) (<http://www.teias.gov.tr/ist2006/32.xls>)

¹⁷ Annual Development of Turkey's Installed Capacity (1913-2006), <http://www.teias.gov.tr/ist2006/1.xls>

¹⁸ Annual Development of Installed Capacity and Generation in Turkey (1970-2006) ,<http://www.teias.gov.tr/ist2006/13.xls>



insignificant in Turkey and there is no nuclear plants, therefore the only low cost /must run plants are hydro, wind and geothermal facilities.

The Ex-ante option defined as a 3 year generation-weighted average based on the most recent data available has been selected for data vintage. The step-wise approach provided in ACM0002 to calculate the combined margin emission factor for Turkey is described below.

Step 3. Calculate the operating margin emission factor according to the selected method

According to the “Tool to calculate the emission factor for an electricity system”, Version 01, the following option C equation is preferred and is therefore applied:

$$EF_{\text{grid, OMsimple, y}} = \sum FC_{i,y} \cdot NCV_{i,y} \cdot EF_{\text{CO}_2,i,y} / \sum EG_y \quad (1)$$

Where:

$EF_{\text{grid, OMsimple, y}}$	=	Simple operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the Project electricity 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)
$EF_{\text{CO}_2,i,y}$	=	CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /GJ)
$EG_{m,y}$	=	Net electricity generated and delivered to the grid by power plant / unit m in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the Project electricity system m in year y
y	=	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

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

- Annual fuel consumption by fuel type¹⁹,
- Annual heating values for fuels consumed for electricity generation²⁰,
- Annual electricity generation by fuel type, import and export²¹

Annual heating values for each fuel type are directly related with the fuel consumption and are used to calculate average Net Calorific Values (TJ/kt) (Table.6).

¹⁹ Fuel Consumed in thermal P.P.in Turkey by the Electric Utilities (2000-2005)&(2006) (<http://www.teias.gov.tr/ist2006/42.xls>)& (<http://www.teias.gov.tr/ist2006/43.xls>)

²⁰ Heating Values Of Fuels Consumed In Thermal P.Ps In Turkey By The Electric Utilities (2000-2005) &(2006), (<http://www.teias.gov.tr/ist2006/44.xls>)& (<http://www.teias.gov.tr/ist2006/45.xls>).

²¹ Annual Development of Turkey's Gross Electricity Generation by Primary Energy Resources and The Electric Utilities (2001-2005) & Turkey's Gross Electricity Generation by Primary Energy Resources and The Electric Utilities (2006), ([http://www.teias.gov.tr/ist2006/35\(2001-2005\).xls](http://www.teias.gov.tr/ist2006/35(2001-2005).xls))& ([http://www.teias.gov.tr/ist2006/36\(06\).xls](http://www.teias.gov.tr/ist2006/36(06).xls)).

**Table.6.** Net Calorific Values for each fuel type for Turkey.

Fuel Type	NCV (TJ/kt)
<i>Hard Coal+ Imported Coal</i>	21.87
<i>Lignite</i>	6.82
<i>Fuel Oil</i>	40.12
<i>Diesel Oil</i>	42.64
<i>LPG</i>	45.99
<i>Naphtha</i>	44.10
<i>Natural Gas</i>	37.08

The operating calculation has been based on data from 3 most recent years available: 2004, 2005 and 2006. The coefficients required for calculation of CO₂ emission factor (tCO₂/TJ) have been obtained through IPCC 2006 guidelines for GHG inventories²². Using the available data and ACM0002 methodology, overall CO₂ production by electricity generation is calculated as given in Table 7 and Table 8 below.

Table 7 - Calculation of total emission by electricity generation

	NCV (TJ/kt)	Lower COEF (tCO₂/TJ)	Consumption (2004 - 2006) (tons or 1000m³)	Total Emission (2004 - 2006) (tCO₂)
<i>Hard Coal+ Imported Coal</i>	21.87	94.6	15,441,634	31,947,227.47
<i>Lignite</i>	6.82	90.9	132,679,613	82,242,778.28
<i>Fuel Oil</i>	40.12	75.5	6,155,607	18,645,702.94
<i>Diesel Oil</i>	42.64	72.6	119,084	368,615.23
<i>LPG</i>	45.99	61.6	25,614	72,564.05
<i>Naphtha</i>	44.10	69.3	306,683	937,333.96
<i>Natural Gas</i>	37.08	54.3	46,117,033	92,789,290.64
Total Emissions				227,003,512.57

Net electricity generated and supplied to the grid by thermal plants has been calculated using data obtained from the TEİAŞ web page²³. The ratio between gross and net generation has been calculated first, and assuming that the same ratio is valid for thermal plants; gross generation by thermal power plants has been multiplied by this ratio in order to find net generation by thermal plants. Summing up this with the imported electricity, total supply excluding low cost / must run sources are determined as given in Table.8 below.

²² Table 2.2.Default Emission Factors for Stationary Combustion in the Energy Industries, Vol.2. Energy, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf)

²³ Annual Development of Electricity Generation-Consumption and Losses in Turkey ([http://www.teias.gov.tr/ist2006/30\(84-06\).xls](http://www.teias.gov.tr/ist2006/30(84-06).xls))

**Table.8.** Net Electricity Generation from thermal power plants (units in GWh)

Year	Gross generation	Net generation	Net/Gross (1)	Gross Gen. Thermal (2)	Net Gen Thermal (1x2)	Import	Total Supply to the grid
2004	150,698	145,066	0.963	104,464	100,559	464	101,023
2005	161,956	155,469	0.960	122,242	117,346	636	117,982
2006	176,299	169,543	0.962	131,835	126,783	573	127,356
Total Net Thermal Gen.					344,688	1,673	346,360

Finally, using the data tabulated in the previous two tables, the OM emission factor considering years 2004 - 2006 has been calculated as simply dividing the total CO₂ emission by total electricity supply to the grid which is (from equation (1) above;

$$EF_{\text{grid, OMsimple, y}} = 227,003,512.57 \text{ tCO}_2 / 346,360,200 \text{ MWh} = \mathbf{0.655 \text{ tCO}_2/\text{MWh}}$$

The Operating Margin emission factor calculated above will be constant throughout the 10-year crediting period.

Step 4. Identify the cohort of power units to be included in the build margin (BM)

The Build Margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units *m* during the most recent year *y* for which power generation data is available.

According to the “Tool to calculate the emission factor for an electricity system”, Version 01, the sample group of power units *m* used to calculate the built margin consists of either:

The cohort of power units to be included in calculation of the Build Margin consists of either:

- Set of 5 power plants/units that have been built most recently, or
- Set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The larger annual generation set of power plants shall be used from those options. Therefore; set of power plants that comprise 20% of the system generation and have been recently added to the system is chosen for BM calculations.

The gross electricity generation in year 2006 is taken as reference for determination of plants that comprise 20% of the system generation. The gross generation was 176,299.8 GWh in 2006 and 20% of that amount is calculated as 35,259.96 GWh. Summing up all the plants build in 2006, 2005 and 2004, the total generation is 35,289.8 GWh.

The lists of most recent capacity additions to the grid by year and their average and firm generation capacities are available at the TEİAŞ web page^{24,25,26}. However; for the year 2006, the annual generation capacity data for each

²⁴ Generation Units Put Into Operation and Out of Operation in 2006, (<http://www.teias.gov.tr/ist2006/8.xls>)

²⁵ Generation Units Put Into Operation and Out of Operation in 2005, (<http://www.teias.gov.tr/ist2005/7.xls>)

²⁶ Generation Units Put Into Operation and Out of Operation in 2004, (<http://www.teias.gov.tr/ist2004/7.xls>)

plant is not available. Two datasets are published for the year 2006; which are: (1) Annual generation capacity by fuel type²³ (2) List of plants added in 2006 with their installed capacity²⁷. Comparing two datasets, it is concluded that 1080 MW of installed capacity mentioned in the first dataset belongs to the power plants working with lignite in the second dataset. Therefore; the generation capacity 7,020 GWh out of 11,155 GWh of thermal total has been accepted to be produced by lignite while the rest is assumed to be produced by natural gas.

BM has been calculated ex-ante using the most recent data available. (Option 1)

Step 5. Calculate the build margin emission factor

The Build Margin emission factor $EF_{grid, BM, y}$ is calculated as the generation-weighted average emission factor of a sample of power plants m for a specific year, as follows:

$$EF_{grid, BM, y} = \sum EG_{m,y} \cdot EF_{EL,m,y} / \sum EG_{m,y}$$

Where:

- $EF_{grid, BM, y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)
- $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
- $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)
- m = Power units included in the build margin
- y = Most recent historical year for which power generation data is available

Data for oxidation index and default values for effective CO₂ emission factor have been obtained through IPCC²⁸ guidelines. For the generation efficiencies, the real values of present thermal power plants have been used from Türkiye Çevre Atlası prepared by Ministry of Environment and Forestry²⁹. The average generation efficiencies have been calculated from the published values for existing plants. The rest of the generation efficiencies (for LPG and Naphta) have been obtained from the reference documents for best available techniques of European Integrated Pollution Prevention and Control Bureau (EIPPCB)³⁰ (Table 9). The Build Margin emission factor has been determined for most recent capacity additions using the EF values calculated for each fuel source (Table 10). The emission factor has been taken as “zero” where no data is available.

Table 9 - Calculation of emission factor from most recent plants.

	A	B	C	D
	COEF (tCO ₂ /Tj)	OXID	Generation Efficiency %	EF _{BAT} (tCO ₂ /MWh) (A*B/C*278)
Coal	94.6	1	33.6%	1.014
Lignite	90.9	1	32.8%	0.998
Fuel Oil	75.5	1	35.1%	0.774

²⁷ Türkiye Elektrik Enerjisi 10 yıllık Üretim Kapasite Projeksiyonu, (2007-2016), pg.76-77
(<http://www.teias.gov.tr/projeksiyon/projeksiyon%20Temmuz2007.pdf>)

²⁸ Table 1.4.Default CO₂ emission factors for Combustion, Vol.2. Energy, 2006 IPCC Guidelines for National Greenhouse Gas Inventories,
(http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf)

²⁹ TabloX.3.1. Türkiyedeki termik santrallerin adları, bulunduğu yer ve diğer bilgiler, Türkiye Çevre Atlası, MoEF, Ankara 2004, pg.197,
(http://www.cedgm.gov.tr/dosya/cevreatlasi/atlasin_metni.pdf)

³⁰ EIPPCB, Reference Document on Best Available Techniques for Large Combustion Plants, (<http://eippcb.jrc.es/pages/FActivities.htm>).



Diesel	72.6	1	27.5%	0.949
LPG	61.6	1	45.0%	0.492
Naphtha	69.3	1	45.0%	0.554
Natural Gas	54.3	1	46.0%	0.425

The Build margin emission factor in the last column has been determined by multiplying each EF value with the corresponding electricity generation for that fuel and dividing by the total generation by selecting most recent capacity additions.

Table 10 - Distribution of most recent capacity additions by fuel source.

	G	H	E	EF_w
		(=G/35289.8)		(=G*H)
Fuel Source	Generation (MWh)	Percent Generation	EF	Weighted EF
Coal	1,463	4.1%	1.014	0.04
Lignite	11,480	32.5%	0.999	0.32
Fuel Oil	565	1.6%	0.775	0.01
Diesel oil	6	0.0%	0.949	0.00
LPG	50	0.1%	0.493	0.00
Naphtha	323	0.9%	0.554	0.01
Natural Gas	19,811	56.1%	0.425	0.24
Renewable and wastes	85	0.2%	0.000	0.00
Solid	5	0.0%	0.000	0.00
Total Renewable	1,502	4.3%	0.000	0.00
TOTAL Capacity additions	35,289.8			0.624

Finally, by summing up the weighted EF_{BAT} values, overall build margin emission factor have been calculated as:

$$EF_{\text{grid, BM, y}} = 0.624$$

STEP 6 - Calculate the combined margin emission factor

Based on ACM0002, weighted average baseline emission factor is calculated as follows;

$$EF_{\text{grid, CM, y}} = w_{\text{OM}} * EF_{\text{grid, OMsimple, y}} + w_{\text{BM}} * EF_{\text{grid, BM, y}} \quad (13)$$

Where:

EF_{grid, BM, y} = Build margin CO₂ emission factor in year y (tCO₂/MWh) as calculated from equation (12) above.

EF_{grid, OM, y} = Operating margin CO₂ emission factor in year y (tCO₂/MWh) as calculated from equation (1) above.



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

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

The default values of the weights, w_{OM} and w_{BM} , as recommended by the selected methodology are both equal to 0.5 and. These default values have been used.

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

$$EF_{\text{grid, CM, y}} = 0.5 * 0.655 + 0.5 * 0.624 = 0.640$$

The combined margin emission factor is therefore **0.640 tCO₂/MWh**, which will be used as the baseline factor in calculation of emission reduction by project activity.

B.6.2. Data and parameters that are available at validation:

Since the Project activity involves electricity generation through hydraulic power, the only data to be monitored continuously will be the electricity delivered to the grid by the plant (EG). Other parameters listed below are calculated/used only once for the crediting period.

Data / parameter:	FC_{i,y}
Data unit:	m ³ or tons
Description:	Amount of fossil fuel type i consumed by the Project electricity system
Source of data:	TEİAŞ web page (www.teias.gov.tr)
Measurement procedures (if any):	-
Monitoring frequency:	• <u>Once</u> for each crediting period
QA/QC procedures:	
Any comment:	Data is published by the transmission company (TEİAŞ) annually. It will be used once for the crediting period

Data / parameter:	NCV_{i,y}
Data unit:	Tj/kt
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data:	Calculated for Turkish grid using the TEİAŞ data(www.teias.gov.tr)
Measurement procedures (if any):	-
Monitoring frequency:	• <u>Once</u> for each crediting period



QA/QC procedures:	
Any comment:	Applied in the calculation of the simple OM, where fuel consumption data is available for all power plants.

Data / parameter:	EF_{CO₂, i, y_i}
Data unit:	tCO ₂ /GJ
Description:	CO ₂ emission factor of fossil fuel type i in year y
Source of data:	2006 IPCC Guidelines for National Greenhouse Inventories
Measurement procedures (if any):	-
Monitoring frequency:	• <u>Once</u> for each crediting period
QA/QC procedures:	
Any comment:	Applied in the calculation of the simple OM, where fuel consumption data is available for all power plants.

Data / parameter:	EF_{CO₂, y}
Data unit:	tCO ₂ /t
Description:	CO ₂ emission factor of fossil fuel type i in year y
Source of data:	2006 IPCC Guidelines for National Greenhouse Inventories
Measurement procedures (if any):	-
Monitoring frequency:	• <u>Once</u> for each crediting period
QA/QC procedures:	
Any comment:	Fossil fuel used in Standby generator

B.6.3. Ex-ante calculation of emission reductions:

1. EF_{OM, simple} of Turkey Electricity Grid

Simple OM emission factor of Turkey Grid has been calculated as 0.655 tCO₂e/MWh.

2. EF_{BM} of Turkey Electricity Grid



EFBM of Turkey Grid has been calculated as 0.624 tCO₂e/MWh

3. EF of Turkey Electricity Grid

Based on OM and BM calculations, the baseline combine emission factor = $(0.655+0.624)/2=0.640$ tCO₂e/MWh).

4. Project Emissions

A standby generator is installed on site to be used for the site buildings in the event of a power cut. At the time of writing the PDD, it is not possible to predict how often it will run. Therefore, this potential source of leakage has not been used in the ex-ante calculation. However, the amount of diesel consumed will be monitored and the resultant emissions will be netted off from ER_y.

5. Emission reduction (ER_y) by the proposed project activity

The predicted electricity production per year is taken from a proprietary model supplied by the developer, shown in Annex 7.

For the crediting period of 10 years, annual emission reduction will be:

$$ER = 327,690 \text{ MWh} \times 0.640 \text{ tCO}_2\text{e/MWh} = 209,722 \text{ tCO}_2 \text{ equivalent}$$

Whereas total emission reduction will be **2,097,220 ktCO₂** equivalent

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emission (tCO ₂ e)	Estimation of baseline Emission (tCO ₂ e)	Estimation of leakage (tCO ₂ e)	Estimation of emission reductions (tCO ₂ e)
2009	0	209,722	0	209,722
2010	0	209,722	0	209,722
2011	0	209,722	0	209,722
2012	0	209,722	0	209,722
2013	0	209,722	0	209,722
2014	0	209,722	0	209,722
2015	0	209,722	0	209,722
2016	0	209,722	0	209,722
2017	0	209,722	0	209,722
2018	0	209,722	0	209,722
Total (tCO ₂ e) 10 Years	0	2,097,220	0	2,097,220

B.7. Application of the monitoring methodology and description of the monitoring plan:

Monitoring methodology applied to the Project is ACM0002 version 7, "Approved consolidated baseline and monitoring methodology for grid connected electricity generation from renewable resources"

B.7.1 Data and parameters monitored:



Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net Electricity generated and delivered to the grid by the power plant in year y
Source of data to be used:	Data will be monitored continuously by redundant metering devices, which will provide the data for the monthly invoicing to TEİAŞ. Monthly invoices will be used for cross-check.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Expected electricity generation is 327,690 GWh per year. Value used has been based on feasibility study of the Project.
Description of measurement methods and procedures to be applied:	Data will be monitored continuously by redundant metering devices, which will provide the data for the monthly invoicing to TEİAŞ. Each month, an officer from TEİAŞ and the electrical engineer of the plant will record the reading. The collected data will be kept by YAPISAN A.Ş. During the crediting period and until two years after the last issuance of VERs for the Darıca-1 HPP project activity for that crediting period.
QA/QC procedures to be applied:	There will be two ammeters that will backup each other. Maintenance and calibration of the metering devices will be made by TEİAŞ every two years. If the difference between the readings of two devices exceeds 0.2%, maintenance will be done before waiting for two years
Any comment:	

Data / Parameter:	Fossil Fuel Use
Data unit:	Tonnes
Description:	Diesel used in standby generator
Source of data to be used:	Store requisition orders
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Deliveries are made in litres, using the IPPC default factors, for density the conversion is made to weight and then emissions. The orders are reconciled with deliveries.
QA/QC procedures to be applied:	Plant Manager to check.
Any comment:	It is likely that this will be a minor source of emissions.

B.7.2. Description of the monitoring plan:

The amount of net electricity generated by the plants will be monitored in order to demonstrate the emission reduction. In addition, the fuel consumption by the auxiliary equipment (diesel generator) will also be considered in the calculations. Monthly generation data will already be measured and recorded by both TEİAŞ and the Project Manager. Data will be recorded in an Excel workbook and kept in electronic and paper form, both at the project site and at the Developer's Head Office in Ankara.



The annual emission reduction by the Project will be calculated by multiplying the net electricity generated with combined margin emission factor. The process of verification of the Project will be followed up by JP Morgan Ventures Energy Corporation.

The plant manager will be responsible to maintain credible, transparent, and adequate data estimation, measurement, collection, and tracking systems of the net electricity generation of the plant. Those records and monitoring systems will be provided to the selected DOE to verify project performance as part of the verification and validation process.

The Monitoring Plan is discussed in further detail in Annex 4.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

Date of completion of the baseline study: 20th February 2008

Baseline determined by JP Morgan Ventures Energy Corporation

Contact Person: Z. Pinar Öztürk

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SECTION C. Duration of the Project activity / crediting period

C.1. Duration of the Project activity:

C.1.1. Starting date of the Project activity:

The Start Date of the project is defined by the VCS as when the Project reached Financial Close. This was on the 28th February 2007

C.1.2. Expected operational lifetime of the Project activity:

Expected economical life time of the Project activity is 49 years.

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

Not Used

C.2.1.1. Starting date of the first crediting period:

Not Used

C.2.1.2. Length of the first crediting period:

Not Used

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

1st July 2009 is taken as the start of the Crediting Period, which is the expected date of commissioning.

**C.2.2.2. Length:**

>> 10 Years

SECTION D. Environmental impacts**D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

Based on the EIA report prepared by TOPÇUOĞLU Madencilik San. Ve Tic. Ltd. Sti., environmental impacts of the Project during construction and operation periods have been determined as follows.

The main impact of the Project activity during construction period will be caused by excavation works. Table.11. summarises the excavation works briefly.

Table.11. Excavation works

Places of Excavation	Amount of Excavation (m ³)
Area and Surroundings of Regulator	24,000
Derivation Tunnel, Tunnel of Approach and Transmission	230,000
Valve Chamber	18,500
Penstock	3,500
Diversion Structure	24,000
Plant Building, Switchgear Area	250,000
Total	550,000

The excavated materials are planned to be used in the construction works, after crushing into concrete aggregates and levelling of the uneven surfaces. If necessary, storage areas will be formed that will show integrity with the topography of the site. The vegetal soil layer will be stored separately and will be re-layered and spread back on top of the fillings. The surface of the storage area shall be greened or afforested after the construction works.

The Project will have negative impacts such as dust, noise, solid and liquid wastes, hazardous wastes, excavation wastes, and the traffic load. In order to prevent dust, a spraying system will be used during excavation and construction work. The liquid and solid wastes will be managed and treated according to the relevant Turkish regulations.

The hazardous waste such as waste oil, accumulator, and paint along with gloves and clothes which used during maintenance work will be collected separately and stored in impermeable containers. According to Turkish Regulation on Hazardous Waste Control, this waste shall be sent to licensed waste facilities by means of licensed transportation firms.

The noise caused by construction machinery may cause disturbance to the vicinity of the Project site. However, based on background noise measurements and noise models, it is concluded that there won't be any negative effect on residential areas. Also it was revealed that noise will not be a significant problem since all the machinery and vehicles would not be operating simultaneously. During the construction the workers will be protected against noise levels of the machinery by earplugs. After all the facilities are established and are operating, noise and vibration will be measured and control measures will be applied as implied by the relevant Turkish regulations.



An emergency evacuation plan has been prepared for natural disasters or accidental fires. Necessary systems for detection and control of smoke, earthquake, water level etc will be installed as well.

When the plant is operational the characteristics of the river habitat will change as some of the flora will be covered with water. A lake habitat will start to form upstream; which may lead to different species to appear in the region. However, this will have positive impacts on the environment, such as; providing nesting, hiding and feeding places for birds. On the other hand, considering the habitat downstream, necessary precautions will be taken for the continuity of aquatic life in the river. Adequate downstream flow of water will be provided and fish passage will be constructed in accordance with Law on Fishery Products. Gratings will also be placed at the entrance of ducts and canals.

D.2. If environmental impacts are considered significant by the Project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impacts of the proposed project are not considered to be significant since there is no settlement near the Project site which will be negatively affected by the Project activity. Land use, grazing or agricultural activities will not be affected by the Project activity. Also, in order to keep the aquatic life, a portion of the water will continuously fed through the river bed as defined by the regulations.

The Ministry of Environment and Forest has approved that the Project has no major environmental impact and issued EIA Affirmative Certificate (Annex.5).

SECTION E. Stakeholders' comments

The local stakeholder meeting has been conducted on 19.10.2006 at Derinçay Village.

E.1. Brief description how comments by local stakeholders have been invited and compiled:

The Stakeholder Meeting was announced through newspaper advertisements and notices displayed in the headman's offices in each village in the location. The meeting was held in the context of Environmental Impact Assessment procedures implemented in the country. In addition to notices and advertisements, officers from related local government institutions and ministries and NGOs have been invited to the meeting. 34 people in total attended the stakeholder meeting. All the comments and questions held during the meeting were noted and the attendance register collected.

E.2. Summary of the comments received:

The meeting started with a brief explanation of the Project and followed by questions and comments from the participants. Fatih Cavlı who is the Project manager of Darica I HPP has explained the details about project, schedule and procedure. Questions asked by participants were responded by the manager. Questions and answers raised during the Project were as follows;

Hasan Okutan (Village Head): What is the reason for the revision in project location?

Fatih Cavlı (YAPISAN): Project has been designed by State Hydraulic Affairs as a part of master plan.

However, during feasibility studies, location of project has changed due to topography, geological formation and integration of the Project.



Huriye Yılmaz(Agricultural Engineer): What is the start and finishing dates for the construction?

Fatih Cavlı (YAPISAN): Construction is expected to start in March 2007 and finish in early 2009

Enver Okutan(Villager): What is the location of the tunnel and power plant?

Fatih Cavlı (YAPISAN): Tunnel will be about 100m below the ground, water from Topçam Dam will be diverted to the tunnel thus the potential energy will be converted to kinetic energy.

Enver Okutan(Villager): Will there be any employment opportunities for local people?

Fatih Cavlı (YAPISAN): Local people will have priority in case of any opportunities.

Elif Şahin(Environmental Engineer) :What is type and amount of explosives used in construction?

Fatih Cavlı (YAPISAN): Type of explosives has not been determined yet since we are design phase. The amount and the types will be decided later.

Nuri Can (Villager): How much water will be used from the river?

Fatih Cavlı (YAPISAN): We'll not use all of the water, a minimum amount will continue to flow through river bed for aquatic life.

Arslan Tarakçı (Villager): What is the start point for construction of the tunnel?

Fatih Cavlı (YAPISAN): Tunnel will be excavated through approach tunnels constructed at 4 four points.

Arslan Tarakçı (Villager): Which roads will be used for construction vehicles?

Fatih Cavlı (YAPISAN): Main road will be renovated and used. Also some new roads will be constructed

As seen from the notes above, no significant issue has been raised since there is no house or any other economical activity affected by the in the Project activity.

E.3. Report on how due account was taken of any comments received:

The issues raised and comments received during the meeting do not require any revision in the Project design. Since all the Project area is owned by treasury, no condemnation will be required for project implementation. YAPISAN Company has also indicated that roads in the region will be renovated and local people will have priority in recruiting during all project phases.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

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Annex 2
Information Regarding Public Funding

No Public funding has been used in the development of this Project.



Annex 3
BASELINE INFORMATION

Data Used in calculation of OM for Turkish Electricity Grid

Table.1. Heating Values of Fuels Consumed in Thermal Power Plants in Turkey by the Electric Utilities (Tcal)³¹

Years	2004	2005	2006
<i>Hard Coal</i>	4,790	5,551	29,504
<i>Imported Coal</i>	19,728	20,984	
<i>Lignite</i>	61,018	68,513	83,932
Total	85,536	95,048	113,436
<i>Fuel Oil</i>	22,926	19,263	16,769
<i>Diesel Oil</i>	295	291	627
<i>Lpg</i>	139	142	0
<i>Naphta</i>	2,197	895	141
TOTAL	25,557	20,591	17,537
<i>Natural Gas</i>	117,464	140,350	150,588
TOTAL	228,557	255,989	281,561

Table.2. Fuel Consumed in Thermal Power Plants in Turkey by the Electric Utilities (Tcal)³²

Years	2004	2005	2006
<i>Hard Coal</i>	1,327,603	1,702,228	5,617,863
<i>Imported Coal</i>	3,237,110	3,556,830	
<i>Lignite</i>	33,776,660	48,319,143	50,583,810
TOTAL	38,341,373	53,578,201	56,201,673
<i>Fuel Oil</i>	2,403,338	2,005,899	1,746,370
<i>Diesel Oil</i>	29,141	28,442	61,501
<i>Lpg</i>	12,673	12,908	33
<i>Naphta</i>	208,749	84,481	13,453
TOTAL	2,653,901	2,131,730	1,821,357
<i>Natural Gas</i>	13,325,721	15,756,764	17,034,548

³¹ Heating Values Of Fuels Consumed In Thermal P.Ps In Turkey By The Electric Utilities (2000-2005) &(2006), (<http://www.teias.gov.tr/ist2006/index.htm>).

³² Fuel Consumed in Thermal P.P.in Turkey by the Electric Utilities (2000-2005)&(2006) (<http://www.teias.gov.tr/ist2006/index.htm>)

**Table.3** . Net Electricity supply to the grid by thermal plants and imports.³³

Year	Gross generation	Net generation	NET/Gross	Gross Gen. Thermal	Net Gen Thermal	Import	Total
2004	150,698.0	145,066.0	0.963	104,464.0	100,559.0	1,144.0	101,703.0
2005	161,956.0	155,469.0	0.960	122,242.0	117,346.0	1,798.0	119,140.0
2006	176,299.8	169,543.1	0.962	131,835.1	126,782.5	573.2	127,355.7

Table.4. Default Emission Factors for Stationary Combustion in the Energy Industries (kg of greenhouse gas per TJ on a Net Calorific Basis)³⁴

Fuel	CO ₂		
	Default Emission Factor	Lower	Upper
Residual Fuel Oil	77,400	75,500	78,800
Gas/Diesel Oil	74,100	72,600	74,800
Residual Fuel Oil	77,400	75,500	78,800
Liquefied Petroleum Gases	63,100	61,600	65,600
Naptha	73,300	69,300	76,300
Anthracite	98,300	94,600	101,000
Lignite	101,000	90,900	115,000
Natural Gas	56,100	54,300	58,300

Data Used in calculation of BM for Turkish Electricity Grid**Table.5.** Generation Units put into Operation in 2004³⁵

GENERATION UNITS PUT INTO OPERATION IN 2004						
POWER PLANTS	INSTALLED CAPACITY (MW)	ELECTRICITY UTILITIES	FUEL TYPE	GENERATION CAPACITY (GWh)		COMMISSIONARY DATE
				Average	Firm	
TÜPRAŞ BATMAN GR V	1.5	AUTOPRODUCERS	D.OIL	4.1	4.1	2003
ECZACIBAŞI BAXTER HAS.ÜRÜN.	1.0	AUTOPRODUCERS	N.GAS	5.8	5.8	13.01.2001
ÇİRAĞAN SARAYI İŞL.	1.4	AUTOPRODUCERS	N.GAS	11.0	11.0	01.11.2002
BAHARİYE MENSUCAT (İzole)	1.0	AUTOPRODUCERS	N.GAS	7.0	7.0	01.01.2004
ANKARA D.G.(BAYMİNA) GR-I-II-III	798.0	BOO	N.GAS	6500.0	6500.0	08.01.2004
ENTEK GR-IV	31.1	IPP	N.GAS+NAPH TA	255.7	255.7	12.02.2004
ATATEKS 2 GM	5.6	AUTOPRODUCERS	N.GAS	45.0	45.0	20.02.2004
TANRIVERDİ 4 GM	4.7	AUTOPRODUCERS	N.GAS	38.7	38.7	24.03.2004
VAN SANT (SÖKÜLDÜ)	-26.0	IPP	FUEL-OIL	-195.0	-195.0	06.04.2004

³³ Annual Development of Turkey's Gross Electricity Generation by Primary Energy Resources and The Electric Utilities (2001-2005) / Turkey's Gross Electricity Generation by Primary Energy Resources and The Electric Utilities (2006), (<http://www.teias.gov.tr/ist2006/index.htm>).

³⁴ Table 2.2.Default Emission Factors for Stationary Combustion in the Energy Industries, Vol.2. Energy, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf)

³⁵ Generation Units Put Into Operation and Out of Operation in 2004, (<http://www.teias.gov.tr/ist2004/index.htm>)



CDM – Executive Board

page 40

ÇOLAKOĞLU(KAPASİTE ARTIRIMI)	45.0	AUTOPRODUCERS	IMPORTED COAL	337.5	337.5	05.05.2004
TEKBOY TEKSTİL 1 GM	2.2	AUTOPRODUCERS	N.GAS	16.0	16.0	18.05.2004
GÜL ENERJİ GR-II	12.5	AUTOPRODUCERS	FUEL-OIL	96.5	96.5	03.06.2004
KOMBASSAN KAĞIT GIDA VE TEKS	5.5	AUTOPRODUCERS	N.GAS	38.1	38.1	09.06.2004
AYEN OSTİM ENERJİ ÜRETİM	31.1	IPP	N.GAS	264.1	264.1	11.06.2004
BİS ENERJİ 2 GT	73.0	IPP	N.GAS	602.7	602.7	16.06.2004
ENERJİ-SA ADANA 1 BT	49.8	AUTOPRODUCERS	NAPHTA	322.9	322.9	23.06.2004
ŞAHİNLER ENERJİ 1 GM	3.2	AUTOPRODUCERS	N.GAS	22.2	22.2	29.06.2004
BESLER GR-2, BT (5,2+7,5)	12.7	AUTOPRODUCERS	N.GAS	97.7	97.7	07.07.2004
KAREGE (Düzelme)	-7.7	IPP	N.GAS	-57.9	-57.9	08.07.2004
ÇELİK ENERJİ ÜR.ŞTİ. 2 GM	2.4	IPP	N.GAS	18.6	18.6	09.07.2004
ÇİNKUR (SÖKÜLDÜ)	-30.0	AUTOPRODUCERS	FUEL-OIL	-150.0	-150.0	20.07.2004
OTOPRODÜKTÖR(DÜZELTME)	6.4	AUTOPRODUCERS		43.2	43.2	20.07.2004
KOMBASSAN KAĞ. MATBAA GIDA	5.5	AUTOPRODUCERS	N.GAS	35.7	35.7	24.09.2004
AYEN OSTİM ENERJİ ÜRETİM(BT)	9.9	IPP	N.GAS	84.0	84.0	01.10.2004
HABAŞ ALİAĞA GRUP I-II	89.2	AUTOPRODUCERS	N.GAS	713.9	713.9	08.10.2004
STANDART PROFİL 3 GM	6.7	AUTOPRODUCERS	N.GAS	49.2	49.2	22.10.2004
KARKEY-II 3+3 DGM	54.3	IPP	FUEL-OIL	369.7	369.7	12.11.2004
HAKKARİ-1	-15.3	MOBILE	D.OIL	-114.8	-114.8	30.11.2004
EÜAŞ DÜZELTME(ADALAR)	-8.2	EÜAŞ	D.OIL	0.0	0.0	09.12.2004
ALTINMARKA GIDA GR I-II-III	3.6	AUTOPRODUCERS	N.GAS	28.8	28.8	17.12.2004
THERMAL TOPLAM	1,170.2			9,490.4	9,490.4	
ERE(BİR KAPILI HES) GRUP-I	48.5	IPP	RUN OF RIVER	170.6	17.0	11.03.2004
ELTA ELK(DODURGA) GR-I-II-III-IV	4.1	AUTOPRODUCERS	RUN OF RIVER	12.3	0.0	26.04.2004
İSKUR TEKSTİL(SÜLEYMANLI) GR-I-II	4.6	AUTOPRODUCERS	RUN OF RIVER	17.86	4.0	28.04.2004
BEREKET EN.(Feslek Hes) Gr-1-2	9.5	AUTOPRODUCERS	RUN OF RIVER	41	25.0	05.08.2004
HYDROLIC TOTAL	66.7			241.8	46.0	
TOTAL	1,236.9			9,732.2	9,536.4	

Table.6. Generation Units put into Operation in 2005³⁶

POWER PLANTS	INSTALLED CAPACITY (MW)	ELECTRICITY UTILITIES	FUEL TYPE	GENERATION CAPACITY (GWh)		COMMISSIONARY DATE
				Average	Firm	
ÇAN GR I	160,000	EÜAŞ	LIGNITE	1,040.0	1,040.0	14.02.2001
ÇAN GR II	160,000	EÜAŞ	LIGNITE	1,040.0	1,040.0	14.03.2001
ELBİSTAN-B GR I	360,000	EÜAŞ	LIGNITE	2,340.0	2,340.0	14.02.2001
AKBAŞLAR GR-II(İZOLE)	8.830	AUTOPRODUCER	N.GAS	73.0	73.0	23.06.2001
AKÇA ENERJİ GR-III	8.730	AUTOPRODUCER	NAPHTHA	65.4	65.4	13.12.2001
AYKA TEKSTİL GR-I	5.500	AUTOPRODUCER	N.GAS	40.0	40.0	23.09.2001
BAYDEMİRLER GR IV-V-VI	6.210	AUTOPRODUCER	N.GAS	51.4	51.4	03.02.2001

³⁶ Generation Units Put Into Operation and Out of Operation in 2005, (<http://www.teias.gov.tr/ist2005/index.htm>)



CDM – Executive Board

page 41

BOSEN GR-III	50.000	AUTOPRODUCER	N.GAS	350.0	350.0	29.12.2001
ÇUMRA ŞEKER	16.000	AUTOPRODUCER	LIGNITE	40.0	40.0	31.12.2000
ETİ MAD.(BAN.ASİT)GR-I	11.500	AUTOPRODUCER	RENEW.+WASTES	85.0	85.0	14.07.2001
EVYAP GR I-II	5.120	AUTOPRODUCER	N.GAS	30.0	30.0	26.08.2001
GRANİSER GRANİT GR-I	5.500	AUTOPRODUCER	N.GAS	42.0	42.0	13.11.2001
HABAŞ ALİAĞA GR III	47.694	AUTOPRODUCER	N.GAS	381.6	381.6	01.06.2001
HABAŞ ALİAĞA GR IV	47.694	AUTOPRODUCER	N.GAS	381.6	381.6	20.09.2001
HABAŞ ALİAĞA GR-V	24.600	AUTOPRODUCER	N.GAS	196.8	196.8	23.11.2001
HABAŞ ALİAĞA (DÜZELTME)	6.158	AUTOPRODUCER	N.GAS	49.3	49.3	23.11.2001
HAYAT KAĞIT GR-I	7.531	AUTOPRODUCER	N.GAS	56.0	56.0	26.05.2001
İÇDAŞ ÇELİK GR-I	135.000	AUTOPRODUCER	IMPORTED COAL	1,080.0	1,080.0	29.11.2001
KAHRAMANMARAŞ KAĞIT GR-I	6.000	AUTOPRODUCER	IMPORTED COAL	45.0	45.0	07.12.2001
KORUMA Klor GR I-II-III	9.600	AUTOPRODUCER	N.GAS	77.0	77.0	02.12.2001
KÜÇÜKÇALIK TEKSTİL GR I-II-III-IV	8.000	AUTOPRODUCER	N.GAS	64.0	64.0	26.11.2001
MERCEDES BENZ TURK GR I-II-III-IV	8.280	AUTOPRODUCER	N.GAS	68.0	68.0	03.02.2001
MODERN ENERJİ GR-III	8.380	AUTOPRODUCER	N.GAS	62.9	62.9	13.06.2001
MODERN ENERJİ GR-II	6.720	AUTOPRODUCER	LPG	50.4	50.4	13.06.2001
MOSB GR I-II-III-IV-V-VI-VII	84.834	AUTOPRODUCER	N.GAS	434.0	434.0	01.03 - 01.08.2005
ORS RULMAN	12.420	AUTOPRODUCER	N.GAS	99.4	99.4	24.08.2001
PAK GIDA(Kemalpaşa) GR-I	5.670	AUTOPRODUCER	N.GAS	45.0	45.0	06.12.2001
TEZCAN GALVANİZ GR I-II	3.664	AUTOPRODUCER	N.GAS	29.0	29.0	26.05.2001
YONGAPAN(KAST.ENTG) GR-II	5.200	AUTOPRODUCER	N.GAS	32.7	32.7	24.05.2001
ZEYNEP GİYİM SAN. GR-I	1.165	AUTOPRODUCER	N.GAS	9.0	9.0	06.07.2001
OTOP DÜZELTME	0.024	AUTOPRODUCER	RENEW.+WASTES	0.0	0.0	
OTOP DÜZELTME	2.109	AUTOPRODUCER	SOLID	5.2	5.2	
OTOP DÜZELTME	0.060	AUTOPRODUCER	LIGNITE	0.0	0.0	
OTOP DÜZELTME	0.612	AUTOPRODUCER	D.OIL	1.8	1.8	
AK ENERJİ(K.paşa) GR- III	40.000	IPP	N.GAS	256.9	256.9	08.11.2001
AK ENERJİ(K.paşa) GR I-II	87.200	IPP	N.GAS	560.1	560.1	29.04.2001
ALTEK ALARKO GR I-II	60.100	IPP	N.GAS	420.0	420.0	13.10.2001
BİS ENERJİ GR VII	43.700	IPP	N.GAS	360.8	360.8	17.03.2001
CAN ENERJİ GR-I	3.900	IPP	N.GAS	28.0	28.0	24.08.2001
ÇEBİ ENERJİ BT	21.000	IPP	N.GAS	164.9	164.9	26.08.2001
ÇEBİ ENERJİ GT	43366	IPP	N.GAS	340.1	340.1	22.08.2001
ENTEK ELK.A.Ş.KOÇ ÜNİ.GR I-II	2.332	IPP	N.GAS	19.0	19.0	06.02.2001
KAREGE GR IV-V	18.060	IPP	N.GAS	141.9	141.9	06.04.2001
KARKEY(SİLOPİ-4) GR-IV	6.150	IPP	F.OIL	47.2	47.2	29.06.2001
KARKEY(SİLOPİ-4) GR-V	6.750	IPP	F.OIL	51.9	51.9	22.12.2001
METEM ENERJİ(Hacısıramat) GR I-II	7.832	IPP	N.GAS	58.0	58.0	28.01.2001
METEM ENERJİ(Peliklik) GR I-II-III	11,748	IPP	N.GAS	89.0	89.0	28.01.2001
NOREN ENERJİ GR-I	8,730	IPP	N.GAS	70.0	70.0	23.08.2001
NUH ENERJİ-2 GR I	46,950	IPP	N.GAS	319.7	319.7	23.05.2001



ZORLU ENERJİ KAYSERİ GR-I-II-III	149,871	IPP	N.GAS	1,144.1	1,144.1	21.07.2001
ZORLU ENERJİ KAYSERİ GR-IV	38,630	IPP	N.GAS	294.9	294.9	25.10.2001
ZORLU ENERJİ YALOVA GR I-II	15,930	IPP	N.GAS	122.0	122.0	25.11.2001
THERMAL TOTAL	1,757,749			12,236.3	12,236.3	
TEKTÜĞ(Kargılık) GR I-II	23,900	IPP	RUN OF RIVER	83.0	19.0	24.04.2001
İÇTAŞ ENERJİ(Yukarı Mercan) GR I-II	14,190	IPP	RUN OF RIVER	44.0	20.0	21.05.2001
MURATLI GR I-II	115,000	EÜAŞ		444.0	400.0	02.06.2001
BEREKET EN.(DALAMAN) GR XIII-XIV-XV	7,500	IPP	RUN OF RIVER	35.8	0.0	15.07.2001
YAMULA GRUP I-II	100,000	BOT	DAM	422.0	345.0	30.07.2001
HYDROLIC TOTAL	260,590			1,028.8	784.0	
SUNJÜT(RES) GR I-II	1,200	AUTOPRODUCER	WIND	2.4	2.0	22.04.2001
WIND TOTAL	1,200			2.4	2.0	
TOTAL	2,019,539			13,267.5	13,022.3	

Table 7 - Generation Units put into Operation in 2006³⁷

		GENERATION CAPACITY (GWh)		
ELECTRIC UTILITIES		INSTALLED CAPACITY	Ortalama	Güvenilir
		(MW)	Average	Firm
EÜAŞ		1,080.0	7,020.0	7,020.0
OTOPRODÜKTÖR	AUTOPRODUCER	143.5	1,086.2	1,086.2
SERBEST ÜR.ŞTİ.	IPP	389.8	3,048.8	3,048.8
THERMAL TOTAL	THERMAL TOTAL	1,613.3	11,155.0	11,155.0
SERBEST ÜR.ŞTİ.	IPP	46.8	188.0	164.5
JEOTER.+RÜZGAR TOP.	GEO THERMAL+WIND TOTAL	46.8	188.0	164.5
EÜAŞ		52.1	124.0	0.0
SERBEST ÜR.ŞTİ.	IPP	105,4	358.1	211.0
HYDROLIC TOTAL	HYDRO TOTAL	157.5	482.1	211.0
TOTAL	GENERAL TOTAL	1,817.6	11,825.1	11,530.5

³⁷ Generation Units Put Into Operation and Out of Operation in 2006,(<http://www.teias.gov.tr/ist2006/index.htm>)

**Table.8.** Thermal Power Electricity Utilities put into Operation in 2006³⁸

ÜNİTENİN ADI	ÜNİTE GÜCÜ (MW)	KURULUŞ ADI	YAKIT CİNSİ	SERVİSE GİRİŞ TARİHİ
EKOTEN TEKSTİL GR-I	1.932	OTOPRODÜKTÖR	DOĞALGAZ	16.02.2006
ERAK GİYİM GR-I	1.365	OTOPRODÜKTÖR	DOĞALGAZ	22.02.2006
ALARKO ALTEK GR-III	21.89	SERBEST ÜRETİM ŞTİ.	BUHAR	23.02.2006
AYDIN ÖRME GR-I	7.52	OTOPRODÜKTÖR	DOĞALGAZ	25.02.2006
NUH ENERJİ-2 GR II	26.08	SERBEST ÜRETİM ŞTİ.	BUHAR TÜRBİNİ	02.03.2006
MARMARA ELEKTRİK (Çorlu) GR I	8.73	SERBEST ÜRETİM ŞTİ.	DOĞALGAZ	13.04.2006
MARMARA PAMUK (Çorlu) GR I	7.73	OTOPRODÜKTÖR	DOĞALGAZ	13.04.2006
ENTEK (Köseköy) GR IV	47.62	SERBEST ÜRETİM ŞTİ.	DOĞALGAZ	14.04.2006
ELSE TEKSTİL (Çorlu) GR I - II	3.16	OTOPRODÜKTÖR	DOĞALGAZ	15.04.2006
BARES IX GRUP	13.5	SERBEST ÜRETİM ŞTİ.	RÜZGAR	20.04.2006
SÖNMEZ ELEKTRİK (Çorlu) GR I - II	17.46	SERBEST ÜRETİM ŞTİ.	DOĞALGAZ	03.05.2006
DENİZLİ ÇİMENTO(DÜZELTME)	0.445	OTOPRODÜKTÖR	DOĞALGAZ	04.05.2006
MENDERES ELEKTRİK GR I	7951	SERBEST ÜRETİM ŞTİ.	JEOTERMAL	10.05.2006
KASTAMONU ENTEGRE (Balıkesir) GR I	7.52	OTOPRODÜKTÖR	DOĞALGAZ	24.05.2006
BARES X. ve XX. GRUPLAR	16.5	SERBEST ÜRETİM ŞTİ.	RÜZGAR	26.05.2006
BOZ ENERJİ GR I	8.73	SERBEST ÜRETİM ŞTİ.	DOĞALGAZ	09.06.2006
ADANA ATIK SU ARITMA TESİSİ	0.803	OTOPRODÜKTÖR	BİOGAZ	09.06.2006
AMYLUM NIŞASTA (ADANA)	-6.2	OTOPRODÜKTÖR	FUEL-OİL	09.06.2006
AMYLUM NIŞASTA (ADANA)	14.25	OTOPRODÜKTÖR	DOĞALGAZ	09.06.2006
ŞIK MAKAS (Çorlu) GR I	1.58	OTOPRODÜKTÖR	DOĞALGAZ	22.06.2006
ELBİSTAN B GR III	360	EÜAŞ	LİNYİT	23.06.2006
ANTALYA ENERJİ GR I - II - III - IV	34.92	SERBEST ÜRETİM ŞTİ.	DOĞALGAZ	29.06.2006
HAYAT TEM. VE SAĞLIK GR I - II	15.04	OTOPRODÜKTÖR	DOĞALGAZ	30.06.2006
EKOLOJİK EN. (Kemerburgaz) GR I	0.98	SERBEST ÜRETİM ŞTİ.	ÇÖP GAZI	31.07.2006
EROĞLU GİYİM (Çorlu) GR I	1,165	OTOPRODÜKTÖR	DOĞALGAZ	01.08.2006
CAM İŞ ELEKTRİK (Mersin) GR I	126.1	SERBEST ÜRETİM ŞTİ.	DOĞALGAZ	13.09.2006
ELBİSTAN B GR II	360	EÜAŞ	LİNYİT	17.09.2006
YILDIZ ENT. AĞAÇ (Kocaeli) GR I	6.184	OTOPRODÜKTÖR	DOĞALGAZ	21.09.2006
ÇERKEZKÖY ENERJİ GR I	49.164	SERBEST ÜRETİM ŞTİ.	DOĞALGAZ	06.10.2006
ENTEK (Köseköy) GR V	37	SERBEST ÜRETİM ŞTİ.	DOĞALGAZ	03.11.2006
ITC-KA EN. MAMAK TOP.M. GR I-II-III	4.239	SERBEST ÜRETİM ŞTİ.	ÇÖP GAZI	03.11.2006
ELBİSTAN B GR IV	360	EÜAŞ	LİNYİT	13.11.2006

³⁸ Türkiye Elektrik Enerjisi 10 yıllık Üretim Kapasite Projeksiyonu, (2007-2016)
<http://www.teias.gov.tr/projeksiyon/projeksiyon%20Temmuz2007.pdf>



CDM – Executive Board

page 44

MARE MANASTIR RÜZGAR (X GRUP)	8	SERBEST ÜRETİM ŞTİ.	RÜZGAR	08.12.2006
ÇIRAĞAN SARAYI GR I	1.324	OTOPRODÜKTÖR	DOĞALGAZ	01.12.2006
ERTÜRK ELEKTRİK Tepe RES GR I	0.85	SERBEST ÜRETİM ŞTİ.	RÜZGAR	22.12.2006
AKMAYA (Lüleburgaz) GR I	6.91	OTOPRODÜKTÖR	DOĞALGAZ	23.12.2006
BURGAZ (Lüleburgaz) GR I	6.91	SERBEST ÜRETİM ŞTİ.	DOĞALGAZ	23.12.2006
VAN-2	-24.7			
TERMİK TOPLAM	1562.294			

Table.9. Default CO₂ Emission Factors for Combustion³⁹

Fuel type	Default Carbon Content (kg/GJ)	Default carbon Oxidation Factor	Effective CO ₂ Emission Factor		
			Default	95% Confidence interval	
	A	B	C=A*B*44/12*1000	Lower	Upper
Residual Fuel Oil	21.1	1	77,400	75,500	78,800
Gas/diesel Oil	20.2	1	74,100	72,600	74,800
Liquefied Petroleum Gases	17.2	1	63,100	61,600	65,600
Naptha	20.0	1	73,300	69,300	76,300
Anthracite	26.8	1	98,300	94,600	101,000
Lignite	27.6	1	101,000	90,900	115,000
Natural Gas	15.3	1	56,100	54,300	58,300

³⁹ Table 1.4.Default CO₂ emission factors for Combustion,Vol.2. Energy, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf)

**Table.10.** The names, places and basic information about Thermal Power Plants in Turkey³⁰

Sıra No	Santralin Adı	Yakıt Cinsi	Bulunduğu İl	Toplam Kurulu Güç (MW)	Proje Üretimi (GWh)	Ortalama Termik Verim(%)	Elektro Filtre	BGD Tes.	Son Durum
1	Afşin-Elbistan A	Linyit	K.Maraş	1360.0	8340.0	30.06	Var	Yok	İşletmede
2	Alağa GT-KÇ	Motorin	İzmir	180.0	540.0	33.78	...	Yok	İşletmede
3	Ambarlı	Fuel-Oil	İstanbul	630.0	4100.0	37.25	...	Yok	İşletmede
4	Ambarlı KÇ *	Doğal Gaz	İstanbul	1350.9	8780.0	48.57	...	Yok	İşletmede
5	Bursa	Doğal Gaz	Bursa	1432.0	10024.0	54.40	...	Yok	İşletmede
6	Çatalağzı B	Taşkömürü	Zonguldak	300.0	1950.0	33.57	Var	Yok	İşletmede
7	Çayırhan 1,2	Linyit	Ankara	320.0	2080.0	34.54	Var	Var	İşletmede
8	Denizli	Tabii Bulur	Denizli	17.5	105.0	11.57	...	Yok	İşletmede
9	Esenyurt I,II,III,IV	Doğal Gaz	İstanbul	188.5	1413.8	45.00	...	...	İşletmede
10	Ereğli (Trakya Elek.)	Doğal Gaz	Tekirdağ	498.7	3740.3	47.00	...	...	İşletmede
11	Ereğli GT	Motorin	Van	15.0	90.0	21.27	...	Yok	İşletmede
12	Hakkari	Fuel-Oil	Hakkari	11.1	83.3	35.03	...	...	İşletmede
13	Hamitabat KÇ	Doğal Gaz	Karabireli	1300.0	7800.0	45.81	...	Yok	İşletmede
14	Hopa	Fuel-Oil	Artvin	50.0	200.0	26.27	...	Yok	İşletmede
15	Kangal 1,2,3 **	Linyit	Sivas	457.0	2970.5	29.76	Var	Var	İşletmede
16	Kemerköy 1,2,3	Linyit	Muğla	630.0	4095.0	33.21	Var	İşletmede	İşletmede
17	Orhanlı	Linyit	Bursa	210.0	1365.0	36.18	Var	Var	İşletmede
18	Ova elektrik	Doğal Gaz	Kocaeli	258.4	1938.0	44.00	...	...	İşletmede
19	Park Termik	Linyit	Ankara	300.0	1072.9	34.71	Var	Var	İşletmede
20	PS3-Sulopi	Fuel-Oil	Ş. Urfa	44.1	330.8	37.36	...	...	İşletmede
21	PS3A-ydi	Fuel-Oil	Mardin	11.4	85.5	35.19	...	...	İşletmede
22	Seritömer	Linyit	Kütahya	600.0	3900.0	32.97	Var	Yok	İşletmede
23	Soma A	Linyit	Manisa	44.0	290.0	30.31	Var	Yok	İşletmede
24	Soma B	Linyit	Manisa	990.0	6435.0	32.45	Var	Yok	İşletmede
25	Tunçbilek A-B	Linyit	Kütahya	429.0	2790.0	31.45	Var	Yok	İşletmede
26	Uzunar	Doğal Gaz	Tekirdağ	504.0	3780.0	37.00	...	...	İşletmede
27	Van	Fuel-Oil	Van	34.0	180.0	39.33	...	Yok	İşletmede
28	Yatağan	Linyit	Muğla	630.0	4100.0	32.67	Var	İşletmede	İşletmede
29	Yeniköy	Linyit	Muğla	420.0	2730.0	34.82	Var	İşletmede	İşletmede

³⁰ TabloX.3.1. Türkiye'deki termik santrallerin adları, bulunduğu yer ve diğer bilgiler, Türkiye Çevre Atlası, MoEF, Ankara 2004, pg.197, (http://www.cedgm.gov.tr/dosya/cevreatlas/atlasin_metni.pdf)



Annex.4.

MONITORING PLAN

The Purpose of the Monitoring Plan is to keep a record of the amount of renewable electricity generated and therefore the greenhouse gas emission reduced in accordance with the methodologies and calculations in this PDD.

The outcome of the monitoring plan will be a Monitoring Report which will be provided to the Verifying Entity.

The Monitoring Plan (MP) used for determining the emission reduction by the Project is based on the approved methodology ACM0002. The Data to be Recorded are outlined in B.7.1 above.

The MP will be implemented by YAPISAN A.Ş. during all stages of the Project activity in conjunction with the approved methodology stated in the PDD. The Project Owner will be able to update or revise the MP during operation stage if required.

The Monitoring Plan will be carried out by the Plant Manager (see organogram below). The Plant Manager will receive training, before the commissioning of the Plant, from a representative of J.P. Morgan ventures Energy Corporation. Internal training will also be provided by the Proponent's Parent Company, which is involved in a number of other projects requiring monitoring for greenhouse gas reduction purposes.

Emission reductions by the project activity will be calculated using electricity generated by Belen WPP. This electricity will displace the power generated by other plants in the grid. A spreadsheet prepared in Excel will be used in order to calculate the emission reduction from the renewable electricity generated. Gross electricity production will be measured monthly through two high precision measuring devices sealed and controlled by TEİAŞ according to the regulations issued of the TEİAŞ and recorded in the Excel workbook.

The annual net electricity generation will be measured by the TEİAŞ officer at the end of each month via two high precision metering devices. The electrical engineer or the plant manager will accompany the officer during monthly measurements. Those data will also form the basis for monthly invoicing to TEİAŞ. The periodical maintenance of the metering devices will be made by TEİAŞ every two years. In case the accuracy of metering devices is less than 0.2%, maintenance will be carried out by TEİAŞ. The data can also be cross-checked by the invoices for electricity sales and records kept by YAPISAN A.Ş..

The fuel consumption of the standby generator at the project will be monitored by invoices together with hours of usage tracked by a counter on the equipment. After cross-checking the two sets of data, the emission from the generator will be calculated by multiplying the annual fuel consumption with NCV and EF values for diesel. This will be used to calculate any leakage from the project.

All these data will be presented in a clear and transparent manner in the Monitoring Report which will be provided to the Verifier at the time of annual verification. During Verification, data can also be cross-checked from electricity sales invoices and records kept by the Project.

The Plant Manager will be responsible for electricity generation in the plant and will be assisted by mechanical and electrical engineers as seen in the figure below. All relevant data will be recorded by the Plant Manager on a monthly basis. Data will be kept by the Project owner both at the project site and at Head Office in Ankara for two years following the completion of the crediting period in electronic and paper form.



The Project owner will be responsible for calculating the Net Emissions reductions from the project, assisted by J.P. Morgan Ventures Energy Corporation. The Monitoring Report will be sent for an Internal Review within JPMVEC to check consistency with the Monitoring Plan and PDD before being sent to the Verifying Entity.

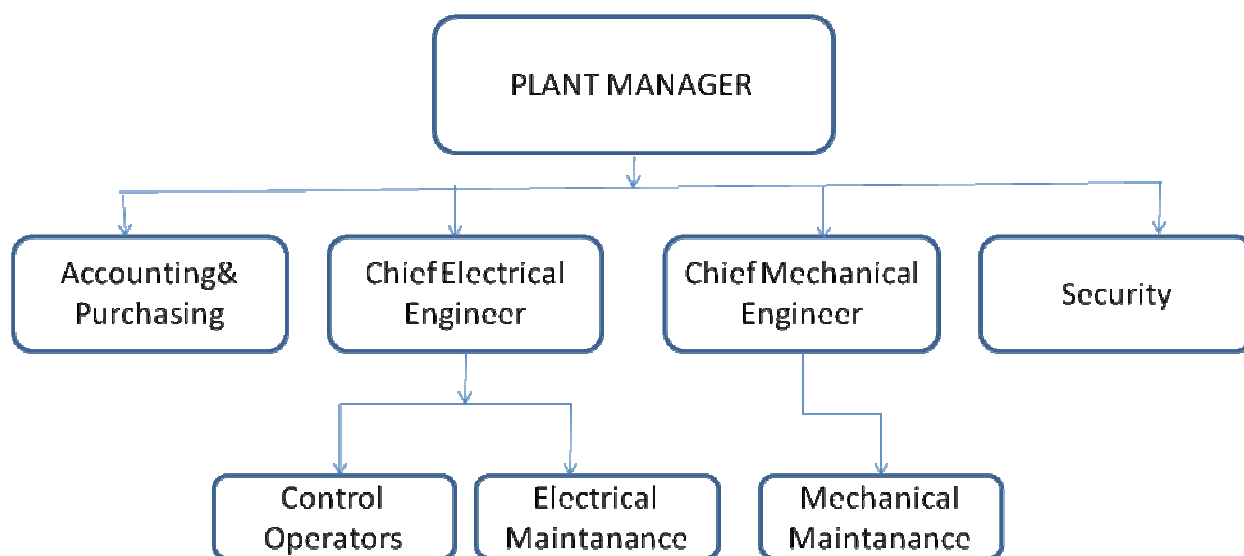


Figure 1. Organization Chart in Darica-I HPP



Annex.5EIA AFFIRMATIVE CERTIFICATE

	T.C. ÇEVRE ve ORMAN BAKANLIĞI Çevresel Etki Değerlendirmesi ve Planlama Genel Müdürlüğü Karar Tarihi: 15/03/2007 Karar No : 1225 ÇED OLUMLU BELGESİ 16.12.2003 tarih ve 25318 sayılı Resmi Gazete’de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği’nin 14.maddesi gereğince; “Karıca Regülatörü, Darıca I HES (kurulu gücü 99MW) ve Malzeme Ocakları” projesi hakkında “Çevresel Etki Değerlendirmesi Olumlu Kararı” verilmiştir. Osman TÜZÜN Bakan a. Genel Müdür Proje Sahibi : Yapısan Elektrik Üretim A.Ş. Projenin Yeri : Ordu İli, Mesudiye İlçesi, Topçam Beldesi
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T.R. Ministry of Environment and Forest, Directorate of Environmental Impact Assessment and Planning

Decision Date: 15/03/2007

Decision No: 1225

EIA AFFIRMATIVE CERTIFICATE

In accordance with Article 14. Of Environmental Impact Regulation which has published on Official Gazette No.25318 on 16.12.2003; “Karıca Regulator, Darıca I HEPP (installed capacity of 99MW) and Supply Assets” project has been decided as “ Environmental Impact Assessment is affirmative”.

Osman Tüzün, General Director

Project Owner: Yapısan Elektrik Üretim A.Ş.

Project location: Ordu province, Mesudiye, Topçam



Annex 6 – VCS 2007 Specific Requirements

Other Programs

The Project has not applied for accreditation under any other greenhouse gas emission reduction program.

Commercially Sensitive Information

A full cashflow and investment analysis for the project has been provided to the Validator. The Investment Return on the project is confidential information and it has not been used in the Barrier Analysis in Section B5 of this PDD and so has not been made publicly available. This information will also be provided to the VCS project Database and applicable VCS Registry.

Declaration of Title

A Declaration of Title Form is provided to the Validator, proving title to the VERs through the ownership of the plant and equipment generating the VERs.

Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction

The project activity comprises of exploiting the available hydro power potential, a renewable energy source, and converting it into electrical power to be fed to the regional electric power grid which is carbon intensive. The reduction in carbon emissions is deemed to occur as the hydro power generated electricity replaces an equivalent amount of power generated by fossil fuel based power stations. The GHG reductions thus achieved are real, measurable, additional, and permanent. So, it is well demonstrated that the project has not been implemented to create GHG emissions primarily for subsequent removal or destruction.

Demonstration that the project will not created another form of environmental credit (for example renewable energy certificates).

There are no rules or obligation regarding Renewable Energy, Sulphur Dioxide, Biodiversity or any other type of environmental credits in Turkey and so this project has not been implemented with the intention of creating them.



Annex 7: Information in Generation

DEPOLAMA TESİSİ İŞLETME ÇALIŞMASI
(HidroE v1.4.1)

Projenin Adı : **DARICA I**

Proje Yeri Akım Değerleri : **1955** Başlangıç İşletme Dönemi : **1995 - 2000**
2000 Sıfır (36 yıl)

Tünel Manning : **0.075** Tünel Karp Kayıpları : **1.150**

Cebri Boru Manning : **0.012** C.Boru Karp Kayıpları : **1.140**

Tünel Çapı : **4.50** m

Tünel Boyu : **8462.0** m

Tünel Tipi : **Akış**

Cebri Boru Çapı : **3.10** m

Cebri Boru Boyu : **720.0** m

Tünelde İzin Verilen Hız : **4.00** m/s

Cebri Boruda İzin Verilen Hız : **4.00** m/s

Depolama Tesisi Karakteristikleri

Hacim Tablosu

KOT (m)	ALAN (km²)	HACİM (hm³)
1	631.0	0.00
2	632.0	0.00
3	634.0	0.01
4	636.0	0.01
5	638.0	0.02
6	640.0	0.03
7	642.0	0.04
8	644.0	0.05
9	646.0	0.06
10	648.0	0.08
11	650.0	0.09
12	652.0	0.10
13	654.0	0.11
14	656.0	0.12
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		

Net Buharlaşma (mm)

Ekim	126.00
Kasım	57.00
Aralık	0.00
Ocak	0.00
Şubat	0.00
Mart	19.00
Nisan	125.00
Mayıs	201.00
Haziran	279.00
Temmuz	356.00
Ağustos	328.00
Eylül	241.00
YILLIK	1732.0

Rezervardan Çeşiden (hm³)

Ekim	0.000
Kasım	0.000
Aralık	0.000
Ocak	0.000
Şubat	0.000
Mart	0.000
Nisan	0.000
Mayıs	0.000
Haziran	0.000
Temmuz	0.000
Ağustos	0.000
Eylül	0.000
YILLIK	0.000

Manşep İhtiyacı (hm³)

Ekim	0.0
Kasım	0.0
Aralık	0.0
Ocak	0.0
Şubat	0.0
Mart	0.0
Nisan	0.0
Mayıs	0.0
Haziran	0.0
Temmuz	0.0
Ağustos	0.0
Eylül	0.0
YILLIK	0.0

Rezervuar Maksimum : **Kot : 450.0 Hacim : 0.691 hm³**

Rezervuar Minimum : **Kot : 446.2 Hacim : 0.391 hm³**

Kuyruklu Kotu : **335.0** m

Teorik Fırtın Güçü : **25.273** MW F.E. Eksiklik %'si : **5.00%**

Üretilen Fırtın Güçü : **24.959** MW F.E. Zamanın %'si : **67%**

Türbin Verimi : **0.893** P = 8,760 x Q x H

Kuru Güç : **99.00** MW

CDM – Executive Board

page 51

DARICA 1 İşletme Çalışması Özet Çıktısı

AYLIK DEĞERLER

Niel Süheriayma (mm)	
Ekim	126,6
Kasım	87,3
Aralık	0,0
Ocak	0,0
Şubat	0,0
Mart	19,0
Nisan	125,5
Mayıs	201,5
Haziran	279,0
Temmuz	356,5
Ağustos	328,0
Eylül	241,0
YILLIK	1732,0

Rezervlerden Çıkılan (ton)	
Ekim	0,0
Kasım	0,0
Aralık	0,0
Ocak	0,0
Şubat	0,0
Mart	0,0
Nisan	0,0
Mayıs	0,0
Haziran	0,0
Temmuz	0,0
Ağustos	0,0
Eylül	0,0
YILLIK	0,0

Menşei İnterpreşyon (km²)	
Edim	0,0
Kaşem	0,0
Anak	0,0
Osak	0,0
Şubel	0,0
Mart	0,0
Nisan	0,0
Mayıs	0,0
Haziran	0,0
Temmuz	0,0
Ağustos	0,0
Eylül	0,0
YILLIK	0,0

Maximilian Schütz, Editorial

	KOT	ALAN	HACIM
1	811,3	0,06	0,06
2	812,3	0,06	0,06
3	814,3	0,01	0,01
4	816,3	0,01	0,04
5	818,3	0,02	0,07
6	840,0	0,03	0,12
7	842,0	0,04	0,16
8	844,0	0,06	0,27
9	846,0	0,06	0,33
10	848,0	0,08	0,42
11	850,0	0,09	0,49
12	852,0	0,10	0,53
13	854,0	0,11	0,56
14	856,0	0,12	0,57
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Projejin Adı :	DARICA 1	Tünel Çapı :	4,50 m (Atrial)
Rezervuar Maksimum Hacmi :	0.691 tırn	Tünel Boyu :	5.642,00 m
Rezervuar Minimum Hacmi :	0.391 tırn	Cebri Boru Çapı :	3,10 m
Kurulu Güç :	99,00 MW	Cebri Boru Boyu :	720,00 m
İletme Debisi :	37,43 m ³ /s	Firm Enerji Zamanı ¹ :	67%
Rezervuar Max. Kotu :	650,0 m	Firm Enerjideki Etkilik :	5,00%
Rezervuar Min. Kotu :	646,2 m	Regülasyon %'li :	93,51%
Santral Kuyrukusu :	335,0 m	Firm Enerji :	218,894 GWh
Teorik Firm Güç :	24,273 MW	Sekonder Enerji :	108,796 GWh
Üretilen Firm Güç :	24,959 MW	Toplam Enerji :	327,690 GWh

Minimum Hazne Says 143 cy

Savak Çalışan Ay Sayı 26 say

AKIMILAR (İsim)

	Ellen	Ewan	Ann	David	Sarah	Mary	Nancy	Maria	Harriet	Thomas	Agnes	Edith	William
1965	22.99	22.86	26.18	27.26	28.03	27.11	23.88	29.11	34.78	23.24	23.25	23.22	42.17
1966	18.81	29.28	21.67	34.54	28.08	29.48	46.55	43.51	24.87	41.43	24.20	26.20	406.83
1967	36.11	27.96	29.08	26.79	14.77	40.64	77.67	33.19	33.17	23.15	26.85	22.99	480.36
1968	14.36	32.85	36.28	38.10	30.75	42.79	186.36	96.36	27.89	23.08	24.30	21.49	575.49
1969	27.31	25.90	30.87	38.20	17.40	32.50	39.77	81.51	27.46	23.90	23.33	21.52	179.66
1970	26.52	28.23	25.14	6.82	28.36	33.69	30.96	23.31	23.81	21.92	25.93	25.31	299.98
1971	18.50	10.14	26.99	23.68	9.46	35.85	36.73	28.05	32.34	22.59	23.86	24.31	295.41
1972	32.57	30.08	38.94	22.75	14.77	37.80	45.77	85.42	111.13	24.92	24.00	22.34	500.53
1973	28.41	30.00	25.56	26.83	16.78	32.29	31.84	21.88	40.88	29.20	23.06	24.36	333.60
1974	26.84	25.41	25.03	7.34	14.54	35.59	29.84	50.37	23.21	34.10	36.29	30.51	319.08
1975	25.06	27.21	34.85	16.45	15.61	41.42	131.65	87.68	40.65	22.59	23.30	22.05	489.71
1976	34.11	25.29	28.17	16.55	9.91	45.06	64.97	96.10	45.62	24.91	27.49	24.64	432.83
1977	29.60	26.40	28.97	18.91	35.89	43.62	90.64	163.90	36.22	23.51	22.90	23.55	522.11
1978	26.16	27.99	31.62	34.10	28.36	36.92	76.56	95.51	28.52	22.98	25.15	22.49	446.37
1979	26.50	33.23	40.76	42.69	33.20	36.12	24.03	35.41	26.66	22.50	22.23	22.57	365.80
1980	25.65	28.58	33.22	8.64	9.26	29.55	93.80	142.58	22.99	21.90	21.18	24.44	461.22
1981	32.62	27.66	33.28	26.00	18.72	33.52	30.80	30.97	74.40	20.71	22.76	21.67	452.79
1982	31.84	29.06	29.75	25.28	25.17	25.66	165.12	87.67	46.89	22.51	23.37	21.47	515.77
1983	23.83	31.98	28.83	18.41	18.23	52.30	74.64	128.62	23.02	29.66	22.62	24.68	478.81
1984	28.27	27.71	30.79	25.98	29.48	29.11	86.25	90.35	46.70	26.77	28.85	21.21	476.48
1985	21.79	24.65	27.88	13.99	18.03	41.79	30.25	27.28	23.27	24.68	21.73	23.65	299.00
1986	36.74	30.37	33.44	23.22	36.05	36.64	29.24	67.15	46.63	20.72	21.22	20.28	404.70
1987	22.60	30.46	31.68	38.66	46.30	80.24	136.92	139.95	38.63	23.30	22.34	21.05	633.51
1988	24.49	30.29	25.88	31.07	56.43	40.81	180.24	156.92	92.11	29.49	28.25	24.14	865.04
1989	40.15	27.25	31.26	27.06	36.21	129.25	114.23	226.25	265.54	28.80	23.83	26.36	584.75
1990	19.21	32.47	42.03	38.47	30.75	33.12	80.24	187.80	46.39	24.44	23.45	24.10	598.46
1991	27.08	30.77	27.39	36.45	19.32	41.36	36.00	307.38	22.71	22.25	22.98	22.64	409.11
1992	32.65	28.58	27.67	38.17	11.35	46.45	75.09	76.96	50.69	27.24	29.36	23.74	439.24
1993	24.32	30.43	32.39	34.34	28.13	45.32	201.82	186.46	83.94	24.06	28.08	23.90	744.00
1994	33.62	27.81	29.94	27.69	25.36	29.13	31.29	28.23	22.36	21.91	21.33	22.81	323.29
1995	25.16	20.78	24.76	40.36	29.13	36.61	83.07	314.24	26.30	26.84	22.49	22.18	474.91
1996	33.71	40.38	29.90	24.87	26.71	34.72	84.68	314.54	47.90	24.16	23.35	21.40	496.33
1997	27.39	24.76	31.79	29.59	30.62	34.41	86.26	303.86	46.20	29.04	24.37	27.12	502.41
1998	40.00	31.87	29.51	32.61	38.22	44.77	115.68	146.30	46.64	23.21	21.75	24.04	597.60
1999	29.55	29.72	35.11	28.17	29.15	40.27	27.15	57.87	29.11	24.15	26.33	22.64	379.32
2000	26.26	26.18	29.40	11.64	17.00	50.70	123.63	99.41	41.38	21.95	21.89	21.57	519.04



Annex 8: GENERATION LICENCE



T.R.(Turkey Republic)
Energy Market Regulatory Authority
GENERATION LICENCE

The generation plant uses Renewable Energy Resources in the context of this licence.
Licence No: EÜ/799-8/655 Date:22/06/2006 This license has been issued to Yapısan Electricity Generation Corporation for the construction of Darıca-1 Hydro Power Plant in Ordu Province and the generation of electricity for 49 years beginning from 22/06/2006 with the decision with the number 799-8 and the date 22/06/2006 by Energy Market Regulation Authority(EPDK) in accordance with the Law of Electricity Market with the number 4628.