ASLANCIK HYDRO POWER PLANT PROJECT

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Document Prepared By

enveco GmbH

in cooperation with eletcon

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Aslancık Elektrik Üretim A.Ş. (referred to as **Aslancık A.Ş.** from here on) has developed *Aslancık Hydro Power Plant Project* (in short: **Aslancık HPP**), a run-of-river hydro power plant (**HPP**) project with an installed capacity of 93 MW_e, which annually feeds an amount of around 418,170 MWh of emission free electricity into the Turkish national grid. *Aslancık HPP* displaces electricity from the current generation mix which is based to a large amount on thermal power plants and will affect the planned capacity extension of the electricity system.

Aslancık HPP thus leads to Greenhouse Gas (GHG) emission reductions which are to be accounted for by verifying and issuing carbon credits under the **Verified Carbon Standard (VCS) Version 3**, (in short **VCS version 3**).

1.2 Sectoral Scope and Project Type

According to guidance from *VCS version 3*, *Aslancık HPP* falls under sectoral scope no. 1 "Energy (renewable/non-renewable)".[1] The project type is Renewable Energy (REN). More specifically, it is a run-of-river HPP project. *Aslancık HPP* is not a grouped project if referring to the relevant *VCS version 3* rules.[2] Referring to CDM rules it is also neither a project bundle nor a debundled component of a large scale project activity.

1.3 Project proponent

As developer, owner and operator of *Aslancık HPP*, *Aslancık Elektrik Üretim A.Ş.* is the project proponent. For detailed contact information refer to

Table 1: Contact Data Project Owner

Organization:	Aslancık Elektrik Üretim A.Ş.
Street/P.O.Box:	Kavacik, Cumhuriyet Caddesi Gürsel Plaza
Building:	No:123 Kat: 3
City:	34805 Beykoz/Istanbul
State/Region:	
Country:	Turkey
Telephone:	+90 216 680 30 30
FAX:	+90 216 680 30 35
E-Mail:	umut.kaya@aslancikelektrik.com.tr
Represented by:	
Salutation:	Mr.
First name:	Umut
Last name:	Kaya

1 See http://www.v-c-s.org/how-it-works/policy-areas-sectors.

2 See VCS Standard Version 3.2, Section 3.4. http://www.v-c-s.org/sites/v-c-s.org/files/VCS%20Standard%2C%20v3.2_0.pdf **[VCS Standard v3.2]**

1.4 Other Entities Involved in the Project

Eletcon Legal Uluslararası Yatırım Ve Danışmanlık Proje A.Ş. (Eletcon) acts as technical, legal and carbon market consultant for the project activity.

Table 2: Contact Data Project Consultant

Organization:	Eletcon Legal Uluslararası Yatırım Ve Danışmanlık Proje A.Ş.
Street/P.O.Box:	Birlik Mah. 411
Building:	Sokak No:9/1
City:	Çankaya/Ankara
State/Region:	Ankara province
Country:	Turkey
Telephone:	+ 90 (312) 495 09 57
FAX:	+ 90 (312) 495 09 53
E-Mail:	mmacit@eletcon.com.tr
Represented by:	
Salutation:	Mrs.
Last name:	BAŞAR MACİT
First name:	Miray

1.5 Project Start Date

The project start date according to *VCS version 3* is defined as the "Date on which the project began generating GHG emission reductions or removals".[3]

For *Aslancık HPP*, this is the expected date of commissioning, i.e. 01/10/2013, see *Table 9* in *Section 2.5 below*.

1.6 Project Crediting Period

The start date of the crediting period is the expected date of commissioning, i.e. 01/10/2013. The expected technical and economic lifetime is 30 years.

In accordance with *VCS version 3* rules[4], a 10 year crediting period is chosen for *Aslancık HPP*.

The crediting period starts on 01/10/2013 and ends on 30/09/2023.

As in accordance with *VCS version 3* rules, the intention is to renew the crediting period.

[3] See VCS Program Definitions Version 3.2 [VCS Definitions], p. 9. http://www.v-c-s.org/sites/v-c-s.org/files/Program%20Definitions%2C%20v3.2.pdf

[4] See [VCS Standard v3.2], Section 3.9.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Aslancık HPP has an installed capacity of 93 MW_e. With an expected annual electricity generation of 418,170 MWh/yr, and an emission factor of 0.533 tCO_2/MWh (see *Section 3.1.2. Step 6 below*), expected annual emission reductions amount to 222,884 tCO_2/yr. As this is less than 1,000,000 tCO_2e per year, *Aslancık HPP* is not a mega project according to *VCS version 3* rules.[5]

Project	X
Mega-project	

The respective expected emission reductions are summarised in

Table 3: Emission Reductions Over the First Crediting Period

Years			Estimated GHG emission reductions or removals (tCO2e)
01/10/2013	-	30/09/2014	222,884
01/10/2014	-	30/09/2015	222,884
01/10/2015	-	30/09/2016	222,884
01/10/2016	-	30/09/2017	222,884
01/10/2017	-	30/09/2018	222,884
01/10/2018	-	30/09/2019	222,884
01/10/2019	-	30/09/2020	222,884
01/10/2020	-	30/09/2021	222,884
01/10/2021	-	30/09/2022	222,884
01/10/2022	-	30/09/2023	222,884
Total estimated ERs			2,228,840
Total number of crediting years			10
Average annual ERs			222,884

1.8 Description of the Project Activity

Aslancık HPP generates electricity and feeds it into the national Turkish grid by using the renewable energy source of the current of Harşit Creek, which arises from Cimli, Karakaban and Kostan mountains in the surrounding of the town of Gümüşhane in the district and province of the same name. The watercourse passes the town of Torul in the district of the same name in Gümüşhane province, and then flows through Kürtün district. Here, the major regional HPP project complex Akköy I+II is located, with its first 101.94 MW_e component implemented in 2009 and another 187.27 MW_e under construction.[6] The watercourse then crosses the border to Giresun province entering Doğankent district where *Aslancık HPP* is located. Further upstream, in Gümüşhane province, there are Akköy I and Akköy II HPP projects. It flows into the the Black Sea East of the the town of Tirebolu, located in the district of the same name. Detailed information on the project location is compiled in *Section 1.9 below*.

Aslancık HPP comprises a barrage and reservoir, a diversion structure, an energy tunnel and penstock and the power house with the electro-mechanic equipment. The power generation is achieved by installing and operating a run-of-river HPP comprising 2 Vertical Francis turbines with a rated capacity of 60 MW each. The installed capacity totals 93 MW_e only, because this is the maximum use of the turbine combination. The estimated annual electricity production is 418,170 MWh/yr. Further details on project technology are given in *Table 4 below*.

5 See [VCS Standard v3.2], Section 3.10.

6 See e.g. http://www.oekb.at/de/exportservice/transparenz-compliance/Bundesgarantierte-Projekte-ab-10-Mio-Euro/2009/Seiten/tuerkei-wkw-akkoey.aspx or http://www.hesiad.org.tr/AKKOYENERJIBILGI.htm.

Aslancık HPP produces GHG emission free, clean electricity, which is fed into the national Turkish grid. All Turkish power plants are connected to this grid[7] and are dispatched centrally by the Turkish grid operator Türkiye Elektrik İletim A.Ş (**TEİAŞ**) and its Market Financial Settlement Centre (Turkish: Piyasa Mali Uzlastirma Merkezi; **PMUM**). The electricity supplied to the national grid is dominated by thermal power plants, see *Table 6* in *Section 1.10 below*. As *Aslancık HPP* is a run-of-river HPP, the electricity amount supplied to the grid depends on external physical conditions, i.e. the flow rate at *Harşit Creek*, though it is regulated to a certain extent by an appropriate management of the planned reservoir. In contrast, the thermal power plants connected to the national grid can fully be regulated. Concluding, the electricity produced by *Aslancık HPP* displaces power generation by thermal power plants, which leads to savings in fuel combustion and thus to the reduction of GHG emissions, as specified and explained in detail in *Section 3 below*.

Aslancık A.Ş. operates the HPP as **Independent Power Producer (IPP)** and has obtained the respective production licence from the Turkish Energy Market Regulatory Authority (Turkish: Enerji Piyasası Düzenleme Kurumu, **EPDK**) on 20/03/2008. The planned commissioning date is 01/10/2013.

Contribution to sustainable development

Building a HPP contributes to a sustainable expansion path of the Turkish energy system, as it serves the steadily growing electricity demand in an environmentally suitable way. The project also contributes to dissemination of state-of-the-art new renewable energy (REN) technology. This helps strengthening those pillars of Turkish energy supply that are based on ecologically sound and domestically sourced technology.

No significant negative ecological impacts can be expected from the proposed project activity. *Aslancık HPP* has undergone a full environmental impact assessment **(EIA)** according to Turkish law. The EIA Report has been submitted on 01/02/2008, leading to environmental approval of the project by the Turkish Ministry of Environment and Forestry (Turkish: Türkiye Cumhuriyeti Çevre ve Orman Bakanlığı, **TÇOB**) on 02/04/2008. A summary of the EIA Report is given in *Section 5 below*.

In fact, there are essential positive environmental effects, as highly polluting electricity generation technologies is displaced by the project. Pollution not only comprises greenhouse gases but other local air pollutants such as SO_2, NO_x, or Particulate Matter, as well.

As for social impacts, significant positive employment effects will occur especially during the construction and installation period. Management, operation and maintenance of the HPP creates permanent jobs which require high qualification, contributing to capacity building and know-how dissemination in Turkey.

[7] The only exemption are the isolated autoproducer plants, where the plant operators use the generated electricity directly for their own demand. See *Figure 6* in *Section 2.3 below*.

Table 4: Technical Data

HYDROLOGY		
Precipitation area: 3,109 km²	**Long term average flow at the dam/barrage:** 45.11 m³/s -1,420.57 hm³/a	
RESERVOIR		
Maximum (minimum) operating water altitude/level: 183m (180m)		
Total storage volume: 1.636 hm³	**Lake area:** 0.175 km²	
BULKHEAD/COFFERDAM AND DIVERSION		
Altitude of the upstream (downstream) cofferdam: 176m (166m)		
Dimensions of the diversion channel: 12m · 7m	**Length:** 330m	
DAM/BARRAGE		
Type: Concrete weight	**Crest elevation:** 185m	**Thalweg elevation:** 165m
Height from thalweg/Dam height: 20m	**Height from foundation:** 29m	
WATER INTAKE STRUCTURE		
Control: Rolling cofferdam cover	**Invert elevation:** 171m	
Dimension of the clear aperture: 2 · 5.5m · 12m	**Limit of submergence:** 3.5m – 6.5m	
GRAVEL PASS		
Type: Orifice radial cover	**Invert elevation:** 165m	**Dimensions of the radial covers:** 6m · 2.95m
SPILLWAY/OVERFALL		
Location and type: on the stem, radial cover, frontal acceptance		
Number of radial covers: 3	**Dimensions of the radial covers:** 13.3m · 15.12m	
ENERGY TUNNEL		
Type: Reverse-U Cross section (modified horseshoe), concrete coated		
Tunnel inside diameter: 5.5m	**Tunnel length (up to steel coating):** 12,907m	
Length and diameter of the Steel coated tunnel: 160m / 4.5m circular		
VALVE CHAMBER		
Type: On the place	**Dimensions:** 18.5m · 8m	**Equipment:** 1 · 4,500mm butterfly valve
SURGE CHAMBER		
Type: Vertical cylindrical shaft	**Shaft diameter:** 22m	**Top of shaft elevation:** 205m
Shaft altitude: 50m	**Maximum water level:** 200m	**Minimum water level:** 155.5m
PENSTOCK		
Diameter: 4,500mm	**Length:** 238m	**Bifurcation area:** 3,200mm (diameter) / 2 · 18=36m (length)
POWER HOUSE		
Type: Half submerged	**Number of units:** 2	**Nominal/Rated installed capacity:** 2 · 60 MW
Turbine: Vertical Francis	**Maximum gross head:** 134.5m	**Unit discharge/flow rate:** 56m³/s
Dimensions: 36.8m · 17m	**Altitude (max.):** 39.8m	**Elevation of Environment:** 58m
SWITCHYARD		
Type: Open-air switchyard	**Operating voltage:** 13.8/154 kV	**Dimensions :** 42m · 81m
Energy transmission line: 1272 MCM / Length 11.4km / End at TEİAŞ' Tirebolu Substation		

1.9 Project Location

Aslancık HPP is located in Doğankent and Tirebolu districts, Giresun province in Turkey.

Figure 1: Location of Doğankent and Tirebolu districts in Giresun province in Turkey

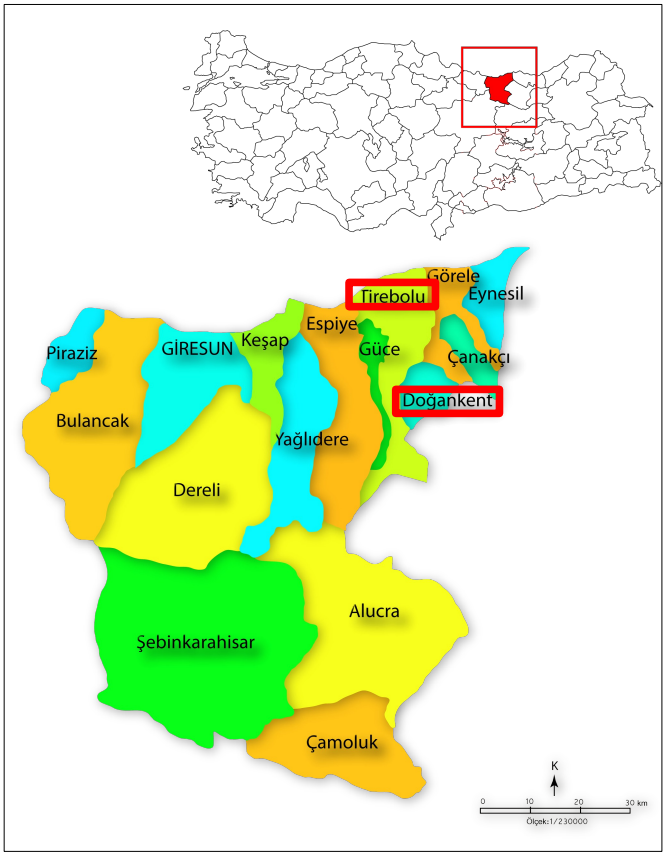


Figure 2: Aslancık HPP location in Doğankent and Tirebolu districts

The dam axis is located some 1.5km North of the town of Doğankent. The energy tunnel stretches over a distance of some 13km alongside the Harşit Creek watercourse, ending in the power plant which is located some 1.5km East of the village of Soğukpınar.

Figure 3: Location of Aslancık HPP project components

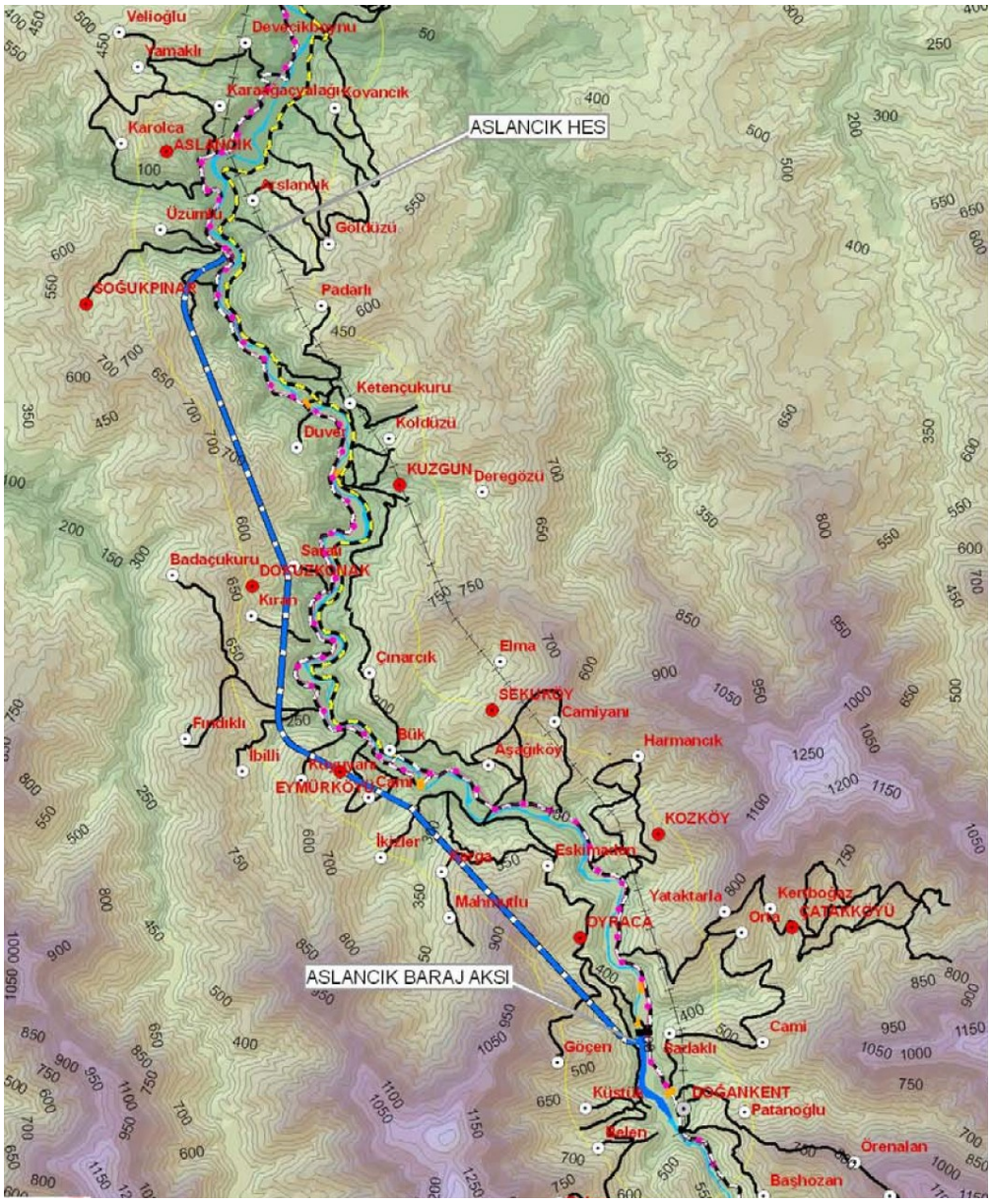


Table 5: Coordinates of Aslancık HPP Project Components

Unit	Longitude (N)	Latitude (E)
Power House	40°54'27.09"N	38°50'45.33"E
Dam Axis	40°49'7.32"N	38°54'47.90"E
	40°49'6.70"N	38°54'38.38"E
Energy Tunnel	40°49'4.20"N	38°54'38.26"E
	40°54'41.26"N	38°50'45.56"E

1.10 Conditions Prior to Project Initiation

The current situation in the Turkish electricity system, i.e. the situation prior to the implementation of the proposed project activity, is characterised by the following distribution of primary energy resources used for electricity generation, as is displayed in Turkish electricity generation-transmission statistics 2010[8] published by *TEİAŞ*:

Table 6: Turkey's Gross Electricity Generation by Primary Energy Resources[9]

	Gross electricity generation (GWh)		
Primary Energy Resources	**2008**	**2009**	**2010**
Hard Coal+Imported Coal	15,857.50	16,595.60	19,104.30
Lignite	41,858.10	39,089.46	35,942.10
Coal Total	57,715.60	55,685.06	2,143.80
Fuel Oil	7,208.60	4,439.77	4.30
Diesel oil	266.30	345.81	0.00
LPG	0.00	0.40	31.90
Naphtha	43.60	17.56	98,143.70
Liquid Total	7,518.50	4,803.53	457.50
Natural Gas	98,685.30	96,094.71	55,380.10
Renewables and wastes	219.90	340.15	19,104.30
Thermal Total	164,139.30	156,923.44	35,942.10
Hydro+Geothermal+Wind Total	34,278.70	37,889.47	2,143.80
TURKEY'S TOTAL	**198,418.00**	**194,812.92**	**211,207.70**

The current generation mix is clearly dominated by fossil fuel fired power sources, causing GHG emissions of 105,940.85 kt CO_2 in 2008.[10] For 2009 and 2010, 98,047 kt CO_2 and 98,582 kt CO_2 are calculated in this document, see *Table 20* in *Section 3.1.2. Step 4 below*.

The coal fired power plants serving the Turkish system are characterised by pulverized coal combustion technology with relatively low pressure and temperature. The average efficiency is around 32-33%, with a maximum of 38%. The average age is approx. 28 years.[11] Typical thermal power plants are also characterised in *Table 7 below*:

8 See http://www.teias.gov.tr/istatistik2010/İstatistik 2010.htm; **[TEİAŞ Statistics]**.

9 Source: [TEİAŞ Statistics], http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/uretim-tuketim(22-45)/40(06-10).xls. For a detailed compilation of all power plants serving the Turkish system, see TEİAŞ (2011): Türkiye elektrik enerjisi 10 yıllık üretim kapasite projeksiyonu (2011–2020) pp. 88-101 (Turkish 10-year electricity generation capacity projection). http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2011.pdf **[TEİAŞ Projection]**

10 Source: TURKEY Greenhouse Gas Inventory 1990 to 2008, CRF Tables; Turkish Statistical Institute 2010 (Download at http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/tur-2010-crf-15april.zip). Figures include emissions from petroleum refining.

11 See Presentation "Clean Coal Technologies" held by Assoc. Prof. Dr. Fehmi Akgün during the "Turkish-American Clean Energy Conference" in Istanbul in January 2008. http://www.americanturkishcouncil.org/events/cleanenergy/pdf/TuesdayMorningBallroom2&3/AkgunFehmi_2008CleanEnergy.pdf.

Table 7: Thermal Power Plants in Turkey[12]

Power plant name	Fuel type	Province	Total capacity (MW)	Projected generation (GWh)	Average thermal efficiency (%)
Afşin-Elbistan A	Lignite	K.Maraş	1,360.00	8,840.00	30.06
Aliağa GT+KÇ	Diesel oil	İzmir	180.00	540.00	33.78
Ambarlı	Fuel oil	İstanbul	630.00	4,100.00	37.25
Ambarlı KÇ	Natural Gas	İstanbul	1,350.90	8,780.00	48.57
Bursa	Natural Gas	Bursa	1,432.00	10,024.00	54.40
Çatalağzı B	Hard Coal	Zonguldak	300.00	1,950.00	33.57
Çayırhan 1,2	Linyit	Ankara	320.00	2,080.00	34.54
Denizli Tabii	Buhar	Denizli	17.50	105.00	11.57
Esenyurt I,II,III,IV	Natural Gas	İstanbul	188.50	1,413.80	45.00
Enron(Trakya Elek.)	Natural Gas	Tekirdağ	498.70	3,740.30	47.00
Engil GT	Diesel oil	Van	15.00	90.00	21.27
Hakkari	Fuel oil	Hakkari	11.10	83.30	35.03
Hamitabat KÇ	Natural Gas	Kırklareli	1,200.00	7,800.00	45.81
Hopa	Fuel oil	Artvin	50.00	200.00	26.27
Kangal 1,2,3	Lignite	Sivas	457.00	2,970.50	29.76
Kemerköy 1,2,3	Lignite	Muğla	630.00	4,095.00	33.21
Orhaneli	Lignite	Bursa	210.00	1,365.00	36.18
Ova elektrik	Natural Gas	Kocaeli	258.40	1,938.00	44.00
Park Termik	Lignite	Ankara	300.00	1,072.90	34.71
PS3-Silopi	Fuel oil	Ş. Urfa	44.10	330.80	37.36
PS3A-idil	Fuel oil	Mardin	11.40	85.50	35.19
Seyitömer	Lignite	Kütahya	600.00	3,900.00	32.97
Soma A	Lignite	Manisa	44.00	290.00	30.31
Soma B	Lignite	Manisa	990.00	6,435.00	32.45
Tunçbilek A+B	Lignite	Kütahya	429.00	2,790.00	31.45
Unimar	Natural Gas	Tekirdağ	504.00	3,780.00	37.00
Van	Fuel oil	Van	24.00	180.00	39.33
Yatağan	Lignite	Muğla	630.00	4,100.00	32.67
Yeniköy	Lignite	Muğla	420.00	2,730.00	34.82

Recent capacity additions are clearly dominated by natural gas plants (see *Table 24* in *Section 3.1.2. Step 5 below* and *Table D* in *Annex: Baseline Information below*) with presumably higher efficiencies than displayed in *Table 7 above* (see also *Table 23* in *Section 3.1.2. Step 5 below*).

[12] Source: Environmental Atlas of Turkey (Türkiye Çevre Atlası) 2004, p. 197. http://www.cedgm.gov.tr/dosya/cevreatlasi/atlasin_metni.pdf.

Current projections for system extension from [TEİAŞ Projection] are represented below:

Figure 4: Shares of energy resources in projected Turkish electricity generation 2011-2020 (scenario 1).[13]

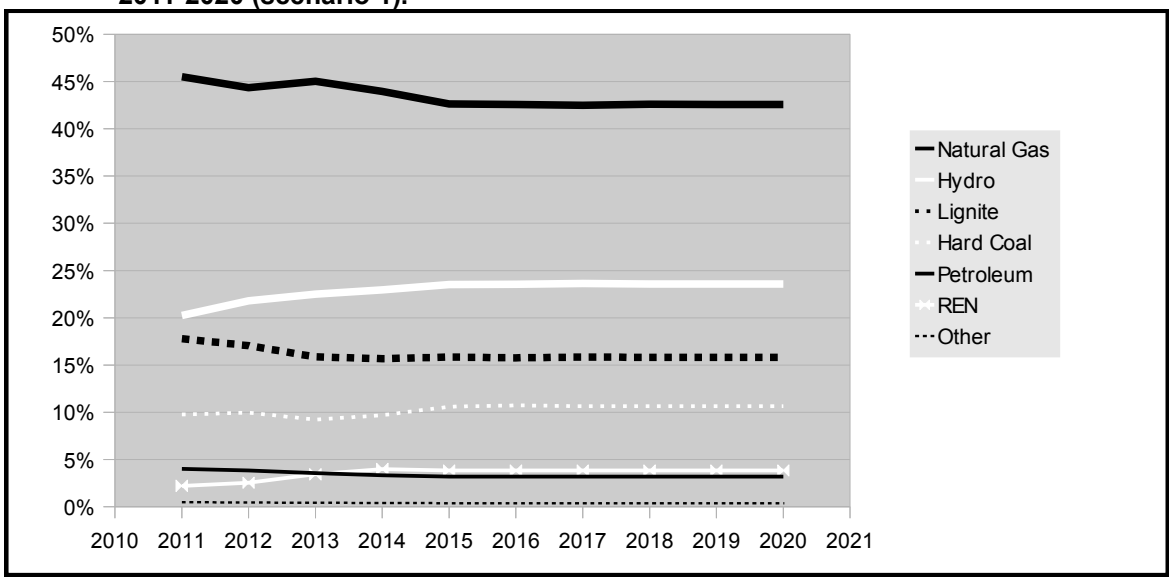
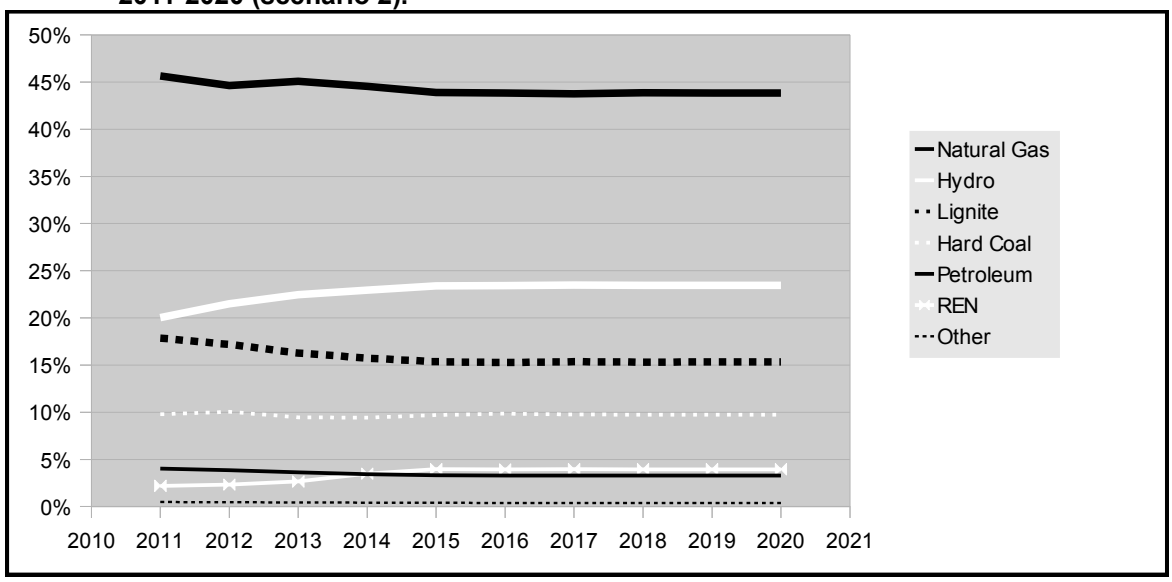


Figure 5: Shares of energy resources in projected Turkish electricity generation 2011-2020 (scenario 2).[14]



As can be seen in both scenarios, electricity generation in Turkey is clearly based on fossil fuels and is expected to remain so in the nearer future, with natural gas representing roughly 45%, hydro electricity being about to stabilize at a level between 20% and 25%, emission intensive lignite keeping a share of around 15%, hard coal keeping a share of approx. 10%, and petroleum based sources expected to stay below 5%. Renewable energy will increase its share significantly, but from a very low level, and is not expected to reach 5%.

[13] For underlying values see *Table A below* in *Annex: Baseline Information*.

[14] For underlying values see *Table B below* in *Annex: Baseline Information*.

The project boundary comprising the relevant emission sources which are affected by *Aslancık HPP* is the Turkish electricity system, see *Figure 6* in *Section 2.3 below*. The project proponent has never in the past had any share of or control over the relevant emission sources. This demonstrates that no GHG emissions were primarily created by the project proponent for the purpose of subsequent removal. The project itself is GHG emission neutral, as is shown in *Section 3.2 below*.

1.11 Compliance with relevant local laws and regulations related to the project

Aslancık HPP is in compliance with all applicable laws and regulations such as

(1) Electricity Market Law. (Law Number: 4628, ratified 20/02/2001, enacted 03/03/2001)
(2) Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy (Law Number: 5346, ratified 10/05/2005, enacted 18/05/2005)
(3) Environment Law (Law Number: 2827, ratified 09/08/1983, enacted 11/08/1983)

The relevant evidence, such as grid connection agreement, land lease contracts, production licence, and relief from duty to perform *EIA* are available for validation and/or displayed in this VCS PD.

1.12 Ownership and other Programs

1.12.1. Proof of Title

Aslancık Elektrik Üretim A.Ş. holds all licences, permits and land use rights related to *Aslancık HPP* and has obtained and owns all equipment used for its implementation.

1.12.2. Emissions Trading Programs and Other Binding Limits

No GHG emissions trading scheme/emission cap is implemented for the Turkish power sector.

1.12.3. Participation under Other GHG Programs

Aslancık HPP does not participate in any GHG program other than the *VCS version 3*.

1.12.4. Other Forms of Environmental Credit

No GHG related environmental credits are applied to the Turkish power sector.

1.12.5. Projects Rejected by Other GHG Programs

N/A

1.13 Additional Information Relevant to the Project

1.13.1. Eligibility Criteria

Not applicable, since *Aslancık HPP* is not a grouped project.

1.13.2. Leakage Management

Not applicable, as leakage is not to be considered, see *Section 3.3 below*.

1.13.3. Commercially Sensitive Information

1. Contract with carbon market consultant
2. Financial data on *Aslancık HPP*
3. Land lease contracts and expropriation documentation
4. Bank loan agreement
5. Supplier contract
6. Grid connection agreement

1.13.4. Further Information

N/A

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

The UNFCCC Clean Development Mechanism (CDM) is a VCS approved GHG program. Concluding, methodologies and methodology elements approved under the CDM may be used for VCS projects.[15]

In this VCS PD, the following CDM methodology elements and methodologies are applied:

1. The Approved Consolidated Baseline and Monitoring Methodology "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" Version 12.3.0 valid as of 02/03/2012 (referred to as **ACM0002** from here on) is used in combination with the
2. "Tool to calculate the emission factor for an electricity system" Version 2.2.1 valid as of 29/09/2011 (referred to as "**EF Tool**" from here on) as well as with the
3. "Tool for the demonstration and assessment of additionality" Version 06.0.0, valid as of 25/11/2011 (referred to as the "**Additionality Tool**" from here on).

2.2 Applicability of Methodology

The "Applicability" Section in *ACM0002* states:

"This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant) [...]. [...] The methodology is applicable under the following conditions:

- The project activity is the installation[...] of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), [...]
- In case of hydro power plants, one of the following conditions must apply: [...] The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity [...] is greater than 4 W/m^2 [...]"

All these criteria and conditions are met by *Aslancık HPP*. Particularly, it results in new reservoirs, and the power density is greater than 4 W/m^2, as is demonstrated in *Section 3.2 below*.

Moreover, *ACM0002* explicitly requires to apply the applicability conditions of *EF Tool* and *Additionality Tool*. The Section "Scope and applicability" in the *EF Tool* states: "[...] This tool may be applied [...] when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid [...]". This is the case for *Aslancık HPP*.

In the *Additionality Tool*, the Section "Scope and applicability" states: "[...] The document provides a general framework for demonstrating and assessing additionality and is applicable to a wide range of project types. [...]" As the project type of *Aslancık HPP* is in accordance with *ACM0002*, and at the same time, *ACM0002* refers to the *Additionality Tool*, the latter can clearly be considered as applicable.

2.3 Project Boundary

ACM0002 **prescribes the baseline scenario** for projects being "[...] the installation of a new grid-connected renewable power plant/unit[...]" as follows:

"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'."

As *Aslancık HPP* is a new grid-connected power plant, this baseline scenario applies.

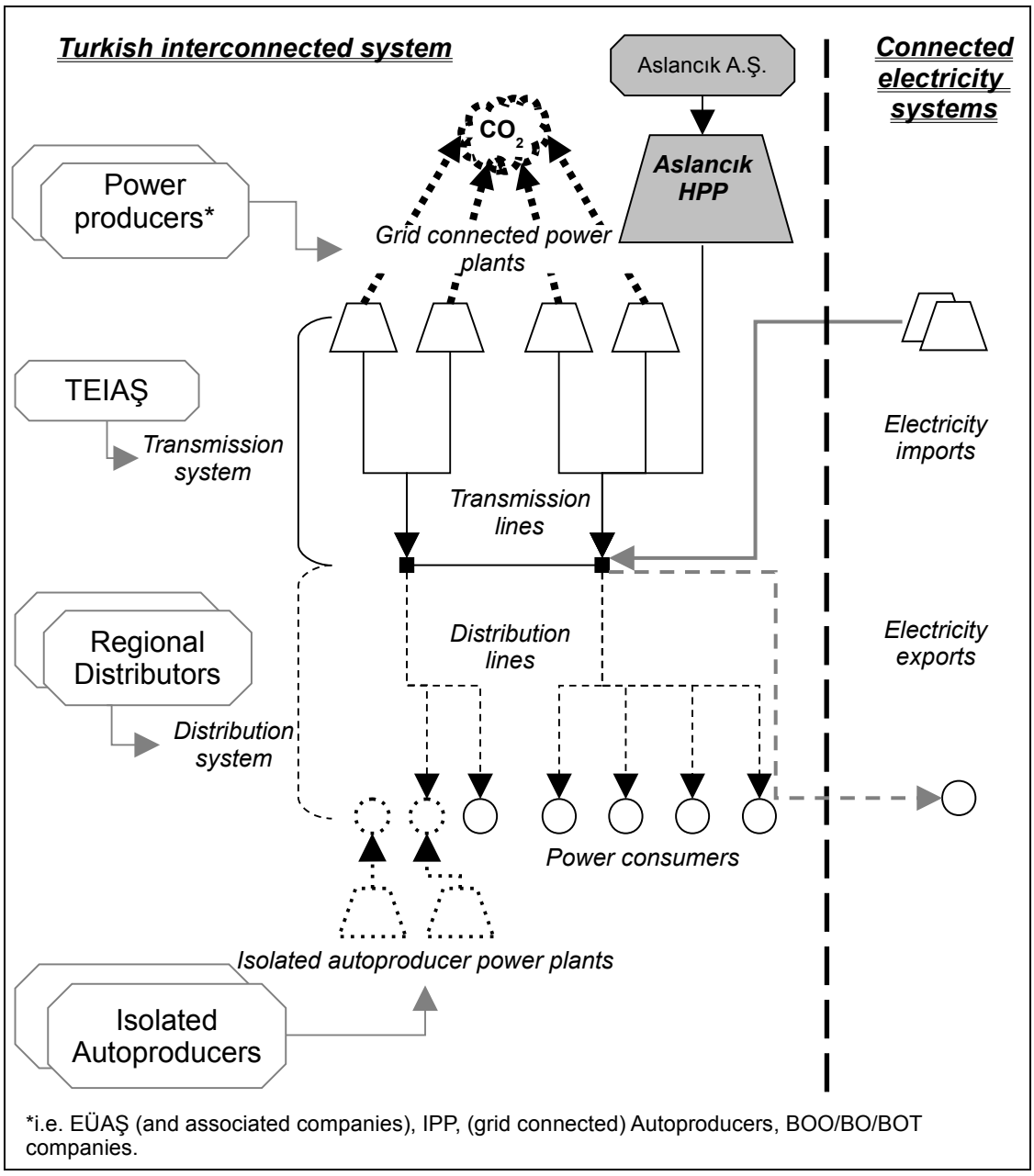
[15] See http://www.v-c-s.org/how-it-works/linked-programs and http://www.v-c-s.org/methodologies/find.

As a consequence, *ACM0002* provisions about identification of GHG sources are as follows:

"The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system [...] that the [...] project power plant is connected to."

So, as relevant sources, basically all power plants connected physically to the Turkish national electricity grid and feeding electricity into it will be included in the project boundary. This includes power plants outside Turkey supplying electricity imports into the Turkish grid. An overview is given in

Figure 6: Flow diagram of Turkish electricity system



As for the relevant greenhouse gases, CO_2 and CH_4 emissions will be included in the project boundary, see

Table 8: Emission Sources Included in the Project Boundary:

Source		Gas	Included?	Justification/ Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project	CH_4 emissions from the reservoir	CO_2	No	Minor emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source

2.4 Baseline Scenario

ACM0002 **prescribes the baseline scenario** for projects being "[...] the installation of a new grid-connected renewable power plant/unit[...]" as follows:

“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’.”

As *Aslancık HPP* is a new grid-connected power plant, this baseline scenario applies.

This is fully in line with *VCS version 3* rules[16] because:

1. Equivalence between the product of the baseline and the product of the project is obvious.
2. The application of the *EF Tool* clearly assures that an overestimation of emission reductions is avoided.

The identified baseline scenario mainly corresponds to the situation prior to the implementation of the proposed project activity as described in *Section 1.10 above*.

The CM calculations reflecting the baseline, the characteristics of the technology that would be employed, and the activities that would take place in the absence of the proposed project activity are described in detail in *Section 3 below*.

The relevant electricity system is identified in *Section 3.1.2. Step 1 below*.

A general characterisation of the power plants included in the baseline scenario's presence component is contained in *Section 3.1.2. Step 3 below*.

The characterisation of the power plants representing the future component of the baseline is given in *Section 3.1.2. Step 5 below*. Also, *Table D* in *Annex: Baseline Information below* lists the actual power plants representing the forecast component.

In *Section 3.1.2. Step 4 below*, the relevant characteristics of the power plants representing the presence component are illustrated, i.e. generation in *Table 20* and emissions in *Table 21*.

[16] See [VCS Standard v3.2], Section 3.14.

2.5 Additionality

ACM0002 requires to use the *Additionality Tool* for demonstrating and assessing additionality and to follow the stepwise approach provided there.

Step 1 Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1.a Define alternatives to the project activity

Considering the expected market share and position of *Aslancık A.Ş.*, representing only a minor share of expected hydro power generation and a negligible share of total generation, there is no indication that Turkish power production system as whole could be influenced by its decisions in any way. So, *Aslancık A.Ş.* has only the choice whether or not to implement the proposed project activity. If not, the respective power will be provided by the (then) existing Turkish generation facilities as represented by *Figure 5* and *Figure 4* in *Section 1.10 above*. Concluding, only the following alternatives to the proposed project activity will be considered:

1. The proposed HPP project without origination and sale of Verified Carbon Units (VCUs).
2. The production of the projected electricity amount by the operation of grid-connected power plants as well as by those power plants subject to the upgrading of Turkish electricity generation according to [TEİAŞ Projection].

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

Both alternatives are in full compliance with all applicable laws and regulations. All required official approvals for *Aslancık HPP* are at hand. The electricity system expansion scenario has been published by an official Turkish authority making any conflict with applicable law very unlikely.

All the alternatives to the project outlined in sub-step 1a above are in compliance with applicable laws and regulations, including:

- Electricity Market Law (Number 4628, ratified 20/02/2001, enacted 03/03/2001)
- Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy (Number 5346, ratified 10/05/2005, enacted 18/05/2005)
- Environment Law (Number 2827, ratified 09/08/1983, enacted 11/08/1983)

Step 2 Investment analysis

The purpose of this step is to demonstrate that the proposed project activity is not economically or financially feasible without the revenue from the sale of VCUs. According to the *Additionality Tool*, "[...] the latest version of the 'Guidelines on the assessment of investment analysis' [in short *Investment Analysis Guidelines*] […] shall be taken into account when applying this step."

Sub-step 2.a Determine appropriate analysis method

The *Additionality Tool* provides for three options regarding investment analysis, i.e. (I) simple cost analysis, (II) investment comparison analysis, and (III) benchmark analysis.

Option (I) is considered appropriate only if the proposed project activity as well as the alternatives presented in *Sub-step 1.a above* generate no financial or economic benefits other than income from carbon trade. As all alternatives and the proposed project activity generate income from electricity sales as well, Option (I) is not applicable.

Option (II) investment comparison is also not applicable. The Annex to the *Additionality Tool* states: "[...] If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate.[...]" *Aslancık A.Ş.* has only the choice between implementing the proposed project activity or not investing at all. In the latter case, *alternative no. 2.* as described in *Sub-step 1.a above* would become effective, which is equal to the one described in the citation above.

Concluding, Option (III), i.e. benchmark analysis, is chosen.

Sub-step 2.b Option III. Apply benchmark analysis

First, an appropriate **financial indicator** must be determined to measure economic attractiveness/ feasibility of the proposed project activity. For the investment decision context of *Aslancık HPP*, the appropriate indicator is considered to be **equity IRR**, because the essential question at the time of investment decision was whether the equity invested by *Aslancık A.Ş.* could be expected to yield a sufficient return. *Aslancık A.Ş.* has made the actual investment decision on 21/07/2010 when the contract with the construction company was closed. A full overview on the most relevant project development milestones is given in

Table 9: Project Time Line

Project development step	**Date**
Agreement on use of water resources with (Devlet Su İşleri Genel Müdürlüğü, DSİ)	17/01/2007
Finalisation of EIA Report	01/02/2008
Granting of EPDK production licence	20/03/2008
Environmental Approval by TÇOB	02/04/2008
Grid connection agreement with TEİAŞ	01/07/2008
Board Decision to use carbon credits	25/08/2008
First Carbon Market Consultant Contract	02/09/2008
Signing of loan term sheet	01/06/2010
Completion of pre-feasibility study	July 2010
Time of investment decision: Construction contract	21/07/2010
First down payment for construction works	22/07/2010
Contract with technology provider	22/12/2010
Contract for power line	30/11/2010
First payment for power line	14/12/2010
Bank loan contract	24/01/2011
First payment to technology provider	18/02/2011
Confirmation of Board Decision to use Carbon Credits	08/06/2011
Termination of Carbon Asset Development Agreement with initial consultant	15/06/2011
New carbon consulting contract with current carbon market consultant	01/07/2011
Expected date of full HPP commissioning	01/10/2013

According to clause 12 of the *Investment Analysis Guidelines,* the appropriate **benchmark** for equity IRR is **required return on equity**.

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

The *Additionality Tool* states that "[...] the financial/economic analysis shall be based on parameters that are standard in the market[...]" except for certain particular circumstances. More precisely, the *Investment Analysis Guidelines* state in their clause 13: "In cases of projects which could be developed by an entity other than the project participant the benchmark should be based on parameters that are standard in the market." As the development of *HPP* projects in Turkey is not reserved to one company only, the application of parameters that are standard in the market is obligatory.

According to clause 15 of the *Investment Analysis Guidelines*, the cost of equity can be determined by selecting values from a list provided in an Annex to the *Investment Analysis Guidelines*. This list dis-

plays default values for expected return on equity calculated on real terms after taxes for a variety of countries and for three groups of project types, respectively. While Turkey is not included in this list, the calculation can be reproduced for Turkey according to the calculation method explained in the Appendix to the *Investment Analysis Guidelines*:

"The expected return on equity is composed of four elements: (a) a risk free rate of return; (b) an equity risk premium; (c) a risk premium for the host country; and (d) an adjustment factor to reflect the risk of projects in different sectoral scopes." The risk free rate is determined as 3.0%, the equity risk premium as 6.5%. The country risk premium is derived from the country's Moody's rating. The adjustment factor depends on the project type. Project types are assigned to three groups. Group 1 incorporates the sectoral scope "Energy Industries" to which *Aslancık HPP* belongs.

This means that applicable values for "Group 1" projects only differ between countries with different Moody's ratings, as can easily be verified by checking the table. Concluding, the applicable value for a "Group 1" project in Turkey must be equal to the values for "Group 1" projects in other countries with the same Moody's rating as Turkey. The Moody's rating of Turkey as of January 2012 is Ba2.[17] It has also been Ba2 in 2011 and 2010, respectively.[18] Concluding, the value displayed in the list contained in the *Investment Analysis Guidelines* for countries with a Ba2 rating is applicable to Turkey, too. These countries are Armenia, Guatemala, Indonesia, and Jordan. The "Group 1" value for these countries is **12.5%**.

According to the *Investment Analysis Guidelines*, this value may be converted into a nominal value by adding the inflation rate in situations where an investment analysis is carried out in nominal terms. As the IRR calculation provided for Validation is conducted in nominal terms, the value must be converted. According to the *Investment Analysis Guidelines* , the inflation rate shall be obtained from the target inflation rate of the central bank in cases where the inflation forecast for the duration of the crediting period is not available. This duration is 10 years, and no inflation forecast is available from Central Bank of Turkey (Turkish: Türkiye Cumhuriyet Merkez Bankası, **TCMB**) for this duration. Thus, the target rate is applied which is **5%**.[19] Seen as the current and recent historical rates have been much higher, this can be considered as highly conservative, please refer also to *Table 13 below*.

Concluding, the **benchmark** is calculated as 12.5%+ 5% = **17.5%**.

The **equity IRR** for *Aslancık HPP* is calculated based on data and assumptions as displayed in

Table 10: Financial Data for Aslancık HPP

Total Investment	$213,997,000
Equity	$53,997,000
Bank Loan Amount	$160,000,000
Bank Loan Duration (after plant commissioning)	9 years
Bank Loan Interest	3.95% + LIBOR
Assumption for LIBOR[20]	0.7185%
Operation Costs + Transmission Fee (annually)	$2,548,400
Assumption for Power Price	120.00 USD/MWh
Royalty fee to be yielded to DSİ	53.77 USD/MWh
Annual electricity generation (net)	418,170 MWh/yr

17 http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html.

18 http://www.stern.nyu.edu/~adamodar/pc/datasets/ctryprem.xls; http://www.stern.nyu.edu/~adamodar/pc/archives/ctryprem10.xls.

19 See TCMB Inflation Report 2012-I, page 9. http://tcmb.gov.tr/research/parapoli/inflation2012I_full.php.

20 Monthly average for July 2010, see http://www.wsjprimerate.us/libor/libor_rates_history.htm.

Based on these assumptions, the **equity IRR** after taxes is calculated as **11.31%** in nominal terms, without any income from carbon credits. This value is clearly below the benchmark of 17.5%.

As a preliminary conclusion, the proposed project activity is not economically or financially feasible without origination and sale of VCS VCUs. Including VCS VCUs and assuming a price of 6 USD/VCU, would lead to an equity IRR of 12.4%.

Sub-step 2.d Sensitivity analysis

To demonstrate that the preliminary conclusion deduced above is robust to reasonable variations in the critical assumptions, a sensitivity analysis is conducted. The *Additionality Tool* suggests to subject only those variables to variation that constitute more than 20% of total project costs. Also, it suggests that a general point of departure should at least cover a range of +10% and -10%.

The variables included in the sensitivity analysis are:

1. Total annual gross income, depending on annual net generation
2. The investment costs

A compilation of the corresponding variations is given in

Table 11: Sensitivity Analysis

	Variation acc. to Additionality Tool			Variation to reach benchmark	
Variable	**Deviation**	**Value**	**IRR**	**Deviation**	**Value**
Net annual electricity production	+10.00%	460,000 MWh/yr	13.61%	+26.34%	528,300 MWh/yr
Total Investment	-10.00%	$192,590,000	13.79%	-21.28%	$168,450,000
Power tariff	+10.00%	132.00 USD/MWh	15.44%	+14.88%	137.85 USD/MWh

Any variation to reach the benchmark is highly unlikely or even impossible:

PMUM power price history clearly shows that the assumption of 120 USD/MWh was highly optimistic, and any increase is very unlikely. An overview is given in

Table 12: Average Power Prices in Turkey 2006 - 2011[21]

Year(s)	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Average 2006-2011**
Annual average (USD/MWh)	79.65	98.07	124.08	93.76	81.43	75.49	93.61

The updated estimation of total investment costs has significantly increased as compared to the 2010 figures.

Other parameters of the IRR calculation can be considered as highly conservative, too. LIBOR rates, e.g. must be expected to rise significantly until 2014 when the first interest payments will be due, because the recent historical and the current levels are very low due to the global financial crisis.

The sensitivity analysis clearly shows that the conclusion reached in *Sub-step 2.c above* is robust.

Concluding, the proposed project activity is additional.

[21] For TL nominated prices, see http://dgpys.teias.gov.tr/dgpys/.
Exchange rates have been taken from *TCMB*, see http://evds.tcmb.gov.tr/yeni/cbt-uk.html.

Step 3 Barrier analysis

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

The barriers that prevent the project from being implemented unless additional revenues from VCS VCUs accounting for its climate protection effects can be generated mainly result from the general economic situation in Turkey as well as from the legal framework for the promotion of REN sources in effect in Turkey at the time of investment decision, i.e. on 21/07/2010, see *Table 9* in *Section 2.5 above*.

A. <u>High country risk:</u>

A.1. Economic key data

The Turkish economy must be considered as a rather volatile and risk intensive economy, not least due to the experience of "a series of severe currency and financial crises culminating in the financial crisis of 2001".[22]

Since then, Turkey has achieved steady economic growth, but the global financial crisis has lead to a slowdown in years 2007 and 2008. At the time of investment decision in the middle of 2010, Turkey had just experienced the first recession year for long time. *Table 13 below* compiles economic key data for the most recent years, showing high inflation rate, a high public debt to GDP ratio, a constant current account deficit, and a high cost of money.

Table 13: Key Economic Indicators for Turkey

Year	2005	2006	2007	2008	2009	2010
GDP growth [%][23]	8.40	6.90	4.70	0.70	-4.80	8.90
Inflation [%][24]	8.20	9.60	8.80	10.40	6.30	8.60
Current account/GDP [%][25]	-4.60	-6.10	-5.90	-5.70	-2.30	-6.60
Debt stock/GDP [%][26]	52.70	46.50	39.90	40.00	46.10	42.20
Lending rate [%][27]	26.00	28.00	27.00	26.50	N/A	N/A

With regard to **GDP growth rate**, the expectations in [IMF WEO 2011] are 6.6% for 2011, 2.2% for 2012, and 4.3% for 2016.[28]

[22] European Bank for Reconstruction and Development **(EBRD),** 2008: Request by Turkey to Become a Recipient Country of the EBRD: Strategic Review, p. 4. **[EBRD Request Review]**

[23] Gross domestic product annual growth rate. Source: International Monetary Fund (IMF): World Economic Outlook September 2011, p. 182. http://www.imf.org/external/pubs/ft/weo/2011/02/pdf/text.pdf; **[IMF WEO 2011]**

[24] Average annual change in consumer price index CPI. Source: [IMF WEO 2011], p. 188.

[25] Source: [IMF WEO 2011], p. 198.

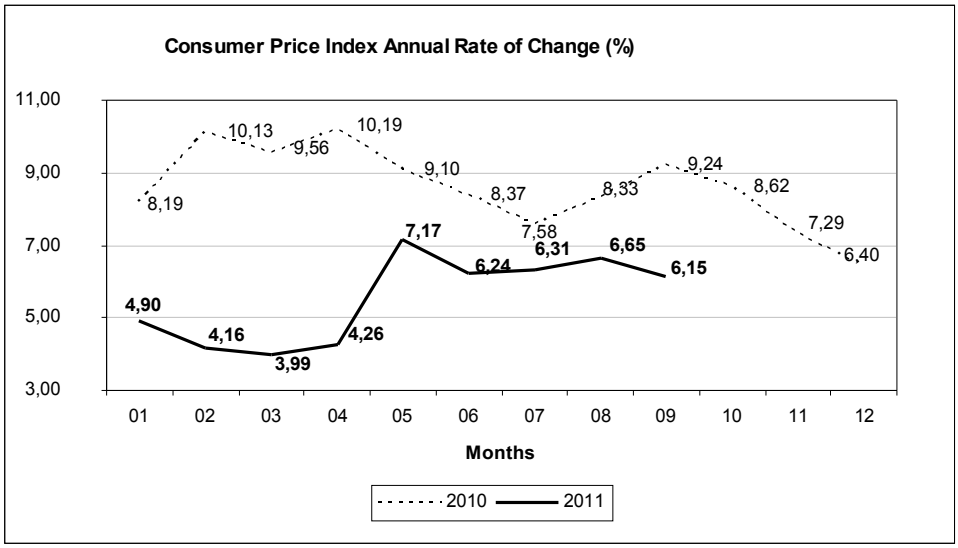
[26] General Government Nominal Debt Stock Defined by EU Standards. Source: Undersecretariat of Treasury. http://www.treasury.gov.tr/irj/portal/anonymous/NominalDebtStockDefinedEU/?guest_user=treasury.

[27] Source: *EBRD* (2009): Strategy for Turkey, p. 57. Note: 2008 value is estimated. http://www.ebrd.com/downloads/country/strategy/turkey.pdf. **[EBRD Country Strategy]**

[28] Source: [IMF WEO 2011], p. 182.

As for **Inflation**, the *IMF* projections are: 6.0% for 2011, 6.9% for 2012, and 5.0% for 2016.[29] Most recent data on inflation provided by Turkish Statistical Institute (Turkish: Türkiye İstatistik Kurumu, **TÜİK**) is represented in

Figure 7: Recent inflation in Turkey[30]



For **Current Account Deficit**, [IMF WEO 2011] projections are: -10.3% in 2011, -7.4% in 2012, and -7.5% in 2016.[31]

In 2009, *EBRD* emphasized the highly adverse coincidence of current account deficit with fiscal deficit, leading to high dependency on domestic and external financing.[32]

For **Debt to GDP Ratio** and **lending rate**, no updated figures are available.

Another major problem is the **highly volatile exchange rate** of the New Turkish Lira (Turkish: Yeni Türk Lirası; YTL) against hard currency like Euro (EUR) or US-Dollar (USD).[33]

A.2. Turkey as a Business Location

Economic key data as presented above leads to a high risk perception by both investors and banks, resulting in comparably high return requirements by investors and significant difficulties in obtaining credit capital. This lack of investor confidence is reflected i.a. in the following *EBRD* statement on Turkey's attractiveness for Foreign Direct Investment (FDI)[34]: "Turkey's record in attracting greenfield FDI has been disappointing until very recently as macroeconomic instability, corruption, inadequate infrastructure, and the unpredictability of the legal regime deterred investors. The country attracted US$ 22 billion in foreign direct investment last year [i.e. 2007, author's note], which is the second straight year of strong FDI inflows; however, at only 3 per cent of GDP, these inflows are still quite modest compared to other transition countries in relative terms."

29 See [IMF WEO 2011], p. 188.

30 Source: TÜİK Press release no. 202/2011; http://www.turkstat.gov.tr/HbGetir.do?id=8604.
Figure is copied directly and thus shows numbers with commas (i.e. ",") for decimal points as usual for Turkey.

31 See [IMF WEO 2011], p. 198.

32 See [EBRD Country Strategy], p. 4.

33 See exchange rate statistics available on TCMB website: http://evds.tcmb.gov.tr/yeni/cbt-uk.html.

34 See [EBRD Request Review], p. 5.

FDI inflows in terms of share of GDP have even deteriorated since then, i.e. to 2.5% in 2008, and to 1.8% in the first quarter of 2009.[35] For current data see

Table 14: Net FDI in Turkey (million USD)[36]

2007	2008	2009	2010
19,940	15,720	6,879	8,500

Although these developments have been somewhat curbed, and Turkey has experienced a strong rebound, there is still the challenge to transform this into strong and sustained growth.[37]

General investment environment is also reflected in Turkey's ranking according to the World Bank's "Doing business" project, which aims at comparing the ease of doing business in 183 countries, using a set of 10 indicators.[38] Turkey's aggregate rank for 2011 is 65, as compared to 60 in year 2010.[39] A more detailed breakdown reveals further adverse results, like e.g. the rank in indicator "Dealing with construction permits", which is highly relevant for REN projects in general. Here, Turkey's rank has further decreased from 133 to 137, due to comparably large number of procedures, long processing time, and high costs.

B. Legal framework for the promotion of different energy sources

B.1. Law no. 5346 on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy:

Representing the basis of legal support for REN in Turkey, this law was enacted in 2005. The provisions contained in its first version limited the purchase guarantee for REN projects to less than ten years and did not mitigate the price risk, as the feed-in tariff was linked to the average market price without any guaranteed minimum. Due to this deficiency with respect to providing incentives to invest in REN power plants[40] article 6 of law no. 5346 was amended by law no. 5627 dated 02/05/2007.[41] The new provisions comprise power purchase obligations imposed on power retailers thus ensuring, that electricity from renewable sources will be sold regardless of the time of its production. But the provisions remain unfavourable, in particular when compared to provisions for other power sources in other legislation:

B.1.a. Guaranteed feed-in tariffs according to law no. 5346, though providing for a minimum tariff of 0.05 EUR/kWh, are meanwhile limited to a maximum of 0.055 EUR/kWh whereas e.g. the "Law on Establishment and Operation of Nuclear Power Plants and Sales of Energy" (Law no. 5710) enacted on 20/11/2007 excludes nuclear plants from any price cap for the generated electricity.

B.1.b. Again, the application of this is limited to plants commissioned until the end of 2011 and is guaranteed only for ten years, while the operation time of HPPs typically is up to 50 years. In contrast, law no. 5710 provides for purchase obligations for a period of 15 years for coal fired power plants with a capacity of more than 1,000 MW as well as for nuclear plants. Also, it provides for a subsidy scheme for coal fired power plants with a capacity of more than 1,000 MW.

35 See [EBRD Country Strategy], p. 23.

36 Source: http://www.ebrd.com/pages/research/publications/flagships/transition/turkey.shtml.

37 See Rauf Gonenc/OECD: Turkey: Exiting the crisis on a stronger growth path. http://www.oecd.org/dataoecd/13/5/46067652.pdf.

38 See http://doingbusiness.org/methodology.

39 See http://doingbusiness.org/data/exploreeconomies/turkey.

40 See GS VER PDD of GS registered Sayalar 30.4 MW Wind Farm Project (https://gs1.apx.com/mymodule/ProjectDoc/Project_ViewFile.asp?FileID=182&IDKEY=f903q4jsafkasjfu90amnmasdfkaidflnmdf9348r09dmfasdff250978)

41 Energy Efficiency Law (http://www.eie.gov.tr/english/announcements/EV_kanunu/EnVer_kanunu_tercume_revize2707.doc).

B.1.c. Finally, although set in Euro cents, the feed-in tariffs pose an exchange rate risk as they are paid out in YTL by Türkiye Elektrik Dağıtım Şirketi (**TEDAŞ**), which provides a purchase guarantee for the entire electricity produced by the HPP. *TEDAŞ* applies the EUR-YTL exchange rate on the date of invoice for the electricity produced, while the actual payment is made around one month after this date. As debt service typically represents the highest share in cash outflow for HPP projects, projects with imported equipment and financed with foreign currency nominated loans face a severe risk of devaluation of YTL, given that even within one month the exchange rate is highly volatile.

Concluding, the provisions of law no. 5346 as valid at the time of investment decision were clearly insufficient for providing significant incentives for investment in HPPs in Turkey.[42] This is also reflected in several announcements to revise regulations involving an increase of the guaranteed feed-in tariff to 0.07 - 0.08 EUR/kWh. But the respective expectations of market participants remained to be disappointed for a long time, with the respective announcement being temporarily withdrawn by governmental authorities.[43] On 29/12/2010, the long awaited legal change was finally effected by passing law no. 6094[44] which amends law no. 5346. Institutional uncertainty w.r.t. promotion of REN sources is clearly demonstrated by this long and erratic legislative process, and, what is more, the renewed change did not bring the improvements hoped for.

Although fixed feed-in tariffs have now been introduced for many kinds of REN technologies, those for HPPs remain more or less on the same level as before, due to the fact that they are now USD nominated instead of EUR, see

Table 15: REN Feed-in Tariffs (USD/kWh) According to Law No. 6094

Hydro Power	0.073
Wind Power	0.073
Geothermal Power	0.105
Biomass (incl. landfill gas)	0.133
Solar Power	0.133

Given USD-EUR exchange rates of the previous year, these tariffs actually represent a reduction, see

Table 16: USD-EUR Exchange-rates since Coming into Effect of Law No. 6094 and Resulting EUR Denominated Feed-in Tariffs[45]

	1 EUR =	**Date**	**feed-in tariff (EUR/MWh)**
Low	1.2669 USD	16/01/2011	57.62
Peak	1.4882 USD	04/05/2011	49.05
Average	1.3752 USD	29/12/10 - 01/06/12	53.08

What is more, this law is limited to facilities commissioned between 18/05/05 and 31/12/15 and remains valid only for 10 years.

42 See statements by Mr. Ü. Tolga BILGIN, chairman of Turkish wind power and hydro power plants businessmen's association (RESSIAD) as documented in: http://www.ressiad.org.tr/makaleler.php?ID=62 and http://www.ressiad.org.tr/makaleler.php?ID=61. See also a presentation held by Mr. Tanay Sidki Uyar at an EU Workshop in Istanbul, Turkey (http://sunbird.jrc.it/biof/pdf/data_gathering_res_istanbul/tanay_turkey.pdf).

43 See DEWI MAGAZIN No. 36, February 2010, p. 27.

44 http://www.enerji.gov.tr/mevzuat/5346/Yenilenebilir_Enerji_Kaynaklarinin_Elektrik_Enerjisi_Uretimi_Amacli_Kullanimina_Iliskin_Kanunda_Degisiklik_Yapilmasina_Dair_Kanun.pdf.

45 See http://www.ecb.europa.eu/stats/exchange/eurofxref/html/eurofxref-graph-usd.en.html.

Concluding, the amendment clearly fails to provide for sufficient incentives for HPP project development, which is reflected in the reaction of the REN sector.[46] And in any case, the legal change occurred **after** the time of investment decision and could not be relied on at that time. Rather, the whole legal history clearly demonstrates the high level of institutional uncertainty in Turkey w.r.t. promotion of REN sources.

B.2. Options for commercialisation of electricity generated from run-of-river HPPs on the Turkish Electricity Balancing and Settlement Market:

Law no. 5346 generally allows for benefiting from the opportunity to sell electricity in the market if the market price is higher than the feed-in tariff limit of 0.055 EUR/kWh (or now 0.073 USD/kWh). Since the start of operation of *PMUM* in August 2006, REN electricity producers have indeed used this option, which is facilitated by the exemption from delivery obligations for non-dispatchable REN plants.

Electricity from those plants is sold upon its production and priced by applying the previous month's averages for each of the three pricing periods of the day, respectively, i.e. day time, peak time, and night time.

From the point of view of a decision to invest in a highly capital intensive long-term project[47], however, significant risks are associated with this option, making it hard to base a financing and investment decision on the market only:

B.2.a. First of all, there is **no guarantee that prices on the market will be** and will remain **higher than the guaranteed feed-in tariff**. Once the current demand surplus is mitigated or even reversed, the price level on *PMUM* might well be much lower. The price development since 2006 drastically demonstrated this, see *Table 12 above*.

B.2.b. Second, there is **no guarantee that *PMUM* will remain a reliable purchaser** of volatile and non-dispatchable REN power. While there is indeed an exemption from delivery obligations for REN producers, in return there is also no obligation to take off the power. The market situation for REN plants may deteriorate dramatically, whether in short term due to economic cycle related electricity demand collapse (see item above) or systematically due to structural changes in supply and demand relations driven by the implementation of large scale capacity additions of dispatchable plants (as is intended and planned for Turkey and reflected by the unbalanced legal framework, see *item B.1. above*).

B.2.c. Moreover, as there is no economically feasible way of timing the electricity production for a run-of-river HPP, the **risk of power** being produced during night time and **being** respectively **unfavourably priced** is very high for run-of-river HPPs, while thermal power plants in general do not face such a risk.

B.2.d. Finally, the prices on *PMUM* are YTL nominated. Given the significant volatility of exchange rates (see *item A.1. above*), any power producer sourcing the equipment from the USD currency area faces a considerably **high exchange rate risk**.

[46] See e.g. http://www.gtai.de/ext/Einzelsicht-Export/DE/Content/__SharedDocs/Links-Einzeldokumente-Datenbanken/fachdokument,templateId=renderPrint/MKT201101288014.pdf

[47] For a comparison of specific investment costs between different types of power sources, see http://www.epdk.gov.tr/lisans/elektrik/kaynakbazinda/kaynakbazinda.htm.

C. Consequences for the proposed VCS project activity

C.1. Unfavourable credit conditions

With the unfavourable economic background described in *item A. above* and the evenly unfavourable institutional background described in *item B. above*, the resulting credit conditions are adverse: A variable interest rate is applied, comprising the LIBOR plus a bank premium.

In an already highly risk-intensive context, the variable credit interest rate poses additional risks to the project, making future costs hard to calculate.

The credit duration of 9 years poses a significant liquidity risk to the project in its first years of operation. The high debt service burden in early years severely endangers liquidity and might actually necessitate further equity injections, because the projected income from electricity sales might not be sufficient to service debt after deduction of operating costs.

This is reflected also by the financing bank's request for significant sureties to be incorporated into the loan contract conditions. Against this background, the loan cannot be considered as straight project finance, thus relocating the project risks almost completely to the shareholders of *Aslancık A.Ş.*. The involvement of sureties beyond the project assets is also a clear indication that the bank did not consider the project to be able to service debt based on only its internal profitability.

C.2. Double exchange-rate risk

As the equipment procured is paid in USD, the loan for the project must be obtained in the same currency. However, the business model was based on the guaranteed feed-in tariff effective on 21/07/2010. At that time, it was defined by law no. 5346 and nominated in EUR. Concluding, there was a severe exchange-rate risk significantly endangering project success because credit costs are the essential financial burdens during operation phase. Devaluation of the EUR against the USD would lead to significant increases in financial burdens. Also, the exchange rate between EUR and YTL remains relevant, because of the situation explained in *item B.1.c. above*. So, there was a double exchange-rate risk for the project at the time of investment decision.

D. Conclusion

Given the fact that an investment in hydroelectricity represents a financial commitment with very long terms, it is essential for the feasibility of such a project to have as many parameters which are predictable and reliable. The main parameters for the investment decision are electricity yield and electricity price on the return side, and debt service costs on the cost side. As demonstrated above, none of these parameters remain reliable and predictable, because (i) electricity yield is depending on precipitation which is beyond the project owner's control; (ii) electricity price is subject to manifold risks, particularly to exchange-rate risk; and (iii) debt service cost is not predictable due to variable interest.

Concluding, the essential requirements for security of investment are not fulfilled, making the project financially not attractive without additional sources of revenue.

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

The analysis of the effects of the institutional setting for the energy sector in Turkey clearly indicates a bias in favour of conventional energy sources. While scenario 2 is mainly characterised by these plant types, the institutional setting constitutes a barrier only effecting scenario 1.

Concluding, barrier analysis clearly shows that scenario 2 is not affected by the barriers described above, so scenario 1 is neither the baseline nor part of it.

Step 4: Common practice analysis

For project activities measures involving the use of renewable energy[48], the *Additionality Tool* provides for a stepwise approach to demonstrate that the project activity is not common practice:

Step 1 Calculate applicable output range as +/-50% of the design output or capacity of the proposed project.

The installed capacity of *Aslancık HPP* is 93 MW_e, thus, the applicable output range is 46.5 MW_e – 139.5 MW_e.

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

The applicable geographical area is Giresun province, where *Aslancık HPP* is located. The development of HPP projects in Turkey depends very much on the local and regional conditions like e.g. water flow, availability of skilled workers and engineers, provincial permission procedures, etc.

A respective list is given in

Table 17: IPP HPPs in Giresun Province[49]

Company Name	Project Name	Capacity (MW_e)
Kalen Enerji Elektrik Üretim A.Ş.	Aksu HPP	5.20
Katırcıoğlu Elektrik Üretim Ltd.Şti.	Karamanlar HPP	1.42
Çelikler Elektrik Üretim A.Ş.	Ören HPP	19.90
Fırtına Elektrik Üretim A.Ş.	Sümer HPP	21.24
Kalen Enerji Elektrik Üretim A.Ş.	Kalen HPP	31.29
Arsan Enerji A.Ş.	Kıran HPP	9.74
Armahes Müh. Müş. Enerji San. Ve Tic. Ltd. Şti.	Muratlı HPP	37.70
Koni İnşaat Sanayi A.Ş.	Akköy HPP	13.37
EÜAŞ	Doğankent HPP	74.50

Only Doğankent A+B HPP operated by EÜAŞ lies within the applicable output range. Concluding, N_{all} = 1.

Step 3 Within plants identified in Step 2, identify those that apply technologies different than the technology applied in the proposed project activity. Note their number N_{diff}.

Doğankent HPP is operated by EÜAŞ, the subsequent company of the formerly fully integrated public electricity utility now limited to operating power plants. It is still a public company, operating a large amount of HPPs and still investing in new HPPs. *Aslancık HPP* in contrast, is operated under the IPP business model, which implies completely different risk and income structures. Thus, N_{diff} = 1.

48 See paragraph 6 of the Additionality Tool.

49 Projects in operation in Giresun province derived from http://www2.epdk.org.tr/lisans/elektrik/lisansdatabase/verilenuretim.asp. Cross-checked for project names with [TEİAŞ Projection], pp. 95-96.

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

F = 1-1/1 = 0.

The proposed project activity is a "common practice" within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) the factor F is greater than 0.2, and

(b) N_{all}-N_{diff} is greater than 3.

With F = 0 and N_{all} – N_{diff} = 0, the proposed project activity is not common practice and thus additional.

2.6 Methodology Deviations

N/A

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

This Section describes the procedure for quantifying baseline emissions, including the explanation of all methodological choices and the presentation of all relevant equations.

3.1.1. Definition of Baseline Emissions

According to *ACM0002*, "baseline emissions include […] CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity." The equation provided there to calculate baseline emissions is:

equation (1a)

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

where

BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the [...] project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system (tCO_2/MWh)

For $EG_{PJ,y}$, *ACM0002* distinguishes between (a) greenfield renewable energy projects, (b) retrofit of replacement of an exiting renewable energy power plant, and (c) capacity addition to an existing renewable energy power plant. *Aslancık HPP* is a greenfield project, so

equation (2)

$$EG_{PJ,y} = EG_{facility,y}$$

where

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

Concluding, baseline emissions are quantified as:

equation (1)

$$BE_y = EG_{facility,y} \cdot EF_{grid,CM,y}$$

$EG_{facility,y}$ has been estimated in advance by expert studies, the result of which is applied in this VCS PD and will be subjected to validation. The parameter will be subjected to monitoring as described in *Section 4 below* and will be verified periodically for the purpose of final determination of actual emission reductions.

ACM0002 prescribes that $EF_{grid,CM,y}$ be calculated by applying the stepwise approach of the *EF Tool*. The combined margin emission factor shall represent the electricity generation displacement effect of the proposed project activity on the electricity system. It is calculated as the weighted average of the operating margin and the build margin. The **operating margin** (OM) refers to a cohort of existing power plants whose electricity generation amount is likely to be affected by the proposed project activity. It represents the presence component of the baseline scenario. The **build margin** (BM) refers to a cohort of power units reflecting the type of power units whose construction/commissioning would be affected by the proposed project activity. It represents the future/forecast component of the baseline scenario.

The steps are:

Step 1: Identification of the relevant power system

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Step 3: Selection of an OM method

Step 4: Calculation of Operating Margin emission factor

Step 5: Calculation of the Build Margin emission factor

Step 6: Calculation of Combined Margin emission factor

3.1.2. Determination of the Emission Factor

Step 1: Identification of the relevant power system

According to the guidance provided in the *EF Tool*, the relevant electricity system, i.e. the **project electricity system**, "is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints." It shall preferably be identified using an official delineation provided by the host country. As this is not available for Turkey, the provisions of the *EF Tool* will be followed: "[P]roject participants should define the project electricity system and any connected electricity system and justify and document their assumptions [...]".

Power can be dispatched without significant transmission constraint in the Turkish national electricity transmission and distribution grid. This is demonstrated i.a. by the fact that Turkey's interconnected peak load in 2009 and 2010 amounts only to some 31-34% of the total capacity of transformers in the national interconnected system:

Table 18: Relation of Peak Load to Transformer Capacity in Interconnected Turkish National Grid in 2009 and 2010[50]

	2009	2010
Turkey's interconnected peak load (instantaneous) (MW)	29,870.0	33,391.9
Total transformer capacity (MVA)	93,672.0	99,852.0
Share	**31,89%**	**33,44%**

Concluding, the Turkish national electricity system as outlined in *Figure 6* in *Section 2.3 above* is the project system.

The **connected electricity system** "is defined as an electricity system that is connected by transmission lines to the project electricity system." This, too, is shown in *Figure 6* in *Section 2.3 above*. In 2009 and 2010, Turkey has imported electricity from Georgia, Iran, and the Azerbaijani Nakhchivan Autonomous Republic and exported electricity to Iraq, Iran, Syria, Georgia, and Nakhchivan. The amount of exports and imports is negligible as compared to total generation[51], and no indications as to a significant increase in imports enabled by additions in transmission capacity can be found. Concluding, for determining the build margin emission factor, the spatial extent is limited to the project electricity system.

As the project electricity system is the Turkish national grid, and, concluding, all connected electricity systems are located in another country, the **emission factor for the electricity imports**, which are to be included in the OM calculations, **is $EF_{grid,import,y}$ = 0 tCO_2/MWh** according to the *EF Tool*.

50 Source: [TEİAŞ Statistics]. http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/kgucunkullanım(13-21)/20(2006-2009).xls (peak load); http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/hat trafo(55-59)/58.xls (transformer capacity)

51 Source: http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/maliyet(67-73)/69.xls.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

No off-grid power plants will be included in the project electricity system.

Step 3: Selection of an OM method

For the OM calculations, the *EF Tool* presents four different options. For the proposed project activity, **option (a) Simple OM** is chosen. The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. This choice is permitted by the *EF Tool* only under the condition that low-cost/must-run resources constitute less than 50% of total grid generation (1) in average of the five most recent years, or (2) based on long-term averages for hydroelectricity production.

Coal is not considered as a must-run resource in Turkey. The respective shares for the last five years for which data is available are shown in

Table 19: Share of Low-Cost/Must-Run Resources in Turkish Electricity Production, 2006-2010[52]

[%]	2006	2007	2008	2009	2010
TOTAL THERMAL	74.8	81.0	82.7	80.6	73.8
TOTAL HYDRO	***25.1***	***18.7***	***16.8***	***18.5***	***24.5***
GEOTHERMAL+WIND	***0.2***	***0.3***	***0.5***	***1.0***	***1.7***
TOTAL TURKEY	100.0	100.0	100.0	100.0	100.0

The *EF Tool* also allows for the choice between an **ex ante** and an **ex post option for data vintage**. For the proposed project activity, the OM will be calculated according to the **ex ante option**, being a 3-year generation-weighted average, based on the most recent data available at the time of submission of the VCS PD for validation, without requirement to monitor and recalculate the emissions factor during the crediting period. For the proposed project activity, **data from the years 2008-2010** is applied, as these are the most recent years covered by [TEİAŞ Statistics].

Step 4: Calculation of Operating Margin emission factor

For the application of the simple OM as chosen in *Step 3*, the *EF Tool* again allows for two options:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For the proposed project activity, **Option B is applied**.

According to the *EF Tool*, option B can only be used if

(a) the necessary data for Option A is not available; and

(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and

(c) Off-grid power plants are not included in the calculation.

[52] Source: http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/uretim-tuketim(22-45)/36.xls.

These premises are analysed below:

ad (a) Option A requires data on power plant/unit specific fuel consumption or, alternatively, power plant/unit specific average electric efficiency data.

ad (b) As stated above, coal cannot be considered a must-run resource in Turkey, so only renewable power generation is considered as low-cost/must-run power source (nuclear power plants are not in operation in Turkey). Also, data on renewable power generation in Turkey is available.

ad (c) Off-grid power plants are not included in the calculation, see *Step 2 above*.

So, all prerequisites for choosing Option B are met. The equation used when applying simple OM calculations according to Option B is:

equation (3a)

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y} \right)}{EG_y}$$

where

$EF_{grid,OMsimple,y}$	=	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 system in year *y* (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
EG_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Summarising, the emission factor is calculated by relating the total emissions to the total generation for the power plants included in the OM.

As fuel consumption data is provided in [TEİAŞ Statistics] not only on a mass/volume unit base but also on a heating value base, NCVs are not necessary for calculating the OM emissions. It is easier to directly convert the heating values from Tcal to TJ:

equation (4)

$$FC_{i,y} \cdot NCV_{i,y} = FC_{HV,i,y}[\mathrm{TJ}] = FC_{HV,i,y}[\mathrm{Tcal}] \cdot 4.1868$$

where

$FC_{HV,i,y}$	=	Amount of energy contained in the amount of fossil fuel type *i* consumed in the project electricity system in year *y* (TJ)

The conversion of the raw data from Tcal to TJ is presented in *Table C* in *Annex: Baseline Information below*. Inserting *equation (4)* into *equation (3a)* leads to:

equation (3)

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{HV,i,y} \cdot EF_{CO_2,i,y} \right)}{EG_y}$$

Data on emission factors ($EF_{CO2,i,y}$) is not available on a country or plant specific base. Thus, IPCC default values at the lower limit of the uncertainty at a 95% confidence interval are applied as in compliance with the *EF Tool*.

The calculation of the numerator of *equation (3)*, i.e. total emissions, is presented in

Table 20: CO_2 Emissions from Power Production in Turkey 2008-2010

Fuel type/year	**FC_{HV}** [TJ]	**$EF_{CO2,i,y}$** [tCO_2/yr]	**Emissions** [$ktCO_2$] **($FC_{HV} \cdot EF_{CO2}$ / 1000)**
Hard Coal+Imported Coal	139,462	89.5	12,482
Lignite	453,125	90.9	41,189
Fuel Oil	86,277	75.5	6,514
Diesel Oil	5,560	72.6	404
Naphta	473	69.3	33
Natural Gas	791,544	54.3	42,981
Subtotal 2008			**103,602**
Hard Coal+Imported Coal	147,081	89.5	13,164
Lignite	408,848	90.9	37,164
Fuel Oil	63,471	75.5	4,792
Diesel Oil	7,663	72.6	556
LPG	5	61.6	0
Naphta	353	69.3	24
Natural Gas	779,858	54.3	42,346
Subtotal 2009			**98,047**
Hard Coal+Imported Coal	165,573	89.5	14,819
Lignite	404,240	90.9	36,745
Fuel Oil	35,877	75.5	2,709
Diesel Oil	877	72.6	64
Naphta	440	69.3	30
Natural Gas	814,279	54.3	44,215
Subtotal 2010			**98,582**
Total 2008 – 2010			**300,232**

As EG_y represents only the electricity produced by sources which are not considered as must-run or low-cost, the generation amount of the latter must be subtracted from the whole Turkish electricity generation. However, electricity imports need to be included, which leads to

equation (5) $$EG_{y,GROSS} = EG_{TOTAL,y,GROSS} + EI_y - EG_{LC-MR,y,GROSS}$$

where:

$EG_{y,GROSS}$ = Gross electricity generated and delivered to the grid by all power sources serving the system (including electricity imports), not including low-cost/must-run power plants/units, in year *y* (MWh)

$EG_{TOTAL,y,GROSS}$ = Gross electricity generated and delivered to the grid by all power sources serving the Turkish system (not including electricity imports) in year *y* (MWh)

EI_y = Electricity imports to Turkish system in year *y* (MWh)

$EG_{LC-MR,y,GROSS}$ = Gross electricity generated and delivered to the grid by low-cost/must-run sources in year *y* (MWh)

The *EF Tool* defines EG_y as **net** generation. With no plant specific data available, net generation is estimated by applying the overall Turkish net to gross generation relation taken from [TEİAŞ Statistics]:

equation (6) $$EG_y = EG_{y,GROSS} \cdot \frac{EG_{TOTAL,y,NET}}{EG_{TOTAL,y,GROSS}}$$

where:

$EG_{TOTAL,y,NET}$ = Net electricity generated and delivered to the grid by all power sources serving the Turkish system (not including electricity imports) in year *y (*MWh)

The denominator of equation (3) above, i.e. total emissions of OM power plants, is calculated in

Table 21: Calculation of Net Electricity Generation in Turkey (GWh) not Including Low-Cost/Must-Run Sources and Including Electricity Imports for the Years 2008-2010

unit: GWh		2008	2009	2010
I	**$EG_{TOTAL,y,GROSS}$**	198,418	194,813	211,208
II	**$EG_{TOTAL,y,NET}$**	189,762	186,619	203,046
III=II/I	**net-to-gross relation**	**95.64%**	**95.79%**	**96.14%**
IV	Geothermal and Wind	1,009	1,931	3,585
V	Hydro	33,270	35,958	51,796
VI=IV+V	**$EG_{LC-MR,y,GROSS}$**	**34,279**	**37,889**	**55,381**
VII	**EI_y**	**789**	**812**	**1,144**
XIII = I – VI+VII	**$EG_{y,GROSS}$**	**164,928**	**157,736**	**156,971**
IX=XIII*III	**EG_y**	**157,733**	**151,101**	**150,905**
TOTAL 2008-2010		**459,739**		

$EF_{grid,OMsimple,y}$ is to be determined as a 3-year generation-weighted average:

$$EF_{grid,OMsimple,y} = \frac{300{,}232\ ktCO_2}{459{,}739\ GWh} = \underline{\mathbf{0.653}}\ \frac{tCO_2}{MWh}$$

Step 5: Calculation of the Build Margin emission factor

As for data vintage, there are two options for calculating the BM emission factor. In this VCS PD, option 1 **ex-ante calculation** is chosen (instead of annually updating of the BM emission factor) for reasons of simplicity and data availability.

The sample group of power units *m* to used to calculate the BM is determined according to the procedure as outlined in the *EF Tool*:

(a) Identify the set of five power units, excluding power units using the carbon market, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh):

$SET_{5\text{-units}}$ comprises the following power plants:

1. ALTEK ALARKO ELKTRİK SANTRALLARI
2. EREN ENERJİ ELEKTRİK ÜRETİM A.Ş.
3. RASA ENERJİ (VAN)
4. KALKANDERE REG. VE YOKUŞLU HES
5. İNTERNATİONAL HOSPİTAL İSTANBUL AŞ.

with a total annual electricity generation of $\mathbf{AEG_{SET\text{-}5\text{-}units} = 4{,}290{,}570\ MWh/yr.}$

See also *Table D below* in *Annex: Baseline Information*.

(b) Determine the annual electricty generation of the project electricity system, excluding power units using the carbon market (AEG_{total}, in MWh). Identify the set of power units, excluding power units using the carbon market, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total}, (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\geq 20\%}$, in MWh):

$\mathbf{AEG_{total}} = EG_{TOTAL;2010,gross} - AEG_{carbon} = 211{,}208{,}000\ MWh - 8{,}964{,}890\ MWh = \mathbf{202{,}243{,}110\ MWh}$

For determination of AEG_{carbon} see also *Table E below* in *Annex: Baseline Information*.

$SET_{\geq 20\%}$ is presented in detail in *Table D below* in *Annex: Baseline Information*, comprising plants commissioned in the years 2008-2010 in Turkey, starting with AKKÖY I HES HPP commissioned on 18/09/2008. This set leads to:

$\mathbf{AEG_{SET\geq 20\%} = 40{,}510{,}000\ MWh}$

This is 20.03% of AEG_{total}. 20% fall on part of the capacity of AKKÖY I HES. Excluding it would lead to $AEG_{SET\geq 20\%}$ = 40,102,000 MWh/yr, i.e. 19.83% of AEG_{total}.

(c) From SET5-units and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin.

$SET_{\geq 20\%}$ clearly comprises the larger annual electricity generation, so $SET_{\geq 20\%} = SET_{sample}$. None of the power units contained in it started to supply electricity more than 10 years ago, see *Table D below* in *Annex: Baseline Information*.

Concluding, SET_{sample} is used to calculate the build margin.

To calculate the BM emission factor, the following equation will be used:

equation (7)

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

where

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year y (tCO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

For EÜAŞ plants included in the BM plant cohort, he most recent historical year for which power generation data is available is 2010: Complete data on power generation EG_m is available on a plant specific level in [TEİAŞ Statistics].

For capacity additions *m* from **other types of power producers** (i.e. Autoproducers, IPP, BOO, BOT) **projected generation in 2010** as displayed in [TEİAŞ Projection] is used to estimate actual current generation, because this is the most current data source.[53] This document also displays firm generation for each single power plant operated under BOT, BOO, IPP, or Autoproducer business model. As negative deviations of firm from projected generation mostly occur with emission neutral hydro power and wind power plants, the choice for projected generation leads to the tendency of an overestimation of the generation share of carbon neutral energy sources, and thus represents the application of a conservative approach.

As the *EF Tool* explicitly refers to net generation while this data is not available on a plant specific level, the parameter must again be estimated. Similar to the approach presented in *equation (6) above*, the overall net to gross relation is applied to each single plant:

equation (8)

$$EG_{m,y} = EG_{m,y,GROSS} \cdot \frac{EG_{TOTAL,y,NET}}{EG_{TOTAL,,GROSS}}$$

where

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

It is applied for the most recent historical year for which power generation data is available, i.e. 2010. The net-to-gross relation for 2010 in Turkey is 96.14%, see *Table 21 above*.

The calculation of net generation of BM plants according to *equation (7)* is represented in:

Table 22: Annual Net Generation of BM Plants

$EG_{m,y,GROSS}$ [GWh]	40,510.00
net-to-gross relation	96.14%
$EG_{m,2010}$ [GWh]	**38,946.31**

[53] See [TEİAŞ Projection], pp. 92-101.

The *EF Tool* states that $EF_{EL,m,y}$ must be "determined as per the guidance in Step 4 (a) for the simple OM, using options A1, A2 or A3, using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin." Option A1 is applicable, if for a power unit *m* data on fuel consumption and electricity generation is available. Option A2 is applicable, if for a power unit *m* data on electricity generation and fuel types used is available. Option A3 is applicable, if for a power unit *m* only data on electricity generation is available.

As for the power units *m* in the Turkish system data on electricity generation and the fuel types used is available, **the emission factor will be determined according to Option A2** which provides for

equation (9)

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \cdot 3.6}{\eta_{m,y}}$$

where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (%)
y	=	The three most recent years for which data is available at the time of submission of the VCS PD to the validator (as the ex ante option is chosen)

To assure a conservative approach, plants for which several fuels are disclosed in the data source were assigned to the least emission intensive fuel. Plants for which no fuel type data is disclosed are deemed emission neutral.

As no plant specific efficiency data ($\eta_{m,y}$) is available, the default values for grid power plants provided in Annex 1 of the *EF Tool* are used, based on the following information:

- Import coal fired plants İÇDAŞ ÇELİK and SİLOPİ ELEKTRİK ÜRETİM A.Ş. are operated as CFBS.[54]
- This is also the case for the first component (160MW) of EREN ENERJİ ELEKTRİK ÜRETİM A.Ş. import coal fired plant. The second and third component of EREN ENERJİ ELEKTRİK ÜRETİM A.Ş. plant are the first supercritical coal plants in Turkey.[55]
- Lignite plants are subcritcal.[56]
- Natural gas plants are combined cycle plants.

The respective calculations are represented in

Table 23: Calculation of $EF_{EL,m,y}$

Fuel type	$\eta_{m,y}$	$EF_{CO2,m,i,y}$ [t CO_2/TJ]	$EF_{EL,m,y}$ [t CO_2/MWh]
Fuel Oil	39.50%	75.50	**688.10**
Lignite	39.00%	90.90	**839.08**
Natural Gas	60.00%	54.30	**325.80**
Supercritical Coal	45.00%	89.50	**716.00**
CFBS Coal	40.00%	89.50	**805.50**

54 http://www.icdas.com.tr/icdas/enerji_en.htm; http://www.cinergroup.com.tr/companies/7/en

55 http://www.erenholding.com.tr/sectors/energy/eren_enerji.

56 See presentation "Clean Coal Technologies" held by Assoc. Prof. Dr. Fehmi Akgün during the "Turkish-American Clean Energy Conference" in Istanbul in January 2008. Download at: http://www.americanturkishcouncil.org/events/cleanenergy/pdf/TuesdayMorningBallroom2&3/AkgunFehmi_2008CleanEnergy.pdf.

The resulting calculations of the numerator of *equation (9) above* are represented in

Table 24: Calculation of BM Emissions

Fuel type	$EG_{m,y,GROSS}$ [GWh]	net/gross relation	$EG_{m,y}$ [GWh]	$EF_{EL,m,y}$ [tCO_2/MWh]	Emissions [kt CO_2]
Fuel Oil	434.00	96.14%	417.25	688.10	287.11
Lignite	147.00	96.14%	141.33	839.08	118.59
Natural Gas	22,695.80	96.14%	21,819.74	325.80	7,108.87
Supercritical Coal	8,011.76	96.14%	7,702.51	716.00	5,515.00
CFBS Coal	3,936.57	96.14%	3,784.62	805.50	3,048.51
Total BM emissions					**16,078.08**

The final calculation of the BM emission factor is:

$$EF_{grid,BM,y} = \frac{16{,}078.08\ ktCO_2}{38{,}946.31\ GWh} = \mathbf{0.413}\ \frac{tCO_2}{MWh}$$

Step 6: Calculation of Combined Margin emission factor

The basic equation for calculating $EF_{grid,CM,y}$ as represented in the *EF Tool* is:

equation (10) $$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (%)
w_{BM} = Weighting of build margin emissions factor (%)

According to the *EF Tool*, for hydro power project activities the following default values for w_{OM} and w_{BM} should be used:

w_{OM} = 0.5 and w_{BM} = 0.5

With the results for $EF_{grid,OM,y}$ in *Step 4 above* and for $EF_{grid,BM,y}$ in *Step 5 above*, this leads to:

$$EF_{grid,CM,y} = 0.655\frac{tCO_2}{MWh} \cdot 0.5 + 0.413\frac{tCO_2}{MWh} \cdot 0.5 = \mathbf{0.533}\frac{tCO_2}{MWh}$$

3.2 Project Emissions

As *Aslancık HPP* is a HPP project, project emissions need to be considered according to *ACM0002*:

equation (11)

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

where

$PE_{HP,y}$ = Project emission from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

For determination of project emissions according to *ACM0002* the power density of the project activity (*PD*) must be calculated:

equation (12a):

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

where

PD = Power density of the project activity (W/m^2)

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W)

Cap_{BL} = Installed capacity of the hydro power plant before implementation of the project activity (W). For new hydro power plants, this value is zero

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

As the proposed project activity is a greenfield project, Cap_{BL} = 0 and A_{BL} = 0. This leads to

equation (12)

$$PD = \frac{Cap_{PJ}}{A_{PJ}}$$

As the project installed capacity is Cap_{PJ} = 93 MW_e and the reservoir area[57] is A_{PJ} = 0.175 km^2, the PD is calculated as

$$PD = \frac{93{,}000{,}000\ W}{175{,}000\ m^2} = \underline{\mathbf{531.43}}\ \frac{\boldsymbol{W}}{\boldsymbol{m^2}}$$

According to *ACM0002*, for PD > 10 W/m^2 project emissions are

equation (11)

$$PE_y = PE_{HP,y} = \underline{\mathbf{0}}\ \frac{\boldsymbol{tCO_2}}{\boldsymbol{yr}}$$

3.3 Leakage

This Section addresses emissions mainly linked to plant construction and fuel handling processes. *ACM0002* allows for neglecting these emissions as long as it is done in both the baseline as well as the project scenario. Concluding, leakage emissions are quantified as

equation (13)

$$LE_y = 0$$

[57] Area of the project dam lake according to the environmental study, see *Section 5 below*.

3.4 Summary of GHG Emission Reductions and Removals

According to *ACM0002*, emission reductions are calculated as

equation (14a)

$$ER_y = BE_y - PE_y - LE_y$$

where

ER_y	=	Emission reductions in year y (t CO_2/yr)
BE_y	=	Baseline emissions in year y (t CO_2/yr)
PE_y	=	Project emission in year y (t CO_2/yr)
LE_y	=	Leakage emissions in year y (t CO_2/yr)

Inserting into *equation (14a)* the results for PE_y presented in *equation (11)* in *Section 3.2 above*, as well as the results for LE_y presented in *equation (13)* in *Section 3.3 above*, leads to

equation (14)

$$ER_y = BE_y$$

As indicated in *Section 3.1.1 above*, baseline emissions are calculated according to

equation (1)

$$BE_y = EG_{facility,y} \cdot EF_{grid,CM,y}$$

With an estimated annual project generation of 418,170 MWh, and $EF_{grid,CM,y}$ calculated in *Section 3.1.2. Step 6 above* as 0.533 tCO_2/MWh, total emission reductions are:

$$BE_y = EG_{facility,y} \cdot EF_{grid,CM,y} = 418{,}170 \ \frac{MWh}{yr} \cdot 0.533 \ \frac{tCO_2}{MWh} = \underline{\mathbf{222{,}884}} \ \frac{\boldsymbol{tCO_2}}{\boldsymbol{yr}}$$

Concluding results for GHG emission reductions are summarised in

Table 25: Emission Reductions for Aslancık HPP

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
01/10/2013 - 30/09/2014	0	222,884	0	222,884
01/10/2014 - 30/09/2015	0	222,884	0	222,884
01/10/2015 - 30/09/2016	0	222,884	0	222,884
01/10/2016 - 30/09/2017	0	222,884	0	222,884
01/10/2017 - 30/09/2018	0	222,884	0	222,884
01/10/2018 - 30/09/2019	0	222,884	0	222,884
01/10/2019 - 30/09/2020	0	222,884	0	222,884
01/10/2020 - 30/09/2021	0	222,884	0	222,884
01/10/2021 - 30/09/2022	0	222,884	0	222,884
01/10/2022 - 30/09/2023	0	222,884	0	222,884
Total	**0**	**2,228,840**	**0**	**2,228,840**

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter:	**$FC_{HV,i,y}$**
Data unit:	Tcal
Description:	Amount of fuel combusted for electricity production in Turkey in the years 2008-2010.
Source of data used:	[TEİAŞ Statistics]; http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/yakıt46-49/49.xls.
Value applied	See *Table C* in *Annex: Baseline Information below.*
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data is necessary to calculate the OM emission factor, see *equation (3)* and *equation (4)* in *Section 3.1.2. Step 4 above*. Data source is published by state-owned company *TEİAŞ*.
Any comment:	

Data / Parameter:	**$EF_{CO2,i,y}$ / $EF_{CO2,i,m,y}$**
Data unit:	tCO_2/TJ
Description:	Carbon emission factors of fuels used for combustion for electricity production by fuel type (IPCC default values at the lower limit of the uncertainty at a 95% confidence interval)
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, table 1.4, pp. 1.23 and 1.24.
Value applied	See *Table 20 p. 33 Section 3.1.2. Step 4 above* for OM. See *Table 23 p. 37 Section 3.1.2. Step 5 above* for BM.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data is necessary to calculate both OM and BM emission factors. See *equation (3) p. 32 Section 3.1.2. Step 4 above* for OM. See *equation (9) p. 37 Section 3.1.2. Step 5 above* for BM. Data source is proposed and accepted by *ACM0002*.
Any comment:	

Data / Parameter:	**EI_y**
Data unit:	GWh
Description:	Gross electricity imports to the Turkish national grid 2008-2010.
Source of data used:	[TEİAŞ Statistics]; http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/uretim-tuketim(22-45)/23.xls
Value applied	See *Table 21 p. 34 Section 3.1.2. Step 4 above* for OM.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data is necessary for calculating electricity generation from sources included in OM emission factor calculation, see *equation (5) Section 3.1.2. Step 4 above*. Data source is published by state-owned company *TEİAŞ*.
Any comment:	

Data / Parameter:	**$EG_{TOTAL,y,GROSS}$**
Data unit:	GWh
Description:	Gross electricity production in Turkey in 2008-2010.
Source of data used:	[TEİAŞ Statistics]; http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/uretim-tuketim(22-45)/23.xls
Value applied	See *Table 21 p. 34 Section 3.1.2. Step 4 above* for OM. See *Table 22 p. 36 Section 3.1.2. Step 5 above* for BM.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data is necessary as a basis for calculating OM generation, see *equation (5) Section 3.1.2. Step 4 above*. Data is also the basis for calculating the overall Turkish net-to-gross generation relation which is again necessary to estimate (i) net generation from sources not considered as low-cost/must-run for OM emission factor, see *equation (6) Section 3.1.2. Step 4 above* and (ii) net generation from sources added to the system most recently and representing 20% of total generation for BM emission factor, see *equation (8) Section 3.1.2. Step 5 above*. Data source is published by state-owned company *TEİAŞ*.
Any comment:	

Data / Parameter:	**$EG_{TOTAL,y,NET}$**
Data unit:	GWh
Description:	Net electricity production in Turkey in 2008-2010.
Source of data used:	[TEİAŞ Statistics]; http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/uretim-tuketim(22-45)/33(84-10).xls
Value applied	See *Table 21 p. 34 Section 3.1.2. Step 4 above*.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data is the basis for calculating net-to-gross relation for Turkish electricity generation which is again necessary to estimate net generation from sources not considered as low-cost/must-run for OM emission factor, see *equation (6) Section 3.1.2. Step 4 above*. Net-to-gross generation relation is also necessary for estimating net generation from sources added to the system most recently and representing 20% of total generation for BM emission factor, see *equation (8) Section 3.1.2. Step 5 above*. Data source is published by state-owned company *TEİAŞ*.
Any comment:	

Data / Parameter:	**Capacity additions**
Data unit:	
Description:	Power plants most recently added to the Turkish electricity system and representing 20% of total current (i.e. 2010) generation
Source of data used:	http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2008.pdf For 2008: *TEİAŞ*: Türkiye elektrik enerjisi 10 yıllık üretim kapasite projeksiyonu (2009–2018); pp. 95-96. http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf For 2009: *TEİAŞ*: Türkiye elektrik enerjisi 10 yıllık üretim kapasite projeksiyonu (2010–2019); pp. 98-101. For 2010: [TEİAŞ Projection]; pp. 102-106.
Value applied	See *Table D* in *Annex: Baseline Information below*.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data is the basis for estimating net generation included in BM emission factor, see *equation (8) Section 3.1.2. Step 5 above*. Data sources are published by state-owned company *TEİAŞ*.
Any comment:	

Data / Parameter:	**$EG_{m,y,GROSS}$**
Data unit:	GWh
Description:	Annual gross generation of the power plants most recently added to the system and representing 20% of total current (i.e. 2010) gross generation in Turkey.
Source of data used:	For EÜAŞ plants: [TEİAŞ Statistics] http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/kguc(1-12)/9.xls; http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/kguc(1-12)/10-11.xls For all other plants: [TEİAŞ Projection], pp. 90-101.
Value applied	See *Table 22 p. 36 Section 3.1.2. Step 5 above*.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data is the basis for determining net generation of BM plants as included in the BM emission factor, see *equation (8) Section 3.1.2. Step 5 above*. Net generation of BM emission plants is then used for estimating BM emissions as included in the BM emission factor, see *equation (6) Section 3.1.2. Step 5 above*. Data sources are published by state-owned company *TEİAŞ*.
Any comment:	

Data / Parameter:	**$EG_{LC\text{-}MR,y,GROSS}$**
Data unit:	GWh
Description:	Gross electricity production from low-cost/must-run sources in Turkey 2008-2010.
Source of data used:	[TEİAŞ Statistics]; http://www.teias.gov.tr/istatistik2010/front page 2010-çiçek kitap/uretim-tuketim(22-45)/23.xls
Value applied	See *Table 21 p. 34 Section 3.1.2. Step 4 above* for OM.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data is necessary for calculating electricity generation from sources included in OM emission factor calculation, see *equation (5) Section 3.1.2. Step 4 above*. Data source is published by state-owned company *TEİAŞ*.
Any comment:	

4.2 Data and Parameters Monitored

Data Unit / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied to by Aslancık HPP to the grid in year *y*.
Source of data:	Electricity meters located at the substation
Description of measurement methods and procedures to be applied:	Continuous measuring of electricity exported to and imported from the grid by *Aslancık HPP*, i.e. 100% of the data is monitored, and no sampling is applied.
Frequency of monitoring/recording:	The electricity meters work continuously. Responsible *TEİAŞ* staff conducts data read-outs monthly and publishes results online in *Aslancık A.Ş.'s PMUM* account. Data is cross-checked and recorded monthly by responsible *Aslancık A.Ş.* staff.
Value applied:	418,170 MWh
Monitoring equipment:	Bi-directional electricity meters with a 0.5s accuracy level, complying with TS EN 62053-22 standard.
QA/QC procedures to be applied:	Electricity meters have been calibrated by Turkish Standard Institute and will be recalibrated after 5 years under the responsibility of *TEİAŞ*. To mitigate risk of failure, a back-up meter with equal characteristics is installed at the substation. To allow for cross-checks, a main and a back-up electricity meter with equal characteristics have been installed at the project site. They are read out monthly by responsible *Aslancık A.Ş.* staff.
Calculation method:	N/A
Any comment:	

4.3 Description of the Monitoring Plan

TEİAŞ has installed one main electricity meter and one back-up electricity meter at the substation to which *Aslancık HPP* power plant is connected. Both electricity meters have 0.5s accuracy level and comply with TS EN 62053-22 standard. They have been calibrated by Turkish Standard Institute.

TEİAŞ performs read-out on these electricity meters at 00:00 of the first day of each month and calculate monthly net electricity fed into the grid. Upon performing monthly data read out on the primary data source, i.e. main electricity meter located at the substation, *TEİAŞ* publishes the results online on the *PMUM* website[58] no later than on the 8th day of the respective month.

The *PMUM* website provides for each power producer access to data concerning their own power plants, including gross electricity generation and consumption. Screen-shots are prepared and printed monthly and stored electronically and as hard copy by *Aslancık A.Ş.* staff at the company headquarters for at least 2 years after the end of the last crediting period as required by *ACM0002*.

Additionally, two electricity meters with 0.5s accuracy level and complying with TS EN 62053-22 standard and calibrated by Turkish Standard Institute have been installed during project construction on the project site. They are read-out by *Aslancık A.Ş.* staff members, who determine the difference between the dial count at the time of last data read out and dial count at the time of current data read out for both, the gross electricity production and the own electricity consumption. No manipulation of meters by *Aslancık A.Ş.* staff is possible, as they are sealed by and only accessible for *TEİAŞ* staff.

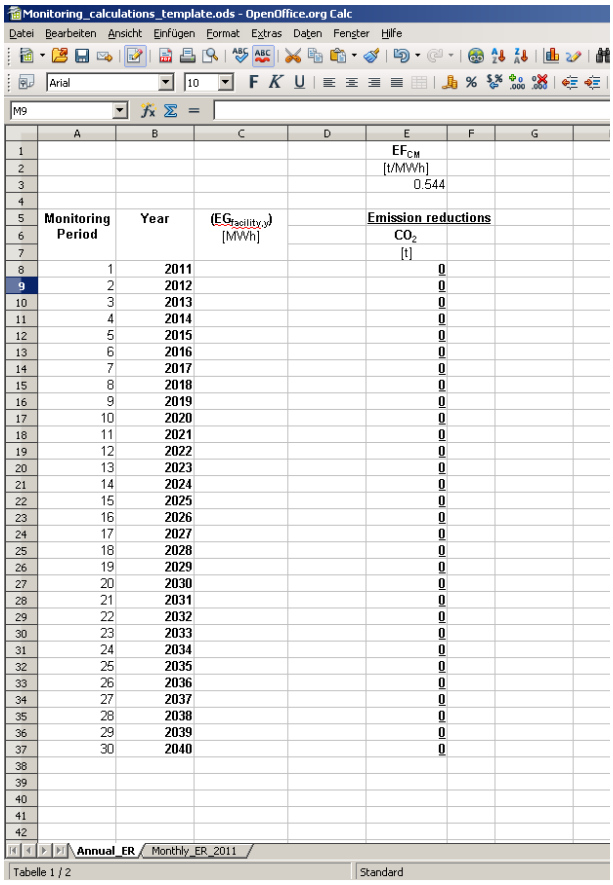
Results of monthly data read outs are compiled by *Aslancık A.Ş.* in a data read out protocol which is stored as hard copy and scanned and stored as electronic file at the company headquarters, both for at least 2 years after the end of the last crediting period.

Aslancık A.Ş. staff compares *TEİAŞ* data with their own read-out protocols. In case of significant deviations, *Aslancık A.Ş.* will exercise their right to object against *TEİAŞ* data. The time limit for objection is the 8th to 16th of each month, respectively. In case of no significant deviations, an invoice is prepared by *Aslancık A.Ş.* and sent to *TEİAŞ*, who returns a record for sold electricity to *Aslancık A.Ş.*. Invoices are stored as hard copy at *Aslancık A.Ş.* premises for at least 2 years after the end of the last crediting period.

[58] See http://dgpys.teias.gov.tr/dgpys/.

Final data for gross electricity production and own electricity consumption is inserted into an electronic spreadsheet file, which will be archived electronically and kept at least for 2 years after the end of the last crediting period. The template is presented in

Figure 8: Monitoring spreadsheet

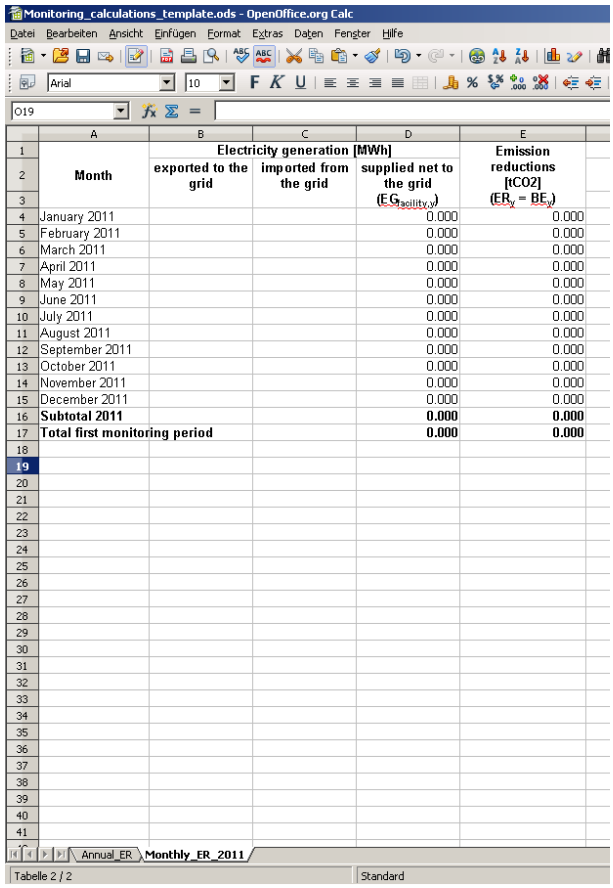


Monitoring_calculations_template.ods - OpenOffice.org Calc

				EF_{CM} [t/MWh]	
				0.544	
Monitoring Period	Year	($EG_{facility,y}$) [MWh]		Emission reductions CO_2 [t]	
1	2011			0	
2	2012			0	
3	2013			0	
4	2014			0	
5	2015			0	
6	2016			0	
7	2017			0	
8	2018			0	
9	2019			0	
10	2020			0	
11	2021			0	
12	2022			0	
13	2023			0	
14	2024			0	
15	2025			0	
16	2026			0	
17	2027			0	
18	2028			0	
19	2029			0	
20	2030			0	
21	2031			0	
22	2032			0	
23	2033			0	
24	2034			0	
25	2035			0	
26	2036			0	
27	2037			0	
28	2038			0	
29	2039			0	
30	2040			0	

Annual_ER | Monthly_ER_2011

Tabelle 1 / 2 | Standard



Monitoring_calculations_template.ods - OpenOffice.org Calc

Month	Electricity generation [MWh] exported to the grid	imported from the grid	supplied net to the grid ($EG_{facility,y}$)	Emission reductions [tCO2] ($ER_y = BE_y$)
January 2011			0.000	0.000
February 2011			0.000	0.000
March 2011			0.000	0.000
April 2011			0.000	0.000
May 2011			0.000	0.000
June 2011			0.000	0.000
July 2011			0.000	0.000
August 2011			0.000	0.000
September 2011			0.000	0.000
October 2011			0.000	0.000
November 2011			0.000	0.000
December 2011			0.000	0.000
Subtotal 2011			**0.000**	**0.000**
Total first monitoring period			**0.000**	**0.000**

Annual_ER | Monthly_ER_2011

Tabelle 2 / 2 | Standard

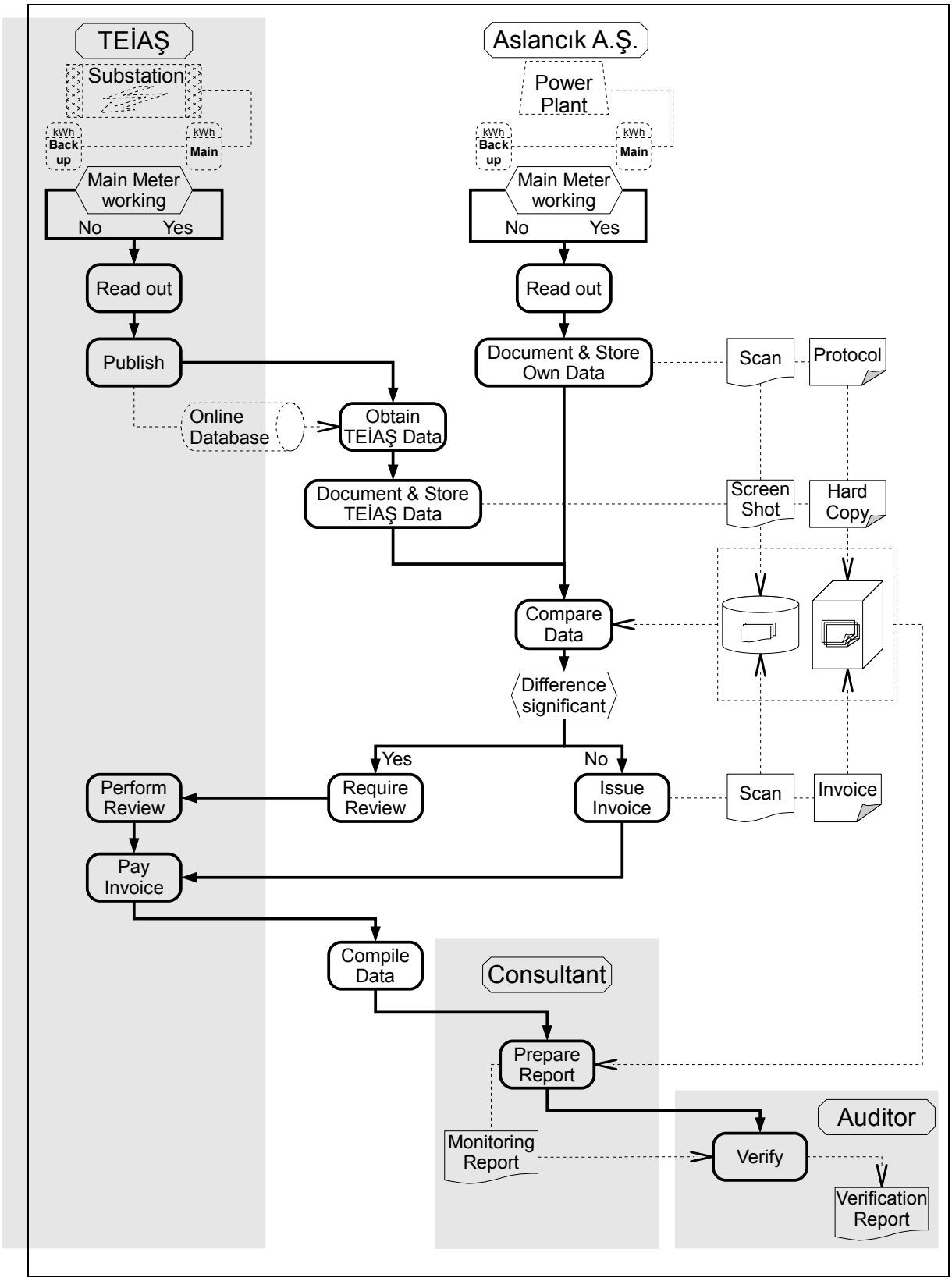
$EG_{facility,y}$ is calculated as the difference between electricity produced (i.e. exported to the grid) and electricity consumed (i.e. imported from the grid) by *Aslancık HPP*. $EF_{grid,CM,y}$ will be used according to *equation (1)* in *Section 3.1.1 above* to determine baseline emissions. $EF_{grid,CM,y}$ will not be monitored but has been determined (in *Section 3.1.2. above*) once for the whole first crediting period and will be recalculated for any subsequent crediting period (see *Section 1.6 above*). These calculations and parameters will be compiled in the Monitoring Report (MR) using the VCS MR template.[59]

Along with the above mentioned monitoring spreadsheet and additional relevant evidence (read-out protocols, invoices, screen-shots, $EF_{grid,CM,y}$ calculation spreadsheet, etc.) it will be subjected to VCS Verification, generally on an annual base. As the project will presumably be registered retroactively, the first Monitoring Period will comprise the whole time period starting with commissioning of *Aslancık HPP* power plant on 01/10/2013 and ending (presumably) with 31/12/2014. From 01/01/2015 on, monitoring documentation will resume the annual rhythm.

Figure 9 below provides for a comprehensive overview on the monitoring plan and the GHG information system. The responsible person for all processes to be conducted by *Aslancık A.Ş.* is the general project manager, Mr. Umut Kaya.

59 See http://www.v-c-s.org/sites/v-c-s.org/files/VCS%20Monitoring%20Report%20Template%2C%20v3.1.doc.

Figure 9: Monitoring Plan and GHG Information System



5 ENVIRONMENTAL IMPACT

Aslancık HPP has undergone a complete EIA, as was required by *TÇOB* upon assessing the project presentation file (Turkish: Proje Tanıtım Dosyası; PTD) submitted in November 2007. The EIA process incorporated a stakeholder consultation, which is described in detail in *Section 6 below*. The EIA Report was submitted in February 2008 and served as the basis for the decision by *TÇOB* to approve of the project activity, see

Figure 10: EIA approval certificate

T.C.
ÇEVRE ve ORMAN BAKANLIĞI
Çevresel Etki Değerlendirmesi ve Planlama Genel Müdürlüğü

Karar Tarihi: 02./04/2008
Karar No : 1466

ÇED OLUMLU BELGESİ

16.12.2003 tarih ve 25318 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği'nin 14.maddesi gereğince; "Aslancık Barajı ve HES(kurulu gücü 90MW)" projesi hakkında "*Çevresel Etki Değerlendirmesi Olumlu Kararı*" verilmiştir.

Medet ÇINAR
Bakan a.
Genel Müdür V.

20 EKİM 2009

Proje Sahibi : Aslancık Elektrik Üretim Ltd.Şti.
Projenin Yeri : Giresun İli, Doğankent ve Tirebolu İlçeleri

Essential results of the EIA Report regarding environmental and socio-economic impacts and the related mitigation measures are summarised as follows:

During **construction stage**, there are possible impacts on water quality, air quality, soil quality as well as on flora and fauna. Also, there will be socio-economic impacts.

Water quality will be affected by concrete production, dust management, and use of potable water. The main impact is the production of 138,000 m3 of waste water from washing concrete aggregates and concrete mixers. This will be mitigated by installing and operating a sewage treatment facility on site. The facility will be subjected to regular monitoring according to the environmental monitoring plan (EMP).

Air quality will be affected during construction by activities like transport, rock blasting, excavation etc. As the expected dust emissions will be significant, modelling of related concentrations and diffusion was conducted according to accepted standards and resulted in concentration indicators below regulatory limits. Mitigation measures comprise watering, implementation of dust filters for the concrete units, speed limits for construction vehicles, use of canvas covers, improvement of access roads, etc. The EMP also covers air quality, including dust analyses to be conducted on a semi-annual base, as well as upon stakeholder request in the course of a complaint mechanism.

Soil quality is affected by use of area and impacts on erosion risks. The area on which construction activities are conducted is characterised mainly as having low agricultural value. The agricultural area covered comprises hazelnut forests, hazelnut plantations and scattered forest areas, but the actual project components are not located on these areas. Solid wastes represent another risk for soil quality. Due to the declines in the landscape, erosion risk impact of the project is deemed significant. Thus, mitigation measures are implemented, like e.g. planting regionally adapted tree types on terraces constructed on open areas with significant decline and high erosion potential. Solid wastes will be collected in containers and will be disposed of by the local waste management.

Flora in the project region was subjected to a two-year survey, revealing no endemic species, no plants contained in the national list of rare, threatened and endemic plants, and no plants covered by the Bern Convention and CITES agreement. **Fauna** in the project area was subjected to a survey, checking the observed terrestrial and aquatic animals against the Red List of the Bern Convention and the Red List of IUCN. The results are that

(i) 14 out of 52 observed mammal species are listed as "near threatened" and 5 as "vulnerable",

(ii) one out of 80 observed bird species is listed as "vulnerable",

(iii) one out of 20 observed reptile species is listed as "near threatened",

(iv) two out of 9 observed amphibian species are listed as "near threatened", and

(v) one out of 12 observed fish species is listed as "vulnerable"

in the IUCN Red List. No endemic species were identified. Impacts on both Fauna and Flora are expected due to dust emissions, vibration and noise during construction, as well as due to flooding of areas in the damming phase. However, the affected species are rich in population and have a high reproduction potential. Thus, no serious reduction in population, let alone extinction, can be expected. There may be temporary displacement effects during construction phase. Mitigation measures comprise limitations on number and intensity of rock blasting activities, and management of dust emissions as described above with regard to impacts on air quality.

Socio-economic impacts are related mainly to expropriation of land, as well as due to dust and noise emissions and vibrations. Expropriation affects hazelnut plantation owners and owners of domestic buildings, but will be limited to only a small number of people, as the dam and the related flooded area are relatively small. Affected people are fully compensated, so that they can obtain equivalent assets. Impacts related to dust, noise and vibration are limited to a very small number of people living in the close vicinity and will be effectively mitigated as described above. The local population will be consulted continuously about any construction activities like e.g. rock blasting, to allow for immediate mitigation if any negative impacts are perceived. A total of 250 workers are expected to be required for construction. The local work force will be preferred when sourcing staff, as will local providers of construction vehicles and equipment.

Project operation will lead to impacts regarding

1. the flooded area
2. local cattle breeding
3. conversion of a watercourse section into a lake
4. regional fish species exposed to reduced water flow
5. local inhabitants encountering changes in landscape

The conversion of a terrestrial ecosystem into an aquatic ecosystem will lead to limited changes in land use, water balance, and food chain. New habitats will be created, with an adapted Fauna moving in. The dam will lead to a rising water level, resulting also in a rise in groundwater levels. As water levels in the lake will vary over the seasons, shore vegetation will have difficulties to establish, leading to increased erosion risks. To compensate for loss of vegetation, planting of the shore areas will be conducted. Planting and creation of terraces will be conducted on all affected areas to reduce erosion

and landslide risks. Landscaping measures will also be taken during operation phase. The lake is intended to be made available for recreational activities. The only sources of noise will be generator and turbines, but the effects are limited and are effectively mitigated by appropriate insulation of the power house. Waste water and solid wastes caused by the permanent staff of estimated 10 persons will be subjected to a waste management system, including the use of appropriate containers and water sewage systems. Minimum flow rates required for preserving livelihood in the residual flow reach will be assured by regular water level controls and respective water discharges.

6 STAKEHOLDERS COMMENTS

In the course of the EIA process, a stakeholder consultation was conducted in compliance with Turkish EIA regulation as an integral part of the scoping phase. The main element of the stakeholder consultation was a physical meeting, conducted on 13/12/2007 in the assembly room of the Imam Hatip School in Doğankent, Giresun, with 80 participants. Invitations had been published in local, regional and national newspapers one week earlier. Also, the heads of the affected villages, as well as community, district and governor administrations had been invited directly to the meeting, and they had disseminated information on the meeting to the affected local public by public announcements and public notices.

In addition to the meeting, a two-day opinion survey was conducted beforehand with the heads of the villages affected by the dam construction works, i.e. Aslancık, Ataköy, Eymür, and Dokuzkonak. The purpose was to gather information on the socio-economic situation in the region and about the public opinion on the project.

Concerns about the project have been raised by the local population mainly with regard to

- location and size of expropriation areas
- impacts of the penstock pipe on groundwater quality
- locations of the access tunnels
- storage location of excavation material
- stability of the dam against the flow of the Harşit Creek
- silting up of the reservoir area
- sourcing of construction workers and start of construction works
- depth of the dam lake
- flooding of Sadaklı community.

During the meeting, the concerns could be generally eliminated. *Aslancık A.Ş.* explained the real potential impact of the project activity to the audience as simply and coherently as possible. A commitment to conduct appropriate mitigation measures was given, as well as to fully compensate any affected party for any unavoidable negative impacts. Also, the local sourcing of construction workers was agreed to. The meeting resulted in a generally positive assessment of, and support for, the project by the audience.

ANNEX: BASELINE INFORMATION

Baseline description

The following tables represent the two 10 year capacity projection scenarios[60] which are the data base for *Figure 5* and *Figure 4*, respectively, in *Section 1.10 above*.

Table A: Projected Turkish Electricity Generation, 2011-2020 (scenario 1). Unit: GWh

Fuel Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Lignite	52,644	52,673	52,900	55,817	58,457	58,457	58,553	58,553	58,553	58,553
Hard Coal+ Asfaltite	3,967	3,967	3,967	3,967	3,967	3,967	3,967	3,967	3,967	3,967
Imported Coal	24,904	26,821	26,780	30,571	35,110	35,801	35,366	35,413	35,413	35,413
Natural Gas	134,618	137,037	150,237	156,574	157,235	157,869	157,036	157,789	157,564	157,564
Geothermal	652	709	1,108	1,451	1,451	1,451	1,451	1,451	1,451	1,451
Fuel Oil	11,685	11,685	11,685	11,685	11,685	11,685	11,685	11,685	11,685	11,685
Diesel Oil	148	148	148	148	148	148	148	148	148	148
other	1,408	1,408	1,408	1,408	1,408	1,408	1,408	1,408	1,408	1,408
Biogas + Waste	783	939	1,033	1,055	1,055	1,055	1,055	1,055	1,055	1,055
Hydro	59,898	67,319	75,066	81,766	86,770	87,302	87,302	87,302	87,302	87,302
Wind	5,101	6,190	9,317	11,689	11,689	11,689	11,689	11,689	11,689	11,689
TOTAL	**295,808**	**308,896**	**333,649**	**356,131**	**368,975**	**370,832**	**369,660**	**370,460**	**370,235**	**370,235**

Table B: Projected Turkish Electricity Generation, 2011-2020 (scenario 2). Unit: GWh

Fuel Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Lignite	52,644	52,673	52,900	54,092	55,007	55,007	55,103	55,103	55,103	55,103
Hard Coal+ Asfaltite	3,967	3,967	3,967	3,967	3,967	3,967	3,967	3,967	3,967	3,967
Imported Coal	24,904	26,821	26,780	28,411	30,790	31,481	31,046	31,093	31,093	31,093
Natural Gas	134,618	136,777	146,502	153,100	157,235	157,869	157,036	157,789	157,564	157,564
Geothermal	652	652	819	1,218	1,451	1,451	1,451	1,451	1,451	1,451
Fuel Oil	11,685	11,685	11,685	11,685	11,685	11,685	11,685	11,685	11,685	11,685
Diesel Oil	148	148	148	148	148	148	148	148	148	148
other	1,408	1,408	1,408	1,408	1,408	1,408	1,408	1,408	1,408	1,408
Biogas + Waste	725	869	998	1,033	1,055	1,055	1,055	1,055	1,055	1,055
Hydro	59,064	65,871	73,021	78,843	83,785	84,317	84,317	84,317	84,317	84,317
Wind	5,101	5,626	6,819	9,755	11,689	11,689	11,689	11,689	11,689	11,689
TOTAL	**294,916**	**306,497**	**325,047**	**343,660**	**358,220**	**360,077**	**358,905**	**359,705**	**359,480**	**359,480**

[60] See [TEİAŞ Projection], p. 33 and p. 41, respectively.

Operating Margin

For calculation of OM emissions, NCVs were not used due to the availability of direct data on fuel use in the electricity sector in Turkey. The data had merely been converted from Tcal to TJ to allow for direct application of the CO_2 emission factors expressed in t CO_2/TJ. The conversion follows

equation (4) $$FC_{i,y} \cdot NCV_{i,y} = FC_{HV,i,y}[\mathrm{TJ}] = FC_{HV,i,y}[\mathrm{Tcal}] \cdot 4.1868$$

as presented in *Section 3.1.2. Step 4 above*. The results of the conversion are presented in

Table C: Conversion of Fuel Use Data in Turkish Electricity Sector 2008-2010 from Tcal to TJ

	2008		2009		2010	
	[Tcal]	[TJ]	[Tcal]	[TJ]	[Tcal]	[TJ]
Hard Coal+Imported Coal+Asphaltite	33,310	139,462	35,130	147,081	39,546	165,573
Lignite	108,227	453,125	97,652	408,848	96,551	404,240
Fuel Oil	20,607	86,277	15,160	63,471	8,569	35,877
Diesel Oil	1,328	5,560	1,830	7,663	209	877
LPG	0	0	1	5	0	0
Naphta	113	473	84	353	105	440
Natural Gas	189,057	791,544	186,266	779,858	194,487	814,279

Build Margin

The compilation below lists all plants included in the build margin. They represent a total annual average gross generation of 40,510,000 MWh which amounts to 20.03% of annual electricty generation of the project electricity system, excluding power units using the carbon market, i.e. AEG_{total} = 202,243,110 MWh.

Table D: Power Plants Included in the Build Margin Calculation[61]

Year	Power Plant	Cap. (MW)	Bus. Model	Fuel type	Gen. (GWh)	Commisionary date
2008	AKKÖY I HES	101.94	IPP	Hydro	408.00	18/09/2008
2008	TAYFUN HES	0.82	IPP	Hydro	5.00	10/10/2008
2008	TORUL HES	105.60	EÜAŞ	Hydro	322.00	16/10/2008
~~2008~~	~~HAMZALI HES~~	~~16.70~~	~~IPP~~	~~Hydro~~	~~117.00~~	~~08/11/2008~~
2008	SARMAŞIK I HES	21.04	IPP	Hydro	96.00	28/11/2008
2008	SARMAŞIK II HES	21.58	IPP	Hydro	108.00	28/11/2008
~~2008~~	~~DEĞİRMENÜSTÜ HES~~	~~25.70~~	~~IPP~~	~~Hydro~~	~~70.58~~	~~05/12/2008~~
~~2008~~	~~DATÇA RES~~	~~8.10~~	~~IPP~~	~~Wind~~	~~22.99~~	~~18/12/2008~~
~~2008~~	~~ODA YERİ~~	~~2.83~~	~~IPP~~	~~REN~~	~~22.24~~	~~29/12/2008~~
2009	ALKİM ALKALİ KİMYA (Cihanbeyli/KONYA)	0.40	Autop.	Lignite	3.00	01/01/2009
2009	ANTALYA ENERJİ (İlave)	41.80	IPP	N.Gas	302.10	01/01/2009
2009	CAM İŞ ELEKTRİK (Mersin) (İlave)	126.10	IPP	N.Gas	1,008.00	01/01/2009
2009	ENTEK KÖSEKÖY(İztek) (Düzeltme)	12.40	IPP	N.Gas	98.68	01/01/2009

[61] Except where other reasons are noted, all crossed out plants are using VERs.

Year	Power Plant	Cap. (MW)	Bus. Model	Fuel type	Gen. (GWh)	Commisio-nary date
2009	GÜL ENERJİ ELKT. ÜRET. SN. VE TİC. A.Ş.	24.30	IPP	N.Gas	170.00	01/01/2009
2009	İÇDAŞ ÇELİK (İlave)	270.00	IPP	CFBS	1,923.33	01/01/2009
2009	NUH ÇİMENTO SAN. TİC. A.Ş.(Nuh Çim.) (İlave)	47.00	Autop.	N.Gas	329.00	01/01/2009
~~2009~~	~~ORTADOĞU ENERJİ (ODA YERİ) (İlave)~~	~~9.90~~	~~IPP~~	~~REN~~	~~77.79~~	~~01/01/2009~~
2009	PETKİM ALİAĞA(Aliağa) (Düzeltme-İlave)	52.00	Autop.	Fuel oil	364.00	01/01/2009
2009	SÖNMEZ ELEKTRİK(UŞak) (İlave)	8.70	IPP	N.Gas	67.08	01/01/2009
2009	TÜPRAŞ RAFİNERİ(Aliağa/İzmir)	24.70	Autop.	N.Gas	170.00	01/01/2009
2009	TÜPRAŞ O.A.RAFİNERİ(Kırıkkale)(Düzeltme)	10.00	Autop.	Fuel oil	70.00	01/01/2009
2009	ZORLU ENERJİ (B.Karıştıran) (İlave)	49.50	IPP	N.Gas	394.97	01/01/2009
~~2009~~	~~BAKİ ELEKTRİK ŞAMLI RÜZGAR~~	~~36.00~~	~~IPP~~	~~Wind~~	~~176.00~~	~~29/01/2009~~
~~2009~~	~~DATÇA RES (Datça)~~	~~21.50~~	~~IPP~~	~~Wind~~	~~61.01~~	~~29/01/2009~~
2009	TAŞOVA YENİDEREKÖY HES (HAMEKA A.Ş.)	2.00	IPP	Hydro	10.00	30/01/2009
~~2009~~	~~ITC-KA ENERJİ MAMAK KATI ATIK TOP.MERK.~~	~~2.80~~	~~IPP~~	~~REN~~	~~21.06~~	~~04/02/2009~~
2009	ERDEMİR(Ereğli-Zonguldak)	37.60	Autop.	N.Gas	227.01	06/02/2009
~~2009~~	~~TEKTUĞ (Erkenek)~~	~~12.50~~	~~IPP~~	~~Hydro~~	~~50.00~~	~~26/02/2009~~
2009	TAV İSTANBUL TERMİNAL İŞLETME. A.Ş.	6.52	Autop.	N.Gas	54.56	06/03/2009
~~2009~~	~~AYEN ENERJİ A.Ş. AKBÜK RÜZGAR~~	~~31.50~~	~~IPP~~	~~Wind~~	~~123.00~~	~~19/03/2009~~
~~2009~~	~~BAĞIŞLI REG. VE HES (CEYKAR ELEKT.)~~	~~9.90~~	~~IPP~~	~~Hydro~~	~~33.11~~	~~21/03/2009~~
2009	KASAR DUAL TEKSTİL SAN. A.Ş. (Çorlu)	5.70	Autop.	N.Gas	38.00	26/03/2009
2009	GÜRMAT ELEKT. (GÜRMAT JEOTERMAL)	47.40	IPP	REN	313.00	02/04/2009
~~2009~~	~~DEĞİRMENÜSTÜ EN. (KAHRAMANMARAŞ)~~	~~12.90~~	~~IPP~~	~~Hydro~~	~~35.42~~	~~16/04/2009~~
2009	DELTA ENERJİ ÜRETİM VE TİC.A.Ş.	60.00	IPP	N.Gas	467.00	21/04/2009
2009	KEN KİPAŞ ELKT. ÜR.(KAREN) (K.Maraş)	17.50	IPP	N.Gas	75.36	23/04/2009
2009	TESKO KİPA KİTLE PAZ. TİC. VE GIDA A.Ş.	2.30	Autop.	N.Gas	18.00	27/04/2009
2009	SİLOPİ ELEKTRİK ÜRETİM A.Ş.	135.00	IPP	CFBS	945.00	02/05/2009
2009	LAMAS III - IV HES (TGT ENERJİ ÜRETİM)	35.70	IPP	Hydro	150.00	06/05/2009
~~2009~~	~~BAĞIŞLI REG. VE HES (CEYKAR ELEKT.)~~	~~19.70~~	~~IPP~~	~~Hydro~~	~~65.89~~	~~07/05/2009~~
2009	TOCAK I HES (YURT ENERJİ ÜRETİM SN.)	4.80	IPP	Hydro	13.00	08/05/2009
~~2009~~	~~BEYOBASI EN. ÜR. A.Ş. (SIRMA HES)~~	~~5.90~~	~~IPP~~	~~Hydro~~	~~23.00~~	~~23/05/2009~~
2009	CARGILL TARIM VE GIDA SAN. TİC. A.Ş.	0.10	Autop.	REN	0.70	26/05/2009
2009	MAURİ MAYA SAN. A.Ş.	2.00	Autop.	N.Gas	16.52	28/05/2009
2009	ÖZYAKUT ELEK. ÜR.A.Ş. (GÜNEŞLİ HES)	1.20	IPP	Hydro	5.33	29/05/2009
2009	YPM SEVİNDİK HES (Suşehri/SİVAS)	5.70	IPP	Hydro	36.00	09/06/2009
2009	YPM GÖLOVA HES (Suşehri/SİVAS)	1.10	IPP	Hydro	3.00	10/06/2009
~~2009~~	~~BEREKET ENERJİ (KOYULHİSAR HES)~~	~~42.00~~	~~IPP~~	~~Hydro~~	~~329.00~~	~~12/06/2009~~
2009	MARMARA PAMUKLU MENS. SN.TİC.A.Ş.	34.90	Autop.	N.Gas	271.11	18/06/2009
2009	KALEN ENERJİ (KALEN I - II HES)	15.65	IPP	Hydro	52.00	19/06/2009
~~2009~~	~~ALİZE ENERJİ (ÇAMSEKİ RES)~~	~~20.80~~	~~IPP~~	~~Wind~~	~~82.00~~	~~24/06/2009~~

Year	Power Plant	Cap. (MW)	Bus. Model	Fuel type	Gen. (GWh)	Commisio-nary date
2009	CİNDERE HES (Denizli)	19.10	IPP	Hydro	59.60	02/07/2009
2009	ŞİRİKÇİOĞLU EL.(KOZAK BENDİ VE HES)	4.40	IPP	Hydro	15.00	08/07/2009
2009	AKUA ENERJİ (KAYALIK REG. VE HES)	5.80	IPP	Hydro	39.00	15/07/2009
~~2009~~	~~ORTADOĞU ENERJİ (KÖMÜRCÜODA)~~	~~5.80~~	~~IPP~~	~~REN~~	~~45.00~~	~~15/07/2009~~
~~2009~~	~~ITC-KA ENERJİ (SİNCAN)~~	~~2.80~~	~~IPP~~	~~REN~~	~~22.00~~	~~17/07/2009~~
~~2009~~	~~ALİZE ENERJİ (KELTEPE RES)~~	~~18.90~~	~~IPP~~	~~Wind~~	~~66.65~~	~~23/07/2009~~
2009	KAYEN ALFA ENERJİ (KALETEPE HES)	10.20	IPP	Hydro	37.00	23/07/2009
2009	OBRUK HES	212.40	EÜAŞ	Hydro	473.00	29/07/2009
2009	GLOBAL ENERJİ (PELİTLİK)	8.55	IPP	N.Gas	65.27	31/07/2009
2009	RASA ENERJİ (VAN)	78.60	IPP	N.Gas	500.06	31/07/2009
~~2009~~	~~ROTOR ELEKTRİK (OSMANİYE RES)~~	~~57.50~~	~~IPP~~	~~Wind~~	~~217.22~~	~~07/08/2009~~
~~2009~~	~~ÜTOPYA ELEKTRİK (DÜZOVA RES)~~	~~15.00~~	~~IPP~~	~~Wind~~	~~46.00~~	~~11/08/2009~~
~~2009~~	~~ANADOLU ELEKTRİK (ÇAKIRLAR HES)~~	~~16.20~~	~~IPP~~	~~Hydro~~	~~60.00~~	~~13/08/2009~~
~~2009~~	~~ÖZTAY ENERJİ (GÜNAYŞE REG.VE HES)~~	~~8.30~~	~~IPP~~	~~Hydro~~	~~29.00~~	~~13/08/2009~~
2009	AKÇAY HES ELEKTRİK ÜR. (AKÇAY HES)	28.80	IPP	Hydro	95.00	14/08/2009
2009	DENİZLİ ELEKTRİK (EGE I HES)	0.90	IPP	Hydro	4.00	27/08/2009
~~2009~~	~~AK ENERJİ (AYYILDIZ RES)~~	~~15.00~~	~~IPP~~	~~Wind~~	~~51.00~~	~~05/09/2009~~
~~2009~~	~~SOMA ENERJİ ÜRETİM (SOMA RES)~~	~~45.00~~	~~IPP~~	~~Wind~~	~~150.00~~	~~05/09/2009~~
~~2009~~	~~SAYALAR RÜZGAR (Doğal Enerji)~~	~~3.60~~	~~IPP~~	~~Wind~~	~~11.24~~	~~06/09/2009~~
~~2009~~	~~MAZI-3 RES ELEKT.ÜR. A.Ş. (MAZI-3 RES)~~	~~22.50~~	~~IPP~~	~~Wind~~	~~78.75~~	~~09/09/2009~~
~~2009~~	~~BAKİ ELEKTRİK ŞAMLI RÜZGAR~~	~~33.00~~	~~IPP~~	~~Wind~~	~~161.33~~	~~11/09/2009~~
~~2009~~	~~FİLYOS ENERJİ (YALNIZCA REG. VE HES)~~	~~14.40~~	~~IPP~~	~~Hydro~~	~~67.00~~	~~16/09/2009~~
~~2009~~	~~BORASKO ENERJİ (BANDIRMA RES)~~	~~45.00~~	~~IPP~~	~~Wind~~	~~179.21~~	~~18/09/2009~~
2009	ERVA ENERJİ (KABACA REG. VE HES)	4.25	IPP	Hydro	16.50	23/09/2009
~~2009~~	~~ELESTAŞ ELEKTRİK (YAYLABEL HES)~~	~~5.10~~	~~IPP~~	~~Hydro~~	~~20.00~~	~~27/09/2009~~
~~2009~~	~~BELEN ELEKTRİK BELEN RÜZGAR-HATAY~~	~~30.00~~	~~IPP~~	~~Wind~~	~~95.00~~	~~02/10/2009~~
~~2009~~	~~ELESTAŞ ELEKTRİK (YAZI HES)~~	~~1.10~~	~~IPP~~	~~Hydro~~	~~6.00~~	~~02/10/2009~~
~~2009~~	~~YAPISAN (KARICA REG. ve DARICA I HES)~~	~~48.50~~	~~IPP~~	~~Hydro~~	~~164.00~~	~~10/10/2009~~
2009	DALSAN ALÇI SAN. VE TİC. A.Ş.	1.20	Autop.	N.Gas	9.00	14/10/2009
2009	MAURİ MAYA SAN. A.Ş.	0.30	Autop.	N.Gas	2.48	16/10/2009
2009	AK GIDA SAN. VE TİC. A.Ş. (Pamukova)	7.50	Autop.	N.Gas	61.00	17/10/2009
~~2009~~	~~ALİZE ENERJİ (SARIKAYA RES) (Şarköy)~~	~~28.80~~	~~IPP~~	~~Wind~~	~~96.00~~	~~19/10/2009~~
2009	ERVA ENERJİ (KABACA REG. VE HES)	4.25	IPP	Hydro	16.50	29/10/2009
2009	AKSA ENERJİ (MANİSA) (İlave)	62.90	IPP	N.Gas	498.07	01/11/2009
2009	TÜM ENERJİ (PINAR REG. VE HES)	30.10	IPP	Hydro	138.00	06/11/2009
~~2009~~	~~REŞADİYE 3 HES (TURKON MNG ELEKT.)~~	~~22.30~~	~~IPP~~	~~Hydro~~	~~175.00~~	~~11/11/2009~~
2009	SELKASAN KAĞIT PAKETLEME MALZ. İM.	9.90	Autop.	N.Gas	73.00	11/11/2009
2009	ÖZYAKUT ELEK. ÜR.A.Ş. (GÜNEŞLİ HES)	0.60	IPP	Hydro	2.67	13/11/2009

Year	Power Plant	Cap. (MW)	Bus. Model	Fuel type	Gen. (GWh)	Commisio-nary date
2009	SARITEPE HES (GENEL DİNAMİK SİS.EL.)	2.45	IPP	Hydro	10.00	19/11/2009
2009	AKSA ENERJİ (Antalya) (İlave)	616.20	IPP	N.Gas	4,744.74	01/12/2009
2009	UZUNÇAYIR HES (Tunceli)	27.30	IPP	Hydro	107.20	02/12/2009
2009	YEŞİLBAŞ ENERJİ (YEŞİLBAŞ HES)	14.00	IPP	Hydro	56.00	04/12/2009
2009	TAV İSTANBUL TERMİNAL İŞLETME. A.Ş.	3.28	Autop.	N.Gas	27.44	12/12/2009
2009	ÇELİKLER TAAH. İNŞ. (RİXOX GRAND)	2.00	Autop.	N.Gas	16.00	15/12/2009
2009	FALEZ ELEKTRİK ÜRETİMİ A.Ş.	11.70	IPP	N.Gas	88.00	16/12/2009
~~2009~~	~~KORES KOCADAĞ RES (Urla/İZMİR)~~	~~15.00~~	~~IPP~~	~~Wind~~	~~56.00~~	~~23/12/2009~~
~~2009~~	~~YAPISAN (KARICA REG. ve DARICA I HES)~~	~~48.50~~	~~IPP~~	~~Hydro~~	~~164.00~~	~~23/12/2009~~
2009	SARITEPE HES (GENEL DİNAMİK SİS.EL.)	2.45	IPP	Hydro	10.00	24/12/2009
~~2009~~	~~ÖZGÜR ELEKTRİK (AZMAK II REG.VE HES)~~	~~6.33~~	~~IPP~~	~~Hydro~~	~~20.00~~	~~25/12/2009~~
~~*2009*~~	~~*SİLOPİ ELEKTRİK ÜRETİM A.Ş.(ESENBOĞA)*~~[62]	~~*44.80*~~	~~*IPP*~~	~~*Fuel oil*~~	~~*315.00*~~	~~*31/12/2009*~~
~~2010~~	~~SELİMOĞLU REG. VE HES~~	~~8.80~~	~~IPP~~	~~Hydro~~	~~35.00~~	~~07/01/2010~~
~~2010~~	~~TUZLA JEOTERMAL~~	~~7.50~~	~~IPP~~	~~REN~~	~~55.00~~	~~13/01/2010~~
2010	KULP IV HES (YILDIZLAR EN.ELK.ÜR.AŞ.)	12.30	IPP	Hydro	41.00	13/01/2010
~~2010~~	~~ROTOR ELEKTRİK (OSMANİYE RES)~~	~~20.00~~	~~IPP~~	~~Wind~~	~~75.56~~	~~14/01/2010~~
2010	CİNDERE HES (ilave)	9.10	IPP	Hydro	28.40	21/01/2010
2010	ETİ SODA	24.00	Autop.	Lignite	144.00	22/01/2010
2010	CAN TEKSTİL	13.03	Autop.	N.Gas	100.00	28/01/2010
2010	ALTINMARKA	4.60	Autop.	N.Gas	37.02	28/01/2010
2010	BAYBURT HES (BAYBURT ENERJİ ÜRET.)	14.63	IPP	Hydro	51.00	28/01/2010
2010	UZUNÇAYIR HES (Tunceli) (İlave)	27.35	IPP	Hydro	107.40	28/01/2010
2010	ALAKIR HES (YURT ENERJİ ÜRETİM)	2.06	IPP	Hydro	6.00	29/01/2010
~~2010~~	~~GAZİANTEP ÇÖP BİOGAZI~~	~~1.13~~	~~IPP~~	~~REN~~	~~8.60~~	~~01/02/2010~~
2010	AKBAŞLAR	1.54	Autop.	N.Gas	12.08	18/02/2010
2010	PETA MÜHENDİSLİK EN. (MURSAL II HES)	4.50	IPP	Hydro	19.00	19/02/2010
~~2010~~	~~ASA ENERJİ (KALE REG.ve HES)~~	~~9.57~~	~~IPP~~	~~Hydro~~	~~32.00~~	~~19/02/2010~~
2010	HETAŞ HACISALİHOĞLU (YILDIZLI HES)	1.20	IPP	Hydro	5.00	23/02/2010
~~2010~~	~~ODA YERİ~~	~~4.20~~	~~IPP~~	~~REN~~	~~33.00~~	~~24/02/2010~~
~~2010~~	~~ASMAKİNSAN (BANDIRMA 3 RES)~~	~~20.00~~	~~IPP~~	~~Wind~~	~~70.83~~	~~26/02/2010~~
2010	GLOBAL ENERJİ (PELİTLİK)	3.50	IPP	N.Gas	26.72	26/02/2010
~~*2010*~~	~~*KONYA ŞEKER SAN. VE TİC. A.Ş.*~~[63]	~~*6.00*~~	~~*Autop.*~~	~~*Lignite*~~		~~*26/02/2010*~~
2010	RASA ENERJİ (VAN)	26.20	IPP	N.Gas	166.69	03/03/2010
~~2010~~	~~SOMA ENERJİ ÜRETİM (SOMA RES)~~	~~4.50~~	~~IPP~~	~~Wind~~	~~15.00~~	~~10/03/2010~~
~~2010~~	~~ROTOR ELEKTRİK (OSMANİYE RES)~~	~~17.50~~	~~IPP~~	~~Wind~~	~~66.11~~	~~10/03/2010~~
2010	DOĞUBAY ELEKTRİK (SARIMEHMET HES)	3.10	IPP	Hydro	10.00	11/03/2010

62 Decommissioned in 2010.

63 not identified in compilation of current system in [TEİAŞ Projection]

Year	Power Plant	Cap. (MW)	Bus. Model	Fuel type	Gen. (GWh)	Commisio-nary date
~~2010~~	~~DENİZ ELEKTRİK (SEBENOBA RES)~~	~~10.00~~	~~IPP~~	~~Wind~~	~~36.67~~	~~12/03/2010~~
~~2010~~	~~AKDENİZ ELEKTRİK (MERSİN RES)~~	~~33.00~~	~~IPP~~	~~Wind~~	~~100.00~~	~~19/03/2010~~
2010	AKSA ENERJİ (ANTALYA)	25.00	IPP	N.Gas	192.50	20/03/2010
~~2010~~	~~MENDERES GEOTERMAL DORA-2~~	~~9.50~~	~~IPP~~	~~REN~~	~~73.00~~	~~26/03/2010~~
2010	NURYOL ENERJİ (DEFNE REG. VE HES)	7.23	IPP	Hydro	22.00	26/03/2010
~~2010~~	~~ASMAKİNSAN (BANDIRMA 3 RES)~~	~~4.00~~	~~IPP~~	~~Wind~~	~~14.17~~	~~26/03/2010~~
~~2010~~	~~ÖZGÜR ELEKTRİK (AZMAK I REG.VE HES)~~	~~5.90~~	~~IPP~~	~~Hydro~~	~~21.50~~	~~01/04/2010~~
2010	BİRİM HİDR. ÜRETİM AŞ. (ERFELEK HES)	3.25	IPP	Hydro	9.50	03/04/2010
~~2010~~	~~BEYTEK El. ÜR. A.S. (ÇATALOLUK HES)~~	~~9.54~~	~~IPP~~	~~Hydro~~	~~31.00~~	~~07/04/2010~~
2010	NİSAN E.MEKANİK EN. (BAŞAK REG. HES)	6.85	IPP	Hydro	22.00	09/04/2010
~~2010~~	~~BOREAS ENERJİ (OREAS I ENEZ RES)~~	~~15.00~~	~~IPP~~	~~Wind~~	~~49.00~~	~~09/04/2010~~
~~2010~~	~~BERGAMA RES EN. ÜR. A.Ş. ALİAĞA RES~~	~~52.50~~	~~IPP~~	~~Wind~~	~~207.08~~	~~09/04/2010~~
~~2010~~	~~ROTOR ELEKTRİK (OSMANİYE RES)~~	~~17.50~~	~~IPP~~	~~Wind~~	~~66.11~~	~~09/04/2010~~
2010	UZUNÇAYIR HES (Tunceli) (İlave)	27.35	IPP	Hydro	107.40	11/04/2010
2010	FIRTINA ELEKTRİK ÜR. A.Ş. (SÜMER HES)	21.60	IPP	Hydro	70.00	16/04/2010
~~*2010*~~	~~*FRİTOLAY*~~	~~*0.06*~~	~~*Autop.*~~	~~*REN*~~		~~*21/04/2010*~~
~~*2010*~~	~~*FRİTOLAY*~~[64]	~~*0.33*~~	~~*Autop.*~~	~~*REN*~~		~~*21/04/2010*~~
~~2010~~	~~BAKRAS EN. ELKT.ÜR. A.Ş. ŞENBÜK RES~~	~~15.00~~	~~IPP~~	~~Wind~~	~~47.00~~	~~22/04/2010~~
2010	YILDIZLI ENTEGRE AĞAÇ (Kocaeli)	12.40	Autop.	N.Gas	80.00	22/04/2010
~~2010~~	~~ALİZE ENERJİ (KELTEPE RES)~~	~~1.80~~	~~IPP~~	~~Wind~~	~~6.35~~	~~28/04/2010~~
~~2010~~	~~KAR-EN KARADENİZ EL.A.Ş. ARALIK HES~~	~~12.41~~	~~IPP~~	~~Hydro~~	~~56.00~~	~~30/04/2010~~
~~2010~~	~~ITC-KA ENERJİ (SİNCAN)~~	~~1.40~~	~~IPP~~	~~REN~~	~~11.00~~	~~30/04/2010~~
2010	ATAER ENERJİ ELEKTRİK ÜRETİM A.Ş.	49.00	IPP	N.Gas	277.89	05/05/2010
2010	BİRİM HİDR. ÜRETİM AŞ. (ERFELEK HES)	3.25	IPP	Hydro	9.50	14/05/2010
2010	CENGİZ ENERJİ SAN. VE TİC. A.Ş. (Tekkeköy)	101.95	IPP	N.Gas	802.00	22/05/2010
2010	KARADENİZ EL.ÜRET. (UZUNDERE-1 HES)	31.10	IPP	Hydro	82.50	27/05/2010
2010	AKIM ENERJİ (CEVİZLİK REG. VE HES)	91.40	IPP	Hydro	330.00	28/05/2010
~~2010~~	~~ÇAKIT HES (ÇAKIT ENERJİ A.Ş.)~~	~~20.18~~	~~IPP~~	~~Hydro~~	~~96.00~~	~~01/06/2010~~
2010	CEYHAN HES (OŞKAN HES) (ENOVA EN.)	23.89	IPP	Hydro	98.00	03/06/2010
2010	ERENLER REG. ve HES (BME BİR.MÜT.EN.)	45.00	IPP	Hydro	85.00	04/06/2010
~~2010~~	~~ROTOR ELEKTRİK (GÖKÇEDAĞ RES)~~	~~20.00~~	~~IPP~~	~~Wind~~	~~75.56~~	~~05/06/2010~~
~~2010~~	~~SOMA ENERJİ ÜRETİM (SOMA RES)~~	~~7.20~~	~~IPP~~	~~Wind~~	~~24.00~~	~~10/06/2010~~
~~2010~~	~~PAŞA REG. VE HES (ÖZGÜR ELEKTRİK)~~	~~8.68~~	~~IPP~~	~~Hydro~~	~~34.00~~	~~11/06/2010~~
~~2010~~	~~GÜZELÇAY-I HES (İLK ELEKTRİK ENERJİ)~~	~~3.14~~	~~IPP~~	~~Hydro~~	~~16.67~~	~~15/06/2010~~
~~2010~~	~~KALE REG. VE HES (KALE ENERJİ ÜR.)~~	~~34.14~~	~~IPP~~	~~Hydro~~	~~116.00~~	~~16/06/2010~~
~~2010~~	~~BERGAMA RES EN. ÜR. A.Ş. ALİAĞA RES~~	~~37.50~~	~~IPP~~	~~Wind~~	~~147.92~~	~~16/06/2010~~

64 No difference in total installed capacity in compilation of current system in [TEİAŞ Projection] could be identified.

Year	Power Plant	Cap. (MW)	Bus. Model	Fuel type	Gen. (GWh)	Commisio-nary date
~~2010~~	~~MAZI-3 RES ELEKT.ÜR. A.Ş. (MAZI-3 RES)~~	~~7.50~~	~~IPP~~	~~Wind~~	~~26.25~~	~~18/06/2010~~
2010	UĞUR ENERJİ ELKTRİK ÜRETİM TİC. VE SAN. A.Ş.	48.20	IPP	N.Gas	405.14	21/06/2010
~~2010~~	~~ERİKLİ-AKOCAK REG. ve AKOCAK HES~~	~~41.25~~	~~IPP~~	~~Hydro~~	~~128.50~~	~~30/06/2010~~
2010	ÇAMLIKAYA REG. VE HES	5.65	IPP	Hydro	19.00	30/06/2010
~~2010~~	~~BORASKO ENERJİ (BANDIRMA RES)~~	~~12.00~~	~~IPP~~	~~Wind~~	~~47.79~~	~~30/06/2010~~
2010	AKSA ENERJİ (ANTALYA)	25.00	IPP	N.Gas	192.50	01/07/2010
2010	DİNAR HES (ELDA ELEKTRİK ÜRETİM)	4.44	IPP	Hydro	15.00	03/07/2010
2010	DAMLAPINAR HES (CENAY ELEKTRİK ÜR.)	16.42	IPP	Hydro	92.00	08/07/2010
2010	DİM HES (DİLER ELEKTRİK ÜRETİM)	38.25	IPP	Hydro	123.00	08/07/2010
2010	ALTEK ALARKO ELKTRİK SANTRALLARI	60.10	IPP	N.Gas	415.57	10/07/2010
~~2010~~	~~ÖZGÜR ELEKTRİK (AZMAK I REG.VE HES)~~	~~5.90~~	~~IPP~~	~~Hydro~~	~~21.50~~	~~10/07/2010~~
2010	KİRPİLİK REG. VE HES (ÖZGÜR ELEKTRİK)	6.24	IPP	Hydro	22.00	11/07/2010
2010	YAVUZ REG. VE HES (MASAT ENERJİ)	22.50	IPP	Hydro	83.00	14/07/2010
2010	EREN ENERJİ ELEKTRİK ÜRETİM A.Ş.	160.00	IPP	CFBS	1,068.24	15/07/2010
~~2010~~	~~ZİYARET RES (ZİYARET RES ELEKTRİK)~~	~~12.50~~	~~IPP~~	~~Wind~~	~~50.00~~	~~15/07/2010~~
2010	FLOKSER TEKSTİL (Çerkezköy/TEKİRDAĞ)	5.20	Autop.	N.Gas	42.00	17/07/2010
~~2010~~	~~KAYABÜKÜ REG. VE HES (ELİTE ELEKT.)~~	~~14.58~~	~~IPP~~	~~Hydro~~	~~49.00~~	~~21/07/2010~~
2010	RB KARESİ İTHALAT İHRACAT TEKSTİL	8.60	Autop.	N.Gas	65.00	23/07/2010
~~2010~~	~~SOMA ENERJİ ÜRETİM (SOMA RES)~~	~~7.20~~	~~IPP~~	~~Wind~~	~~24.00~~	~~28/07/2010~~
~~2010~~	~~SOMA ENERJİ ÜRETİM (SOMA RES)~~	~~6.30~~	~~IPP~~	~~Wind~~	~~21.00~~	~~28/07/2010~~
~~2010~~	~~ERİKLİ-AKOCAK REG. ve AKOCAK HES~~	~~41.25~~	~~IPP~~	~~Hydro~~	~~128.50~~	~~29/07/2010~~
2010	CENGİZ ENERJİ SAN. VE TİC. A.Ş. (Tekkeköy)	101.95	IPP	N.Gas	802.00	31/07/2010
2010	GÖK REG. ve HES (GÖK ENERJİ EL. SAN.)	10.01	IPP	Hydro	43.00	06/08/2010
~~2010~~	~~BULAM REG. VE HES (MEM ENERJİ ELK.)~~	~~7.03~~	~~IPP~~	~~Hydro~~	~~32.40~~	~~10/08/2010~~
2010	KESKİNOĞLU TAVUKÇULUK VE DAM. İŞL.	3.50	Autop.	N.Gas	25.00	11/08/2010
~~2010~~	~~SOMA RES (BİLGİN RÜZGAR SAN. EN.ÜR.)~~	~~32.50~~	~~IPP~~	~~Wind~~	~~110.86~~	~~13/08/2010~~
2010	BİNATOM ELEKTRİK ÜRETİM A.Ş.	2.00	IPP	N.Gas	13.00	17/08/2010
2010	CAN ENERJİ ELEKTRİK ÜR. A.Ş.(Tekirdağ)	29.10	IPP	N.Gas	203.00	19/08/2010
2010	KURTOĞLU BAKIR KURŞUN SAN. A.Ş.	1.59	Autop.	N.Gas	12.00	19/08/2010
2010	CEYHAN HES (BERKMAN HES)(ENOVA EN.)	12.61	IPP	Hydro	51.50	20/08/2010
2010	GÜDÜL I REG. VE HES (YAŞAM ENERJİ)	2.36	IPP	Hydro	14.00	25/08/2010
2010	SÖNMEZ ELEKTRİK(UŞak)	33.24	IPP	N.Gas	256.28	26/08/2010
2010	KARŞIYAKA HES (AKUA ENERJİ ÜRET.)	1.59	IPP	Hydro	8.00	28/08/2010
2010	CEYHAN HES (BERKMAN HES)(ENOVA EN.)	12.61	IPP	Hydro	51.50	28/08/2010
~~2010~~	~~ITC ADANA BİOKÜTLE SANT.~~	~~9.90~~	~~IPP~~	~~REN~~	~~80.00~~	~~02/09/2010~~
~~2010~~	~~BELEN ELEKTRİK BELEN RÜZGAR-HATAY~~	~~6.00~~	~~IPP~~	~~Wind~~	~~19.00~~	~~02/09/2010~~
2010	TEKTUĞ ELEKTRİK (ANDIRIN HES)	40.50	IPP	Hydro	106.00	03/09/2010
~~2010~~	~~ÜTOPYA ELEKTRİK (DÜZOVA RES)~~	~~15.00~~	~~IPP~~	~~Wind~~	~~46.00~~	~~03/09/2010~~

Year	Power Plant	Cap. (MW)	Bus. Model	Fuel type	Gen. (GWh)	Commisio-nary date
2010	SELEN ELEKTRİK (KEPEZKAYA HES)	28.00	IPP	Hydro	124.00	06/09/2010
~~2010~~	~~REŞADİYE 2 HES (TURKON MNG ELEKT.)~~	~~26.14~~	~~IPP~~	~~Hydro~~	~~210.00~~	~~17/09/2010~~
2010	KOZAN HES (SER-ER ENERJİ)	4.00	IPP	Hydro	9.00	21/09/2010
~~2010~~	~~SOMA RES (BİLGİN RÜZGAR SAN. EN.ÜR.)~~	~~27.50~~	~~IPP~~	~~Wind~~	~~93.81~~	~~23/09/2010~~
2010	KIRKA BORAKS(Kırka) (Eti Maden İŞl.) (İlave)	10.00	Autop.	N.Gas	65.93	29/09/2010
2010	KAHRAMAN REG. VE HES (KATIRCIOĞLU)	1.42	IPP	Hydro	6.00	30/09/2010
2010	NARİNKALE REG. VE HES (EBD ENERJİ)	3.10	IPP	Hydro	10.00	30/09/2010
~~2010~~	~~SOMA ENERJİ ÜRETİM (SOMA RES)~~	~~9.00~~	~~IPP~~	~~Wind~~	~~30.00~~	~~01/10/2010~~
2010	ENERJİ-SA (BANDIRMA)	930.80	IPP	N.Gas	7,540.00	07/10/2010
2010	ERENKÖY REG. VE HES (TÜRKERLER)	21.46	IPP	Hydro	87.00	07/10/2010
2010	UĞUR ENERJİ ELKTRİK ÜRETİM TİC. VE SAN. A.Ş.	12.00	IPP	N.Gas	100.86	07/10/2010
~~2010~~	~~ZİYARET RES~~	~~22.50~~	~~IPP~~	~~Wind~~	~~90.00~~	~~13/10/2010~~
2010	KAHTA I HES (ERDEMYILDIZ ELEK. ÜRT.)	7.12	IPP	Hydro	35.00	14/10/2010
~~2010~~	~~ROTOR ELEKTRİK (GÖKÇEDAĞ RES)~~	~~2.50~~	~~IPP~~	~~Wind~~	~~9.44~~	~~15/10/2010~~
~~2010~~	~~ULUABAT KUVVET TÜNELİ VE HES~~	~~48.51~~	~~IPP~~	~~Hydro~~	~~186.00~~	~~27/10/2010~~
2010	SABUNSUYU II HES (ANG ENERJİ ELK.)	7.35	IPP	Hydro	21.00	28/10/2010
2010	EREN ENERJİ ELEKTRİK ÜRETİM A.Ş.	600.00	IPP	Sup. Coal	4,005.88	01/11/2010
~~2010~~	~~BURÇ BENDİ VE HES (AKKUR ENERJİ)~~	~~27.33~~	~~IPP~~	~~Hydro~~	~~113.00~~	~~04/11/2010~~
2010	KARADENİZ EL.ÜRET. (UZUNDERE-1 HES)	31.10	IPP	Hydro	82.50	07/11/2010
~~2010~~	~~GÜZELÇAY-II HES (İLK ELEKTRİK ENERJİ)~~	~~4.96~~	~~IPP~~	~~Hydro~~	~~26.33~~	~~11/11/2010~~
~~2010~~	~~KUYUCAK RES (ALİZE ENERJİ ÜRET.)~~	~~8.00~~	~~IPP~~	~~Wind~~	~~34.38~~	~~11/11/2010~~
2010	MURGUL BAKIR (Ç.Kaya) (İlave)	19.60	IPP	Hydro	40.17	11/11/2010
~~2010~~	~~SOMA RES (BİLGİN RÜZGAR SAN. EN.ÜR.)~~	~~30.00~~	~~IPP~~	~~Wind~~	~~102.33~~	~~11/11/2010~~
2010	MARMARA PAMUKLU MENSUCAT (İlave)	26.20	Autop.	N.Gas	203.53	25/11/2010
~~2010~~	~~ULUABAT KUVVET TÜNELİ VE HES~~	~~48.51~~	~~IPP~~	~~Hydro~~	~~186.00~~	~~25/11/2010~~
~~2010~~	~~REŞADİYE 1 HES (TURKON MNG ELEKT.)~~	~~15.68~~	~~IPP~~	~~Hydro~~	~~126.00~~	~~26/11/2010~~
~~2010~~	~~EGEMEN 1 HES (ENERSİS ELEKTRİK)~~	~~8.82~~	~~IPP~~	~~Hydro~~	~~31.88~~	~~26/11/2010~~
2010	ALİAĞA ÇAKMAKTEPE ENERJİ (İlave)	69.90	IPP	N.Gas	558.40	26/11/2010
2010	YEDİGÖZE HES (YEDİGÖZE ELEKTRİK)	155.33	IPP	Hydro	474.00	02/12/2010
2010	SÖNMEZ ELEKTRİK(UŞak)	2.56	IPP	N.Gas	19.74	07/12/2010
~~2010~~	~~KUYUCAK RES (ALİZE ENERJİ ÜRET.)~~	~~17.60~~	~~IPP~~	~~Wind~~	~~75.63~~	~~09/12/2010~~
~~2010~~	~~UMUT III REG. VE HES (NİSAN ELEKTR.)~~	~~12.00~~	~~IPP~~	~~Hydro~~	~~26.00~~	~~13/12/2010~~
2010	TÜPRAŞ RAFİNERİ (İZMİT)	0.90	Autop.	N.Gas	5.82	15/12/2010
2010	POLYPLEX EUROPA POLYESTER FİLM	7.81	Autop.	N.Gas	61.00	16/12/2010
2010	ALTEK ALARKO ELKTRİK SANTRALLARI	21.90	IPP	N.Gas	151.43	18/12/2010
~~2010~~	~~SARES RES (GARET ENERJİ ÜRETİM)~~	~~15.00~~	~~IPP~~	~~Wind~~	~~60.00~~	~~22/12/2010~~
~~2010~~	~~FEKE 2 BARAJI VE HES (AKKUR ENERJİ)~~	~~69.34~~	~~IPP~~	~~Hydro~~	~~223.00~~	~~24/12/2010~~
~~2010~~	~~EGEMEN 1B HES (ENERSİS ELEKTRİK)~~	~~11.10~~	~~IPP~~	~~Hydro~~	~~40.12~~	~~28/12/2010~~

Year	Power Plant	Cap. (MW)	Bus. Model	Fuel type	Gen. (GWh)	Commisio-nary date
2010	EREN ENERJİ ELEKTRİK ÜRETİM A.Ş.	600.00	IPP	Sup. Coal	4,005.88	29/12/2010
2010	RASA ENERJİ (VAN)	10.10	IPP	N.Gas	64.26	29/12/2010
2010	KALKANDERE REG. VE YOKUŞLU HES	14.54	IPP	Hydro	63.00	30/12/2010
~~2010~~	~~TURGUTTEPE RES (SABAŞ ELEKTRİK ÜR.)~~	~~22.00~~	~~IPP~~	~~Wind~~	~~64.00~~	~~30/12/2010~~
2010	İNTERNATİONAL HOSPİTAL İSTANBUL AŞ.	0.77	Autop.	N.Gas	6.00	31/12/2010

The power units in Turkey that use the carbon market and thus are to be excluded when determining AEG_{total} (see *Section 3.1.2. Step 5 above*) are compiled in

Table E: Power Units in Turkey Using the Carbon Market (Status 2010)

Power Plant	Cap. (MW)	Fuel type	AEG (GWh)	Commis-sioned	Carbon Status
TEKTUĞ(Kargılık) GR I-II	23.90	Hydro	83.00	24/04/05	VCS264
ITC-KA EN. MAMAK TOP.M. GR I-II-III	4.30	REN	32.35	20/02/06	GS440
BARES IX GRUP	13.50	Wind	47.25	10/05/06	VER+
MENDERES ELEKTRİK GR I	7.95	REN	56.00	09/06/06	VCS 120
BARES X. VE XX. GRUPLAR	16.50	Wind	57.75	09/06/06	VER+
TEKTUĞ(Kalealtı) GR I - II	15.00	Hydro	52.00	27/06/06	VCS 111
MARE MANASTIR RÜZGAR (X GRUP)	8.00	Wind	26.33	11/08/06	GS368
MARE MANASTIR RÜZGAR ENERJİ(ilave)	11.20	Wind	36.86	25/01/07	GS368
ANEMON EN.ELEK.ÜRETİM.AŞ.	8.00	Wind	24.21	21/02/07	GS347
MARE MANASTIR RÜZGAR ENERJİ(ilave)	20.00	Wind	65.82	12/04/07	GS368
ITC-KA Enerji Üretim Aş.(Mamak)(İlave)	1.40	REN	10.53	22/05/07	GS440
DENİZ ELEK. ÜRETİM Ltd.Şti.(karakurt)	10.80	Wind	28.00	27/05/07	VCS66
BURGAZ RES (Doğal Enerji Üretim A.Ş.)	4.00	Wind	12.89	14/08/07	GS439
BURGAZ RES (Doğal Enerji Üretim A.Ş.)	10.90	Wind	35.11	14/08/07	GS439
ANEMON EN.ELEK.ÜRETİM.AŞ.	15.20	Wind	46.00	16/08/07	GS347
ANEMON EN.ELEK.ÜRETİM.AŞ.	7.20	Wind	21.79	21/11/07	GS347
İNNORES ELK YUNTDAĞ RÜZG. (Aliağa)	42.50	Wind	161.00	07/03/08	GS352
SEBENOBA (DENİZ ELK.) (Samandağ-HATAY)	20.00	Wind	73.33	26/03/08	VCS553
ÇALDERE ELK.(ÇALDERE HES)Dalaman-MUĞLA	8.74	Hydro	35.00	02/04/08	VCS 363
MARAŞ ENERJİ (FIRNIS REGÜLATÖRÜ VE HES)	7.22	Hydro	36.00	05/06/08	VER+
SAYALAR RÜZGAR (Doğal Enerji)	30.60	Wind	96.63	06/06/08	GS369
ERTÜRK ELEKTRİK Çatalca RES	60.00	Wind	210.00	14/06/08	GS367
LODOS RES (Taşoluk)(G.O.P./İSTANBUL)	24.00	Wind	85.00	20/06/08	GS503
BAKİ ELEKTRİK ŞAMLI RÜZGAR	21.00	Wind	102.67	08/08/08	GS351
HAMZALI HES (TURKON MNG ELEKTRİK)	16.70	Hydro	117.00	08/11/08	GS633
DEĞİRMENÜSTÜ EN. (KAHRAMANMARAŞ)	25.70	Hydro	70.58	05/12/08	VCS565
DATÇA RES (Datça)	8.10	Wind	22.99	18/12/08	GS438
ORTADOĞU ENERJİ (ODA YERİ) (Eyüp/İST.)	2.80	REN	22.00	29/12/08	GS707

Power Plant	Cap. (MW)	Fuel type	AEG (GWh)	Commis-sioned	Carbon Status
ITC-KA Enerji Üretim A.Ş.(Mamak)(İlave)	14.13	REN	106.29		GS440
HAMZALI HES	16.70	Hydro	117.00	08/11/08	GS633
DEĞİRMENÜSTÜ HES	25.70	Hydro	70.58	05/12/08	VCS565
DATÇA RES	8.10	Wind	22.99	18/12/08	GS438
ODA YERİ	2.83	REN	22.24	29/12/08	GS707
ORTADOĞU ENERJİ (ODA YERİ) (İlave)	9.90	REN	77.79	01/01/09	GS707
BAKİ ELEKTRİK ŞAMLI RÜZGAR	36.00	Wind	176.00	29/01/09	GS351
DATÇA RES (Datça)	21.50	Wind	61.01	29/01/09	GS438
ITC-KA ENERJĠ MAMAK KATI ATIK TOP.MERK.	2.80	REN	21.06	04/02/09	GS440
TEKTUĞ (Erkenek)	12.50	Hydro	50.00	26/02/09	VCS693
AYEN ENERJİ A.Ş. AKBÜK RÜZGAR	31.50	Wind	123.00	19/03/09	GS436
BAĞIŞLI REG. VE HES (CEYKAR ELEKT.)	9.90	Hydro	33.11	21/03/09	VCS657
DEĞİRMENÜSTÜ EN. (KAHRAMANMARAŞ)	12.90	Hydro	35.42	16/04/09	VCS565
BAĞIŞLI REG. VE HES (CEYKAR ELEKT.)	19.70	Hydro	65.89	07/05/09	VCS657
BEYOBASI EN. ÜR. A.Ş. (SIRMA HES)	5.90	Hydro	23.00	23/05/09	VCS603
BEREKET ENERJİ (KOYULHİSAR HES)	42.00	Hydro	329.00	12/06/09	VCS713
ALİZE ENERJİ (ÇAMSEKİ RES)	20.80	Wind	82.00	24/06/09	GS399
ORTADOĞU ENERJİ (KÖMÜRCÜODA)	5.80	REN	45.00	15/07/09	GS707
ITC-KA ENERJİ (SİNCAN)	2.80	REN	22.00	17/07/09	GS675
ALİZE ENERJİ (KELTEPE RES)	18.90	Wind	66.65	23/07/09	GS437
ROTOR ELEKTRİK (OSMANİYE RES)	57.50	Wind	217.22	07/08/09	GS474
ÜTOPYA ELEKTRİK (DÜZOVA RES)	15.00	Wind	46.00	11/08/09	GS672
ANADOLU ELEKTRİK (ÇAKIRLAR HES)	16.20	Hydro	60.00	13/08/09	GS917
ÖZTAY ENERJİ (GÜNAYŞE REG.VE HES)	8.30	Hydro	29.00	13/08/09	GS636
AK ENERJİ (AYYILDIZ RES)	15.00	Wind	51.00	05/09/09	GS634
SOMA ENERJİ ÜRETİM (SOMA RES)	45.00	Wind	150.00	05/09/09	GS398
SAYALAR RÜZGAR (Doğal Enerji)	3.60	Wind	11.24	06/09/09	GS369
MAZI-3 RES ELEKT.ÜR. A.Ş. (MAZI-3 RES)	22.50	Wind	78.75	09/09/09	GS388
BAKİ ELEKTRİK ŞAMLI RÜZGAR	33.00	Wind	161.33	11/09/09	GS351
FİLYOS ENERJİ (YALNIZCA REG. VE HES)	14.40	Hydro	67.00	16/09/09	GS618
BORASKO ENERJİ (BANDIRMA RES)	45.00	Wind	179.21	18/09/09	GS744
ELESTAŞ ELEKTRİK (YAYLABEL HES)	5.10	Hydro	20.00	27/09/09	VCS582
BELEN ELEKTRİK BELEN RÜZGAR-HATAY	30.00	Wind	95.00	02/10/09	GS390
ELESTAŞ ELEKTRİK (YAZI HES)	1.10	Hydro	6.00	02/10/09	VCS583
YAPISAN (KARICA REG. ve DARICA I HES)	48.50	Hydro	164.00	10/10/09	VCS 506
ALİZE ENERJİ (SARIKAYA RES) (Şarköy)	28.80	Wind	96.00	19/10/09	GS577
REŞADİYE 3 HES (TURKON MNG ELEKT.)	22.30	Hydro	175.00	11/11/09	GS645
KORES KOCADAĞ RES (Urla/İZMİR)	15.00	Wind	56.00	23/12/09	GS601

Power Plant	Cap. (MW)	Fuel type	AEG (GWh)	Commis-sioned	Carbon Status
YAPISAN (KARICA REG. ve DARICA I HES)	48.50	Hydro	164.00	23/12/09	VCS 506
ÖZGÜR ELEKTRİK (AZMAK II REG.VE HES)	6.33	Hydro	20.00	25/12/09	VCS 554
SELİMOĞLU REG. VE HES	8.80	Hydro	35.00	07/01/10	GS635
TUZLA JEOTERMAL	7.50	REN	55.00	13/01/10	GS353
ROTOR ELEKTRİK (OSMANİYE RES)	20.00	Wind	75.56	14/01/10	GS474
GAZİANTEP ÇÖP BİOGAZI	1.13	REN	8.60	01/02/10	GS764
ASA ENERJİ (KALE REG.ve HES)	9.57	Hydro	32.00	19/02/10	GS637
ODA YERİ	4.20	REN	33.00	24/02/10	GS707
ASMAKİNSAN (BANDIRMA 3 RES)	20.00	Wind	70.83	26/02/10	GS683
SOMA ENERJİ ÜRETİM (SOMA RES)	4.50	Wind	15.00	10/03/10	GS398
ROTOR ELEKTRİK (OSMANİYE RES)	17.50	Wind	66.11	10/03/10	GS474
DENİZ ELEKTRİK (SEBENOBA RES)	10.00	Wind	36.67	12/03/10	VCS553
AKDENİZ ELEKTRİK (MERSİN RES)	33.00	Wind	100.00	19/03/10	GS753
MENDERES GEOTERMAL DORA-2	9.50	REN	73.00	26/03/10	GS445
ASMAKİNSAN (BANDIRMA 3 RES)	4.00	Wind	14.17	26/03/10	GS683
ÖZGÜR ELEKTRİK (AZMAK I REG.VE HES)	5.90	Hydro	21.50	01/04/10	VCS554
BEYTEK El. ÜR. A.S. (ÇATALOLUK HES)	9.54	Hydro	31.00	07/04/10	GS872
BOREAS ENERJİ (OREAS I ENEZ RES)	15.00	Wind	49.00	09/04/10	GS702
BERGAMA RES EN. ÜR. A.Ş. ALİAĞA RES	52.50	Wind	207.08	09/04/10	GS735
ROTOR ELEKTRİK (OSMANİYE RES)	17.50	Wind	66.11	09/04/10	GS474
BAKRAS EN. ELKT.ÜR. A.Ş. ŞENBÜK RES	15.00	Wind	47.00	22/04/10	GS733
ALİZE ENERJİ (KELTEPE RES)	1.80	Wind	6.35	28/04/10	GS437
KAR-EN KARADENİZ EL.A.Ş. ARALIK HES	12.41	Hydro	56.00	30/04/10	GS663
ITC-KA ENERJİ (SİNCAN)	1.40	REN	11.00	30/04/10	GS675
ÇAKIT HES (ÇAKIT ENERJİ A.Ş.)	20.18	Hydro	96.00	01/06/10	VCS685
ROTOR ELEKTRİK (GÖKÇEDAĞ RES)	20.00	Wind	75.56	05/06/10	GS474
SOMA ENERJİ ÜRETİM (SOMA RES)	7.20	Wind	24.00	10/06/10	GS398
PAŞA REG. VE HES (ÖZGÜR ELEKTRİK)	8.68	Hydro	34.00	11/06/10	GS681
GÜZELÇAY-I HES (İLK ELEKTRİK ENERJİ)	3.14	Hydro	16.67	15/06/10	GS711
KALE REG. VE HES (KALE ENERJİ ÜR.)	34.14	Hydro	116.00	16/06/10	VCS
BERGAMA RES EN. ÜR. A.Ş. ALİAĞA RES	37.50	Wind	147.92	16/06/10	GS735
MAZI-3 RES ELEKT.ÜR. A.Ş. (MAZI-3 RES)	7.50	Wind	26.25	18/06/10	GS388
ERİKLİ-AKOCAK REG. ve AKOCAK HES	41.25	Hydro	128.50	30/06/10	VCS535
BORASKO ENERJİ (BANDIRMA RES)	12.00	Wind	47.79	30/06/10	GS744
ÖZGÜR ELEKTRİK (AZMAK I REG.VE HES)	5.90	Hydro	21.50	10/07/10	VCS554
ZİYARET RES (ZİYARET RES ELEKTRİK)	12.50	Wind	50.00	15/07/10	GS617
KAYABÜKÜ REG. VE HES (ELİTE ELEKT.)	14.58	Hydro	49.00	21/07/10	GS726
SOMA ENERJİ ÜRETİM (SOMA RES)	7.20	Wind	24.00	28/07/10	GS398

Power Plant	Cap. (MW)	Fuel type	AEG (GWh)	Commis-sioned	Carbon Status
SOMA ENERJİ ÜRETİM (SOMA RES)	6.30	Wind	21.00	28/07/10	GS398
ERİKLİ-AKOCAK REG. ve AKOCAK HES	41.25	Hydro	128.50	29/07/10	VCS535
BULAM REG. VE HES (MEM ENERJİ ELK.)	7.03	Hydro	32.40	10/08/10	GS642
SOMA RES (BİLGİN RÜZGAR SAN. EN.ÜR.)	32.50	Wind	110.86	13/08/10	GS655
ITC ADANA BİOKÜTLE SANT.	9.90	REN	80.00	02/09/10	GS715
BELEN ELEKTRİK BELEN RÜZGAR-HATAY	6.00	Wind	19.00	02/09/10	GS390
ÜTOPYA ELEKTRİK (DÜZOVA RES)	15.00	Wind	46.00	03/09/10	GS672
REŞADİYE 2 HES (TURKON MNG ELEKT.)	26.14	Hydro	210.00	17/09/10	GS644
SOMA RES (BİLGİN RÜZGAR SAN. EN.ÜR.)	27.50	Wind	93.81	23/09/10	GS655
SOMA ENERJİ ÜRETİM (SOMA RES)	9.00	Wind	30.00	01/10/10	GS398
ZİYARET RES	22.50	Wind	90.00	13/10/10	GS617
ROTOR ELEKTRİK (GÖKÇEDAĞ RES)	2.50	Wind	9.44	15/10/10	GS474
ULUABAT KUVVET TÜNELİ VE HES	48.51	Hydro	186.00	27/10/10	VCS538
BURÇ BENDİ VE HES (AKKUR ENERJİ)	27.33	Hydro	113.00	04/11/10	VCS419
GÜZELÇAY-II HES (İLK ELEKTRİK ENERJİ)	4.96	Hydro	26.33	11/11/10	GS711
KUYUCAK RES (ALİZE ENERJİ ÜRET.)	8.00	Wind	34.38	11/11/10	GS576
SOMA RES (BİLGİN RÜZGAR SAN. EN.ÜR.)	30.00	Wind	102.33	11/11/10	GS655
ULUABAT KUVVET TÜNELİ VE HES	48.51	Hydro	186.00	25/11/10	VCS538
REŞADİYE 1 HES (TURKON MNG ELEKT.)	15.68	Hydro	126.00	26/11/10	GS643
EGEMEN 1 HES (ENERSİS ELEKTRİK)	8.82	Hydro	31.88	26/11/10	GS755
KUYUCAK RES (ALİZE ENERJİ ÜRET.)	17.60	Wind	75.63	09/12/10	GS576
UMUT III REG. VE HES (NİSAN ELEKTR.)	12.00	Hydro	26.00	13/12/10	GS720
SARES RES (GARET ENERJİ ÜRETİM)	15.00	Wind	60.00	22/12/10	GS963
FEKE 2 BARAJI VE HES (AKKUR ENERJİ)	69.34	Hydro	223.00	24/12/10	VCS534
EGEMEN 1B HES (ENERSİS ELEKTRİK)	11.10	Hydro	40.12	28/12/10	GS755
TURGUTTEPE RES (SABAŞ ELEKTRİK ÜR.)	22.00	Wind	64.00	30/12/10	GS610