CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

Grid-Connected Electricity Generation From Renewable Resources:

78 MW AKOCAK Hydroelectric Power Plant

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Title:78 MW AKOCAK Hydroelectric Power Plant
Version: 03
Date: 20/07/2010

A.2. Description of the project activity:

AKOCAK is a run of river type hydroelectric power plant (HEPP) project located on Karadere River, in Trabzon province, in East Black sea region of Turkey. The purpose of the project is to generate energy from the running waters of Karadere River. The electricity generation license has been awarded to AKENERJI Elektrik Uretimi ve Ticaret A.Ş. for a period of 49 years by the Turkish licensing authority named as Energy Market Regulatory Authority (EMRA).

The project includes two weirs. The first weir called Erikli weir shall be built on Alcak Brook, a branch of Karadere, on 1,339 meters riverbed elevation. A sediment pool of 41 meters long and 2.3 meters wide shall be built along the riverbed. The other weir called Akocak weir shall be built on Karadere branch of the river, on 1,328 meter riverbed elevation. The sediment pool of Akocak weir shall be 41 meters long and 4.3 meters wide. The powerhouse shall be located on Karadere River, at 570 meters riverbed elevation. The UTM ED coordinates for Erikli weir is 580 500 E, 4 495 600 N; Akocak weir: 577 425 E, 4 496 300 N; powerhouse: 576 375E, 4 502 625 N.

The waters collected at the Erikli weir shall be connected with a 3 meter diameter, circular section, derivation tunnel of 3,250 meters long to the upstream of Akocak weir. The Akocak weir shall transmit the collected waters to a surge tank through a 6,150 meters long transmission tunnel of 3 meters cross section. The penstock extending from the surge tank to the powerhouse is 1,842 meters long, with an average diameter of 1.82 meters.

The power house shall include two turbines of vertical pelton type, each 39 MW. The design flow rate is 12.30 m^3/sec. Net head is 744 meters. There shall be two generators, each 48.75 MVA. The installed capacity of Akocak HEPP shall be 78 MWe. The generated electrical energy shall be connected to Arsin TM grid substation through a double circuit 2 x 477 MCM, 32 km long 154 kV transmission line. The annual estimated electrical energy generation is 257.440 GWh. Corresponding emission reduction is about 144,681 tCO_2 per year. Compared with a natural gas power plant, the Project will replace a consumption of about 60 million m^3 of natural gas and save about 25 million US Dollars of foreign currency per year.

Milestones of the Project

Milestone	Date
License Issuance	23/11/2005
EIA Approval	17/10/2006
Equipment Purchase Agreement	05/10/2006*
Start of Construction	01/12/2006
License Amendment	17/05/2007

LSC Meeting	27/10/2008
Expected Commissioning Date	01/07/2010
Expected Monitoring Frequency	Annual
End of Licensing Period	22/11/2054

Table 1. Akocak HEPP Project Milestones (*Investment Decision Date)

The main goals of the Akocak HEPP project include;

- Using Turkey's hydroelectric potential to meet the increasing demand for electricity and contributing toward the guarantee of Turkey's energy security.
- Increase the share of run of river type HEPPs in the mix of electricity generation in Turkey, reduce dependency on imported fossil fuel and as a consequence provide a tangible reduction in GHG emissions.
- Contribute to economic development by creating direct and indirect job opportunities during the construction and operation phases.

The project will contribute to the sustainable development in the region through creating new job opportunities during the construction and operational phases. Approximately 200 people will be employed during construction phase. After the commissioning of the plant, the project is expected to create permanent job opportunities for about 30 local employees. In addition to direct and indirect job opportunities the project will contribute to sustainable development through activities conducted within the framework of corporate social responsibility. In addition to contribution to local economy, project will also contribute to the use of local and renewable resources to meet the increasing energy demand of Turkey and reduce dependency on fossil fuels. According to Turkish Electricity Transmission Company (TEIAS) statistic, in 2007 about 50% of the electricity has been generated by natural gas (NG) power plants which is fully imported and 20bn m^3 NG has been consumed. In terms of fuel dependency, Akocak HEPP is expected to replace about 60 million m^3 NG and contribute to balance of payments which will, in addition, increase air quality and access to affordable energy services in national level[1].

According to the research conducted by State Planning Organization(SPO) on socio-economic level of Districts in Turkey, Arakli District is ranked as 475th among 872 Districts in Turkey in terms of development level and classified in third (out of six) group. Unemployment rate of Araklı District has been determined as 6.56% whereas population increase rate is about 11.44%. About 77.7% of the population works on agriculture and 18.1% works on service sector whereas only 4.2% works on industry. In that respect, direct and indirect contribution of project activities to local economy through employment and supply of needs from the region will have a significant effect on development in the region.[2] Industrial plants and agricultural lands are limited in the region (only 25% of land within the province can be used for agriculture) and main products are tea plant, hazelnut, corn and grains. [3]

[1] http://www.teias.gov.tr/ist2007/43.xls

[2] Socioeconomical Development Index of Districts in Turkey, State Planning Organization, 2004 (page 206)

[3] EIA Report, Section IV.3, page 126

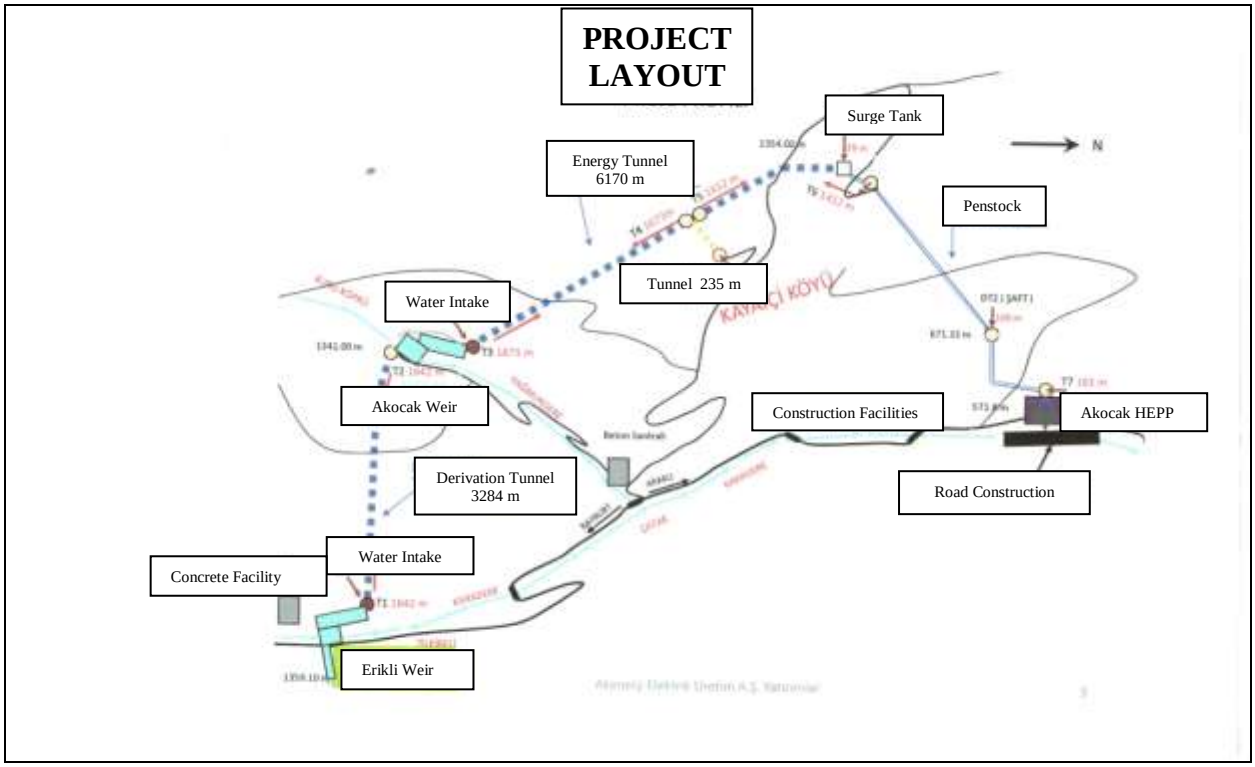

Figure 1. Akocak HEPP Project Layout

A.3. Project participants:

Name of Party involved (*) ((Host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant
Turkey (Host)	AKENERJI Elektrik Uretim AS (Project Owner) Global Tan Energy Limited (Project Developer)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The Akocak HEPP project is located within the boundaries of Arakli District of Trabzon Province. The nearest settlements to the project site are Kayaici and Gelber Villages.

A.4.1.1. Host Party(ies):

Although Turkey, the Host Country, passed legislation in Parliament on February 5th 2009 to ratify the Kyoto Protocol - Turkey does not have yet a quantitative emission reduction limit and it is likely that it

will not have a quantitative emission reduction limit until post 2012. As such, Turkey will in the interim period continues to be eligible for voluntary emission reduction projects.

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

East Black Sea Region, Trabzon Province.

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

Kayaici Village, Arakli District, Karadere Region

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

GPS coordinates of the weirs and powerhouse is given below.

	LONGITUDE	LATITUDE
Erikli Weir	E 39° 57′ 5.4″	N 40° 36′ 23.8″
Akocak Weir	E 39° 54′ 54.9″	N 40° 36′ 47.5″
Powerhouse	E 39° 54′ 12.9″	N 40° 40′ 13″

The closest settlements to project site are Kayaici and Gelber Villages.

Figure 2. Akocak HEPP Project Site

Figure 3. Akocak HEPP Project Location

Figure 4. Akocak Weir Project Site

Figure 5. Erikli Weir Project Site

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

The project category is included in the sectoral scope 1 "Energy Industry – Renewable Sources" according to the UNFCCC definition.

Proposed project consists of a single hepp and is not a grouped project activity.

Since the project delivers more than 5,000 tons CO_2e and less than 1,000,000 tons of CO_2e per year, it neither a micro project nor a mega project. Most of the land around project site is mountainous and uneven and agricultural area is limited. Most the lands around project site is owned by Directorate of Forestry with limited lands owned by settlements around. Project boundaries do not include any protected area, national parks, reserve sites, historical or cultural sites or grassland.
[4]

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

Hydroelectric power plants are structures that generate electricity utilizing the energy of flowing water. The project consists of two turbines and generators which are used to transform the potential energy of water to mechanical energy at a first stage and later into electrical energy. A table summarizing the technical characteristics of the Akocak HEPP project is given below.

LOCATION:	ON KARADERE RIVER, IN ARIKLI DISTRICT OF TRABZON PROVINCE
DESIGN FLOW RATE:	12.30 M3/SEC
LENGTH OF DERIVATION TUNNEL:	3.284 KM
DIAMETER OF TUNNEL:	3.00 M
LENGTH OF ENERGY TUNNEL:	6.170 KM
NET HEAD:	744 M
TOTAL INSTALLED CAPACITY:	78 MWe
NUMBER OF UNITS:	2 EACH
TURBINE TYPE:	PELTON TYPE – VERTICAL AXIS - 41.23 MW
TURBINE MANUFACTURER:	VOITH SIEMENS HYDRO POWER
GENERATOR:	46 MVA, 0.9 POWER, FACTOR, 13.8 kV, 750 RPM
GENERATOR MANUFACTURER:	VOITH SIEMENS HYDRO POWER
ENERGY TRANSMISSION LINE:	32.00 KM, 2 x 477 MCM, 154 kV
LENGTH OF PENSTOCK:	1842 M
DIAMETER OF PENSTOCK:	1.82 M
AVERAGE ANNUAL POWER GENERATION:	257.440 GWH
TYPE OF METERING DEVICES	To be determined later according to local regulations of Energy Market Regulatory Authority (EMRA) of Turkey[5].

Table 2. Technical Characteristic of Akocak HEPP project.

Grid Connection

[4] Akocak HEPP EIA Report (p. 14, 93)

[5] http://www.epdk.gov.tr/english/regulations/electric/meters.doc

The electrical energy generated at Akocak HEPP project shall be connected to 154 kV Arsin TM grid substation through a double circuit 2 x 477 MCM, 32 km long, double circuit, 154 kV transmission line.

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

Years	Annual estimation of emission reductions in tones of CO_2 e
2010 (01/07/2010-31/12/2010)	72,340
2011	144,681
2012	144,681
2013	144,681
2014	144,681
2015	144,681
2016	144,681
2017	144,681
2018	144,681
2019	144,681
2020 (01/01/2020-30/06/2020)	72,341
Total emission reductions (Tones of CO_2 e)	**1,446,810**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2e)	144,681

Table 3. Estimated amount of emission reduction

A.4.5. Public funding of the project activity:

No public funding or ODA is used for the project.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

The United Nations approved consolidated baseline methodology applicable to this project is ACM0002 "Consolidated methodology for grid-connected electricity generation from renewable sources", Version 10[6].

ACM0002 refers to the following tools:

- "Tool for the demonstration and assessment of additionality", Version 05.2, [7]and
- ''Tool to calculate the emission factor for an electricity system'', Version 02[8].

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

The choice of methodology ACM0002, Version 10, is justified as the project activity meets its applicability criteria:

- The Akocak HEPP is a grid connected renewable electricity generation project,
- The project does not involve switching from fossil fuel use to renewable energy at the site of the project activity; and
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.
- Project causes formation of a new reservoir whose power density is higher than 4 W/m^2.

Since there exists no delineation of project electricity system or connected electricity systems by DNA, following criteria has been used to determine the existence of significant transmission constraints:

- In case of electricity systems with spot markets for electricity: there are differences in electricity prices (without transmission and distribution costs) of more than 5 percent between the systems during 60 percent or more of the hours of the year.
- The transmission line is operated at 90% or more of its rated capacity during 90% percent or more of the hours of the year.

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6 http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_YOYKBRCBIK7TSPSB7MQT75SPX75PE8

7 http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

8 See: http://cdm.unfccc.int/methodologies/Tools/EB35_repan12_Tool_grid_emission.pdf

Since the project output is fed to the Turkish electricity grid which does not involve any distinct electricity systems that applies different price, first criteria defined above is not applicable. Also, since the transmission line between the proposed project and nearest substation is built within the scope of the project and there exist no information on grid capacity utilization, second criteria is also inapplicable. Based on assessment above, it is difficult to conclude with a significant transmission constraint or grid boundary. Since there is no dispatch grid system in Turkey, the project boundary is considered as the National Electricity Grid of Turkey according to applied tool. The geographical and physical boundaries of the Turkish grid and location of the power plants are well identified as given diagram below.

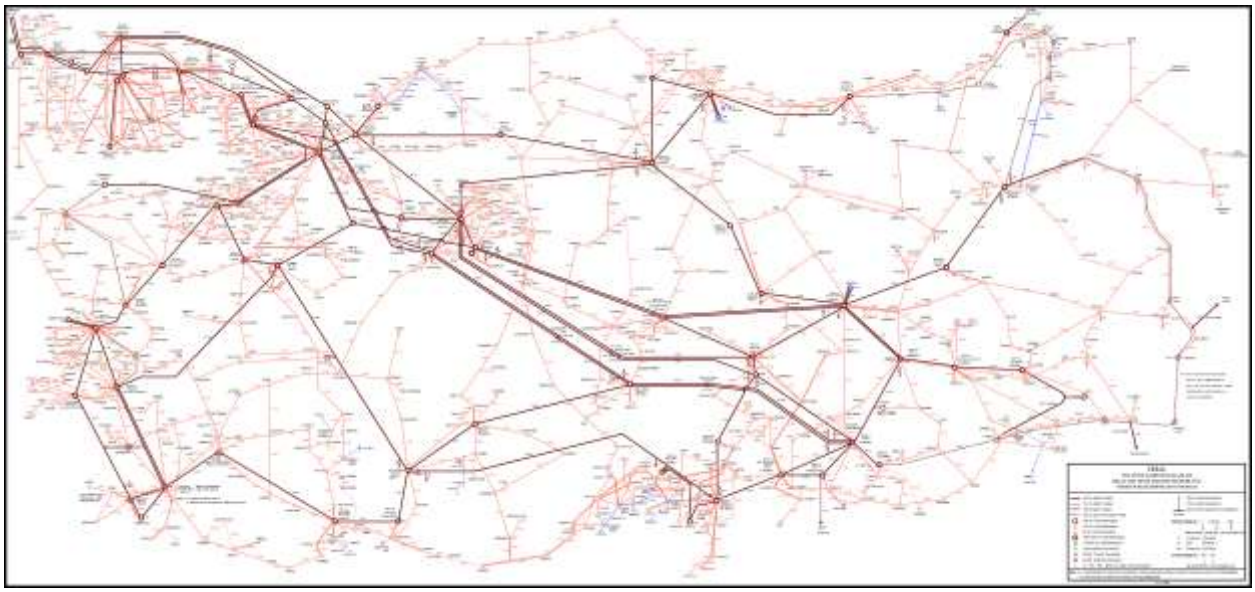

Figure 4. Turkish Electricity Grid[9]

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

GHG included in the project boundary and used in the calculation of emission reduction by the project activity are given in table below.

	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity generation in baseline (Turkey Grid)	CO_2	Yes	Main Emission Source
		CH_4	No	Minor emission source. Excluded for simplification
		N_2O	No	Minor emission source. Excluded for simplification
Project Activity	Emission from the reservoir of the proposed project is excluded as per the tool applied requires.	CO_2	No	Zero-emission electricity generation
		CH_4	Yes	CH_4 emissions have been considered in the project

[9] http://www.teias.gov.tr/eBulten/makaleler/2008/t%C3%BCrkiye%20elektrik%20sistemi.pdf

		N_2O	No	Zero-emission electricity generation

Table 4. GHG gases included in the project boundary

The project boundary is limited by the National Electricity Grid of Turkey. The Geographical and physical boundaries of the Turkish grid and location of the power plants are clear. Import data obtained from the relevant government agencies (EUAS- Turkish Electricity Generation Corp., TEIAS – Turkish Electricity Transmission Corp., Ministry of Energy and Natural Resources) have been included in the calculations of the combined margin emissions.

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

This project follows the methodology described in the ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 10. Selected methodology has been applied together with the "tool to calculate the emission factor for an electricity system, version 02" and "tool for assessment and demonstration of additionality, version 5.2".

The baseline scenario has been identified as "*Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system"*

Turkish electricity generation is mainly composed of thermal power plants and the share of renewable resources; especially hydroelectric power plants have decreased significantly in recent years. According to the TEIAS statistics[10], share of HEPPs in total installed capacity of Turkey is about 32.8% whereas share of HEPPs in total generation has been realized as about 18.6% in 2007[11]. However, when we look at the historical data, it seen that total installed capacity of thermal power plants has shown a rapid growth in parallel with the demand for electricity whereas the increase in hydroelectric power generation has been much slower. This has decreased the share of hydroelectric power from 40% in the past to the current levels[12].

The trend in Turkey to date and given historically slow development of alternative energy resources is to build an increasing number of thermal power plants in the future to satisfy the annual growth in energy consumption demand. Turkey as an advanced developing nation has looked at dealing with energy security by developing and constructing high capacity coal and natural gas power plants. The development of thermal power plants has been also encouraged by the large natural resource availability in Turkey, especially the abundance of economically accessible lignite.

In the absence of the proposed project activity, the same amount of electricity is required to be supplied via either the current power plants or by increasing the number of thermal power plants thus increasing GHG emissions.

[10] http://www.teias.gov.tr/ist2007/1.xls

[11] http://www.teias.gov.tr/ist2007/13.xls

[12] IEA Turkey Country Report, 2005 (Table 16 in page 117)

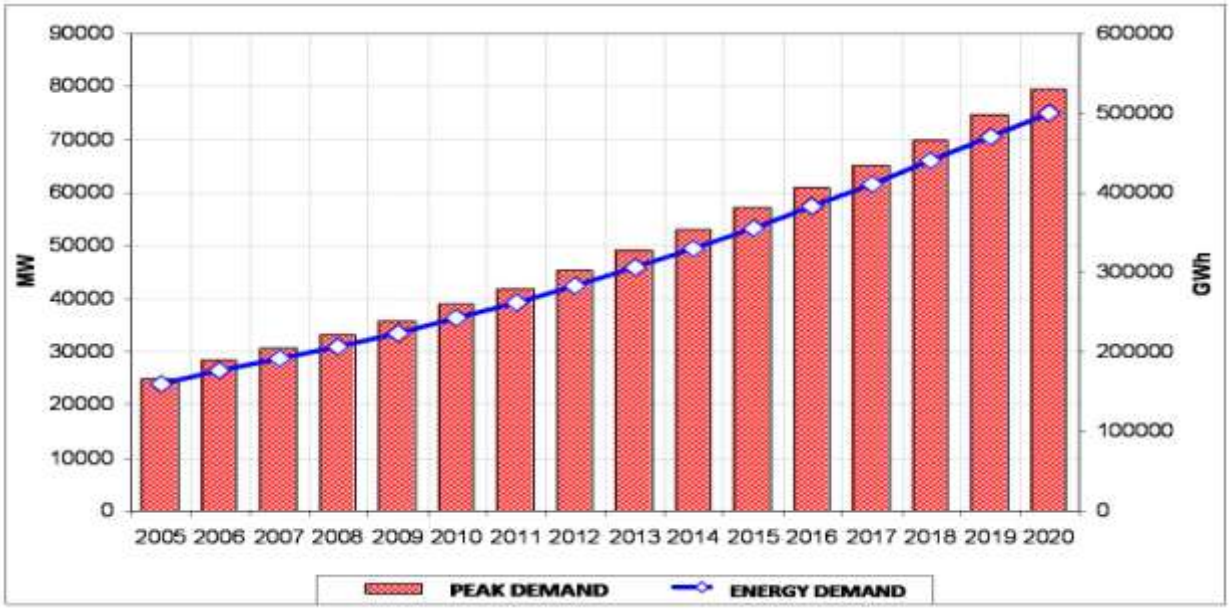

Figure 5. Peak Load and consumption projection for Turkish electricity system between 2005-2020[13]

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

According to the applied methodology the baseline scenario for the project has been defined as "generation of equal amount of electricity by the power plants connected to the grid". Emission factor for the baseline scenario has been calculated according to the combined margin approach as defined by the selected methodology. Within this framework, the project is expected to generate about 257.440 GWh electricity and reduce about 144,681 tCO_2 emissions through replacing the electricity that would need to be supplied via the National grid in the absence of the project activity. Additionality of the proposed project has been assessed according to the applied tool for demonstration of additionality as shown in following steps.

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

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

The most realistic and reliable alternatives to the project activity are:

1. Proposed project not undertaken as a VER project activity,

[13] http://www.teias.gov.tr/apkuretimplani/veriler.htm

2. Continuation of the current situation-supply of equal amount of electricity by the new power plants connected to the grid,
3. Construction of a thermal power plant with the same installed capacity or the same annual power output.

The first alternative, which is the implementation of the project without carbon revenue is not financially attractive as discussed in investment analysis section below. The Second alternative (Scenario 2) is the baseline scenario and implementation of the proposed project as a VER activity would be additional to this scenario. In the absence of project scenario, the electricity will be supply by the grid and in order to meet the increasing demand, new power plants should be built and connected to the grid which means implementation of new thermal power plants also.

The last alternative is considered as a significant alternative to the project activity since the growth of thermal power plants has increased and is expected to continue to disproportionately increase in the future due to demand for electricity predicted to increase by near 100% from the current level of approximately 40,000 MW to 79,000 MW by 2020.

Outcome of Step 1a

Three realistic alternatives have been identified for the project scenario as defined above. In the absence of proposed VER activity, most likely scenarios will be

- Supply of electricity by the grid which requires addition of new power plants or ;
- Implementation of a thermal power plant to deliver electricity in order to meet the electricity demand.

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

The following applicable mandatory laws and regulations have been identified:

1. Electricity Market Law[14]
2. Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy[15]
3. Energy Efficiency Law [16]
4. Forest Law[17]
5. Environment Law[18]

The resultant alternatives to the project as outlined in Step (1a) are in compliance with the applicable laws and regulations which are assessed by EMRA before issuing license. The renewable energy generation

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[14] Law number 4628, enactment date 03/03/2001 http://www.epdk.gov.tr/english/regulations/electricity.htm

[15] Law number 5346, enactment date 18/05/2005 http://www.eie.gov.tr/duyurular/YEK/LawonRenewableEnergyReources.pdf

[16] Law number 5627, enactment date 02/05/2007 http://www.eie.gov.tr/english/announcements/EV_kanunu/EnVer_kanunu_tercume_revize2707.doc

[17] Law number 6831, enactment date 31/08/1956

[18] Law number 2872. Published in official gazette No. 18132 on 11/08/'83

license for Akocak HEPP has been issued considering Electricity Law and Law in utilization of Renewable Energy Resources for the purpose of generating electricity energy. The proposed project is also within the scope of and in compliance with Energy Efficiency Law(Article 2 of Part One). Environment Law is also satisfied in terms of sustainable development principles and EIA conducted for the proposed project activity. Finally, Forest Law which specifies that forest areas can be allocated by Ministry of Environment and Forestry to institutions or individuals for energy plants if the project implementation serves common good for public.

Outcome of Step 1b

It has been demonstrated that proposed project is in compliance with the laws. Also, existence of thermal power plants serves as an evidence for demonstrating that alternatives are not prevented by laws or regulations.

Based on the above analysis, the proposed project activity is not the only alternative amongst the project participants that is in compliance with mandatory regulations. Therefore, the proposed VER project activity is considered as additional.

Step 2 - Investment analysis

An investment analysis has been carried out in order to make an economic and financial evaluation of the project. No public funding or ODA are available in Turkey for the finance of this type of project. Akocak HEPP has been financed through companies own resources.

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

There are three options for the determination of analysis method which are:

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

Since the Project generates economic benefits from sales of electricity, the simple cost analysis is not applicable. Also, since the baseline of the project is generation of electricity by the grid, no alternative investment is considered at issue. So, it has been decided to use benchmark analysis for evaluation of the project investment.

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

According to the "Tool for the demonstration and assessment of additionality", a relevant benchmark for an equity IRR can be derived from official sources or government bond rates increased by a suitable risk premium (to reflect private investment and/or project type). For benchmark analysis of the project, Eurobond rates from web page[19] of a government bank available on 05/10/2006 (investment decision date) have been used as given in table below.

Bond	Maturity Date	Currency	Rate
US900123AW05	05.02.2025	USD	7.32

Table 5. Government bond rate used for the benchmark analysis

[19] http://www.ziraat.com.tr/tr/bankamiz/faiz-ve-ucretler/aspx/eurobond.aspx

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

Parameters	Unit	Data Value
Installed Capacity	MW	78
Grid Connected output	GWh	257.44
Capital Investment	Million €	86.141
Income tax rate	%	20
Loan	%	50
Tariff	€ Cents/kWh	5.5
Expected VERs price	€/ tCO_2e	6

Table 5. Main financial parameters used for investment analysis

Equity IRR of Akocak HEPP has been calculated as 8.60 % based on the parameters given above without considering the carbon revenue. Date of investment decision has been identified as the date of equipment purchase agreement. For estimation of the construction costs, pricing figures in estimate cost report has been used which is a conservative approach as the investment figures has significantly increased during investment period. Analysis has period has been selected to include three years construction period and 20 years operation period. The residual value of the asset has been included in last year of period as income. Electricity tariff has been used as €5.5 Cent/kWh although this is the maximum amount and floor price is €5.0 Cents/kWh as given in renewable energy law. Annual generation has been taken as 257.44 GWh. This IRR value represents the most optimistic scenario in terms of capital investment, electricity sales price and electricity generation. The residual value of the assets at the end of analysis period has been added as required by the methodology. Value added tax (VAT) has been included in investment cost for all domestic goods and services as indicated by regulation[20] and deducted in cash flow.

Considering the Government bond rates(7.32%) and estimated country risk premiums which are around 9.41% for Turkey[21], it can be concluded that expected return on investment for these types of projects should be above 16.73% for reasonable investors whereas many equity funds target higher returns[22]. For Akocak HEPP, in order to exceed the benchmark IRR values, average electricity tariff must be above 8.25 €c/kWh so that the investment will become reasonable Expectation that the floor electricity prices will increase is the risk for investors whereas realization of this expectation will increase the premium. Carbon revenue has a significant affect in this respect in terms of decreasing the period for return on investment and minimizing investment risk.

When we include the 6 €/ton carbon revenue in the cash flow, project IRR increases to 9.59% and the return of investment becomes comparable to other investment tools in the market and attractive for the investors who take the view that energy sale prices that can be achieved from the Project will likely increase in future years.

Sub-step 2d - Sensitivity Analysis

[20] http://www.alomaliye.com/kdv_23.htm

[21] http://www.stern.nyu.edu/~adamodar/pc/archives/ctryprem06.xls (accessed on 19/02/2010)

[22] http://www.greatturkfund.com/images/data/GTF_Presentation_9Nov2009.pdf (page 3, accessed on 19/02/2010)

Sensitivity analysis has been carried out for three main parameters as identified below;

- Investment Cost,
- Operating Cost,
- Electricity Sales Revenue.

These parameters have been identified as the most important parameters affecting project

For a range of ±10% fluctuations in investment and operating cost, and 30% fluctuation for electricity income, table below has been obtained.

	-10	**-5**	**-2.5**	**0**	**2.5**	**5**	**10**
Investment Cost	10.37	9.43	9.00	8.60	8.21	7.84	7.16
Operating Cost	8.75	8.67	8.64	8.60	8.56	8.52	8.44
	-30	**-20**	**-10**	**0**	**10**	**20**	**30**
Electricity Income	3.63	5.31	6.96	8.60	10.22	11.82	13.42

Table 6a. Sensitivity analysis for Akocak HEPP project (excluding carbon revenue)

Since the realized investment figures are much above the anticipated costs, investment cost, which is the most significant parameter, is not expected to change in favour of higher IRR. The electricity income which is combination of both tariff and generation is the critical parameter which will determined the profitability of the project. The analysis above has shown that tariff should increase more than 30% of the maximum guaranteed price (assuming that estimated generation figure is achieved) so that the project can become profitable.

Outcome of Step 2:
The investment and sensitivity analysis shows that the VER revenues will improve the financial indicators of the project and make the project more attractive for investors and funding institutions.

Based on the analysis and information above, it is concluded that investing in the project has significant risks and it is not the most attractive option considering the alternative investment opportunities. Therefore, project is considered as additional to the baseline scenario.

Step 3. Barrier analysis

This step is not applied as the financial additionality is demonstrated in previous step.

Step 4. Common Practice Analysis

Sub-step 4a. Analysis of other activities similar to the proposed project activity
According to the TEIAS statistics[23], share of HEPPs in total installed capacity of Turkey is about 32.8% whereas share of HEPPs in total generation has been realized as about 18.6% in 2007[24]. However, when we look at the historical data, it seen that share of hydroelectric was much higher in the past as seen in the figure below.

[23] http://www.teias.gov.tr/ist2007/1.xls

[24] http://www.teias.gov.tr/ist2007/13.xls

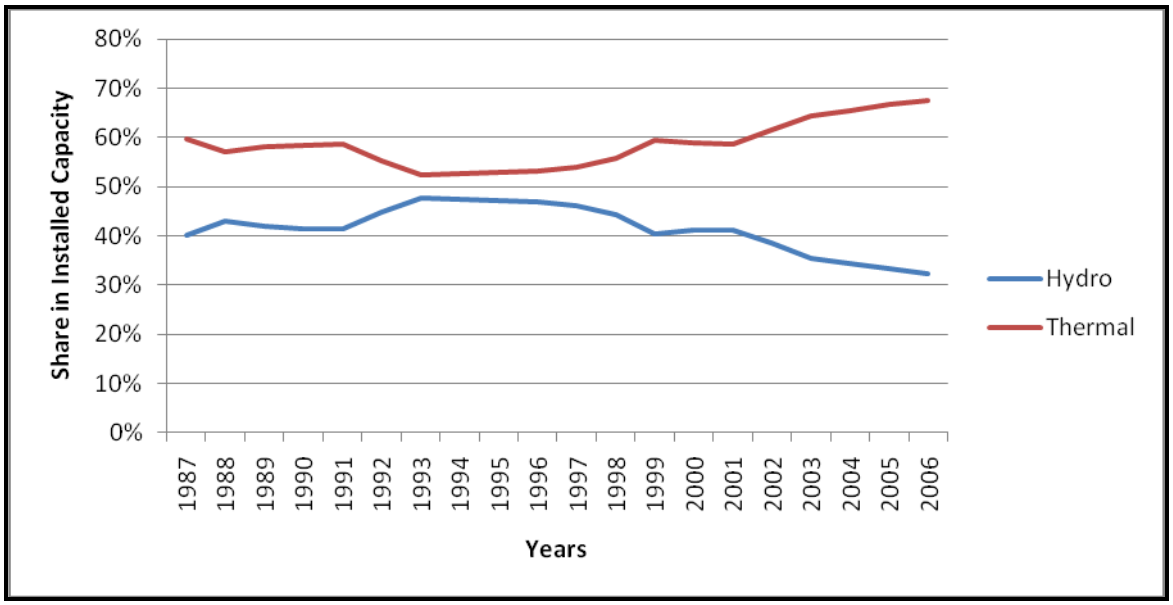

Figure 6. Annual Development of Turkey's Installed Capacity

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

The main reason behind the decrease in share of hydro electricity power is due to the changes in government's economic policy which intends to encourage private companies to invest in energy generation and lower the weight of government on energy generation as a part of privatization efforts. On the other hand, private companies have mainly preferred to invest in thermal power plants which can be commissioned in shorter time periods, require lower initial investment and uses conventional technologies. Installed capacity of thermal power plants owned by generation companies has increased from 123.4 MW in 1996 to 10,688.8 MW in 2007 whereas the total capacity of hydro electricity power plants has only increased from 75.3 MW to 1,345 MW(including autoproducers, generation companies, Build-Operate-Transfer(BOT)plants and concessionary companies) in the same period which show that private companies find more attractive to invest is thermal power plants[25,26,27].

Besides the fact that each project is different and has unique characteristics, information (Investment Model, incentives, investment&finance cost or IRR) about these plants is not publicly available. Therefore a reliable comparison of these plants would not result in a reliable outcome. Figure below demonstrates that recently built hydroelectric power plants are not as efficient as the previous ones and serve as a good example to the point issued in previous statement. The figure also shows the fluctuation in electricity generation which poses high investment risk especially for run-off-river type hepps.

[25] http://www.teias.gov.tr/ist2007/5(1984-05).xls

[26] http://www.teias.gov.tr/ist2006/8.xls

[27] http://www.teias.gov.tr/ist2007/8.xls

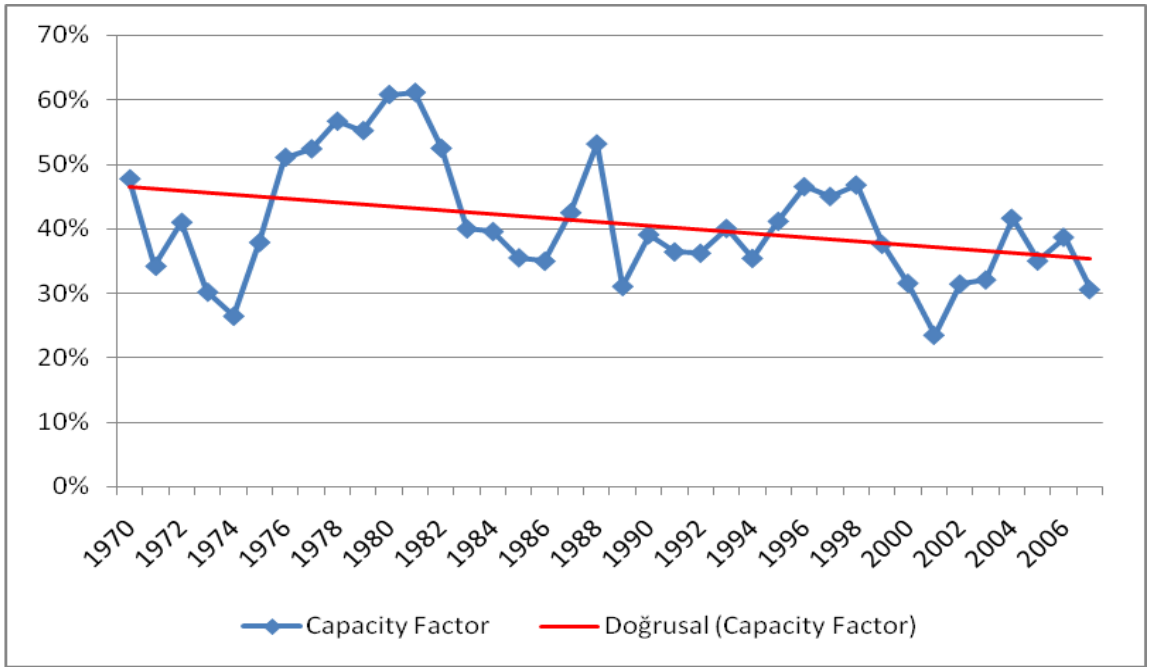

Figure 5. Fluctuation in Utilization of Installed Capacity of HEPPs in Turkey.[23,24]

Outcome of step 4:

Within the framework of the discussion above, hydroelectric power plants constructed by private companies are not considered as common practice in Turkey. A detailed analysis has shown that there exists no plant in the region or with similar capacity operational at time of investment decision.

As mentioned and illustrated from the above facts, there exists no similar project and the proposed project is significantly different from the existing plants in terms of installed capacity and ownership, therefore the proposed type of project should not be considered as a common practice for Turkey.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission factor has been calculated in a conservative manner as requested by the methodology. Basic assumptions made are;

Emission factor will remain same over the crediting period,
Emission factor of fuels sources is "0" or the lowest value in the references when there is no information.

The additionality assessment of the project activity has been demonstrated using the latest version of the 'Tool for assessment and demonstration of additionality'.

According the "Tool to calculate the emission factor for an electricity system", ver. 02, the following four methods are applicable to calculate the operating margin:

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

Since the fuel consumption data is not available for each power plant, method (d) is eliminated. Also due to insufficient data available, methods (b) and (c) are not considered and thus (a) simple OM method is used in calculations. The following table is used for demonstrating the share of low cost/must run resources. In order to calculate total share of low cost/must run resources, hydro, wind geothermal and renewable/waste sources have been considered as a conservative approach.

Year	Total Generation (GWh)	Low-Cost, Must-Run Resources (GWh)	Share of Low-Cost, Must-Run Resources
1975	**15,623**	6,124	39%
1976	**18,283**	8,536	47%
1977	**20,565**	8,791	43%
1978	**21,726**	9,472	44%
1979	**22,522**	10,433	46%
1980	**23,275**	11,484	49%
1981	**24,673**	12,726	52%
1982	**26,552**	14,167	53%
1983	**27,347**	11,343	41%
1984	**30,614**	13,448	44%
1985	**34,219**	12,051	35%
1986	**39,695**	11,916	30%
1987	**44,353**	18,676	42%
1988	**48,049**	29,018	60%
1989	**52,043**	18,002	35%
1990	**57,543**	23,228	40%
1991	**60,246**	22,803	38%
1992	**67,342**	26,685	40%
1993	**73,808**	34,085	46%
1994	**78,322**	30,716	39%
1995	**86,247**	35,849	42%
1996	**94,862**	40,734	43%
1997	**103,296**	40,193	39%
1998	**111,022**	42,574	38%
1999	**116,440**	34,984	30%
2000	**124,922**	31,208	25%
2001	**122,725**	24,392	20%
2002	**129,400**	34,010	26%
2003	**140,581**	35,595	25%
2004	**150,698**	46,339	31%
2005	**161,956**	39,836	25%
2006	**176,300**	44,619	25%
2007	**191,558**	36,576	19%
Average			**37.9%**

Table 8. Breakdown by source of the electricity generation (1975-2007)[28]

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

Data / Parameter:	**$EG_{y, Total}$**
Data unit:	GWh
Description:	Net Electricity delivered to the grid by power plants in Turkey in years 2005, 2006 and 2007
Source of data used:	TEIAS web page - http://www.teias.gov.tr/ist2007/30(84-07).xls
Value applied:	155,469.1 GWh; 169,543.1 GWh; 183,339.7 GWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used for emission reduction calculation(for calculation of OM, Net-to-Gross electricity ratio and share of low-cost must-run sources)
Any comment:	

Data / Parameter:	**$EF_{CO2, i, y i}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of fossil fuel type "i" in year "y"
Source of data used:	-For EF of fossil fuels, IPCC values at the lower limit have been used.
Value applied:	**Fuel Source** / **EF(tCO2/Tj)**: Coal 89.5; Lignite 90.9; Fuel Oil 75.5; Diesel 72.6; LPG 61.6; Naphta 69.3; Natural Gas 54.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to ACM0002, IPCC default values at lower limit of 95% confidence interval can be used. Although, the actual emission reduction is expected to be higher due to high EF of fuels consumed in existing power plants, IPCC values have been used for conservativeness as requested by the methodology.
Any comment:	

Data / Parameter:	**$FC_{i, y}$**

[28] http://www.teias.gov.tr/istatistik2008/32(75-08).xls

Data unit:	Tons or 1000m^3 for gases
Description:	Amount of fuels consumed by thermal power plants for electricity generation in terms of fossil fuel type "i" in year "y"
Source of data used:	TEIAS web page (http://www.teias.gov.tr/ist2007/43.xls)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used for OM calculation
Any comment:	

Data / Parameter:	**GE**
Data unit:	%
Description:	Generation efficiency of thermal power plants
Source of data used:	Annex I- Tool to calculate the emission factor for an electricity system
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used for BM calculation
Any comment:	

Data / Parameter:	**NCV**
Data unit:	Tj/kt
Description:	Net Calorific Values of Fuel combusted in power plants.
Source of data used:	TEIAS web page (http://www.teias.gov.tr/ist2007/45.xls)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used for OM and BM calculation
Any comment:	

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

As per the tool, the following six steps for calculation of emission reductions have been applied:

Step 1. ***Identification of the relevant electrical power system***

According to the ‘‘Tool to calculate the emission factor for an electricity system’’, a project electricity system has to be defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity, and that can be dispatched without significant transmission constraints. Therefore, in this project activity the project electricity system includes the project site and all power plants attached to the Interconnected Turkish National Grid, which has an installed capacity of 40,835.7MW and gross generation about 191,558.1 by 2007[29,30].

For imports from connected electricity systems located in another host country (ies), the emission factor is taken as “0” tCO_2/MWh as requested by the methodology.

Step 2. Select an operating margin method

The Simple Operating Margin (OM) emission factor ($\mathbf{EF}_{grid, OM, y}$) is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all the generating plants serving the system, excluding low-cost/must-run power plants. As electricity generation from solar and low cost biomass facilities is insignificant and there are no nuclear plants in Turkey, the only low cost /must run plants considered are hydroelectric, wind and geothermal facilities.

The tool gives two options for the calculation of $\mathbf{EF}_{grid, OM, y}$;

- ***Ex-ante* option**
  A 3-year generation-weighted average, based on the most recent data available at the time of submission of the VER-PDD to the DOE for validation, without the requirement to monitor and recalculate the emissions factor during the crediting period, or
- ***Ex-post* option**
  The year in which the project activity displaces grid electricity, with the requirement that the emissions factor to be updated annually during monitoring.

For this project the *ex-ante* approach is selected. Data for calculating the three year average is obtained from the period 2005 – 2007, the most recent data available at the time of PDD submission to the DOE.

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

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 plants / units. It may be calculated:

- Based on fuel consumption and net electricity generation data of each power plant / unit (Option A), or
- Based on net electricity generation data, the average efficiency of each power unit, and the fuel type (s) used in each power unit (Option B), or
- Based on total net electricity generation data of all power plants serving the system, fuel types, and total fuel consumption of the project electricity system (Option C)

29 http://www.teias.gov.tr/ist2007/1.xls

30 http://www.teias.gov.tr/ist2007/13.xls

As fuel consumption and average efficiency data for each power plant / unit are not available, Option C is used for simple OM calculation. Under Option C, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must run power plants / units, and based on fuel type(s), and total fuel consumption of the project electricity system, as follows:

(1)

where:

$EF_{grid, OM, y}$	Simple operating margin CO_2 emission factor in year "y" (tCO_2/GWh)
$FC_{i, y}$	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)
$EF_{CO2, i,}$	CO_2 emission factor of fossil fuel type "*i"* in year "y" (tCO_2/GJ)
EGy	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	Either the 3 most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

For the calculation of the Simple OM, the amount of fuel consumption ($FC_{i, y}$) and heating values of fuels are taken from website of TEIAS[31,32,33,34], the official source of related data. Fuel consumption values for the relevant years are given in table below:

	$FC_{i,y}$ unit [Ton, except for Natural Gas (NG) (1000 m^3)]			
Fuel Type	**2007**	**2006**	**2005**	**Total**
Hard Coal	6,029,143	5,617,863	5,259,058	16,906,064
Lignite	61,223,821	50,583,810	48,319,143	160,126,774
Fuel Oil	2,250,686	1,746,370	2,005,899	6,002,955

31 http://www.teias.gov.tr/ist2007/42.xls

32 http://www.teias.gov.tr/ist2007/43.xls

33 http://www.teias.gov.tr/ist2007/44.xls

34 http://www.teias.gov.tr/ist2007/45.xls

Diesel Oil	50,233	61,501	28,442	140,176
LPG	0	33	12,908	12,941
Naphtha	11,441	13,453	84,481	109,375
Natural Gas	20,457,793	17,034,548	15,756,764	53,249,105

Table 7. Fuel Consumption in thermal power plants

The NCV of the fuels consumed have been calculated using data from the TEIAS web page. The emission factors required for calculation of CO_2 emission coefficient have been obtained through IPCC 2006 guidelines for GHG inventories for fuels. Details of the data used for the calculations are given in Annex 3.

	COEF (tCO_2/kt)	**Consumption (2005 - 2007)** (tons or $1000m^3$)	**Total Emission (2005 - 2007) (tCO_2)**
Coal	1,954	16,906,064	33,032,943
Lignite	601	160,126,774	96,197,334
Fuel Oil	3,026	6,002,955	18,165,198
Diesel Oil	3,112	140,176	436,185
LPG	2,830	12,941	36,623
Naphtha	3,061	109,375	334,828
Natural Gas	2,003	53,249,105	106,643,758
Total Emissions			**254,846,869**

Table 8. Calculation of emission factors for fuels

Net electricity generated and supplied to the grid by thermal plants has been calculated using data obtained from the TEIAS web page[35,36,37,38]. The ratio between gross and net generation has been calculated first, and assuming that the same ratio is valid for thermal plants; gross generation by thermal power plants has been multiplied by this ratio in order to find net generation by thermal plants. The calculation of $EF_{grid,OM,\ y}$ requires the inclusion of electricity imports with an emission factor of 0 tCO_2/GWh. By including the imports in the electricity production this requirement is fulfilled. Summing up this with the imported electricity, total supply excluding low cost / must run sources are determined as given in table below.

Year	Gross Generation	Net Generation	Net/Gross	Gross Gen. Thermal	Net Gen Thermal	Import	Total Supply to the grid

35 http://www.teias.gov.tr/ist2007/35(2001-2005).xls

36 http://www.teias.gov.tr/istatistik2007/36(06-07).xls

37 http://www.teias.gov.tr/ist2007/35(2001-2005).xls

38 http://www.teias.gov.tr/istatistik2007/35.xls

2005	161,956	155,469	0.960	122,242	117,346	636	117,982
2006	176,299	169,543	0.962	131,835	126,783	573	127,356
2007	191,558	183,340	0.957	155,195	148,537	864	149,401
				Total Net Thermal Gen.	**392,665**	**2,073**	**394,739**

Table 9. Gross/Net electricity generation by Turkish Grid

Having calculated the total fuels emissions and net generation by thermal power plants as given in previous two tables, The $EF_{grid, OM, y}$, is calculated by simply dividing total emission by total net thermal electricity generation as defined in equation (1) above;

$\mathbf{EF}_{grid, OM, y}$ = 254,846,869 tCO_2 / 394,739 GWh
= 646 tCO_2/GWh.

Step 4. Identifying the cohort of the power units to be included in the build margin.

The sample group of power units (m) used to calculate the build margin consists of whichever is larger of:

a) The set of five power units that have been built most recently, and
b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently[39].

Option (b) has been chosen to identify this cohort of power units to be included in the build margin, since it is larger (in terms of power generation) than the result of (a).

The list of the most recent capacity additions to the grid and their average and actual generation capacities are available at the TEIAS web page [40,41,42,43,44][45]. For determination of plants that comprise 20% of the system's generation, gross generation in year 2007 which is 191,558.1 GWh has been taken as reference and its 20% has been determined as about 38,311.6 GWh. Since 20% of the most recent year's generation (38,311.6 GWh) falls partly on capacity of a power plant, this plant was fully included in the calculations as requested by the methodological tool applied. Thus, total capacity included in BM calculation has increased to 41,056 GWh which reduces again to 40,519.3 GWh after excluding plants benefitting from VER revenue.

Step 5. Calculate the build margin emission factor

The Build Margin emission factor $\mathbf{EF}_{grid, BMs, y}$ is calculated as the generation-weighted average emission factor of a sample of power plants *m* for a specific year, as follows:

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39 If 20% falls on part capacity of a unit, that unit is fully included in the calculation

40 http://www.teias.gov.tr/istat2004/7.xls

41 http://www.teias.gov.tr/istatistik2005/7.xls

42 http://www.teias.gov.tr/ist2006/8.xls

43 http://www.teias.gov.tr/ist2007/8.xls

44 http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202007.pdf

45 http://www.teias.gov.tr/projeksiyon/CAPACITY%20PROJECTION%202008-2017.pdf

$$\mathbf{EF}_{\text{grid, BM, y}} = \sum \mathbf{EG}_{\text{,m,y}} \,.\, \mathbf{EF}_{\text{EL,m,y}} / \sum \mathbf{EG}_{\text{,m,y}} \qquad \textbf{(2)}$$

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

"Tool to Calculate the Emission Factor for an Electricity System" has been used for plant efficiency data although this approach is very conservative. Since tool does not contain any specific data for plants with LPG, Naphta etc. all of the plants consuming liquid fuels have been considered as open cycle plants. Plants using lignite and coal have been assumed as suing subcritical technology, whereas natural gas plants have been assumed as combined cycle plants. The assumptions have been based on TEIAS statistics which gives heating values of fuels consumed in thermal power plants[46,47] and corresponding electricity generation[48, 49] which shows that values used are very conservative compared to actual situation.

Plant efficiency data has For EF values of fuels consumed, IPCC values at lower limit of 95% confidence interval has been used as requested by applied methodology.

	EF CO_2 (tCO2/Tj)	**Generation Efficiency**	**EF (tCO_2/MWh)**
Coal	89.5	39.0%	0.826
Lignite	90.9	39.0%	0.839
Fuel Oil	75.5	39.5%	0.688
Diesel	72.6	39.5%	0.662
LPG	61.6	39.5%	0.561
Naphtha	69.3	39.5%	0.632
Natural Gas	54.3	60.0%	0.326

Table 10. Calculation of emission factor from most recent power plants

The build margin emission factor has been determined for the most recent capacity additions as shown in table below. For electricity generation from renewables and solid wastes, the emission factors have been

[46] http://www.teias.gov.tr/ist2007/45.xls

[47] http://www.teias.gov.tr/ist2007/45.xls

[48] http://www.teias.gov.tr/ist2007/36(06-07).xls

[49] http://www.teias.gov.tr/ist2007/35(2001-2005).xls

taken as being "zero" since data is not available and the contribution of these plants is insignificant. The Build margin emission factor in the last column has been determined by multiplying each EF value with the corresponding electricity generation value for that fuel and dividing it by the total generation by the most recent capacity additions.

Fuel Source	Generation (MWh)	Percent Generation	EF	Weighted EF
Coal	1,463	3.6%	0.826	0.03
Lignite	11,482	28.0%	0.839	0.23
Fuel Oil	675	1.6%	0.688	0.01
Diesel oil	2	0.0%	0.662	0.00
LPG	50	0.1%	0.561	0.00
Naphtha	323	0.8%	0.632	0.00
Natural Gas	23,974	58.4%	0.326	0.19
Renewable and wastes	85	0.2%	0.000	0.00
Solid	5	0.0%	0.000	0.00
Total Renewable	2,999	7.3%	0.000	0.00
TOTAL Capacity additions	41,056.3	100.0%		

Table 11. Most recent capacity additions corresponding to 20% by fuel source

From the list of the plants included in BM calculation, those built using VER revenue has been excluded as per the tool.

PROJECT	TYPE	INSTALLED CAPACITY (MW)	GENERATION CAPACITY (GWh)	STANDARD
ANEMON	WPP	30.4	92	GS
BARES	WPP	30.0	105	VER+
DOGAL ENERJI(BURGAZ)	WPP	14.9	48	GS
KARAKURT	WPP	10.8	28	GS
MARE MANASTIR	WPP	39.2	129	GS
KARGILIK	HEPP	23.9	83	VCS
KALEALTI	HEPP	15.0	52	VCS
Total		**164,2**	**537**	

Table 12. List of plants identified as VER projects

Source: http://www.markitenvironmental.com and http://cdmgoldstandard.org

Finally, by summing up the weighted EF values, overall build margin emission factor have been calculated as:

$\mathbf{EF}_{grid, BM, y}$ = 19,350 tCO_2 / (41,056.3-537) GWh
= 478 tCO_2/GWh.

STEP 6 - Calculate the combined margin emission factor

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

$$\mathbf{EF}_{grid, CM, y} = \mathbf{w}_{OM} * \mathbf{EF}_{grid, OM, y} + \mathbf{w}_{BM} * \mathbf{EF}_{grid, BM, y} \quad \textbf{(3)}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh) as calculated from equation (12) above.

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh) as calculated from equation (1) above.

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

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

The default values of the weights, w_{OM} and $w_{BM,}$ as recommended by the selected methodology are both 0.5. These default values have been used in calculating CM emission factor together without rounding the values of EF_{OM} and EF_{BM}.

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

$$\mathbf{EF}_{grid, CM, y} = 0.5 * 646 + 0.5 * 478 = \mathbf{562}$$

The combined margin emission factor is therefore **562 tCO_2/GWh.** Emission factor will remain same during the first crediting period as.

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

$$\mathbf{ER}_y = \mathbf{BE}_y - \mathbf{PE}_y - \mathbf{LE}_y \quad \textbf{(4)}$$

Where:

ERy = Emission reductions in year *y* (tCO_2)
BEy = Baseline emissions in year *y* (tCO_2)
PEy = Project Emissions in year *y* (tCO_2)
LEy = Leakage emissions in year *y* (tCO_2)

Baseline emissions

Baseline emission is calculated according to the formula

$$\mathbf{BE}_y = \mathbf{EG}_y \times \mathbf{EF}_y \quad \textbf{(5)}$$

Where:

EGy = Net electricity delivered to the grid by the project activity in year y excluding transmission losses of the grid.

EFy = Emission factor calculated according to selected methodology

Project emissions

The proposed project activity involves the generation of electricity by a hydroelectric power plant which has power density higher than $10W/m^2$ therefore emissions from reservoir is ignored as per the applied methodology.

The power density of the project activity (PD) is calculated as follows:

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

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 the 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 (m2). For new reservoirs, this value is zero

For proposed project HEPP,

Cap_{PJ}	=	78.000 000 W
Cap_{BL}	=	0.0 W
A_{PJ}	=	32,120 (m^2)[50]
A_{BL}	=	0.0 (m^2)

Therefore PD is calculated as ;

$$PD = \frac{78000000 - 0}{32120 - 0}$$

$$PD = 2{,}428\ W/m^2$$

[50] Akocak, Reservoir Area Calculations

Leakage
The energy generating equipment is not transferred from or to another activity. Therefore leakage is also considered as "0".

$$LE_y = 0$$

As a result: Total Emission Reduction is;

$$ERy = BE_y$$

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

Years	Annual estimation of emission reductions in tones of CO_2 e
2010 (01/07/2010-31/12/2010)	72,340
2011	144,681
2012	144,681
2013	144,681
2014	144,681
2015	144,681
2016	144,681
2017	144,681
2018	144,681
2019	144,681
2020 (01/01/2020-030/06/2020)	72,341
Total emission reductions (Tones of CO_2 e)	**1,446,810**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2e)	144,681

Table 13. Estimated emission reduction by the proposed project

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

Data / Parameter:	**$EG_{facility, y}$**
Data unit:	MWh
Description:	Net Electricity generated and delivered to the grid by the Akocak Hydroelectric Power Plant in year "y"
Source of data to be used:	Metering devices used in power plants, monthly records signed by TEIAS and plants manager and invoices will be used.
Value of data applied for the purpose of	Estimated annual generation forming the basis for emission reduction calculation is 257.44 GWh

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Generation data will be recorded by two metering devices continuously. These records will provide the data for the monthly invoicing to TEIAS. Each month, an officer from TEIAS and the manager/electricity technician of the plant will record the readings and sign. This record will form the basis for monthly invoicing.
QA/QC procedures to be applied:	Two calibrated ammeters will act as backup for each other. Maintenance and calibration of the metering devices will be made by TEIAS periodically. In addition to invoices and metering devices, the electricity delivered to the grid can be cross checked through TEIAS web page(http://pmum.teias.gov.tr) using the ID and password of the project owner.
Any comment:	

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data to be used:	Project site
Measurement Procedure	N/A
Monitoring Frequency	Yearly
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data to be used:	Project site
Measurement Procedure	Measured from topographical surveys or maps
Monitoring Frequency	Yearly
QA/QC procedures to be applied:	-
Any comment:	Maximum area is already calculated in feasibility report and considered in calculations. Annual measurements are not expected to be higher than this value.

B.7.2. Description of the monitoring plan:

Monitoring is a key procedure to verify the real and measurable emission reductions from the proposed project. To guarantee the proposed project's real, measurable and long-term GHG emission reductions, the monitoring plan is established.

In order to demonstrate the emission reduction, only the required data is the net electricity delivered to the grid by the project activity.

Net electricity generation will be measured and recorded by both TEIAS and project owners for billing purposes therefore no new additional protocol will be needed monitoring emission reduction. Power Plant Manager, will be responsible for the electricity generated, gathering all relevant data and keeping the records. He will be informed about VER concepts and mechanisms and how to monitor and collect the data which will be used for emission reduction calculations.

Generation data collected during crediting period will be submitted to Global Tan Energy who will be responsible for calculating the emission reduction subject to verification: Generation data will be used to prepare monitoring reports which will be used to determine the vintage from the project activity. These reports will be submitted to the duly authorized and appointed Designated Operational Entity 'DOE' before each verification period.

The monitoring system organization chart is shown in Figure below, in which the authority and responsibility of project management are defined.

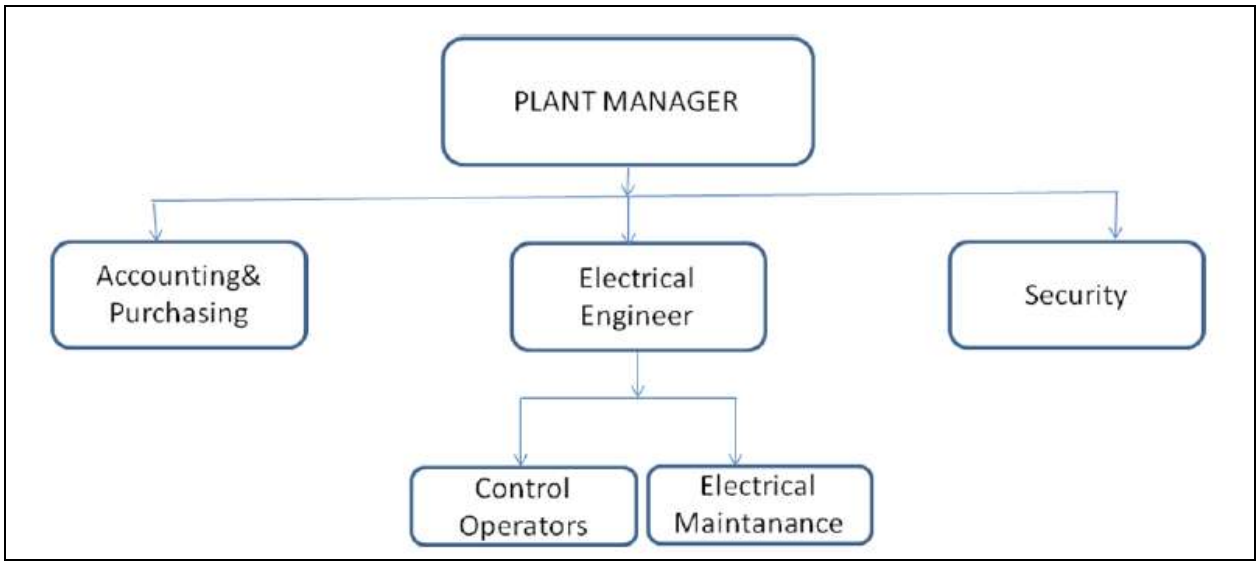

Figure 6. Operational structure of Akocak HEPP

VER Team Members is expected to include;

Plant Manager: Overall responsibility of compliance with VER monitoring plan
Electrical Engineer: Responsible for day to day running of plant, recording and monitoring of relevant data and periodic reporting
Accounting Manager: Responsible for keeping data about power sales, invoicing and purchasing.
Control Operators &Electrical Maintenance: Staff will responsible for day to day operation and maintenance of the plant and equipments. All staff will be trained and have certificate for working with high voltage equipments.
Global Tan Energy: Responsible for emission reduction calculations, preparing monitoring report and periodical verification process.

Installation of meter and data monitoring will be carried out according to the regulations by TEIAS. Two metering devices (one of them used as spare) will be used for monitoring the electricity generated by the power plant. Readings will be done using main metering devices and spare metering device will be used for comparison only. Data from metering devices will be recorded by TEIAS monthly and form the basis for invoicing using the template formed by TEIAS[51]. In addition to the two metering devices, generation of the Akocak HEPP can be cross checked from TEIAS – PMUM web site(http://pmum.teias.gov.tr) which is accessible using a password provided to electricity generation companies. Since the data in PMUM web page will show the net electricity generated less transmission loss, in order to match the data, the figures taken from PMUM web site must be multiplied by transmission loss factor of the grid.

In case of a major failure at both metering at the same time, electricity generation by the plant since the last measurement will be able to be monitored by another metering device at the inlet of the main substation operated by TEIAS where the electricity is fed to the grid. Electricity generated by the power plant is also available at the SCADA (supervisory control and data acquisition system) of the grid operator TEIAS, through the RTU (remote terminal unit) installed at the power plant and supervised by the Load Dispatch Centre of TEIAS.

The net electricity fed to the grid will be measured continuously and recorded monthly by the TEIAS and plant staff. For consistency, recorded data will be compared with electricity sale receipts. All data collected will be recorded daily and archived both as electronically and as hard copy for at least two years.

Calibration of the metering devices will be made by TEIAS and sealed during first operation of the plant. The meters will be calibrated by TEIAS when there exists significant inconsistency between two devices using a fixed template[52] or upon request by either project owner or TEIAS[53].

All data collected as part of monitoring will be archived electronically and be kept at least for 2 years after the end of the last crediting period.

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

Baseline and monitoring methodology completed in 15/06/2009
By:
Mehmet Kemal Demirkol and Ferit Arsan
Global Tan Energy Limited (GTE- http://www.gte.uk.com)
Telephone: +90 232 465 21 87
Fax: +90 232 465 21 29
E-mail: kemal@gte.uk.com

[51] http://www.teias.gov.tr/mali/GDUY/PRO_FORM/OLCUM/K01.xls

[52] http://www.teias.gov.tr/mali/GDUY/PRO_FORM/OLCUM/DAG02.xls

[53] http://www.epdk.gov.tr/english/regulations/electric/balancing/balancing.doc

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

Project construction has started in 01/12/2006. Project is expected to start operation by 01/07/2010.

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

The license has been issued to project owner for 49 years starting from the date of issue. The plant will be delivered to the government at the end of operation period. Considering the implementation period, the expected operational lifetime of the project is estimated as 45 years.

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

Renewable crediting period is chosen for the project activity.

C.2.1. Renewable crediting period:

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

The crediting period is expected to start in 01/07/2010

C.2.1.2. Length of the first crediting period:

First crediting period will be valid for ten years.

SECTION D. Environmental impacts

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

The EIA assessment for Akocak HEPP project has been prepared by PRD. as defined by the regulations. The Report was approved by the Ministry of Environment and Forestry (MoEF) on 17th October 2006.

The EIA Report prepared for the project covers all aspects of the project including capacity, interaction with other plants in the vicinity, natural resources used, waste management, social and economic impacts, technology and materials used, current land use in the region, any historical or protected site within the project boundaries, geological assessment of the project site and any communities affected by the project.

This Report has been evaluated by the relevant local government agencies and Ministry of Environment and Forestry (MoEF). After evaluation of the project and comments of the local agencies, the Ministry of Environment and Forestry has concluded that project does not have significant environmental effects and the EIA assessment is positive for the project activities.

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

The environmental impacts of the proposed project are not considered to be significant since no negative impact of the project activities have been identified. Land use, grazing or agricultural activities will not be affected negatively by the project activity. All necessary permissions including, environmental, health and safety, have been acquired from relevant agencies and all precautions have been applied strictly by the Investor Company.

SECTION E. Stakeholders' comments

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

Initial Stakeholder meeting of the project was organized and held on October 27th, 2008 in Arakli District of Trabzon Province. Participation list of the meeting is included in Annex 8. Local and international NGOs, Government Agencies and individuals were invited.

Invitations were made by registered mails, newspaper ads and through village heads. Although there exist no DNA in Turkey, Ministry of Environment and Forestry and Ministry of Energy and Natural Resources were invited by registered mail to the meeting. When possible, participation of the invitees was confirmed in order to make necessary arrangements for the meeting.

Yurtta Barış Dünyada Barış
M. Kemal Atatürk

TAKA

22 EKİM 2008 ÇARŞAMBA GÜNLÜK SİYASİ GAZETE www.takagazete.com Fiyatı: 50 YKR

DUYURU

GÖNÜLLÜ ANLAŞMALAR ÇERÇEVESİNDE KARBON TİCARETİ SERTİFİKALANDIRILMASINA YÖNELİK OLARAK, AKENERJİ ELEKTRİK ÜRETİM A.Ş. TARAFINDAN YÜRÜTÜLEN ERİKLİ - AKOCAK HİDROELEKTRİK SANTRALİNE İLİŞKİN PAYDAŞLAR TOPLANTISI 27 EKİM 2008 TARİHİNDE GERÇEKLEŞTİRİLECEKTİR.
TOPLANTIYA İLİŞKİN DETAYLAR VE TOPLANTI PROGRAMI AŞAĞIDA BİLGİLERİNİZE SUNULMUŞTUR. İLGİLİ KİŞİLERİN TOPLANTIMIZA KATILMALARI BİZLERİ MEMNUN EDECEKTİR.

Paydaşlar Toplantısı:
Tarih : 27 Ekim 2008 - Pazartesi
Saat : 14:00 – 16:00
Yer : Araklı Dağbaşı Yolu 41. Km, Çatak Mevkii Akocak - TRABZON

Toplantı Programı:
14:00 - 14:20 Açılış ve Tanıtım
14:20 - 14:50 Proje Tanıtımı
14:50 - 15:10 İklim Değişikliği, Karbon Ticareti ve Proje (GTE)
15:10 - 15:50 Forum (DSİ – ETKB – ÇvOB – AKENERJİ – GTE)
15:50 - 16:00 ÇEVRESEL VE SOSYAL DEĞERLENDİRME LİSTESİ (GTE)

KONUYLA İLGİLİ BİLGİ ALMAK VE KATILIM İÇİN: skm@gte.uk.com ADRESİNE E-POSTA GÖNDEREBİLİR VEYA 0(232) 465 21 87 No'lu TELEFONU ARAYABİLİRSİNİZ.

Figure 7. Newspaper announcement dated 22nd of October 2008 for initial SC meeting of Akocak HEPP Project

The meeting was held on 27.October.2008, at 41st kilometres of Araklı Dagbasi road, at Catak region of Akocak, which is the closest settlement to the site of Akocak HEPP Project. Agenda of the meeting was scheduled as:

14:00 Opening Speech
14:20 Presentation of the Project
14:50 Climate change, carbon emission, and the project (GTE)
15:10 Forum
15:50 List of Environmental and social Evaluation

Meeting schedule was published in local newspaper/s as given above.

Figure 8. Akocak HEPP Project Stakeholder Meeting

This Initial Stakeholders Consultation Meeting was recorded on video and minutes of the meeting were noted. Comments were also requested from the government agencies and invitees by postal letters.

E.2. Summary of the comments received:

Initial stakeholders' consultation meeting has been organised and held on October 27th, 2008 in Arakli District of Trabzon Province. In general stakeholders' comments were positive about the Project.

Three main issues raised by the participants during the SC meeting were:

- Are there lands still not expropriated? When will the costs of the land be paid?
- The number of fishes in the brook seems to have decreased.
- Will the project provide employment opportunities?

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

All comments from stakeholders are taken into account and promptly responded as given below.

Payment for the cots of the expropriated land

Payments are partially completed and payments to the landowners are already made. The expropriation process of the remaining land used during the project is going on. Payments for these lands shall be made as soon as possible.

Decrease of fishes in the brook

The Environmental Impact Assessment report prepared before the start of the project shows that there are no negative impacts of the project on the environment. However if required, reinforcement of fishes into the brook would be carried out by the project owner.

Employment opportunities

Construction process is carried out by a local subcontractor. This company being a local company have provided a lot of employment opportunities to the nearby and surrounding villages. Not only during the construction stage but also after the plant is commissioned, number of local employees at the power plant shall be kept as high as possible.

SECTION F. Additional requirements by VCS

F.1. Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction (1.12):

The project activity involves construction of a run of river hydro electric power plant having an installed capacity of 78 MW. Since the project activity involves electricity generation from renewable resources, it does not create any GHGs.

F.2. Demonstration that the project has not created another form of environmental credits(for example renewable energy certificates(1.13)):

Project owner confirms that the project activity does not create any other form of environmental credits.

F.3. Project rejected under other GHG programs(if applicable (1.14)):

Not Applicable. Project has not applied for any other GHG credit program.

F.4. Ownership- Proof of title (8.1)

The generation license issued by Energy Market Regulatory Authority (EMRA) of Turkey is the proof of the ownership for the plant. GHG emission reductions will also be owned by project investor.

F.5. Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable(8.2)):

Not applicable. Project does not participate in an emissions trading program.

F.6. Commercially Sensitive Information:

PDD does not involve any commercially sensitive information.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	AKENERJI ELEKTRIK URETIM AS.
Street/P.O.Box:	Miralay Sefik Caddesi Taksim
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Postfix/ZIP:	34437
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Telephone:	(0090) 212 249 82 82
Fax:	(0090) 212 249 73 55
E-Mail:	info@akenerji.com.tr
URL:	http://www.akenerji.com.tr
Represented by:	
Title:	Project Coordinator
Salutation:	Ms.
Last Name:	PALABIYIK
Middle name:	-
First name:	Özlem Sefer
Department:	Strategic Planning & Business Development
Direct fax:	(0090) 212 249 73 55
Direct tel:	(0090) 212 249 82 82
Personal E-Mail:	opalabiyik@akenerji.com.tr

Organization:	Global Tan Energy Limited
Street/P.O.Box:	Ehlibeyt Mahallesi 1259 Sk. Balgat
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State/Region:	-
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Fax:	(0090) 312 472 33 66
E-Mail:	email@gte.uk.com
URL:	www.gte.uk.com
Represented by:	
Title:	Director
Salutation:	Mr.
Last name:	Demirkol
Middle name:	Kemal
First name:	Mehmet
Department:	Management
Direct fax:	+90 312 472 35 00
Direct tel:	+90 312 472 33 66
Personal e-mail:	kemal@gte.uk.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

NO PUBLIC FUNDING WAS USED FOR FINANCING THE PROJECT ACTIVITIES.

Annex 3

BASELINE INFORMATION

Data Used in calculation of OM for Turkish Electricity Grid

	NCV (Tj/kt) (1000m^3 for gas)	EF (tCO_2/Tj)	COEF(tCO2/kt)
Coal	21.83	89.5	1,954
Lignite	6.61	90.9	601
Fuel Oil	40.08	75.5	3,026
Diesel Oil	42.86	72.6	3,112
LPG	45.94	61.6	2,830
Naphtha	44.17	69.3	3,061
Natural Gas	36.88	54.3	2,003

Table 14. Values used in calculation of OM

	2005	2006	2007	Total Fuel Consumption 2005-2007	Total Emission 2005-2007
Hard Coal	5,259,058	5,617,863	6,029,143	16,906,064	34,915,268
Lignite	48,319,143	50,583,810	61,223,821	160,126,774	96,197,334
Fuel Oil	2,005,899	1,746,370	2,250,686	6,002,955	18,165,198
Diesel Oil	28,442	61,501	50,233	140,176	436,185
LPG	12,908	33	0	12,941	36,623
Naphtha	84,481	13,453	11,441	109,375	334,828
Natural Gas	15,756,764	17,034,548	20,457,793	53,249,105	106,643,758

Table 15. Amount of fuels used for electricity generation[54,55,]

Year	Gross Generation	Net Generation	Net/Gross	Gross.Gen. Thermal	Net.Gen Thermal	Import	Total
2005	161,956.2	155,469.1	0.960	122,242.3	117,345.9	636	117,982
2006	176,299.8	169,543.1	0.962	131,835.1	126,782.5	573	127,356
2007	191,558.1	183,339.7	0.957	155,195.2	147,274.7	864.3	148,139
Total Net Thermal Gen.					**392,665**	**2,073**	**393,476.5**

Table 16. Net Electricity supply to the grid by thermal plants and imports (GWh)[56]

54 http://www.teias.gov.tr/istatistik2005/46.xls

55 http://www.teias.gov.tr/ist2007/43.xls

Data Used in calculation of BM for Turkish Electricity Grid

	NCV	EF $_{CO2}$	Generation Efficiency	EF
	(Tj/kt or m^3 for gas)	(tCO_2/Tj)	%	(tCO_2/MWh)
Coal	21.83	89.5	39.0%	0.826
Lignite	6.61	90.9	39.0%	0.839
Fuel Oil	40.08	75.5	39.5%	0.688
Diesel	42.86	72.6	39.5%	0.662
LPG	45.94	61.6	39.5%	0.561
Naphtha	44.17	69.3	39.5%	0.632
Natural Gas	36.88	54.3	60.0%	0.326

Table 17. Net calorific values, generation efficiency and emission factor data used in calculations

Fuel Source	**Electricity Generated** (MWh)	**EF**	**Share in total generation**
Coal	1,463	0.826	3.6%
Lignite	11,482	0.839	28.0%
Fuel Oil	675	0.688	1.6%
Diesel oil	2	0.662	0.0%
LPG	50	0.561	0.1%
Naphtha	323	0.632	0.8%
Natural Gas	23,974	0.326	58.4%
Renewable and wastes	85	0.826	0.2%
Solid	5	0.839	0.0%
Total Renewable	2,999	0.688	7.3%
TURKEY'S TOTAL	41,056.3		100.0%

Table 18. Most recent capacity additions corresponding to 20%.[57,58,59,60]

56 http://www.teias.gov.tr/ist2007/49.xls

57 http://www.teias.gov.tr/istat2004/7.xls

58 http://www.teias.gov.tr/istatistik2005/7.xls

59 http://www.teias.gov.tr/ist2006/8.xls

60 http://www.teias.gov.tr/ist2007/8.xls

Annex 4

MONITORING INFORMATION

Information about monitoring plan is given in section B.7.2.

Annex 5

EIA APPROVAL LETTER

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

Karar Tarihi: 13/10/2006
Karar No : 1165

ÇED OLUMLU BELGESİ

16.12.2003 tarih ve 25318 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği'nin 14.maddesi gereğince; "Erikli-Akocak Regülatörleri, Akocak HES ve Malzeme Ocakları" projesi hakkında "*Çevresel Etki Değerlendirmesi Olumlu Kararı*" verilmiştir.

Osman TÜZÜN
Bakan a.
Genel Müdür

Proje Sahibi : AkEnerji Elektrik Üretimi A.Ş.
Projenin Yeri : Trabzon İli, Araklı İlçesi, Karadere Havzası

Annex 6
GENERATION LICENSE

T.C.
ENERJİ PİYASASI DÜZENLEME
KURUMU

EPDK

ÜRETİM LİSANSI

Lisans No : EÜ/582-5/590

Tarih : 23/11/2005

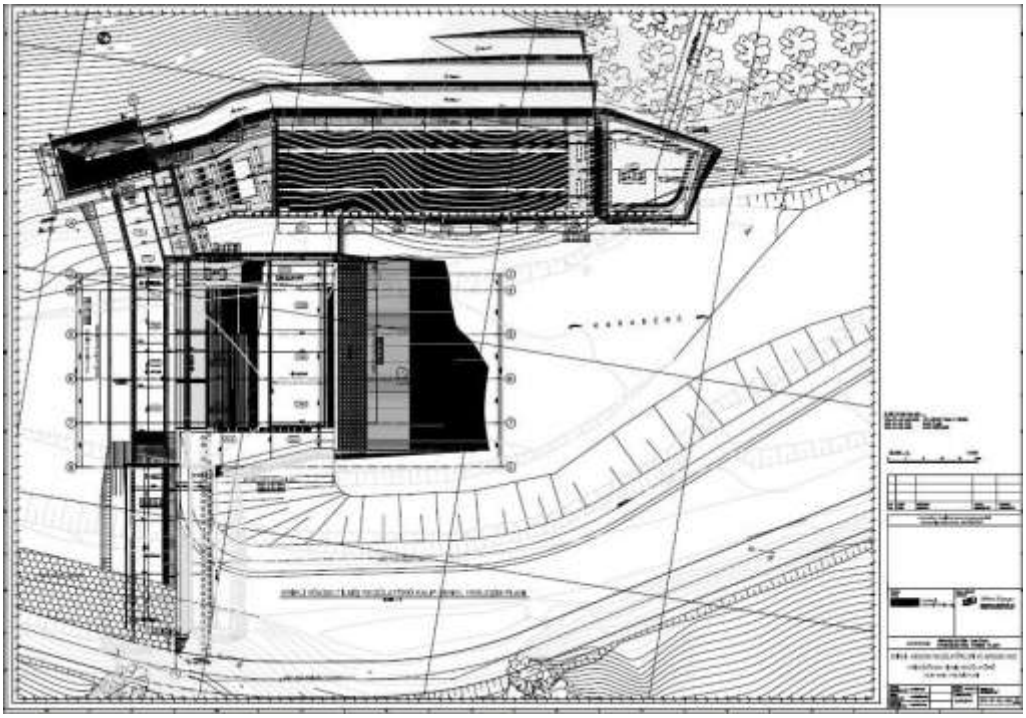
Bu Lisans, **Akenerji Elektrik Üretim Anonim Şirketi**'ne, Trabzon İli'nde kurulacak olan **Araklı Karadere Projesi Erikli-Akocak Regülatörleri ve Akocak Hidroelektrik Santralı** üretim tesisinde 23/11/2005 tarihinden itibaren 49 yıl süreyle (17/05/2007 tarihli ve 1197/13 sayılı Kurul Kararı ile 45 yıl olan lisans süresi değiştirilmiştir), üretim faaliyeti göstermek üzere 4628 sayılı Elektrik Piyasası Kanunu ve ilgili mevzuat uyarınca Enerji Piyasası Düzenleme Kurulu'nun 23/11/2005 tarihli ve 582-5 sayılı Kararı ile verilmiştir.

Yusuf GÜNAY
Başkan

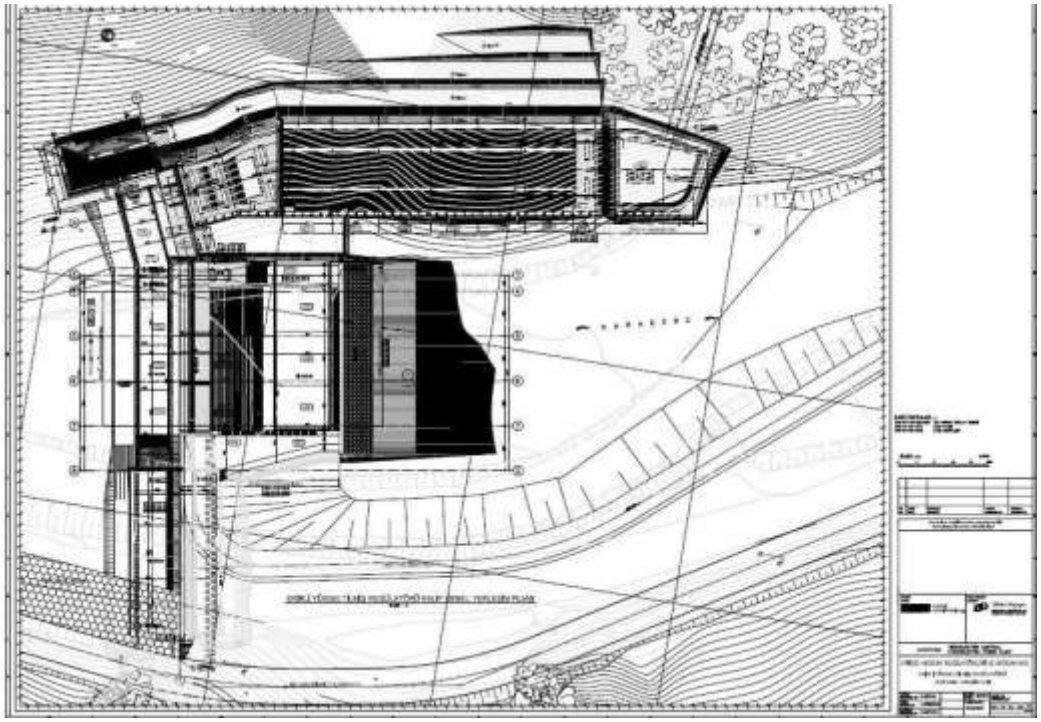
Bu lisans; genel ve özel hükümleri ile ayrılmaz bir bütündür.

Annex 7

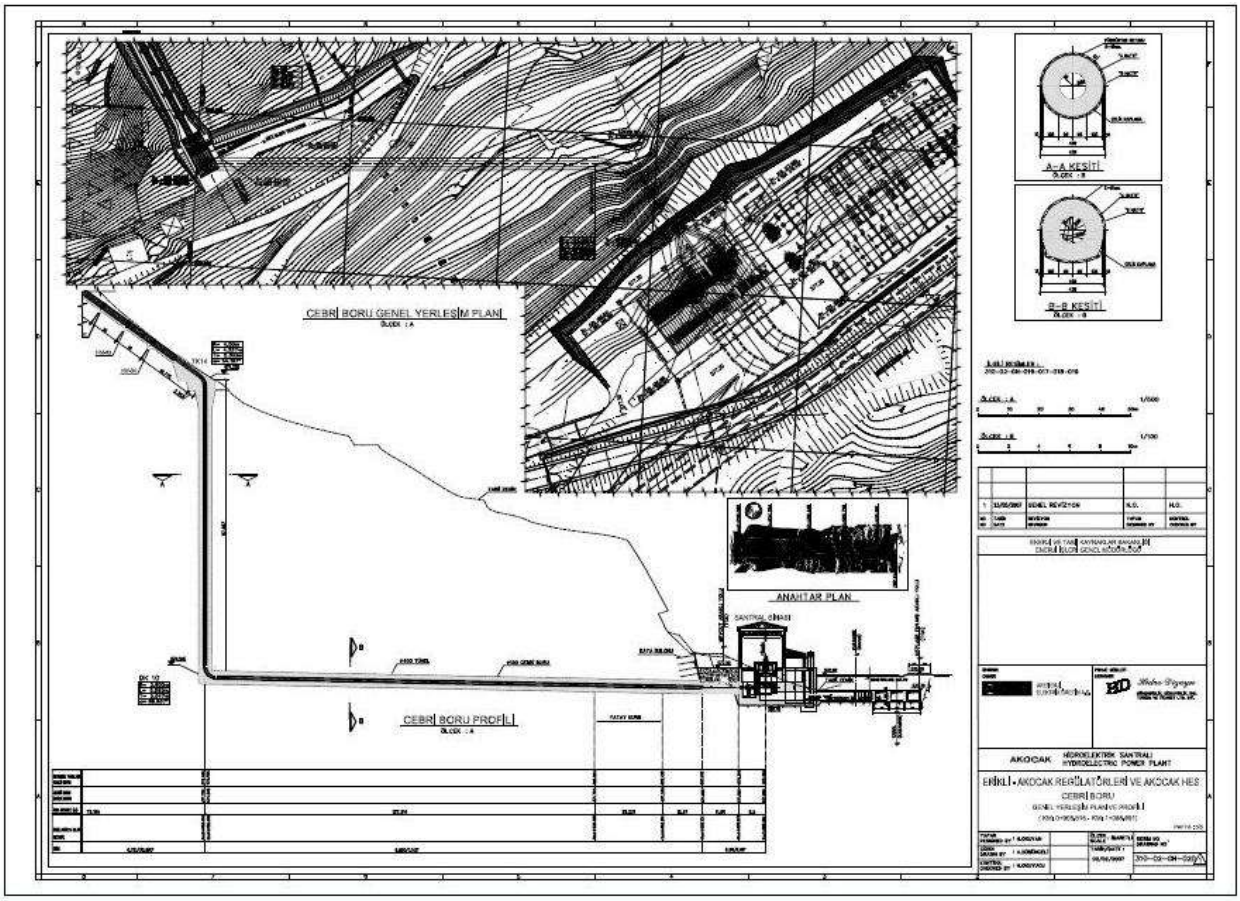
AKOCAK HEPP PLAN and PROFILE



Erikli Weir Plan



Akocak Weir Plan



Penstock and Powerhouse

Annex 8

PARTICIPATION LIST OF STAKEHOLDER MEETING 0F AKOCAK HEPP PROJECT		
NAME	ORGANIZATION / TITLE	TELEPHONE
Avni KULA	Araklı Governor	(0462) 721 66 10
Fahrettin ULU	Environment Manager of Province	(0462) 230 21 67
Dursun KIRAÇ	Military Officer	(0462 726 10 39
Ercan KAYA	Sürmene Forest Operation Manager	(0462) 746 10 55
Hasan AKTAŞ	Araklı Forest Operation Manager	(0462 721 60 53
Bayram GÖKDEMİR	Village Head	(0535) 693 24 37
Atilla GÜRBÜZ	EİE - M. of E.N.R.	
Erdal ÇALIKOĞLU	EİE - M. of E.N.R.	
Ece TOK	MoEF	
Derya HATİMOĞLU	MoEF Provincial Management	
Bülent SAĞIR	MoEF Provincial Management	
Hilal ATICI	Greenpeace	
Haydar GÜRE	WWF Türkiye	
Evren KALELİ	GTE	(0533) 567 29 16
Sevilay TOPÇU	GTE	(0532 407 25 85
Kemal ÖZARAR	Akenerji	(0532) 252 54 54
Musa GÖNÜL	Akenerji	(0530) 566 99 73
Tufan ÖZÇAĞ	Akenerji	
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Lokman AKDAĞOĞLU	Local Participant	(0535) 792 01 70
İsmail ÖZKAN	Local Participant	(0537) 623 14 91
Yusuf AYSOY	Local Participant	(0537) 520 08 63
İsmet ELYİĞİT	Local Participant	(0535) 253 01 80
Seyit ERGİNSOY	Local Participant	(0537) 726 34 00
Hasan AKDAĞOĞLU	Local Participant	(0534) 651 80 82
Muzaffer ERDOĞAN	Local Participant	(0537) 270 90 35
Hasan AKSOY	Local Participant	(0462) 732 54 12
Hüsnü ÖZKAN	Local Participant	(0539) 582 05 01
Ali AKOVA	Local Participant	(0539) 424 27 19

Annex 9:
Hepps Owned By Generation Companies