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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Title: RESADIYE-II 26.68 MW HYDROELECTRIC POWER PLANT
Version: 14
Date:26/09/2013

A.2. Description of the project activity:

RESADIYE-II is a run-off river type hydroelectric power plant (HEPP) project located on Kelkit River in Turkey. The electricity generation license has been awarded to TURKON-MNG Elektrik Uretimi ve Ticaret A.Ş. for a period of 49 years by the Turkish licensing authority named as Energy Market Regulatory Authority (EPDK). Name of the company has later been changed as "Resadiye Hamzali Elektrik Üretim Sanayi ve Ticaret Anonim Sirketi" on 28/06/2010 upon change in company structure.

The original project design which involves a single HEPP with a higher capacity has been revised considering the geological characteristics of the site and divided into three projects namely, Resadiye-I, Resadiye-II and Resadiye-III HEPP projects. Resadiye-II and Resadiye-III HEPP projects have remained within the boundaries of Resadiye District of Tokat Province, whereas Resadiye-I has remained in Koyulhisar District of Sivas Province. The aim of splitting the Reşadiye HEPP Project into three consecutive hydropower projects was to propose a cost competitive and more workable method of realisation that optimises the water-use efficiency, improve environmental performance and mitigation practices at the new power plants. A preferable solution would be to split the Resadiye HEPP Project into three hydropower projects in order to provide easier project financing and more efficient and high capacity energy generation using indigenous hydropower resources of Kelkit river.

The purpose of the project is to generate energy from the running waters of Kelkit River and consists of a weir, derivation tunnel, source and downstream cofferdams, spillway, conveyance channel and power house with turbines. Location of the project is selected to utilize the hydraulic potential of tail water of Resadiye-I HEPP which is diverted to conveyance channel through KARACA weir. Total length of the conveyance line is 12.675 whereas design flow rate of the project is 60 m^3/s and elevation difference of about 49.70 m.

Resadiye-II HEPP will have a total installed capacity of 26.68 MW with an expected electricity generation of about 182.41 GWh per annum. Corresponding emission reduction is about 102,514 tCO_2 per year. Compared with a natural gas power plant, the Project will replace consumption of about 40 million m^3 of natural gas and save about 18 million US Dollar foreign currency per year.

The main goals of the Resadiye-II 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-off river type HEPPs in the mix of electricity generation in Turkey, reduce dependency on imported fossil fuel and providing as a consequence 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 150 people will be employed during construction phase. After the commissioning of the plant, the project is expected to create permanent job opportunities for about 15 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.

Main milestones of the project are given in table below.

Milestone	**Date**
Feasibility Study Report	June 2006
License Issuance	05/10/2006
Revised Feasibility Study Report	October 2006
EIA Report	October 2006
Loan Agreement*	19/10/2006
Board Decision for Carbon Certification	20/10/2006
Equipment Purchase Contract	15/02/2007
License Amendment	25/05/2007
Construction Agreement and Start of Construction	01/04/2008
EIA Amendment	October 2008
Preliminary Consultation Meeting	24/12/2008
Uploading Documents on GS Registry	11/09/2009
Commissioning Date	17/09/2010
PFA Report by Gold Standard	21/09/2010
Stakeholder Feedback Round Meeting	14/12/2010

*Investment Decision Date and Start date of project activity

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)	Resadiye Hamzali Elektrik Üretim Sanayi ve Ticaret Anonim Sirketi Global Tan Energy Ltd.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The Resadiye-II HEPP project is located within the boundaries of Resadiye District of Tokat Province. The nearest settlements to the project site are Cavuşbeyli, Umurca, Altıparmak 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 2015 as per the Climate Change Action Plan of Turkey. 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.:

Central Anatolia Region, Tokat Province

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

Altıparmak Village of Resadiye District.

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

	LONGITUDE	LATITUDE
1. KARACA WEIR	E 37° 34′ 18″	N 40° 19′ 56″
2. POWERHOUSE	E 37° 29′ 18″	N 40° 21′ 00″

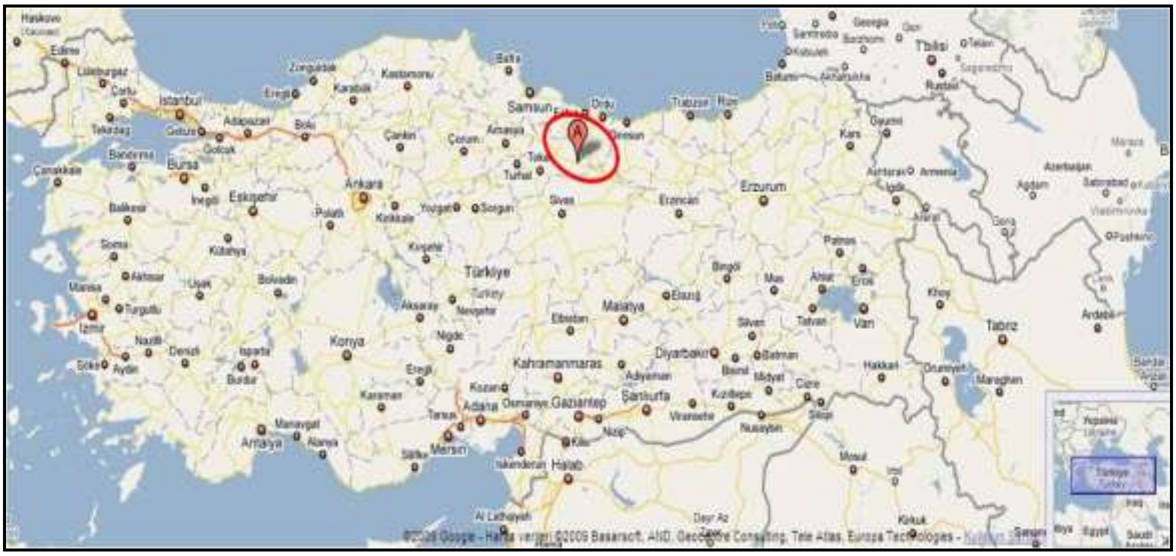

Figure 1. Location of the Project Activity

Figure 2. Resadiye-II HEPP Project Site

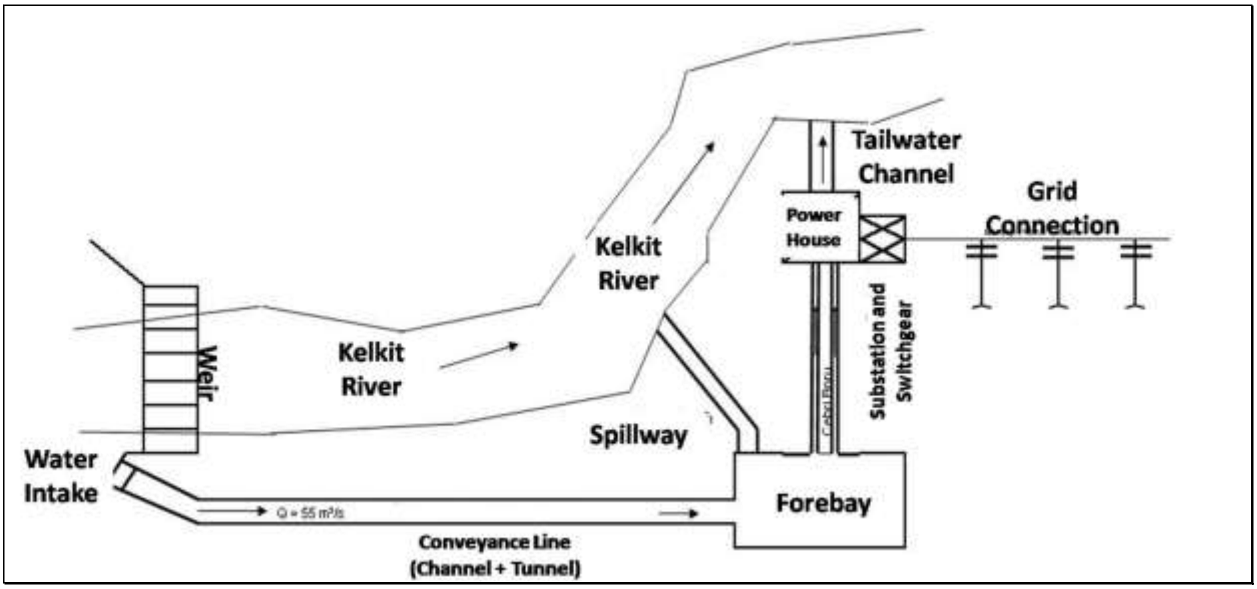

Figure 3. Reşadiye II Layout

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.

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.

LOCATION:	ON KELKIT RIVER COURSE, IN RESADIYE DISTRICT OF TOKAT PROVINCE
DESIGN DISCHARGE:	60.0 M^3/s[1]
TOTAL LENGTH OF CONVEYANCE LINE:	12.675 KM[2]
Net HEAD:	49.71 M[3]
TOTAL INSTALLED CAPACITY:	26.68 MWm/26.14 MWe[4]
NUMBER OF UNITS:	2 EACH[5]
TURBINE TYPE:	KAPLAN TYPE – VERTICAL AXIS – SIZE 21 WITH 5 RUNNER BLADES[6]
TURBINE MANUFACTURER:	VOITH-SIEMENS (SPAIN)[7]
GENERATOR TYPE:	INDAR PSA 1800S/18 WITH 8.975 KVA APPARENT POWER, NOMINAL SPEED 333 RPM[8]
GENERATOR MANUFACTURER:	INDAR (SPAIN)[8]
TRANSFORMER MANUFACTURER:	ABB (TURKEY)[7]
ENERGY TRANSMISSION LINE CAPACITY:	33 KV[9]
NUMBER OF PENSTOCKS:	2 EACH[10]
AVERAGE ANNUAL POWER GENERATION:	182.41 GWH[11]
GRID CONNECTION	THE GRID CONNECTION WILL BE PROVIDED BY VIA SUSEHRI TRANSMISSION LINE INITIALLY AND THEN TRANSFERRED TO TUNE HEPP BASIN SUBSTATION LATER. [12]
TYPE OF METERING DEVICE	ISKRA MT830[13]

Characteristics of the project are obtained from FSR and turbine agreements.

[1] Feasibility Study Report

[2] Revised FSR page 1-2

[3] Revised FSR page 1-9

[4] Generation License

[5] Generation License

[6] Revised FSR page 1-9

[7] Equipment Agreement

[8] Equipment Agreement

[9] System Connection Agreement

[10] Revised FSR

[11] Generation License

[12] Generation License

[13] Equipment Brochure

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 (01/10/2010 – 31/12/2010)	25,629
2011	102,514
2012	102,514
2013	102,514
2014	102,514
2015	102,514
2016	102,514
2017 (01/01/2017- 30/09/2017)	76,885
Total emission reductions (Tones of CO_2 e)	**717,598**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tones of CO_2e)	102,514

Table 1. 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[14].

ACM0002 refers to the following tools:

- "Tool for the demonstration and assessment of additionality", Version 05.2, [15] and,
- ''Tool to calculate the emission factor for an electricity system'', Version 01.1[16].

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

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

- The Resadiye-II 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.
- Power density of the project is higher than the 4 W/m^2 (see project emissions under Step 6)

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14 http://cdm.unfccc.int/UserManagement/FileStorage/NF9EDAOV5K382HW0JR14GS7XYQUMCP

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

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

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	No	Zero-emission electricity generation
		N_2O	No	Zero-emission electricity generation

Table 2. 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 01.1” 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. Since Turkey is an advanced developing country, there is an increasing demand for electricity which is fully expected to continue in the foreseeable future.

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.

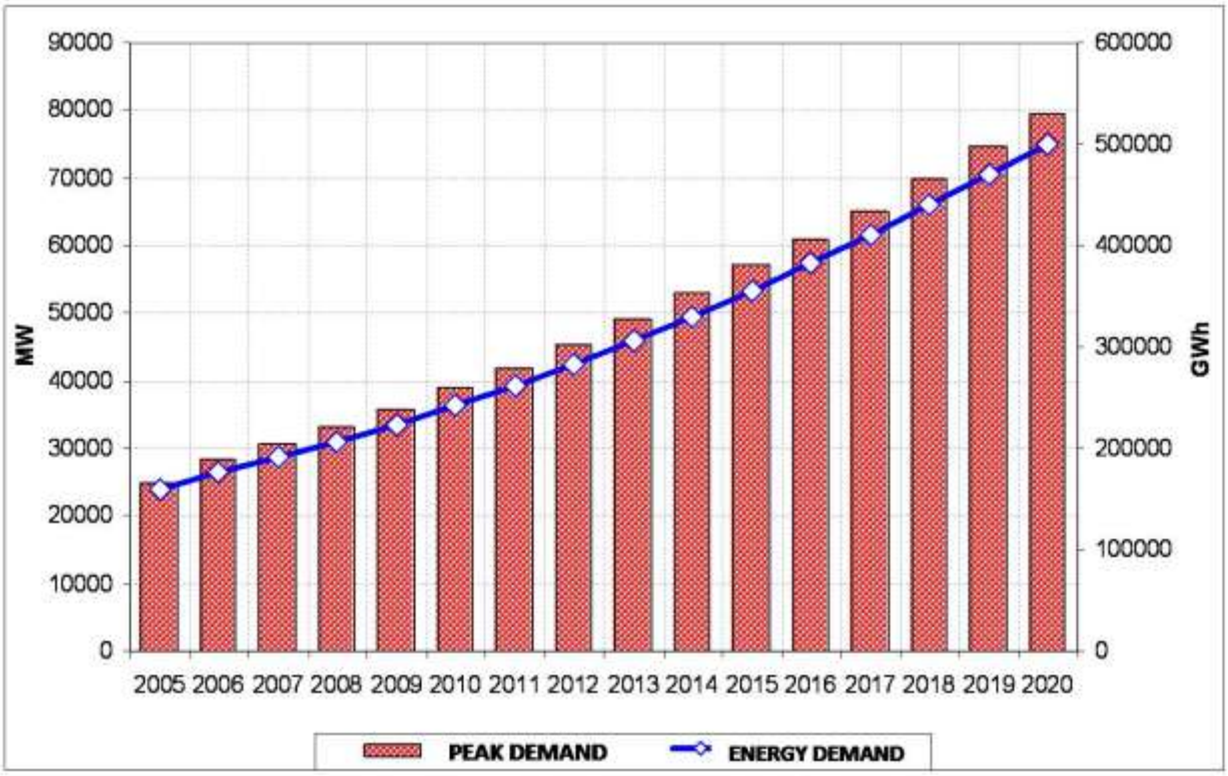

Figure 4. Peak Load and consumption projection for Turkish electricity system between 2005-2020[17]

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):

17 http://www.teias.gov.tr/apkuretimplani/veriler.htm

According to the applied methodology (ACM0002) 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 182.41 GWh electricity and reduce about 102,514 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
2. Continuation of the current situation-supply of equal amount of electricity by the grid via newly build power plants.

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.

Outcome of Step 1a

Continuation of the current situation is not considered as a realistic alternative due to increasing electricity demand therefore new plants should be built to meet the demand. Project is therefore considered as additional to the baseline scenario.

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

The following applicable mandatory laws and regulations have been identified:

1. Electricity Market Law[18]
2. Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy[19]
3. Energy Efficiency Law [20]
4. Forest Law[21]
5. Environment Law[22]

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

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

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

21 Law number 6831, enactment date 31/08/1956

The resultant alternatives to the project as outlined in Step (1a) are in compliance with the applicable laws and regulations.

Outcome of Step 1b

Mandatory legislation and regulations for each alternative are taken into account in sub-step 1b. 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

The investment analysis has been done in order to make an economic and financial evaluation of the project. No public funding or ODA are available in Turkey for finance of this type of projects. Resadiye-II HEPP has been financed through loans from commercial banks and company 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 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 government bond rates increased by a suitable risk premium (to reflect private investment and/or project type). For benchmark analysis of the project, Government bond rates from web page of Central Bank of The Republic of Turkey (TCMB) have been used as given in table below.

Government Bond	Auction Date	Currency	Rate
TRT120111T10	12.06.06	TRY	16.47
TRT090408T17	13.06.06	TRY	18.15
TRB041006T24	03.07.06	TRY	19.25
TRT040707T10	04.07.06	TRY	0.14
TRT020708T11	04.07.06	TRY	22.67

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

TRB170107T11	18.07.06	TRY	19.90
TRT160708T15	18.07.06	TRY	19.00
TRT040707T10	08.08.06	TRY	19.17
TRT160708T15	08.08.06	TRY	17.55
TRB210207T14	22.08.06	TRY	13.96
TRT020708T11	22.08.06	TRY	24.62
TRB140307T12	11.09.06	TRY	19.68
TRT160708T15	12.09.06	TRY	19.33
TRT070911T19	12.09.06	TRY	23.50
TRT071107T11	26.09.06	TRY	19.79
TRT190111T13	26.09.06	TRY	20.65
TRB030107T17	02.10.06	TRY	15.86
TRT130808T17	02.10.06	TRY	12.48
TRT070911T19	02.10.06	TRY	23.71
TRT190111T13	17.10.06	TRY	20.29
		Average	**18.31**

Table 3. Sample of Government bond rates used for the benchmark analysis[23]

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

Parameters	Unit	Data Value
Installed Capacity	MW	26.68[24]
Grid Connected output	GWh	182.41[24]
Capital Investment	Million €	60.155[25]
Income tax rate	%	20[26]
Loan	Million USD	~100*
Expected Tariff	€ Cents/kWh	5.5[18]
Expected VERs price	€/ tons CO_2e	7.0
Operation&Maintenance Cost	€/Year	639,000[27]

**Loan agreement is signed for four projects of the investor. About 100M USD has been allocated to Resadiye project. At time of loan agreement, the project had been planned as single project.*

Table 4. Main financial parameters used for investment analysis (Figures in brackets show the values at time of investment decision and before project revision)

[23] http://www.tcmb.gov.tr/evds/dibs/istihl.xls (Column Z , accessed on 09/10/2009)

[24] Resadiye HEPP 2.Revised FSR Table 1

[25] Resadiye HEPP Financial Model

[26] http://www.mmmb.org.tr/default.aspx?pid=24826&nid=16297

[27] Resadiye HEPP Revised Feasibility Report

IRR has been calculated according to the tool as stated in the applied methodology. 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 182.41 GWh and maintenance cost has been assumed as €640,000 (excluding grid fee). Investment decision date has been identified as the date of loan agreement and bonds used in benchmark have been selected accordingly. Calculation and estimations have been made conservatively therefore IRR value represents the most optimistic scenario in terms of capital investment and electricity generation. On the other hand electricity tariff is expected to increase so that the investment becomes attractive however as given below, expectations have not been realized yet due to the market conditions.

Considering the Government bond rates which is around 18.31% and estimated country risk premiums which are around 4.50% for Turkey[28], it can be concluded that expected return on investment for these types of projects should be around 22.81% for reasonable investors. The expectation of many investors is returns around 25% for successful investments for some investment funds[29]. Another benchmark for similar project types have been defined by Worldbank as 15% [30] by a report generated in 2009, whereas an earlier World Bank report gives financial IRRs for several projects as 16% to 23% for similar projects.[31] Even if we consider the minimum benchmark IRR which is 15%, for proposed project, in order to reach this IRR values, average electricity tariff must be around 6.5 €c/kWh in the absence of carbon revenue and assuming that initial investment figures are realized so that the investment will become reasonable.

For Resadiye-II HEPP, when the investment analysis is performed for 46 years(remaining license period after construction), residual value of the project becomes zero since the project is delivered to government at the end of this period. However, since the lifetime of turbines are limited (assumed as 150,000 hours as per EB50 decision), it is seen that turbines should be replaced before 22 years. So, turbine replacement cost have been added to years 22 and 44. For simplicity, other maintenance cost of penstock, transmission line and conveyance line has not been included although these costs are expected to increase as the plant gets older. Equity IRR of the project has been calculated as 11.48% with these parameters which is below the benchmark. Equity IRR increases to 12.89% when carbon revenue is added.

However, due to the uncertainty in economical environment, demand for electricity has decreased significantly in recent years which have frustrated the investors expecting higher electricity prices. Under this circumstances most reliable scenario for financiers and investors is the renewable law which guarantees 5.0€ to 5.5€ cents per kWh. Recent trends in global economy have shown that the consideration of guaranteed price is a realistic and reliable scenario that should be considered in investment analysis for similar projects.

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[28] http://www.stern.nyu.edu/~adamodar/pc/archives/ctryprem06.xls

[29] www.**greatturkfund**.com/images/data/GTF_Presentation_9Nov2009.pdf

[30] Project Appraisal Document for a proposed IBRD Loan (page 81) http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2009/05/11/000333037_20090511030724/Rendered/PDF/468080PAD0P112101Official0Use0Only1.pdf

[31] http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2004/03/09/000090341_20040309095924/Rendered/PDF/254970TR.pdf (page 36)

Following figure is given in order to reflect the actual electricity prices realized obtained from monthly reports of Market Settling and Balancing Center[32] between 01/01/2009-31/01/2010. It should be considered that these prices are highest prices obtained and power plants which sell electricity through bilateral agreements have lower income. Figure shows that the actual prices have even been lower than guaranteed price in some cases therefore assumption of 5.5€cents per kWh (or 55 €/MWh) is a realistic scenario as demonstrated below. Similarly, average weighted tariff of 2006 has been calculated as 6€cents/kWh.

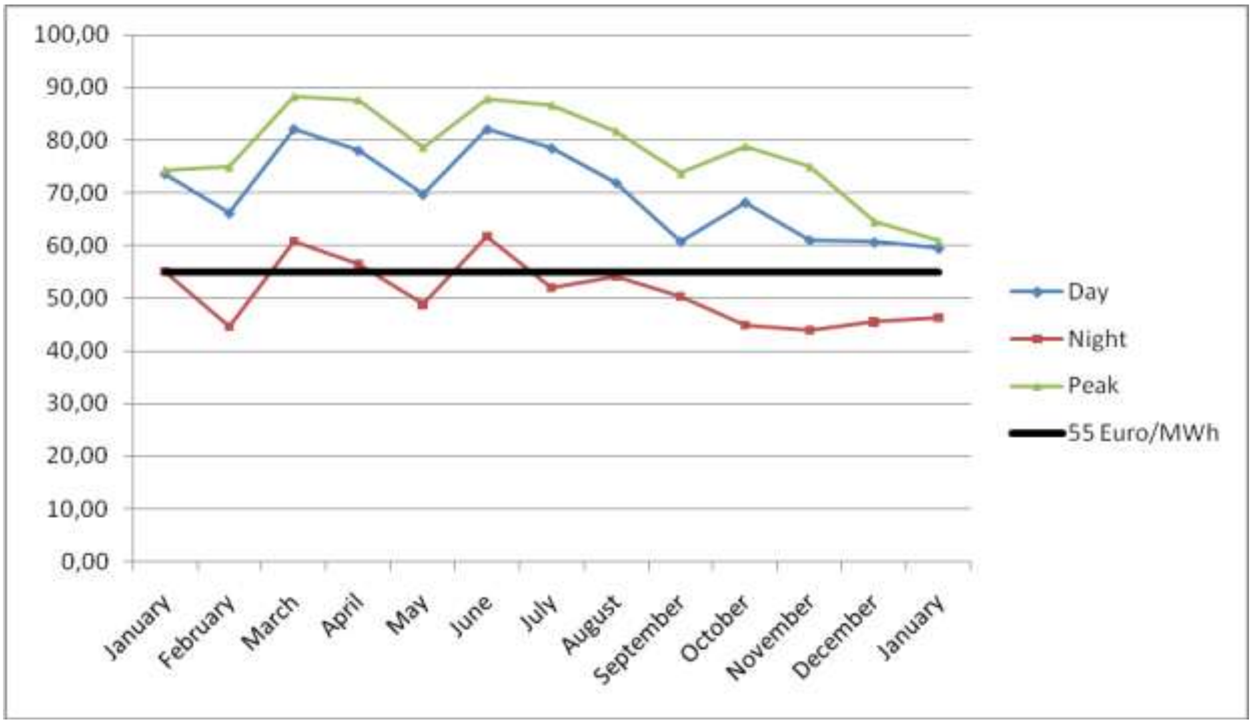

Figure 4. Highest tariffs observed between January 2009-January 2010 (€/MWh)

This IRR value represents the most optimistic scenario in terms of capital investment and electricity generation whereas electricity tariff is expected to increase due to increasing electricity demand so that the investment becomes attractive.

For the proposed project, in order to reach the benchmark IRR values, average electricity tariff must be above 7€c/kWh so that the investment will become reasonable. Considering that control of run-off-river hydroelectric power plants on generation period is limited, 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.

Sub-step 2d - Sensitivity Analysis

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

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[32] http://pmum.teias.gov.tr/UzlasmaWeb/

- Investment Cost
- Operating Cost
- Electricity Sales revenue

For a range of ±20% fluctuations in parameters investment and operational cost ±30% fluctuation in electricity income, table below has been obtained.

	% Fluctuation						
	-20	**-10**	**-5**	**0**	**5**	**10**	**20**
Investment Cost	15.30	13.10	12.24	11.48	10.79	10.16	9.07
Operating Cost	12.02	11.75	11.61	11.48	11.34	11.21	10.94
				% Fluctuation			
	-30	**-20**	**-10**	**0**	**10**	**20**	**30**
Electricity Income	6.50	8.17	9.82	11.48	13.15	14.96	16.81

Table 5. Sensitivity analysis for Resadiye HEPP project without carbon revenue

Sensitivity analysis has been carried out according to the conditions when the investment decision is given hence for 182.41 GWh generation and 5.5€c/kWh guaranteed price. The parameter electricity income includes both tariff and generation figure. Although the tariff may not be below 5.0 €cents/kWh, generation may significantly deviate from the expected figures therefore ±30% fluctuation has been considered.

Outcome of Step 2:
The investment and sensitivity analysis shows that the VER revenues will improve the financial indicators of the Project remarkably. Considering that figures above are based on a higher price rather than the government guaranteed floor price, optimistic estimations for yearly generation and that those figures do not reflect the risk for investment, role of carbon income is a most significant number to enable the project to proceed.

According to local regulations, electricity price is determined daily according to Market Financial Settlement Center (MFSC) as defined in the regulations and there exists three tariffs during day, peak and night hours. Thermal power plants and HEPPs with storage facilities have flexibility to schedule their generation at peak hours when the tariff is high. However, run-off-river type HEPPs do not have significant storage facility therefore may not be able to benefit from high prices realized at when demand is high. According to MFSC figures, electricity tariff fluctuated between 4.4 €c/kWh and 8.8 €c/kWh between 01/12/2008 and 20/07/2009 whereas the weighted average of the tariff has been calculated as 6.8€c/kWh in this period[33]. Since this value shows the spot price at the time of selected investment decision date, it does not provide any guarantee about the actual selling price as the control on generation period and tariff is limited and it may not be possible to generate and sell electricity during peak tariff periods. Also, considering that fluctuation in water resources is high and fact that a part of the electricity can be sold through bilateral agreements to free consumers with a discount rate over market price, guarantee price has been taken as reference in investment analysis which also provides input for evaluation of financing institutions.

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[33] https://pmum.teias.gov.tr/UzlasmaWeb/

Actual cost for investment has been realized as slightly below the figures in FSR. Therefore, best case scenario has been defined as 0% decrease in investment and operation costs and 30% increase in electricity sales income, IRR is calculated as 16.81% in the absence of carbon revenue. Since two parameters, operational costs and electricity have been calculated in a more conservative basis, they are not expected to change much in favor of investments. Tariff is fixed annually and when you choose to sell at guaranteed price, you cannot benefit from higher market price and also you are not affected from lower prices in the market. Considering the figure about market electricity price figures given above, it is seen that 30% increase in tariff is not realistic. Also, as per the project design, after splitting the project into three parts, costs of each project has not been splitted pro rata, hence Resadiye II is the largest project but some of the investments has been recorded under Resadiye III Hepp which is smaller than Resadiye II Hepp. Hence, although Resadiye II HEPP is about 20% larger in terms of generation capacity compared to Resadiye III Hepp, investment cost for Resadiye II Hepp has been realized as about 30% lower than Resadiye III HEPP due to the fact that three projects significantly dependent on each other.

Operation cost does not have significant impact on IRR therefore, major parameter subject to change becomes electricity income which is a combination of tariff and generation. Electricity price, which is expected to increase and exceed 7 €c/kWh levels to meet expectations so that the investment becomes reasonable. However, there is no guarantee to reach that price as the tariffs in 2006 has clearly shown that average price is around 6€cents/kWh and the fact that income is also dependent on generation and availability of water also creates significant risk. It should also be noted that average prices are calculated on average annual figures and electricity prices are higher in summer period where most of the hydros suffer from insufficient water resources to generate electricity and benefit from higher prices.

Based on the above information, it is seen that project is not the most attractive option. Therefore project is considered as additional to the baseline scenario.

Step 3. Barrier analysis

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

Step 4. Common Practice Analysis

Sub-step 4a. Analysis of other activities similar to the proposed project activity

According to the TEIAS statistics[34], 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[35]. 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, as seen in the Figure below [36].

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

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

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

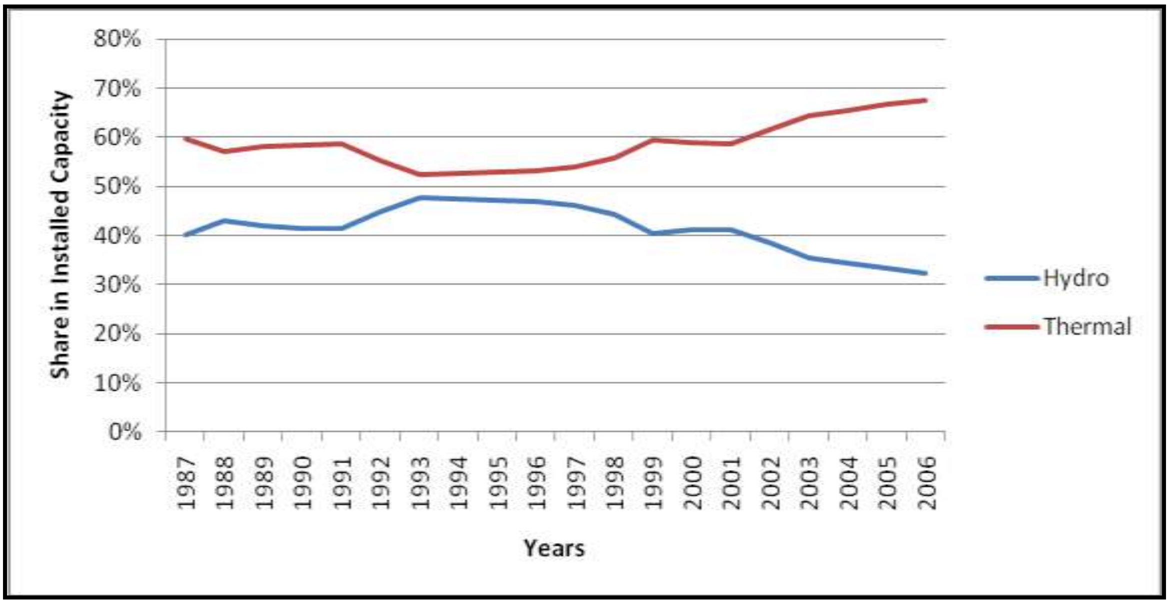

Figure 5. Annual Development of Turkey's Installed Capacity

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

The main reason behind the decrease in share of hydro electricity power is the changes in government's energy 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 private 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, private 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[37,38,39].

When we look at the distribution of hydro power capacity by utilities, it is seen that total generation capacity of the hydroelectric power plants owned by private generation companies is 1,273 GWh by end of 2006[40] which corresponds to 0.72% of the total generation capacity (176,299.8 GWh)[41] of Turkey at that time. However, a detailed review of these has shown that majority of these plants have been initially licensed/implemented as either Autoproducer or BOT power plants but later licenses have been revised as Generation Company License during liberalization of Turkish Electricity Market and some of them have

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

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

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

[40] http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202007.pdf (page 75)

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

been built using VER revenue (See Annex 8 for details). When these plants are excluded, there exist only one plant in the list which is operational at time of investment decision (0.6 MW Basaran HEPP) which corresponds to less than **0.003%** of total generation capacity at time of investment decision.

Besides the fact that each project is different and has unique characteristics, information (Investment Model, incentives, investment&finance cost or IRR) about individuals' 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.

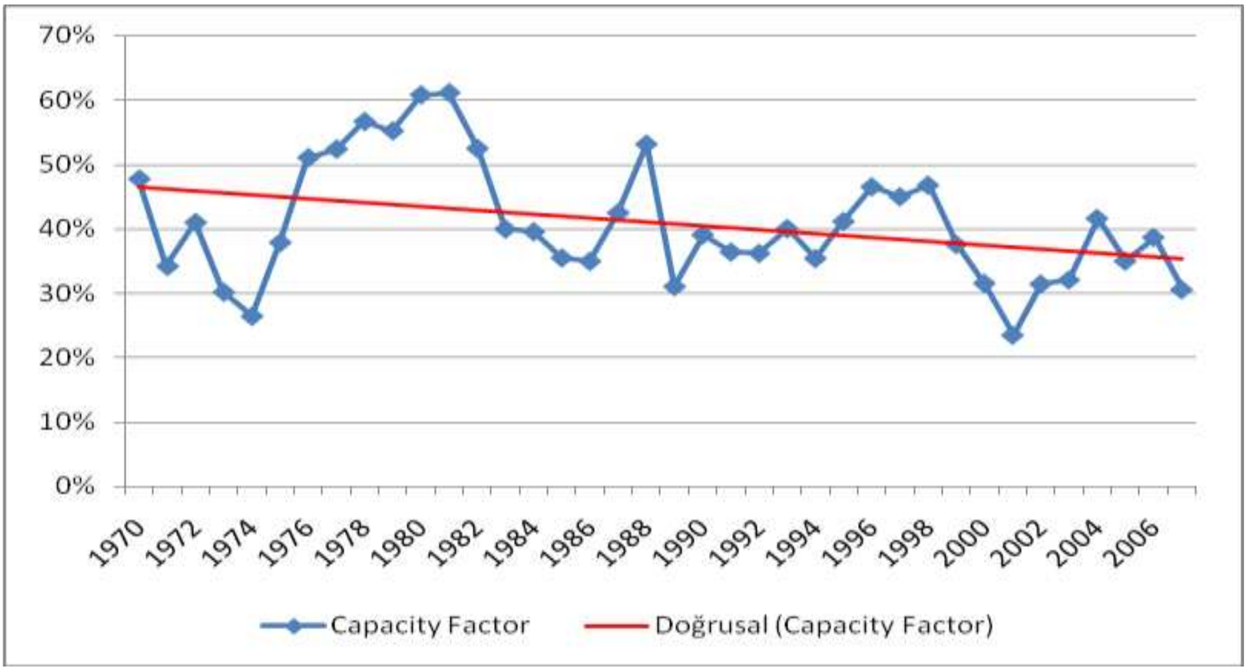

Figure 6. Evolution of Capacity (Plant Load) Factor of HEPPs in Turkey.[34,35]

A major difference between dam type and run-off-river type HEPPs is dependency and sensitivity on natural resources. Generation capacity of the HEPPs is mainly dependent of the precipitation and flow rate of the basin.

Outcome of step 4:

Within the framework of the discussion above, considering that share of run-off-river type hydroelectric power plants constructed by private generation companies are less than 0.003. Even, if the share of hydro power seems high at overall generation mix of Turkey, considering that most of them have storage facilities and built by government or through concessionary agreements, it is clear that the existing projects are not similar to the proposed project.

Given the past and continuing weight and presence of the Government influence, as mentioned and illustrated from the above facts, the proposed type of project should not be considered as a common practice in Turkey.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission factor has been calculated in a conservative 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. 01.1, 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 share of low-cost / must-run sources is below 50%, 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.

		2007	2006	2005	2004	2003	Average
Total Generation	**[GWh]**	191,558	176,300	161,956	150,698	140,581	164,219
Low-cost / must run	**[GWh]**	36,362	44,465	39,714	46,235	35,480	40,451
Low-cost / must run	**[%]**	19	25	25	31	25	25

Table 6. Breakdown by source of the electricity generation for the five most recent years[42]

Equations esed for the project activity are given below. Application of the equations are given in detail in section B.6.3

$EF_{Grid,OMSimple,y} = \sum FC_{i,y} * NCV_{i,y} * EF_{CO2,I,y} / EG_y$	(1)
$EF_{grid,BM,y} = \sum EG_{m,y} \cdot EF_{EL,m,y} / \sum EG_{m,y}$	(2)

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

$EF_{grid, CM, y} = w_{OM} * EF_{grid, OM, y} + w_{BM} * EF_{grid, BM, y}$	(3)
$PEFC_{j,y} = \sum FC_{i,j,y} \times COEF_{i,y}$	(4)
$ER_y = BEy - PE_y - LE_y$	(5)
$BE_y = EG_y \times EF_y$	(6)
$PD = Cap_{PJ} - Cap_{BL} / (A_{PJ} - A_{BL})$	(7)

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

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net Electricity delivered to the grid by the Resadiye-II HEPP in year y
Source of data used:	Feasibility Report for Resadiye-II HEPP
Value applied:	182.41 GWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used for emission reduction calculation.
Any comment:	

Data / Parameter:	$EG_{y, Total}$
Data unit:	MWh
Description:	Net Electricity delivered to the grid by power plants in Turkey in year 2007
Source of data used:	TEIAS web page - http://www.teias.gov.tr/ist2007/30(84-07).xls
Value applied:	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 has 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:	**$FC_{i,y}$**
Data unit:	Tons or 1000 m^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 of Tool applied.
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:

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[43,44].

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

Since the fuel consumption data is not available for each power plant, method (d) is eliminated. Also due to insufficient data, 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.

		2007	2006	2005	2004	2003	Average
Total Generation	**[GWh]**	191,558	176,300	161,956	150,698	140,581	164,219
Low-cost/ must run	**[GWh]**	36,362	44,465	39,714	46,235	35,480	40,451
Low-cost/ must run	**[%]**	19	25	25	31	25	25

Table 7. Breakdown by source of electricity generation for the five most recent years[45]

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

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

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

The Simple Operating Margin (OM) emission factor (**$EF_{grid, OM, y}$**) 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 **$EF_{grid, OM, y}$**;

- *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)

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:

$$EF_{Grid,OMSimple,y} = \sum FC_{i,y} * NCV_{i,y} * EF_{CO2,I,y} / EG_y \qquad \textbf{(1)}$$

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[46,47,48,49], the official source of related data. Fuel consumption values for the relevant years are in table below.

Fuel Type	$FC_{i,y}$ unit [Ton, except for Natural Gas (NG) (1000 m^3)]			
	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
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 8. 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)**

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

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

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

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

			(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 9. 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[50,51,52,53]. 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
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 10. 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;

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

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

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

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

$\mathbf{EF}_{grid,\ OM,\ y}$ = 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[54].

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 [55,56,57,58,59,60]. 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 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:

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

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

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

55 http://www.teias.gov.tr/istat2004/7.xls
56 http://www.teias.gov.tr/istatistik2005/7.xls
57 http://www.teias.gov.tr/ist2006/8.xls
58 http://www.teias.gov.tr/ist2007/8.xls
59 http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202007.pdf
60 http://www.teias.gov.tr/projeksiyon/CAPACITY%20PROJECTION%202008-2017.pdf

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[61] and corresponding electricity generation[62, 63] which shows that values used are very conservative compared to actual situation.

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 11. 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 renewable and solid wastes, the emission factors have been 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

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

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

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

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 12. 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**	**537.0**	

Table 13. 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:

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

STEP 6 - Calculate the combined margin emission factor

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

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

Where:

$EFgrid,BM,y$ =Build margin CO2 emission factor in year y (tCO_2/MWh) as calculated from equation   above.
$EFgrid,OM,y$ =Operating margin CO2 emission factor in year y (tCO_2/MWh) as calculated from equation (1) above.
wOM   =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 0.5, respectively. 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 recommended by the methodology ACM0002.

Project emissions

The proposed project activity involves the generation of electricity by hydro electric power plant therefore project activity does not result in greenhouse gas emissions. Power density of the project is calculated as 236 W/m^2 which is significantly higher than 10 W/m^2 for 26.68 MW installed capacity and 0.113 km^2 maximum reservoir area[64].

The only emission source in the plant is the diesel generator which is used as auxiliary power source when there is no electricity generation in the plant or supply by the grid. According to the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[65]" ver 02 CO_2 emissions from fossil fuel combustion for process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$\boxed{\mathbf{PEFC}_{j,y} = \sum \mathbf{FC}_{i,j,y} \times \mathbf{COEF}_{i,y}} \qquad \textbf{(4)}$$

Where:
$PEFC_{j,y}$ = Are the CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr);

$FC_{i,j,y}$

$COEF_{j,y}$ = Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit)
i = Is the fuel types combusted in process j during the year y

Leakage

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

$$\boldsymbol{LE_y = 0}$$

[64] Resadiye HEPP, Revised Feasibility Report Section 7.2, page 7-3

[65] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

As a result: Total Emission Reduction is;

$$ER_y = BE_y - PE_{FC_{j,y}}$$

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

Years	**Estimation of Project Activity Emissions*** *(Tonnes of CO_{2e})*	**Estimation of Baseline Emissions** *(Tonnes of CO_{2e})*	**Estimation of Leakage** *(Tonnes of CO_{2e})*	**Annual estimation of emission reductions** (Tonnes of CO_{2e})
2010 (01/10/2010 – 31/12/2010)	0	25,629	0	25,629
2011	0	102,514	0	102,514
2012	0	102,514	0	102,514
2013	0	102,514	0	102,514
2014	0	102,514	0	102,514
2015	0	102,514	0	102,514
2016	0	102,514	0	102,514
2017 (01/01/2017-30/09/2017)	0	76,885	0	76,885
Total emission reductions (Tons of CO_2 e)	**0**	**717,598**	**0**	**717,598**

Table 14. Estimated emission reduction by the proposed project

**Project emissions due to diesel generation are not expected to be significant but it will be calculated and included in the monitoring report.*

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net Electricity generated and delivered to the grid by the Resadiye-II 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 calculating expected emission reductions in section B.5	Estimated annual generation forming the basis for emission reduction calculation is 182.41 GWh
Description of measurement methods and procedures to be applied:	Generation data will be recorded by two metering devices (Elster A1500)[66] continuously. Meters will be located at control room in powerhouse. 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. Data will be monitored continuously and recorded monthly.
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. Accuracy class of the meters will be in compliance with regulations[67] which are defined as 0.2 or 0.5 class. Calibration period will be maximum 10 years as given in the report.[68]
Any comment:	

Data / Parameter:	**$FC_{i,j,y}$**
Data unit:	Mass or volume unit per year (e.g. ton/yr or m^3/yr)
Description:	Quantity of fuel type i combusted in Diesel power generator during the year y
Source of data to be used:	Onsite measurements from equipment working hours. Data can be checked from invoices provided by the plant operator for fuel purchase
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0. Value to be determined during verification period
Description of measurement methods and procedures to be applied:	Gauges and reading devices on diesel generator. Data will be monitored and recorded annually.
QA/QC procedures to be applied:	Data recorded by the equipment will be cross-checked by the fuel invoices
Any comment:	-

Data / Parameter:	**Cap_{PJ}**
Data unit:	W

[66] http://www.elstermetering.com/en/869.html

[67] http://www.epdk.gov.tr/web/elektrik-piyasasi-dairesi/44

[68] Ministry of Industry and Trade- Regulation for metering devices.

Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data to be used:	Site visit and Equipment purchase agreement.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	26.68 MW
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on recognized standards during on site visits
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
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Value has been calculated as 0.113 km^2 during Feasibility studies(FSR Section 7.2, page 7-3). It will be calculated again after implementation of the Project.
Description of measurement methods and procedures to be applied:	Calculated from topographical surveys. Data will be monitored annually.
QA/QC procedures to be applied:	In case of difficulty in calculating reservoir area, maximum surface area will be calculated as is the reservoir is full.
Any comment:	The maximum reservoir level has been defined in the Feasibility Report already. There is no possibility that the reservoir level can exceed this level since the excess water will flow from spillway when the water level exceed maximum operating level. The area can be calculated from topographical surveys however in an y case it will be less than maximum 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 and consumption for the auxiliary diesel generator. IPCC guidelines will be used as data source for calculating the project emissions due to diesel fuel consumption.

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.

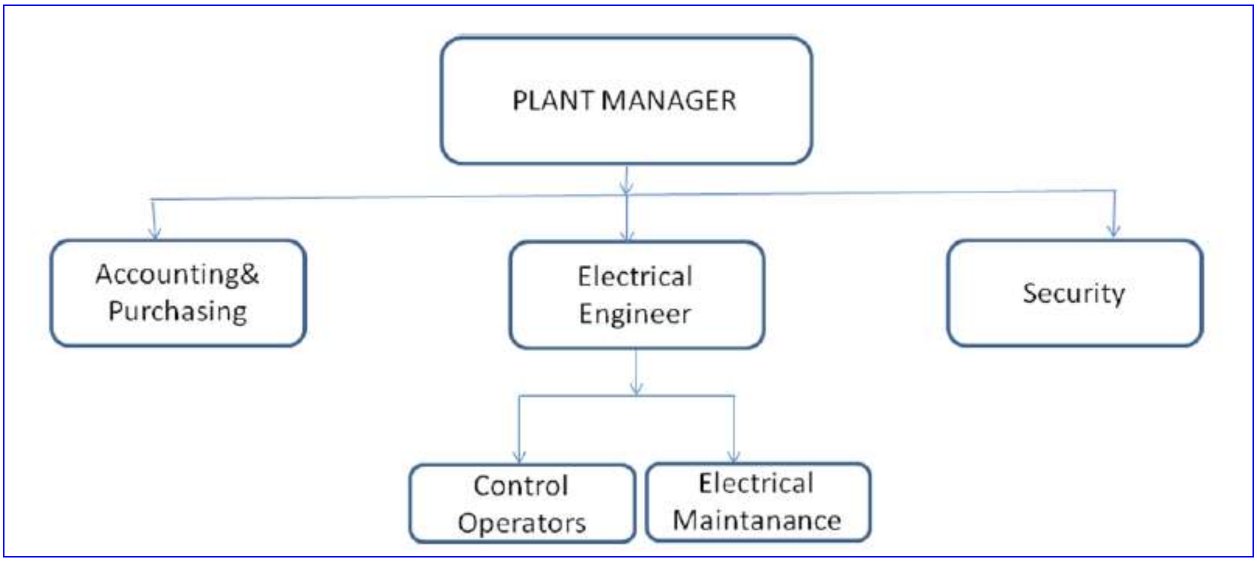

Figure 8. Operational structure of the Reşadiye HEPP

VER Team Members is expected to include;

Plant Manager: Overall responsibility of compliance with VER monitoring plan;
Accounting Manager: Responsible for keeping data about power sales, invoicing and purchasing;
Control Operators & Electrical Maintanance: Staff will responsible for day to day operation and maintenance of the plant and equipments. All staff will be trained and have certificated 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[69] which will be used for cross checking of generation data. In addition to the two metering devices, generation of the Reşadiye 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. All data will be kept for at least two years after the crediting period for QA/QC purposes.

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.

In addition to emission reductions, sustainable development indicators given in passport will be monitored by the project developer also as given in GS Passport.

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 Calculated By:
Mehmet Kemal Demirkol
Baseline completed on 24/10/2008
Global Tan Energy Limited (GTE- http://www.gte.uk.com)
Telephone: +90 312 472 35 00
Fax: +90 312 472 33 66
E-mail: kemal@gte.uk.com

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

The starting date of project activity has been determined as 19/10/2006, date of loan agreement.

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

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

The expected economic lifetime of the project is more than 50 years; however, as per the generation license issued, project will be operated by project proponent for about 46 years after the construction and delivered to Government at the end of license period.

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 01/10/2010

C.2.1.2. Length of the first crediting period:

The project will use a renewable crediting period of 3x7 years

SECTION D. Environmental impacts

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

The pre-EIA assessment for Resadiye-II HEPP project has been prepared by *En-Cev Ltd. Şti.* as defined by the regulations. The Report was approved by the Ministry of Environment and Forestry (MoEF) on 19th October 2006. A revised EIA has also been conducted by the same company on October 2008 considering the new project design of the project activity.

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. The EIA approval letter has been included as Annex 5 of this document.

There exists several dam type plants in the upstream of the plant in the Kelkit Basin which have higher design flow rate, storage capacity and determine the flow characteristics of the plant. Therefore, marginal impact of the project will be smaller compared to these plants. By dividing the project into three parts instead of the single plant with higher capacity, project owner has aimed optimizing the energy potential of the river and reducing risks due to the earthquake in the region. Dividing the project into three parts have caused three smaller plants which have smaller capacities and thus less cumulative impact. Environmental impact assessment of these projects have been assessed considering initial and revised project designs.

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.

Project will be implemented and operated in compliance with necessary regulations. In order to minimize impact on river habitat and biodiversity, minimum flow determined by State Hydraulic Works Authority (DSI) will be released continuously from the river bed. Initial figure determined by the DSI may be increased in the future if necessary as per the agreements between investor and DSI. Also, a fish passage will be built to enable upward migration in the plant. Project will also be implemented to enable sediment transport along the river bed and prevent accumulation in the weir area.

Project site is mainly irregular forest area and located in earthquake zone. Therefore, in order to prevent landslide during construction and operation phases, clearance and leveling will be carried out around the channel route. During the leveling, instead of impacted trees, new will be built by Directorate of Forestry.

SECTION E. Stakeholders' comments

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

Preliminary Stakeholder meeting of the project was organized and held on December 24th, 2008 in Resadiye District of Tokat Province. Invitation list for the local stakeholder meeting has been based on Gold Standard Toolkit. 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. Local representatives of three GS supporting NGOs were invited through postal system and or courier or hand delivery letters.

Figure 7. Newspaper announcement dated on 18th of December 2008 for preliminary SC meeting of Resadiye-II HEPP Project

The meeting was held in the meeting room of Resadiye public education center. Agenda of the meeting was scheduled as requested by GS toolkit. Meeting schedule was published in local newspaper/s as given above. Meeting was recorded on video also.

Figure 8. Resadiye-II HEPP Preliminary Project Stakeholders Meeting

Figure 9. Resadiye-II HEPP Stakeholder Feedback Round Meeting

E.2. Summary of the comments received:

In general stakeholders' comments were positive about the Project. Some negative scores given by stakeholders about other pollutants and biodiversity have been assessed in LSC report and will be further discussed during feedback round which will be organized after receiving Gold Standard's comments about local stakeholder consultation.

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

- Building overpasses and fences on conveyance channel ,
- Job opportunities for local people and,
- Contribution requests to improve the infrastructure of local settlements around the project site.

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.

Building overpasses&fences on conveyance channel:

Bridges and overpasses have been built in locations requested by local representatives upon their confirmation. Also, new roads that will enable easier and more comfortable access to their houses have been built as contribution to locals. The part of channel near the settlement area have been covered with fences and walls.

Job opportunities for local people:

The investor company already gives priority in employing local people since they are more familiar with the region and there is no need for relocation. However some roles require specific talents and education and we are facing difficulties finding people with the required skill set.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Resadiye Hamzali Elektrik Üretim Sanayi ve Ticaret Anonim Sirketi
Street/P.O.Box:	İran Caddesi
Building:	Karum Is Merkezi D Blok 6.Kat No:448
City:	Ankara
Postfix/ZIP:	06700
Country:	Turkey
Telephone:	+90 312 468 00 57
Fax:	+90 312 468 00 67
E-Mail:	aalptekin@energopro.com
URL:	www.energopro.com
Represented by:	
Title:	Manager
Salutation:	Mrs.
Last Name:	Alptekin
Middle name:	-
First name:	Aydan
Department:	Management
Direct fax:	+90 312 468 00 57
Direct tel:	+90 312 468 00 67
Personal E-Mail:	aalptekin@energopro.com

Organization:	Global Tan Energy Limited
Street/P.O.Box:	Ehlibeyt Mahallesi 1259. Sokak
Building:	No. 7/2
City:	Ankara
Country:	Turkey
Telephone:	(0090) 312 472 35 00
Fax:	(0090) 232 472 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 15. 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 16. Amount of fuels used for electricity generation[70,71,]

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**

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

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

Table 17. Net Electricity supply to the grid by thermal plants and imports (GWh)[72]

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 18. 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 19. Most recent capacity additions corresponding to 20%.[73,74,75,76]

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[72] http://www.teias.gov.tr/ist2007/49.xls

[73] http://www.teias.gov.tr/istat2004/7.xls

[74] http://www.teias.gov.tr/istatistik2005/7.xls

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

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

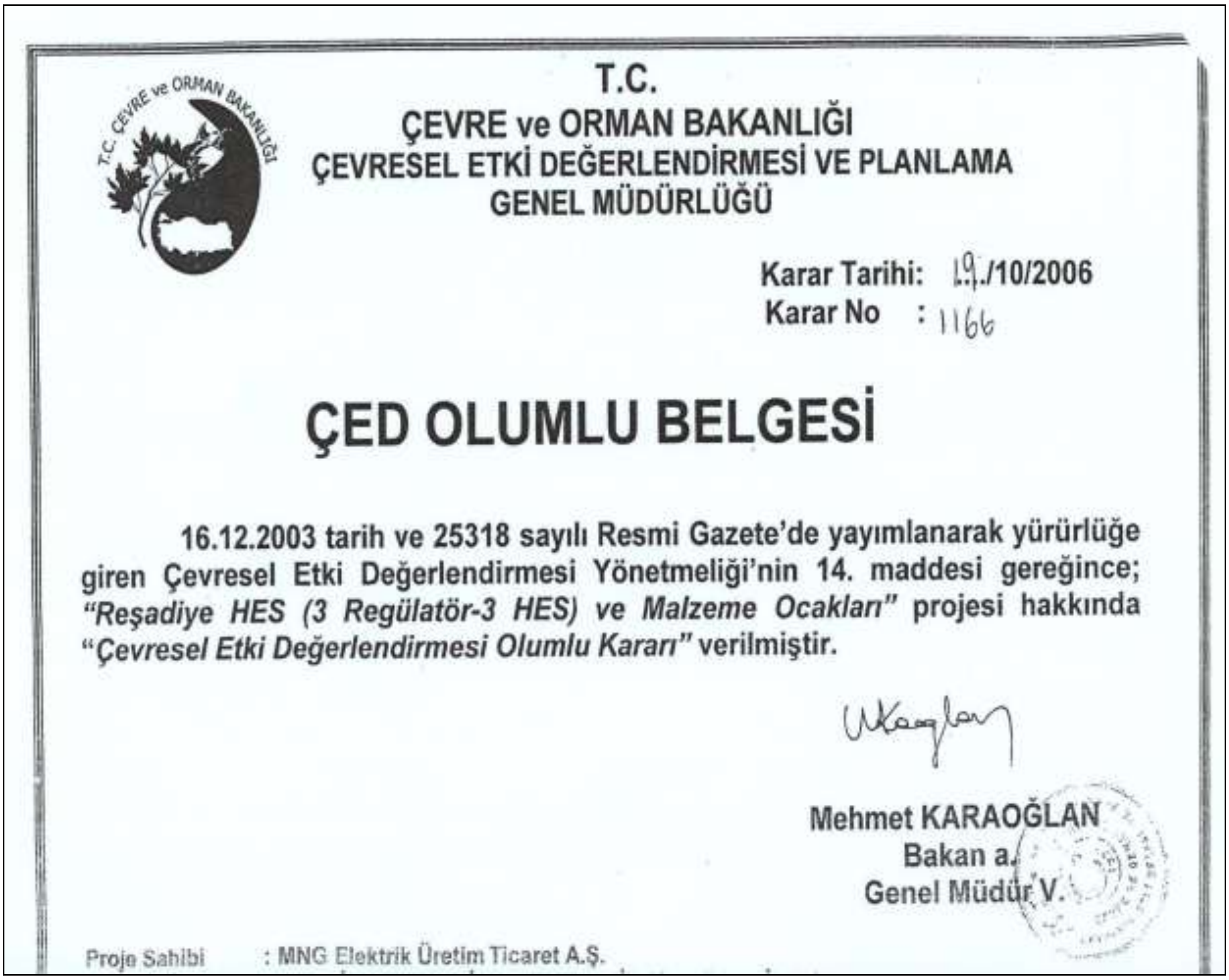
Annex 4

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 ETKİ DEĞERLENDİRMESİ VE PLANLAMA
GENEL MÜDÜRLÜĞÜ

Karar Tarihi: 19./10/2006
Karar No : 1166

ÇED OLUMLU BELGESİ

16.12.2003 tarih ve 25318 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği'nin 14. maddesi gereğince; *"Reşadiye HES (3 Regülatör-3 HES) ve Malzeme Ocakları"* projesi hakkında "*Çevresel Etki Değerlendirmesi Olumlu Kararı"* verilmiştir.

Mehmet KARAOĞLAN
Bakan a.
Genel Müdür V.

Proje Sahibi : MNG Elektrik Üretim Ticaret A.Ş.

Figure 10. EIA Approval Letter provided by Ministry of Environment and Forestry

T. C.
TOKAT VALİLİĞİ
İL ÇEVRE VE ORMAN MÜDÜRLÜĞÜ

Karar Tarihi : [illegible]/11/2008
Karar No : 2008/9

ÇEVRESEL ETKİ DEĞERLENDİRME BELGESİ

17 Temmuz 2008 tarih ve 26939 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği'nin Ek-II Listesinde yer alan "Reşadiye HES ve Malzeme Ocakları Projesi HES (2/3) ve HES (3/3) Kapasite Artırımı" projesi ile ilgili olarak inceleme-değerlendirme yapılmış ve Proje Tanıtım Dosyasında çevresel etkilere karşı alınması öngörülen önlemler yeterli görülmüştür. Ayrıca ÇED Raporu hazırlanmasına gerek bulunmadığı tespit edilmiş olup, söz konusu projeye ÇED Yönetmeliğinin 17. Maddesi gereğince Valiliğimizce "Çevresel Etki Değerlendirmesi Gerekli Değildir Kararı" verilmiştir.

Bayram GALE
Vali a.
Vali Yardımcısı

Proje Sahibi : Turkon-MNG Elektrik Üretimi ve Tic. A.Ş.
Faaliyetin Yeri : Tokat İli, Reşadiye İlçesi

Figure 11. EIA Approval Letter for Revision of Resadiye HEPP Project.

Annex 8

POWER PLANTS CONSIDERED FOR COMMON PRACTICE ANALYSIS

Company / Name of Project	**Installed Capacity (MW)**	**Generation Capacity (GWh)**	**Status**	**Link**
BEREKET (DENİZLİ)	3.7	12	Built As Autoproducer	http://www.teias.gov.tr/istatistikler/12-13.xls
BEREKET (DALAMAN)	37.5	179	Built As Autoproducer	http://www.teias.gov.tr/istatistikler/12-13.xls
BEREKET (FESLEK)	9.5	41	Built As Autoproducer	http://www.teias.gov.tr/istat2004/7.xls
BEREKET (GÖKYAR)	11.6	43	Built As Autoproducer	http://www.dsi.gov.tr/skatablo/Tablo1.htm
BEREKET (MENTAŞ)	39.9	163	Built As Autoproducer	http://www.epdk.org.tr/lisans/elektrik/lisansdatabase/sonaerdirilen.asp
EKİN ENERJİ (BAŞARAN HES)	0.6	5	No information is available (Initially Designed by DSI)	http://www.dsi.gov.tr/skatablo/Tablo1.htm
ERE - BİRKAPILI	48.5	171	Initially Built as autoproducer	http://www.ere.com.tr/enerji_birkapili.html
ERE - AKSU - ŞAHMALLAR	14.0	45	Built As Autoproducer	http://www.ere.com.tr/enerji_gazipasa.html
ERE - SUGÖZÜ - KIZILDÜZ	15.4	55	Built As Autoproducer	http://www.ere.com.tr/enerji_gazipasa.html
EŞEN-II (GÖLTAŞ)	43.4	170	Built As Autoproducer	http://www.teias.gov.tr/istat2004/13-14.xls
ELTA (DODURGA)	4.1	12	Built As Autoproducer	http://www.teias.gov.tr/istat2004/7.xls
İÇTAŞ YUKARI MERCAN	14.2	44	Built As Autoproducer	http://www.epdk.org.tr/lisans/elektrik/lisansdatabase/sonaerdirilen.asp
MOLU ENERJİ (BAHÇELİK HES)	4.2	30	Built As Autoproducer	http://www.teias.gov.tr/istat2004/13-14.xls
PAMUK (Toroslar)	23.3	112	Build-Operate-Transfer	http://www.limak.com.tr/index.php?lang=tr&pid=420
SU ENERJİ (ÇAYGÖREN HES)	4.6	19	Build-Operate-Transfer	http://www.dsi.gov.tr/bolge/dsi25/topraksu.htm
TEKTUĞ-KARGILIK	23.9	83	Built as VER Project	www.markitenvironmental.com
TEKTUĞ-KALEALTI HES	15.0	52	Built AS VER Project	www.markitenvironmental.com
YAPISAN HACILAR	13.3	90	Built As Autoproducer	http://www.dsi.gov.tr/skatablo/Tablo1.htm
TOTAL HYDRAULIC	**326.7**	**1,273**		

Table 21. List of HEPPs Operational at the time of investment decision