ADIGUZEL II HYDROELECTRIC POWER PLANT

Document Prepared By GAIA CARBON FINANCE

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Table of Contents

1 PROJECT DETAILS

1.1 Summary Description of the Project

The first version of the PD for Adiguzel HEPP were completed on 16/12/2013.

PEKER ENERJI A.Ş. plans to install ADIGUZEL II HYDRO ELECTRIC POWER PLANT (hereafter referred to as ADIGUZEL II HEPP) of which the plant is located in the Guney county of the city of Denizli, in Turkey. The objective of the project, is to generate zero emission electricity to be fed into the interconnected national grid. *Due to its significant contribution to climate change mitigation and sustainable development in the region, this project is expected to fulfil the requirements of VCS rigorously.*

ADIGUZEL II HEPP, which is comprised of the construction of a green field 30.09MWe[1] run-of-river hydroelectric power plant located in the Buyuk Menderes river basin, in Turkey's Aegean Sea Region[2]. The plant has been projected to comprise cofferdam of upstream, penstock, energy transmission line, a headpond, a surge tank and a power station, having 2 Francis turbines of vertical axis with 15.05 MWe power each.

It is stated in the revised feasibility report dated March 2011 (the first feasibility report dated on July 2005) that the electricity production of the proposed project is going to be 71,180 MWh/year, with a plant load factor computed as 27 %[2] .Since the project activity is a clean energy project, it reduces greenhouse gases (GHGs) emissions that would have otherwise occurred in the absence of the project activity by avoiding electricity generation from fossil fuel sources. In the baseline scenario, the electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants. Since Turkey's grid mainly consists of thermal power plants, this would have resulted in GHG emissions. However, in the project scenario, the project will generate electricity from hydro power and will result in emission reductions in parallel with its electricity generation figures. The average annual emission reductions of the proposed project for the crediting period are estimated to be 44,741 tonnes of CO_2e (tCO_2e).

Since the Project activity is intended to generate clean electrical energy through sustainable means in a system already overwhelmed by thermal power production plants, it may well be asserted that the project activity shall contribute to the climate change mitigation efforts by displacing an equivalent amount of carbon-intensive grid electricity and reducing the dependency on fossil fuels.

1.2 Sectoral Scope and Project Type

This is a voluntary project, but it follows the CDM rules.

According to Annex A of the Kyoto Protocol, the Project fits in:

Sectoral Scope Number: 1

Sectoral Scope: Energy Industries - Renewable Energy

[1] In the equipment agreement dated December2011, the installed capacity is stated both as 30,146 MWe
[2] Adıgüzel Feasibility Report dated March 2011, Section 1.2
[2] The plant load factor is not stated in the feasibility report but is calculated as 71,180MWh / 30.096 MWe / 8,760 h = 26.9% = 27%

The project is not a grouped project.

1.3 Project Proponent

The project developer:

In accordance with the Electricity Market Law No. 4628, PEKER Enerji A.Ş. was founded to construct, commission, operate a hydroelectric power plant in order to generate and market electricity power for the licence period.

Its mission is to be one of the energy companies that effectively utilize domestic and renewable resources by transforming advanced technology and knowledge into efficiency and making maximum contribution to national economy without neglecting international quality standards.

The following table shows the project proponent's contact information:

Organization name	PEKER ENERJI A.S
Street/P.O.Box	UGUR MUMCU CD. UGUR MUMCU'NUN SOK.
Building	6
City	GOP/ANKARA
Postfix/ZIP	06700
Country	TURKEY
Contact person	EREN
Last Name	KENT
First Name	EREN
Title	PROJECT COORDINATOR
Telephone	+90 312 436 10 36
Fax	+90 312 446 96 80
URL	http://www.pekerenerji.com.tr/
Personal Email	ekent@peker.com

As stated before the contact person is Mr. Eren Kent. Their responsibilities regarding the carbon credits process are to analyze the related documents, the coordination between internal departments and to setup meetings with companies.

The following table shows the Carbon Asset Development Consultants' contact information

Organization name	GAIA CARBON FINANCE
Street/P.O.Box	HALASKARGAZI CAD. ZAFER SOK.
Building	MANUEL APT. 11/4
City	ISTANBUL
Postfix/ZIP	34371
Country	TURKEY
Contact person	FULYA EKINCI
Last Name	EKINCI
First Name	FULYA
Title	CARBON ASSET DEVELOPER
Telephone	+90 212 224 50-51
Fax	+90 212 224 0466
URL	http://www.gaiacf.com/en/
Personal Email	fekinci@gaiacf.com

Responsibilities of GAIA Carbon Finance regarding the carbon credits process are the preparation of the PD and assisting Peker Enerji A.Ş. during the validation process.

1.4 Other Entities Involved in the Project

There are no other entities involved in the project

1.5 Project Start Date

The construction was started on 15 April 2013 and the estimated project start date is 31 December 2014. (Date on which the project is expected to commence electricity production).

1.6 Project Crediting Period

The crediting period of the project begins on 31 December 2014 which is the commissioning date of the plant. It is estimated that the project will reduce 44,741 tCO2e annually, generating an expected total of 447,405 tCO2e for the duration of the initial 10-year crediting period. VCS project crediting period will be renewed once which will make the total crediting period 20 years. The end date of the first crediting period is 30 December 2024.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Projects are categorized by size according to their estimated average annual GHG emission reductions or removals, as follows:

1) Projects: Less than or equal to 300,000 tCO2e per year; and

2) Large projects: Greater than 300,000 tCO2e per year.

Since the estimated annual emission reductions resulting from the project is less than 1,000,000 tCO2e, the category of the project is defined as “Project”:

Project Scale	
Project	**X**
Large project	

Year	**Estimated GHG emission reductions or removals (tCO_2e)**
Year 2014	3,922
Year 2015	44,741
Year 2016	44,741
Year 2017	44,741
Year 2018	44,741
Year 2019	44,741
Year 2020	44,741
Year 2021	44,741
Year 2022	44,741
Year 2023	44,741
Year 2024	40,818
Total estimated ERs	447,405
Total number of crediting years	10
Average annual ERs	44,741

1.8 Description of the Project Activity

The proposed project is claimed to be an emission free project since it will generate electricity from hydro power and will result in emission reductions in parallel with its electricity generation figures. Adiguzel II HEPP will reduce greenhouse gas emissions that would otherwise occur by avoiding electricity generation from fossil fuel sources both in the operating margin and build margin of the national grid. The average annual emission reductions of the proposed Project are estimated to be 44,741 tonnes of CO_2e (tCO_2e). The lifetime of the project has been defined as 49 years in parallel with the generation licence period of the project.

VCS crediting period start date: 31/12/2014

- VCS project crediting period: 10 years, renewable once.
- Expected operational lifetime of the project activity: 49 years
- The Turbine Lifetime: 15 years[3]

The following table shows a full detail of the project's technical specifications:

Power Plant Building		
Length	M	28.70
Width	M	15.00
Turbines		
Type		Vertical Francis Turbine
Number of Units		2
Unit Rated Power	MWe	15.048[4]
Total Installed Capacity	MWe	30.096
Project rated discharge	M^3/s	66,00
Transformer		
Type		Outdoor Type, oily, three phased
Number of Units		2
Power of a Unit	kVA	16,750
Voltage	kV	10,5 / 34,5 kV
Efficiency	%	99
Penstock		
Inner Diameter	m	3,30
Steel Thickness	mm	12,00
Length	m	270
Generator		
Type		Vertical axis, three phased synchron
Number of Units		2
Max. Voltage Output	kW	10,5
Power Factor		0,90
Efficiency	%	98

Table 2: ADIGUZEL HEPP's Technical properties

By means of the Adiguzel Regulator which is located in the village of Guney in the central county of Denizli on the Buyuk Menderes River, clean energy production has been aimed by utilizing water flow from the thalweg elevation of 320.50 meters to 267.00 meters of tailwater elevation where the power house is planned to be constructed. Maximum water level is 318.00 m and tailwater level is 267.00 m. Water will be transported via penstock which has 270 m in length and 3.30m in diameter. The length of the energy transmission line is about 5 km and the transmission line is connected to Adiguzel Dam which is located ata the source side of the Project. The water

[3] http://www.gib.gov.tr/fileadmin/user_upload/Yararli_Bilgiler/amortisman_oranlari2011.html
[4] Source: Turbine Generator Unit Label has been provided to the DOE. Unit Rated Power = Label Rated capacity (16.72) * Power factor (0.90) = 15.048MWe

from the surge tank will be transferred to Adiguzel II HEPP, which has 2 vertical shaft Francis turbines with a total installed capacity of 30.09 MW and vertical axis, three phased synchron generator will be used. The turbine and generator manufacturer of the project is Zhejiang Orient Engineering Co. Ltd.

1.9 Project Location

The Project site is located in the Buyuk Menderes river basin in Turkey, in the Aegean Sea region, approximately 5 km to the south of the Guney county of Denizli. The project area is given the feasibility report which is the dam body is located 42º 23' 179''– 6º 89' 102'' coordinates, and Adiguzel II HEPP is located 42º 23' 179'' - 6º 89' 030'' coordinates. The following figures show the project's location. Please see the table below:

Figure 1: The project's location in Turkey

Figure 2 : The Project Lay-out

1.10 Conditions Prior to Project Initiation

As the project activity is a greenfield project, the conditions prior to the project initiation is the continuation of the current situation, i.e. the equivalent amount of energy would have been produced by other grid-connected units, which are mainly thermal power plants, undertaking business as usual maintenance. In addition, since the project is a Greenfield project, emissons that occur during construction and operation are negligible and non-existent respectively.The area of the project activity is forest land and the expropriation for the project is not made yet.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The applicable mandatory laws that will be applied for the project are:

i. *Electricity Market Law*[5]: It was enacted in March 3rd, 2001. This Law aims at to ensure the development of a financially sound and transparent electricity market operating in a competitive environment under the provisions of the civil law. It also underlines the needs to produce a sufficient, high quality, low cost and environmentally friendly electricity to consumers. The text also provides guidelines to structure the autonomous regulation and the supervision of the market.
ii. *The Renewable Energy Law*[6]: It compels electricity selling companies to purchase from "Green" energy providers at a defined ratio and price. This ratio is based on previous year sales over total energy sold in the country. The price is based on a yearly average wholesale purchase price predetermined by the Energy Market Regulatory Authority (EMRA).

[5] Law Number: 4628 Ratification Date: 20.02.2001 Enactment Date: 03.03.2001
[6] Law Number: 5346 Ratification Date: 10.05.2005 Enactment Date: 18.05.2005

iii. *Environmental Law*[7]: This law came into force in 1983, it considers the environment as a single domain, aiming not only to prevent and eliminate environmental pollution, but also to allow the management of land and natural resources in an integrated manner. According to its basic principles, and as also stated in the Constitution, citizens as well as the State bear responsibility for the environment protection. Furthermore, this law states that in all economic activities, every measure should be taken to minimize pollution.[8]

iv. Regulation on procedures and principles of signing the agreement of water resources utilization to generate electricity for the electricity market[9].

The project complies with all aforementioned laws as its activity aims at generating electricity by using a renewable resource, hydroelectric power, in a sufficient, low-cost and environmentally-friendly manner, using the latest technology available in the market. Due to its law impact to the environment the project was not required to conduct an EIA study by Ministry of Environment of Turkey. (See Annex 2 for the Positive EIA certificate).Please refer to ***Section 5*** for detailed information.

Furthermore in the project site, there are no National Parks, Nature Park, Nature Protection Zone, Wild Life Protection Zones, Special and Environment Protection Zones, Wet Land, Biogenetic Reserve Zone, Biosphere Reserves under protection in accordance with the legislation of Ministry of Environment and Forestry and Ministry of Culture and Tourism and no registered pasture lands.[10]

1.12 Ownership and Other Programs

1.12.1 Right of Use

The generation license is presented in **ANNEX 1** as proof of title.

The ownership of the emission reductions will belong to PEKER Enerji A.S.

1.12.2 Emissions Trading Programs and Other Binding Limits

Net GHG emission reductions or removals generated by the project will not be used for compliance with an emissions trading program or for meeting binding limits on GHG emissions.

1.12.3 Other Forms of Environmental Credit

The project has not created another form of Environmental Credit.

1.12.4 Participation under Other GHG Programs

The Project has not been registered or seeking registration under other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

The Project has not been rejected by other GHG programs.

[7] Law Number 2872 Published in Offical Gazette Ratification Date: 09.08.1983 Enactment Date: 11.08.1983
[8] "Turkey's Environment: a review and evaluation of Turkey's environment and its stakeholders", May 2002. (http://www.rec.org/REC/Programs/ExtensionToTurkey/TurkeysEnvironment.pdf)
[9] Official Gazette: #25150, on 26.6.2003
[10] The Adiguzel HEPP Feasibility Report dated March , 2011 ; Section 7

1.13 Additional Information Relevant to the Project

Eligibility Criteria

Adiguzel HEPP is not a grouped project.

Leakage Management

As suggested in ACM0002/Version 15.0.0, the leakage emissions are not calculated and assumed to be "0". Please refer to Section 3.3.

Commercially Sensitive Information

There is no information that needs to be excluded from the public version of the VCS PD which will be displayed on the VCS Project Database.

Further Information

The project is a renewable energy project for power generation that enables the substitution for fossil fuel based electricity. The contribution of the project activity towards sustainable development in Turkey is regarded as follows:

Adiguzel HEPP contributes to the region's sustainable development in particular and Turkey's sustainable development in the following manner: (a) social well-being, (b) economical well-being, (c) environmental well-being and (d) technological well-being.

Specifically, the Project contributes in the social and economic development in the project area significantly as the following:

1. Employment of the local people in the construction process has been provided.
2. Scholarships have been given to some local students.
3. Construction works of the local people have been helped

In addition, the project activity contributes in the environmental and technological development in the project area significantly as the following:

1. The scheme will not alter any environmental or biological attributes of the area.
2. The project activity will not result in degradation of any natural resources, health standards, etc. in the project area.
3. As the project is hydro based it will generate clean energy, real, measurable and long-term emissions reductions of greenhouse gases.
4. Project activity would utilize potential water resources available in the area for exploiting all possible resources for local development thus illustrating the effective utilization of renewable energy sources available in the area.
5. The project will utilise environmentally safe and sound technology in the hydroelectric power sector.

Furthermore, it is important to note that within the geographical boundaries of the project activity, there are no national parks, cultural sites, hunting areas or wild animal reproduction areas.[11]

[11] Adiguzel HEPP Feasibility Report dated March, 2011 ;Section 7.2.1.3. and 7.2.1.4

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

For the purpose of calculating the emission factor of the Turkish electricity grid," Tool to calculate emission factor for an electricity system", Version 04.0 is employed.[12] The baseline and monitoring plan for the project was established through the official methodology of ACM0002/Version 15.0.0, "Grid-connected electricity generation from renewable sources "[13] as approved by the CDM Executive Board. Also, to prove additionality and to calculate the grid emission factor, the official methodology: "Tool for the demonstration and assessment of additionality, Version 07.0.0"[14] is used. Conservative options and data were selected during the implementation of the methodology.

2.2 Applicability of Methodology

The methodology is applicable to grid-connected renewable power generation activities under certain conditions. The applicability conditions of the approved consolidated methodology and how the project activity complies with them are described below:

Applicability condition in the ACM0002/Version 15.0.0	**Compliance of the condition**
This methodology is applicable to grid-connected renewable power generation project activities that: (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s) (e) Involve a replacement of (an) existing plant(s)/unit(s).	The project activity is a greenfield grid connected run-of-river hydroelectric power plant and located across the Buyuk Menderes River basin. The project comprises cofferdam of upstream, penstock, energy transmission line, a headpond, a surge tank and a power station, having 2 Francis turbines of vertical axis with 15.05 MWe power each. (In the Electricity Generation License dated 18/04/2012, the total installed capacity is stated as 30,09 MWe)
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The project activity is the installation of a run-of-river hydro power plant.
In the case of capacity additions, rehabilitations, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 16 to calculate the parameter EGPJ,y): the	This condition is not applicable to the project activity as it involves the installation of a new hydroelectric power plant.

[12] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf
[13] http://cdm.unfccc.int/methodologies/DB/MPY3HVJIMTKE5P0UNTYE827D6Q7EHB
[14] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	
In case of hydro power plants, one of the following conditions must apply: (a)The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or (b) The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2 ; or (c) The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m2 (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m2 all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m2 (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project	The project activity involves a reservoir area of 875,264.111 m^2. The power density (PD) for this reservoir area is calculated as follows: PD = 30,096,000 W/875,264.111 m^2 PD = 34.385 W/m^2 PD > 4 W/m^2, therefore, according to the methodology, there will be no emissions from the reservoir.
This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy sources at	This condition is not applicable to the project activity as it does not involve switching from fossil fuel to renewable energy at the site of

the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site.	the project activity.
This methodology is not applicable to biomass fired power plants.	This condition is not applicable to the project activity as it does not involve the installation of a biomass fired power plant.
This methodology is not applicable to hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2.	Even though the project activity involves the installation of an HPP it involves a reservoir area where the power density of the power plant is more than 4 W/m^2.Therefore, this condition is not applicable.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	This condition is not applicable to the project activity as it does not involve a capacity addition, retrofit or replacement of existing grid-connected renewable power plant/unit(s).

Hence, the approved consolidated methodology ACM0002/Version 15.0.0 is applicable to the project activity.

The project activity also complies with the applicability conditions of the "*Tool to calculate the emission factor for an electricity system"* (Version 04.0) as it displaces electricity generated by power plants in the Turkish electricity system. Moreover, it complies with the applicability criteria of the *"Tool for the demonstration and assessment of additionality"* (Version 07.0.0), as this tool provides a general framework for demonstrating and assessing additionality and is applicable to a wide range of project types.

2.3 Project Boundary

Adiguzel HEPP entails the construction and operation of a 30.09 MWe hydroelectric power plant. The project consists of cofferdam, penstock, energy transmission line, a headpond, a surge tank and a power station, having 2 Francis turbines of vertical axis with 15.05 MWe power each[15].

The greenhouse gasses and emission sources are defined for the project activity and the baseline scenario. As per the methodology, "the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to". As a result, the project boundary for Adiguzel HEPP is as demonstrated in the figure below:

[15] The Electricity Generation License, dated 18/04/2012

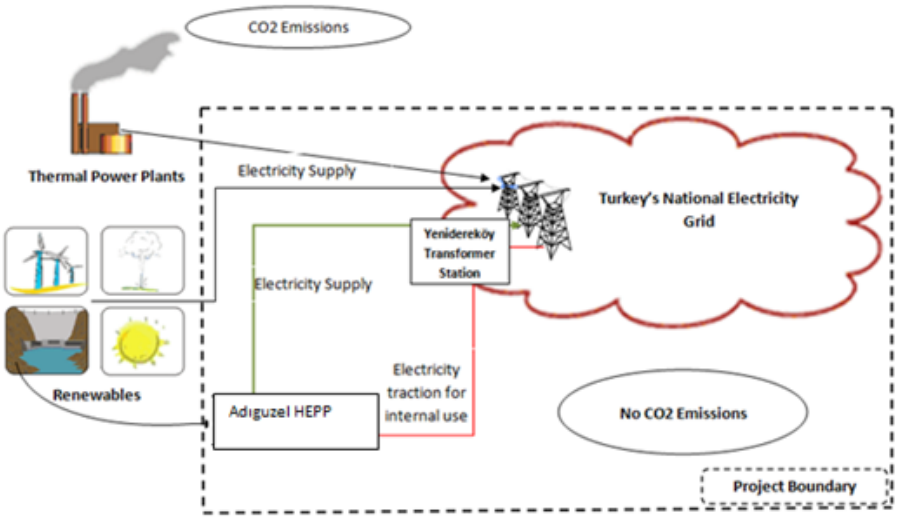


Figure 3: Physical delineation of the project boundary

The greenhouse gases and emission sources included in or excluded from the project boundary are listed in the table below:

Source		Gas	Included?	Justification/Explanation
Baseline	Generation mix of electricity grid in Turkey	CO_2	Yes	CO_2 emission from fossil fuel fired power plant that are displaced since project activity was taken into account.
		CH_4	No	Minor emission sources as suggested by ACM0002 Version 15.0.0
		N_2O	No	Minor emission sources as suggested by ACM0002 Version 15.0.0
Project	Emissions of CH_4 from reservoir	CO_2	No	As net electricity approach is adopted, emissons that occur during construction and operation are negligible and non-existent respectively.
		CH_4	Yes	Main emission source as suggested by ACM0002 Version 15.0.0. Emissions from the reservoir are negligible, since the power density is higher than 10 MW/m^2 .
		N_2O	No	Minor emission source as suggested by ACM0002 Version 15.0.0

Table 4: The justification of the project boundary

Indirect emissions can result from project construction, transportation of materials and other upstream activities. In the case of the proposed project activity, these emissions are thought to be

comparable or less than the life cycle emissions which would result from the eventual construction and operation of alternative capacity. The life cycle emissions of alternative power generation plants, in particular fossil fuel-fired power plants, are typically higher than those from hydroelectric power plants when including emissions due to mining, refining and transportation of fossil fuel. The project does not claim emissions reductions from these activities. Therefore no significant net leakage from the above activities was identified. This approach is stated to be conservative.

For the purpose of determining the electricity emission factor, the project electricity system is defined as the overall Turkish electricity network. There is an interconnected system for the electric distribution in Turkey[16]. Thus there is no independent regional electricity system or any significant transmission constraints. For electricity imports from neighbouring countries, the emission factor of 0 ton of CO_2 per MWh is applied.

No GHG sources in terms of sinks and reservoirs could be identified for this project.

2.4 Baseline Scenario

From the methodological perspective, according to Validation and Verification Manual EB65 and paragraph 122*: "*The PD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required*".* Since we use the approved methodology ACM0002 Version 15.0.0 , the baseline scenario is prescribed as:

"If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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

Thus the baseline scenario is the electricity production existing prior to the implementation of the project.

2.5 Additionality

The project's additionality has been demonstrated using the latest version of the "*Tool for the demonstration and assessment of additionality"*- Version 07.0.0.

The following steps from the additionality tool are completed below:

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

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

[16] TEİAŞ and Energy Efficiency and Renewable Energy, Turkey - National study, Pr Ahmet Koyun, Termodinamik Anabilim Dal, Yildiz Teknik Universitesi, March 2007, Page 71 (http://planbleu.org/sites/default/files/upload/files/TR_National_Study_Final.pdf)

Legally, the company is not restricted to using only hydropower as an investment alternative. In this geographical area, the company opted to use hydropower as the most sound alternative.

From the methodological perspective, according to Validation and Verification Manual EB65 and paragraph 122*: "*The PD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required*".* Since we use the approved methodology ACM0002 Version 15.0.0 , the baseline scenario is prescribed as:

"If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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

Thus the baseline scenario is the electricity production existing prior to the implementation of the project. There is no need to further analyze alternatives to the project activity to assess and demonstrate the additionality, since the methodology ACM0002 prescribes the baseline scenario for the proposed project.

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

The alternative, i.e. the prescribed baseline scenario, is realistic and feasible and complies with applicable laws and regulations.

The following applicable mandatory laws and regulations have been identified:

1. Electricity Market Law [17]
2. Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy[18]
3. Energy Efficiency Law[19]
4. Forest Law[20]
5. Environment Law[21]
6. Regulation on procedures and principles of signing the agreement of utilization of water resources for the purpose of electricity production in the electricity market[22]
7. Regulation on Environmental Impact Assessment[23]

All energy projects are in compliance with the mandatory laws and regulations listed above except 2nd and 6th one. "Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy" is only applicable for renewable energy projects. Also, "Regulation on procedures and principles of signing the agreement of utilization of water

[17] Law number 4628, enactment date 03/03/2001, http://www.epdk.gov.tr/english/regulations/electricity.htm
[18] Law number 5346, enactment date 18/05/2005, http://www.eie.gov.tr/duyurular/YEK/LawonRenewableEnergyReources.pdf
[19] Law number 5627, enactment date 02/05/2007, http://www.eie.gov.tr/english/announcements/EV_kanunu/EnVer_kanunu_tercume_revize2707.doc
[20] Law number 6831, enactment date 31/08/1956.
[21] Law number 2872. Published in Official Gazette No. 18132 on 11/08/"83.
[22] National Gazette number 25150, 06/06/2003
[23] National Gazette number 26939, 17/07/2008

resources for the purpose of electricity production in the electricity market" is only applicable for hydropower projects. The electricity Market Law structures the market in general. Therefore, it is applicable for all projects in the electricity market. On the other hand, Forest Law, Environment Law, energy efficiency Law and the Regulation on EIA are also applicable for all alternatives.

Outcome of Sub-Step b

The alternatives discussed above are in line with applicable legal and regulatory requirements.

STEP 2 – Investment analysis

The purpose of the investment analysis is to determine whether the proposed project activity is not:

a) The most economically or financially attractive; or

b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (VCS-VERs).

In the Investment Analysis all financial and technical figures were derived from the second feasibility study of the Project. The study was submitted to State Hydraulic Works for their approval and the investment decision for the Project was also based on this study.

Sub-step 2a - Determine appropriate analysis method

The *"Tool for the demonstration and assessment of additionality"* (Version 07.0.0) recommends three analysis methods, namely simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

The proposed Project generates financial and economic benefits through the sales of electricity other than Voluntary Emissions Reduction (VCS-VER) related income. Therefore the simple cost analysis (Option I) cannot be taken.

According to the EB62 Report, Annex 5- *''Guidelines on The Assessment of Investment Analysis (Version 05)''*[24] the purpose of the investment comparison analysis (Option II) is to determine whether the project is less financially attractive than at least one alternative in which the project participants could have invested. In cases where the alternative requires investment anyhow and baseline emissions are based on that alternative, the only means of determining that the project activity is less financially attractive than at least one alternative is to conduct an investment comparison analysis. The benchmark approach is therefore suited to circumstances where the baseline does not require investment or is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest.

Between the investment comparison analysis (Option II) and the benchmark analysis (Option III), the benchmark analysis (Option III) is preferred.

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

While applying the Benchmark Analysis, Option III, the Equity IRR is selected as the financial indicator for the demonstration of the additionality of the project as permitted in the additionality tool.

[24] https://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

According to the *"Tool for the demonstration and assessment of additionality"* (Version 07.0.0), in the cases of projects which could be developed by an entity other than the project participant, the relevant benchmark for a Project's equity IRR should be based on publicly available data sources which can be clearly validated by the DOE. The benchmark for a Project's equity IRR shall, therefore, be derived from Turkish Eurobonds rates, plus a risk premium calculated by using the average market risk correlation factors (beta) of the equity returns of the publicly traded energy companies in the Istanbul Stock Exchange and Turkey's risk premium as explained below.

The IRR inputs used are:

Input name	Input Value	Reference Document	Page Number	Date of Document
Capacity	30.05MWe	The Generation Licence	3	March,2011
Operational Lifetime	49 years	The Generation Licence	_	18 April, 2012
Annual energy production	71,170 MWh/year	The Generation Licence	1	March,2011
Electricity sales price	7.3 (ABD Doları cent/kWh)	Guaranteed purchase price by law number: 6094 Ratification Date: 29.12.2010 ("Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy") http://www.tbmm.gov.tr/kanunlar/k6094.html	2	29 December 2010
O&M expenses	367,430 US$	The Feasibility Report	8	March,2011
Renovation expenses	45,922 US$	The Feasibility Report	8	March,2011
Loss and Pilferage rate	2%	TEIAŞ invoices	_	_
Total investment (the breakdown is given below)	40,193,971 US$	The Feasability Report	8	March,2011
Body and spillway	21,934,156 US$	The Feasability Report	8	March,2011
Upstream Cofferdam	95,359 US$	The Feasability Report	8	March,2011

Deriviation Conduit	605,713 US$	The Feasability Report	8	March,2011
Penstock and valve room	2,454,260 US$	The Feasability Report	8	March,2011
Powerhouse and tailwater canal	4,995,564 US$	The Feasability Report	8	March,2011
Roads	1,541,749 US$	The Feasability Report	8	March,2011
Social Facilities	212,173 US$	The Feasability Report	8	March,2011
EMT + Transformers and Switchgear	7,958,247 US$	The Feasability Report	8	March,2011
Energy Transmission Line	396,750 US$	The Feasability Report	8	March,2011
Depreciation (as useful life)	Roads: 8 years Buildings: 40 years Transmission line: 30 years Electromechanical equipment: 15 years	State Revenue Admin: http://www.gib.gov.tr/fileadmin/user_upload/Yararli_Bilgiler/amortisman_oranlari2011.html	_	_
Average 6 month Libor rate	0,687	http://www.globalrates.com/interest-rates/libor/americandollar/2012.aspx	_	_
Interest on loan	LİBOR + %6,7	Loan agreement (L.A.)	_	09.07.2012
Other Loan Conditions	Tenor :12 years	Loan agreement (L.A.)	_	09.07.2012
Crediting period (carbon)	10 + (10) years	VCS Standard Version 3.2	Section 3-8.1	4 October 2012
Anticipated price	1-2	Assumption by the Consultant	_	_

of VCS-VERs	USD/tCO2			
Rf, Risk-free rate	7,36 %	http://www.isyatirim.com.tr/ WebMailer/files_att/2_2010 0802081328615_1.pdf	_	_
B, Beta. Used to measure level of risk.	0,945	The average of betas of the energy companies traded in ISE 100 from Reuters.	_	_
Risk premium	9,40%	http://pages.stern.nyu.edu/~adamodar/ New_Home_Page/datafile/ctryprem.html	_	_

Table 5: List of IRR inputs

The first assumption pertains to the cost of equity benchmark which is calculated as the Turkish risk premium plus risk free rate.

As the Turkish Eurobonds represent a risk-free rate, it must be increased by a suitable risk premium, which reflects the premium that investors demand for an investment with a comparable risk. The interest rate that we derive from the yield curve for a synthetic Turkish Eurobond with a term to maturity of 47 years at the decision making date is 7.36%. The actually trading Eurobond with the longest duration of 30 years was US900123BG46-30.05.2040 with an interest rate of 6.28%.

According to Mr. Aswath Damodaran, professor of Finance at the Stern School of Business at New York University[25], the suitable risk premium for Turkey can be estimated as 9.40% updated for Jan 2012.

The IRR benchmark value is then calculated using the interest rate derived from the Turkish Eurobonds rates, 7.36%, plus the risk premium, 9.40%. As explained here under:

$$Re = Rf + \beta \times \text{Risk premium}$$

$$Rf + \beta \times \text{Risk premium} = Re$$

$$7.36\% + 0.945 \times 9.40\% = 16.26\%$$

The technical assumptions along with construction and M&E costs are calculated according to the market values stated in the feasibility report dated March 2011 and other international standards by an independent advisor to the project owner. The feasibility study dated March 2011 was the base for the investment decision.

[25] Aswath Damodaran is a Professor of Finance at the Stern School of Business at New York University, where he teaches corporate finance and equity valuation. He also teaches on the TRIUM Global Executive MBA Program, an alliance of NYU Stern, the London School of Economics and HEC School of Management. Professor Damodaran is best known as author of several widely used academic and practitioner texts on Valuation, Corporate Finance, and Investment Management

The cash flow was prepared for 47 years, generation licence period minus investment lag.

Electricity Selling Price was assumed to be 7.3 USD Cents/kWh which was the selling price of electricity to the Turkish Transmission Line Company according to the ("*Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy*") "EMRA's board decision number 6094, dated 29.12.2010.

Operation and Maintenance expenses were calculated according to State Hydraulic Works criteria (O&M factors) based on their past experiences to be approximately 1% of the total construction and electromechanical costs.

Interest rate of 6.70% (all in cost) was assumed with a 12 year loan with a grace period of the minimum of '2.5 years after all the loan is taken' and '6 months after the projects start date'. In this case the minimum is the former; 2.5 years after the commencement of the loan.

Sub-step 2c - Calculation and comparison of financial indicators (only applicable to options II and III)

The parameters needed for calculation of key financial indicators are given in table 6.

Table 6 includes the results of the financial analysis for the Project, at the time that the decision to go ahead was made, both with and without VER financing. The IRR of the Project without VER financing was lower than the applicable benchmark rate of return. This therefore indicates that in comparison to alternative investments, the Project was financially unattractive in the absence of VER financing.

Based on the parameters above, the equity IRRs with and without the VCS-VERs sales revenue are calculated and shown in

	IRR
Without VCS-VERs revenues	12.04
With VCS-VERs revenues at USD 5/ton	12.71

Table 6: Impact of VCS-VER revenues on the Proposed Project's IRR

In accordance with benchmark analysis (Option III), if the financial indicators of the proposed project, such as the project IRR, are lower than the benchmark, the proposed project is not considered financially attractive.

Table 6 highlights the project IRR with and without carbon revenues. Without the additional income to the project developer resulting from VER sales, the Equity IRR is 12.04 %, which is lower than the financial benchmark. Thus, the proposed project is not financially attractive. However, taking VER revenues into consideration, the Equity IRR increases to 12.71 % (with 5 EUR/ton VER price).

While the IRR with VERs remains lower than the financial benchmark of 16.26 %, the Project Developer will also benefit from the following intangible benefits that VERs provide:

Sub-step 2d - Sensitivity Analysis

The sensitivity analysis shall show whether the conclusion regarding the financial attractiveness is robust under reasonable variations in the critical assumptions. The sensitivity in the investment amount was applied to the investment items which represent equal or above 20% of the total investment amount as suggested by "EB 62 Report Annex 5, ''Guidelines on the assessment of investment analysis''(Version 05)[26] . The result of this for the project four basic parameters have been selected as sensitive factors to check out the financial attractiveness

- The electricity production
- Electricity selling price
- Annual operational costs
- Investment costs

Table 7 below shows variation on energy production was applied in a bandwidth of -16% and 16%. The equity IRR without VER revenues of the project, even with an increase of 16% in the electricity production, cannot exceed 16.26% which is lower than the benchmark rate. To demonstrate it, the sensitivity analysis was performed within an interval of [-16 +16] for electricity production

	IRR Sensitivity with the electricity production				
Change in %	**-16,0%**	**-5,0%**	**0,0%**	**5,0%**	**16,0%**
Without VER	9,23%	11,13%	12,04%	12,98%	15,13%
@ 3US$/ton VER	9,55%	11,50%	12,44%	13,41%	15,63%
@ 4US$/ton VER	9,66%	11,62%	12,58%	13,56%	15,80%
@ 5US$/ton VER	9,77%	11,75%	12,71%	13,70%	15,97%

Table 7: The sensitivity analysis with respect to the electricity production

Due to the fact that the feed in guaranteed tariff prices are fixed in Turkey, the unit energy price is not considered to be an exogenous variable. However, sensitivity on the upward side was also applied to see the effect of price changes.

	IRR Sensitivity with electricity selling price				
Change in %	**-10,0%**	**-5,0%**	**0,0%**	**5,0%**	**10,0%**
Without VER	10,26%	11,13%	12,04%	12,98%	13,95%
@3 US$/ton VER	10,65%	11,52%	12,44%	13,39%	14,37%
@4 US$/ton VER	10,77%	11,65%	12,58%	13,53%	14,51%
@5 US$/ton VER	10,90%	11,78%	12,71%	13,67%	14,65%

Table 7: The sensitivity analysis with respect to the electricity selling price

Since the hydraulic turbines have already been specified and no change more than 10% in installed capacity is expected due to the production license and contract with Zhejiang Orient Engineering Co. Ltd. no change more than 10% in annual operational and maintenance costs is likely to happen.

	IRR Sensitivity with Annual Operational Costs				
Change in %	**-10,0%**	**-5,0%**	**0,0%**	**5,0%**	**10,0%**

[26] https://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

Without VER	12,19%	12,11%	12,04%	11,96%	11,89%
@3 US$/ton VER	12,59%	12,52%	12,44%	12,36%	12,29%
@4 US$/ton VER	12,73%	12,65%	12,58%	12,50%	12,42%
@5 US$/ton VER	12,86%	12,79%	12,71%	12,63%	12,56%

Table 7: The sensitivity analysis with respect to the annual operational costs

Applying variations on investment costs, the range was considered to be in a bandwidth of +10% and –10%. Since the electromechanical equipments solely form a major part of the investment costs and no change is expected in agreed purchasing price of the equipments, a change greater than 10% in overall investment cost is highly unlikely to occur.

	IRR Sensitivity with Investment Cost				
Change in %	**-10,0%**	**-5,0%**	**0,0%**	**5,0%**	**10,0%**
Without VER	13,06%	12,53%	12,04%	11,58%	11,15%
@3 US$/ton VER	13,50%	12,95%	12,44%	11,97%	11,52%
@4 US$/ton VER	13,65%	13,09%	12,58%	12,09%	11,65%
@5 US$/ton VER	13,79%	13,23%	12,71%	12,22%	11,77%

Table 7: The sensitivity analysis with respect to the investment costs

The above benchmark and accompanying sensitivity analyses reveal the fact that no alternative scenario, with or without VER revenues, can make the project pass the benchmark IRR expectation. The equity IRR without VER revenues of the project, even with an increase of 10% in the investment amount and electricity price/production (even if electricity production increases of 16%), cannot exceed 16.26% which is lower than the benchmark rate. On the other hand, in case of a 10% increase in the electricity production and price, the equity IRR with VER revenues approaches the benchmark rate, but not exceeds. Therefore, the project is not financially attractive without VER revenues. Consequently, the project has a strong additionality argument according to the results of investment analysis.

Sensitivity analysis has been carried out for the stated costs and assumptions. It shows that under none of those scenarios the IRR of the project exceeds the Benchmark.

Outcome of Step 2: Hence, the above figures have demonstrated that the project activity is not the most economically or financially attractive alternative[27].

The registration of the project as a VCS project will provide the following benefits that will help overcome the above mentioned barriers:

- Additional revenues from the sale of VERs which will provide financial visibility, contributing significantly to the project's financial sustainability.

- Enhanced corporate green image of the project developer through its contribution to a clean source of electricity and the diversification of electricity sources in Turkey, which broadens stakeholder confidence

The time table below demonstrates the workflow in order to achieve VER registration:

[27] All financial data and calculations have been provided to the DOE.

Project Timeline and Timeline of events and actions which have been taken to achieve VCS-VER registration events and action	Date	Evidence
Water Usage Agreement	30/09/2009	Water Usage Agreement
Revised Feasibility Report	March 2011	The Feasibility Report
Board Decision for Early Consideration Investment and Carbon Finance Support	11/07/2011	The Board Desicion
Electromechanical Equipment Contract	30/12/2011	Electromechanical Agreement
EIA-Not-Required Certificate	31/01/2012	EIA-Not-Required Certificate
Generation Licence	18/04/2012	The Generation Licence
Construction Contract	May 2012	Construction Agreement
Loan Agreement	09/07/2012	Loan Agreement
Revised Transmission System Contract	30/09/2013	Transmission System Agreement
Expected Project Start Date (Comissioning of Power Plant)	31/12/2014	Estimation of Project Proponant

Table 8: Project timeline and early consideration of carbon credits.

STEP 3 – Barrier Analysis

Not applicable.

STEP 4 – Common Practice Analysis

Sub-step 4a - Analyze other activities similar to the proposed project activity

Since the project is a renewable project, it applies the second measure (ii) of the 4 measures listed in the Definiton section in the Tool for the demonstration and assessment of additionality version 07.0.0 stated below:

(ii) Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on renewable energy);

As the project applies one of these measures, the tool at this point refers to the latest version of the "Guidelines on common practice" available on the UNFCCC website and therefore sub-step 4b of the additionality tool does not apply.

The following steps in the EB69 Annex 8- Guidelines on Common Practice (Version 02.0) are followed;

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

The installed capacity of the project is 30.09 MWe. Therefore, the lower limit of the applicable output range is 15.045 MW and the upper limit is 45.135 MW.

Step 2: Identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

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

The most up-to-date list of the plants operating in Turkey given by Annex-I in the TEIAS Capacity projection report for 2013 was considered[28] . The report lists the plants in operation as of the end of 2012.

There are 752 such plants (Please also refer to the Common practice excel sheet)

(b) The projects apply the same measure as the proposed project activity;
Renewable energy projects were chosen. There are 451 such projects

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

Hydro projects were chosen. There are 353 such projects.

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

All the plants chosen produce electricity.

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

The plants whose capacities are between 15.045 MW and 45.135 MW were chosen. There are 89 such projects.

All the plants chosen started operation before the project as they were already in operation in 2011.

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number Nall and Nall =57.

Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number Ndiff=57

The project identify Step 3, started operating before 2010 whereas the project investment decision date is after 2010.Therefore, the investment environment of the project is different from that of those projects. One particular factor for the investment environment is the guaranteed electricity price by the state, the price which was 6.5 dollar cents/kwh before December 2010, and 7.3 dollar cents/kwh after December 2010. As the difference in the investment environment can be interpreted as a technology difference in EB69 Annex 8- Guidelines on Common Practice (Version 02.0)[29] Step 4 ''Investment climate on the date of the investment decision, inter alia'' part, Nall=Ndiff =57.

Step 5: calculate factor F=1-Ndiff/Nall representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used

[28] http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2013.pdf
[29] http://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid44.pdf

in the proposed project activity that deliver the same output or capacity as the proposed project activity.
Calculating F with the formula is meaningless as Nall=57, and thus Nsimilar is zero,

The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and Nall-Ndiff is greater than 3. Therefore the project is not common practice as Nsimilar is zero.

2.6 Methodology Deviations

There are no methodology deviations.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

The method to describe and calculate the baseline is clearly specified by the Baseline Methodology. CDM Executive Board has already provided a consolidated tool for appraising and demonstrating the additionality feature of the projects.

Since the project is an installation of a new grid-connected renewable power plant, the baseline scenario is formulated in ACM 0002/ Version 15.0.0 : ".Grid-connected electricity generation from renewable sources ".

The project is not a modification/retrofit of an existing grid-connected renewable power plant/unit. Therefore the other alternative baseline scenario mentioned in ACM 0002/ Version 15.0.0 is not chosen.

According to the "Baseline Methodology Procedure", the steps in "Tool to calculate the emission factor for an electricity system" should be followed.

According to the *"Tool to calculate the emission factor for an electricity system / Version 04.0"*, the following six steps are applied to calculate the baseline emissions:

STEP 1- Identify the relevant electric power system

The project electricity system is defined as "the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints" in the "Tool to calculate the emission factor for an electricity system". Similarly, the Tool defines a connected electricity system as "a connected electricity system, e.g. national or international, is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint".

In the project's case "the project electricity system" and "the connected system" are the same. As also confirmed by TEIAS (Turkish Electricity Transmission Company Inc.), the Turkish transmission system is interconnected. There is no independent regional grid system either in Denizli nor in the Turkey's Aegean Sea Region.

In addition to this, since there is no DNA in the host country to delineate the project electricity system, the suggested criteria in "Tool to calculate the emission factor for an electricity system" was used. According to this, 1-The capacity usage figure for the transmission line should be checked. 2-Spot market prices of different systems in the country should be compared.

Since there is no capacity usage figure for transmission line published, the criteria "The transmission line is operated at 90% or more of its rated capacity during 90% percent or more of the hours of the year." could not be proved.

On the other hand, there is no spot electricity market available in the country as suggested in the second criteria "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." Therefore, this criterion is not applicable as well.

As for the grid definition, the "Tool to calculate the emission factor for an electricity system" says "if these criteria do not result in a clear grid boundary, use a regional grid definition in the case of large countries with layered dispatch systems (e.g. provincial / regional / national)." However, there are no layered dispatch systems in Turkey. As a result the national grid was used as the project electricity system. Hence, the estimation of OM (Operating Margin) and BM (Built Margin) are based on the definition of the Turkish electricity network as one single interconnected system.

The interconnected electricity transmission grid of Turkey is as shown below:

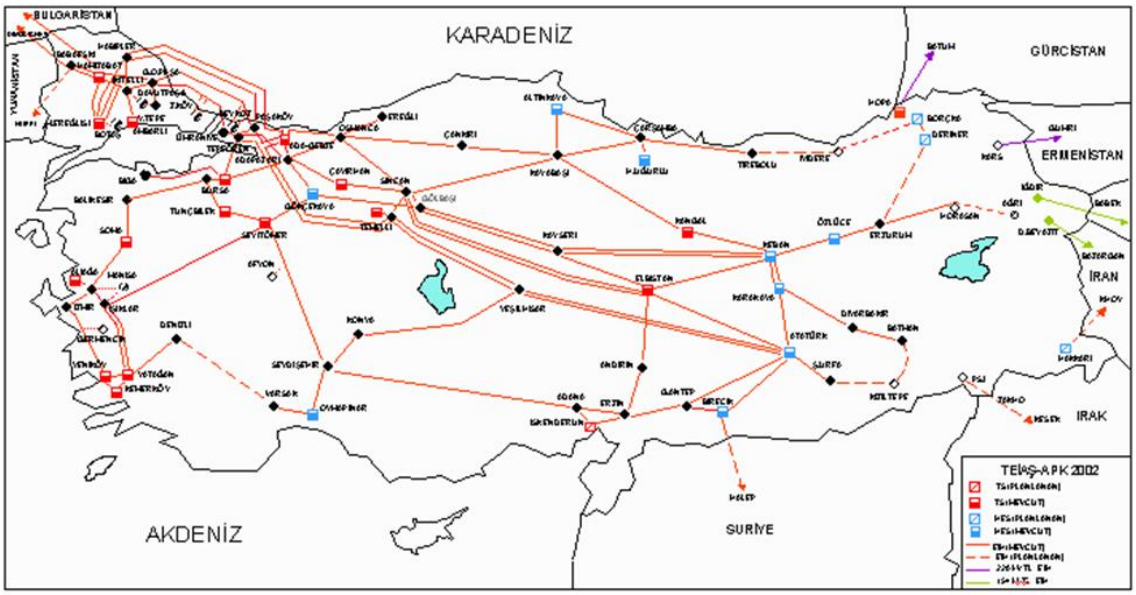


Figure 4: Turkish electricity grid

STEP 2: Choose whether to include 0ff-grid power plants in the project electricity system

According to "Tool to calculate the emission factor for an electricity system, Version 04.0", the OM and BM values can be calculated based on the following two options:

Option I: Only grid power plants are included in the calculation

Option II: Both grid power plants and off-grid power plants are included in the calculation.

Option I is selected in the calculation of Built Margin and Operating Margin for the proposed project activity. The reason why the tool suggests the Option II is, "in some countries off-grid power generation is significant and can partially be dispatched by CDM project activities, e.g. if off-grid power plants are operated due to an unreliable and unstable electricity grid."

As Turkey's grid is more appropriate for calculating the OM and BM values according to Option I, this option is selected.

STEP 3- Select an operating margin (OM) method

According to "Tool to calculate the emission factor for an electricity system", four alternative methods to calculate OM can be chosen. In choosing the right method for the calculation of OM, "Simple adjusted OM", "Dispatch data analysis OM" and "Average OM" methods were eliminated since all these methods require power plant specific information of power plants which are connected to the grid. However, no power plant specific information is available. Similarly, option A of "Simple OM" methods was also eliminated as there is no publicly available power plant specific data.

All in all, option B of "Simple OM" method was adopted as "the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system" is the only available data in the host country.

STEP 4- Calculate the operating margin emission factor according to the selected method

For calculating the OM factor according to the selected method, Option B has been selected. Simple OM option B method is eligible when low cost and/or must run resources constitute, as an average of the five most recent years, less than 50 percent of the total generation for the grid. Nevertheless, the only relevant low operating cost and must run resource in Turkey is hydropower because the share of all other renewable resources is close to nil and therefore can be assumed negligible. The share of all non-hydro renewable resources in the entire electricity generation is less than %3 for the years between 2008 and 2012. There is no example of coal being used as must-run and nuclear energy is not practiced in Turkey.

As it can be seen in the electricity generation statistics of TEIAS and as depicted in Table 5 the share of low-cost/must run resources (including hydroelectric, wind and geothermal) were never higher than 50% not only between 2008 and 2012, but also for last two decades (since 1989).

	2008	**2009**	**2010**	**2011**	**2012**
Turkey's Gross Electricity Production (GWh)[30]	198,418	194,813	211,208	229,395	239,497
Electricity Production from Hydro (GWh)	33,269	35,958	51,795	52,338	57,865
Electricity Production from Hydro&Wind&Geothermal (GWh)	34,279	37,890	55,380	57,757	64,625

Table 13: Share of hydroelectric, wind and geothermal in Turkey, 2008 – 2012

[30] http://www.youtube.com/watch?v=JYSF4idTUO8&index=20&list=RDcY-eMi4bII4

The Simple Operating Margin Emission Factor ($EF_{OM, y}$) is computed as the generation-weighted average emissions per electricity unit (tCO_2 /MWh) of the entire bundle of generating sources that supply into the system, except for low operating cost and must run resources including hydro, geothermal, wind, low-cost biomass, nuclear and solar generation as determined by the Baseline Methodology.

According to "Tool to calculate the emission factor for an electricity system", the formula given below is applied for computing the $EF_{grid, OMsimple, y}$.

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y}$$

Where:

$EFgrid_{,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

$FC_{i,y}$ = Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)

$EFCO_{2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)

EG_y =Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)

i = All fossil fuel types combusted in power sources in the project electricity system in year y

Y = Either the three most recent years for which data is available at the time of submission of the CDM-PD 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.

In order to calculate the emission amounts from each fuel types, emission factors from IPCC website were used[31]. Three sets of emission factors were identified as minimum, medium and maximum values. To be conservative side, the minimum values are used in the OM calculations.

	kg CO2/GJ			**Default Carbon Oxidaton Factor**
	min.	**mid**	**max.**	
hard coal	92.8	96.1	100.0	1.0
Lignite	90.9	101.0	115.0	1.0
fuel oil	75.5	77.4	78.8	1.0
diesel oil	72.6	74.1	74.8	1.0
natural gas	54.3	56.1	58.3	1.0
Lpg	61.6	63.1	65.6	1.0
Naphta	69.3	73.3	76.3	1.0

[31] http://www.ipcc-nggip.iges.or.jp/EFDB/find_ef_s1.php

Table 14: Emission factors from IPCC[32]

For years 2010, 2011 and 2012, the CO_2 emissions are calculated with the IPCC minimum values:

	2010	2011	2012
CO2 Emission from Electricity Production (tons)	99,128,859	110,822,748	111,983,636

Table 15: CO_2 Emission of Turkey from Electricity Production

The calculation of net electricity production is demonstrated below. As the efficiency factor from gross to net electricity for thermal resources is not known, the overall relation between gross and net electricity production is assumed to be the same for thermal production. Table 17 shows the overall gross/net relation where the estimated net electricity production from thermal resources were calculated by using the same relation.

Electricity generation (EGy) [GWh]	2010	2011	2012
Gross Electricity Production	211,207.7	229,395.1	239,496.8
Net Electricity Production	203,046.1	217,557.7	227,707.3
Net/Gross	0.961	0.948	0.951
Gross Electricity Production from Thermal Sources	155,370.1	171,169.1	174,151.0
Net Electricity Production from Thermal Sources	149,366.2	162,336.3	165,578.3
Imports	1,143.8	4,555.8	5,826.7
Net Electricity Production from Thermal Sources + Imports	150,510.0	166,892.1	171,405.0

Table 12: Net Electricity Production of Turkey from Thermal Sources[33]

Obviously, using the same relation for both overall electricity production and thermal production is an approximation based on a rough assumption. Yet, such an assumption results in a very conservative estimation because the efficiency of thermal plants is much lower than other plants as the operational consumption in those plants is relatively higher and this would only lead to a lower net electricity generation with higher OM emission factor and higher emission reductions.

[32] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Chapter 1 Introduction, Table 1.4
[33] http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/uretim%20tuketim(23-47)/37(06-12).xls

With respect to the Baseline Methodology, electricity import amount was added to the domestic supply where the imports from connected grids located in other countries are weighted with an emission factor of zero tCO_2/MWh.

The last part of Step 1 calculates the ratio of emissions and generation. Based on the Simple Operating Margin Emission Factor formula $EF_{OM, y}$ values for 2010, 2011, 2012 are calculated as follows:

	2010	2011	2012
EF Grid,OM,simple,y (tCO2/MWh)	**0.659**	**0.664**	**0.653**

Table 13: OM Emission Factor for 2010 – 2012

According to the methodology, two data vintages are allowed for the calculation of the OM emission factor, ex-ante and ex-post:

- Ex-ante: A 3-year average, based on the most recent statistics available at the time of PD submission
- Ex-post: The year in which project generation occurs, if the OM emission factor is updated based on ex-post monitoring

In this case, the ex-ante approach is preferred because the data is available and it is a conservative approach due to the forecast that the weight of fossil fuel use in the generation of electricity in Turkey will increase.

Using the weighted average of the figures between 2010 and 2012, the OM emission factor was found to be 0.659 tCO_2 / MWh.

STEP 5- Calculate the build margin emission factor

According to the methodology, one of the following two options can be used while calculating the BM emission Factor in terms of vintage of data:

- Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

- Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 is chosen for the calculation of the Built Margin Emission Factor

Capacity additions from retrofits of power plants is not included in the calculation of the build margin emission factor.[34]

Calculation details of AEGset units is explanied in the Annex 3 based on the procedure suggested in the tool [35].

The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units m during the most recent year y for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$ [36]

Where:

EFgrid,BM,y = Build margin CO2 emission factor in year y (t CO2/MWh)

EGm,y = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$= CO2 emission factor of power unit m in year y (t CO2/MWh)
m = Power units included in the build margin

y = Most recent historical year for which electricity generation data is available

The CO2 emission factor of each power unit m ($EF_{EL,m,y}$) is determined according to equation 3 of Step 4 in the tool for the simple OM, using Options A1,A2or A3 using for y the most recent historical year for which electricity generation data is available, and using for m the power units included in the build margin.

As for the power units m only data on electricity generation and the fuel types used is available, the emission factor will be determined according to equation (3) of Option A 2 which provides for the following equation:

$$EF_{EL,m,y} = \frac{EF_{co2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$ = CO2 emission factor of power unit m in year y (t CO2/MWh)

$EF_{CO2,m,i,y}$ = Average CO2 emission factor of fuel type i used in power unit m in year y (t CO2/GJ)

[34] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf prg-70
[35] As the operation start dates of the plants that became operational in 2012 are not known, a check has been made by using the 5 units which have the largest production. It is seen that even the sum of the those plants is well below AEGset>=20%
[36] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf -prg 73

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit m in year y(ratio)

m = All power units serving the grid in year y except low-cost/must-run power units

y = The relevant year as per the data vintage chosen in Step 3

The computations display a weighted Build Margin emission factor of 0.598 tCO_2 / MWh.

STEP 6- Calculate the combined margin (CM) emissions factor

The baseline emission factor is the weighted average of the Operating Margin Emission Factor and Build Margin Emission Factor. The "*Tool to calculate the emission factor for an electricity system*" (version 04.0) guideline recommends equal weight values for hydropower projects as seen in the formula below:

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

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

The default values recommended by "Methodological tool (Version 04.0) to calculate the emission factor for an electricity system" for wOM and wBM for activities other than wind and solar power generation projects are 0.5 and 0.5, respectively.

$EF_{grid,\,CM,\,y}$ = 0.659 x 0.5 + 0.598 x 0.5

Therefore resulting $EF_{grid,CM,y}$ is 0.629 tCO_2/MWh

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all the project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

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

Where:

BE_y Baseline emissions in year y (tCO_2)

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the VCS project activity in year y(MWh/yr)

$EF_{grid,CM,y}$ Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the *"Tool to calculate the emission factor for an electricity system*"

Calculation of $EG_{PJ,y}$

Since the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity:

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

Where:

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the VCS project activity in year y (MWh/yr)

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

3.2 Project Emissions

The project emissions shall be accounted using the following equation:

$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$

Where:

PE_y Project emissions in year y (tCO_2e/yr)

$PE_{FF,y}$ Project emissions from fossil fuel consumption in year y (tCO_2/yr)

$PE_{GP,y}$ Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/yr)

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

Project emission from Fossil fuel consumption ($PE_{FF,y}$):

The project internal consumption is approximately 400 kVA, which can be considered negligible. This consumption will be satisfied from the electricity generation when the plant is in operation or from the grid when the plant is not in operation. Eventually, if there is no electricity available in the grid and the plant is not in operation the internal consumption will be satisfied from a diesel generator, but this would rarely occur. If diesel engines would be used, emissions associated would be calculated according to the *"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"* and considered as project emissions.

Therefore:

$PE_{FF,y} = 0$

Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$):

Since the project activity does not involve the operation of a geothermal power plant,
$PE_{GP,y} = 0$

Emission from water reservoirs:

Emission from hydro power plants has to be considered following the procedure described in most recent version of ACM0002 Version 15.0.0 . For hydro power project activities that result in new single or multiple reservoirs and hydro power project activities that result in the increase of single or multiple existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoirs, estimated as follows:

If the power density of the single or multiple reservoirs (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_{HP,y} = \frac{EF_{Res} \cdot TEG_y}{1000}$$

Where:

$PE_{HP,y}$ = Emission from reservoir expressed as tCO_2e/year

EF_{Res} = Default emission factor for emissions from reservoirs of hydro power plants in year y (tCO_2e /MWh) = 0.09

TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).

However, again according to ACM0002 version 15.0.0 if the power density (PD) of the hydro power plant is above 10 W / m^2 , PEy is 0.

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

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

Where:

PD = Power density of the project activity, in W/m^2

CapPJ = Installed capacity of the hydro power plant after the implementation of the project activity (W)

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

APJ = 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)

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

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

The project has a reservoir area of 875,264.111 m^2.

The power density (PD) for this regulation pond is calculated as follows:

CapPJ = 30,096,000 W

CapBL = 0 (Justification: The project is a new hydro power plant)

APJ = 875,264.111 m^2

ABL = 0 (Justification: The project is a new hydro power plant))

PD = 30,096,000 W / 875,264.111 m^2

PD = 34.38 W/m^2

PD > 10 W/m^2

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

Hence, PE_y= 0

3.3 Leakage

As the project is a newly built hydropower plant, there is no energy generating equipment being transferred from or to another activity involved in the project activities. No leakage is considered in the proposed project, LE*y* =0.

Please refer to ANNEX 3 for details of all baseline related calculations.

3.4 Net GHG Emission Reductions and Removals

Accordingly the baseline emissions BEy are calculated as the following:

$$BEy = (EGy - EGbaseline) \times EF_{grid, CM, y}$$

Where:

BEy Baseline emissions (tCO_2e)

EGy Annual electricity supplied by the project to the grid (MWh)

EGbaseline Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.

$EF_{grid, CM, y}$ Baseline emission factor (tCO_2e/MWh)

Y Refers to a given year

EGy = 71,180 MWh/year

EGbaseline = 0 (The figure is zero for the project as the project is new)

Therefore, the expected baseline emission for the full year production of the project is:

BEy = 0.629 x (71,180 – 0) = 44,741 tCO_2e

The emission reduction (*ERy*) by the project activity during a given year y is the difference between baseline emissions (*BEy*), project emissions (*PEy*) and emissions due to leakage(*LEy*), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y Emission reductions for the year y (tCO_2)

BE_y Baseline emissions for the year y (tCO_2)

PE_y Project emission for the year y (tCO_2)

LE_y Leakage emissions in year *y* (t CO_2/y)

ER_y = 44,741- 0-0 = 44,741 tCO_2 e

All in all, the expected emission reduction of the project is as the following:

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 2014	3,922	0	0	3,922
Year 2015	44,741	0	0	44,741
Year 2016	44,741	0	0	44,741
Year 2017	44,741	0	0	44,741
Year 2018	44,741	0	0	44,741
Year 2019	44,741	0	0	44,741
Year 2020	44,741	0	0	44,741
Year 2021	44,741	0	0	44,741
Year 2022	44,741	0	0	44,741
Year 2023	44,741	0	0	44,741
Year 2024	40,818	0	0	40,818
Total	447,405	0	0	447,405

Table 16: Summary of GHG Emission Reductions and Removals

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	**EGgross, y**
Data unit	GWh
Description	Turkey's Gross Electricity Generated by primary energy source for the five most recent years (2008 - 2012).
Source of data	Turkish Electricity Transmission Company (TEIAS) http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/uretim%20tuketim(23-47)/30(06-2012).xls
Value applied:	Please see Section 3.1, Table 12
Justification of choice of data or description of measurement methods and procedures applied	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, providing the most up-to-date and accurate information available.
Purpose of Data	
Comments	-

Data / Parameter	**Cap_{BL}**
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data	Project site
Value applied:	0 (this is a new hydro power plant)
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	-
Comments	-

Data / Parameter	**$FC_{i,y}$**
Data unit	Ton (m^3 for Natural Gas)
Description	Amount of fossil fuel type *i* consumed in the project electricity system in year *y*
Source of data	Turkish Electricity Transmission Company (TEIAS) http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/yakıt48-53/49.xls
Value applied:	Please see Section 3.1 and Annex 3
Justification of choice of data or	TEIAS (Turkish Electricity Transmission Company) is the

description of measurement methods and procedures applied	official source for this data, providing the most up-to-date and accurate information available.
Purpose of Data	To calculate the Operating Margin (OM) emission factor
Comments	-

Data / Parameter	**$NCV_{i,y}$**
Data unit	TJ/Ton (TJ/m^3 for Natural Gas)
Description	Net calorific value of fossil fuel type
Source of data	TEIAS website: "Heating Values of Fuels Consumed in Thermal Power Plants in Turkey by the Electric Utilities" 2008-2012: http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/yakıt48-53/51.xls
Value applied:	Please see Annex 3
Justification of choice of data or description of measurement methods and procedures applied	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, providing the most up-to-date and accurate information available.
Purpose of Data	To calculate the Operating Margin (OM) emission factor
Comments	-

Data / Parameter	**$EFCO_2,i, y$**
Data unit	tCO2/GJ
Description	Default CO_2 emission factor of fossil fuel type i used in power in year y
Source of data	IPCC default values (as provided in Table 1.4, Chapter 1, Volume 2 (Energy), 2006 IPCC) Guidelines for National Greenhouse Gas Inventory) are used. Link: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied:	Please see Section 3.1. and Annex 3
Justification of choice of data or description of measurement methods and procedures applied	There is no information on the fuel specific default emission factor in Turkey. Hence, IPCC values haves been used as per the "Tool to calculate the emission factor for an electricity system (version 04.0)".
Purpose of Data	To calculate the Operating Margin (OM) emission factor
Comments	-

Data / Parameter	**Electricity Imports**
Data unit	GWh
Description	Electricity imported to the Grid from other countries
Source of data	Turkish Electricity Transmission Company (TEIAS)

	http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/uretim%20tuketim(23-47)/30(06-2012).xls
Value applied:	Please refer to the link above for Turkey's electricity imports.
Justification of choice of data or description of measurement methods and procedures applied	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, hence providing the most up-to-date and accurate information available.
Purpose of Data	-
Comments	-

Data / Parameter	**Electricity Capacity Additions**
Data unit	Name of the plant; Installed capacity (MW); Fuel type; Commissioning date.
Description	Set of power capacity additions in the electricity system that comprise 20% of the system generation (in GWh) and that have been built most recently.
Source of data	Turkish Electricity Transmission Company (TEIAS) Generation units put into operation in 2009-2010 http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2013.pdf
Value applied:	Please refer to Section 2.4 for Capacity Additions
Justification of choice of data or description of measurement methods and procedures applied	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, hence providing the most up-to-date and accurate information available.
Purpose of Data	To calculate the Operating Margin (OM) factor
Comments	-

Data / Parameter	**$\eta_{m,y}$**
Data unit	**-**
Description	Average net energy conversion efficiency of power unit *m* in year *y*
Source of data	UNFCC web site: "Tool to calculate the emission factor for an electricity system".
Value applied:	Please refer to **ANNEX 3**
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	-
Comments	- No official efficiency values based on each power plant or each fuel type is available in Turkey Most natural gas power plants in Turkey are combined cycle, most coal power plants operate sub-critical and most liquid fuel power plants adopt an open cycle technology.

Data / Parameter	**$EG_{m,y}$**
Data unit	**MWh**
Description	Net electricity generated by power plant/unit m in year *y*
Source of data	Annex I of Turkish Electricity Transmission Company (TEIAS) Capacity Projection Report for 2012. http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2012.pdf
Value applied:	Please refer to Section 3.1., Table 12
Justification of choice of data or description of measurement methods and procedures applied	TEIAS (Turkish Electricity Transmission Company) is the official source for this data, hence providing the most up-to-date and accurate information available.
Purpose of Data	
Comments	N/A

Data / Parameter	**$EF_{L,m,y}$**
Data unit	**$kgCO_2/GJ$**
Description	The CO_2 emission factor of the grid power unit *m* (Default CO_2 emission factor of fossil fuel types are used)
Source of data	IPCC default values (as provided in Table 1.4, Chapter 1, Volume 2 (Energy), 2006 IPCC) Guidelines for National Greenhouse Gas Inventory) are used. Link: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied:	Please refer to ANNEX 3
Justification of choice of data or description of measurement methods and procedures applied	There is no information on the power unit specific emission factor in Turkey. Hence, IPCC values have been used as per the "Tool to calculate the emission factor for an electricity system (version 04.0)".
Purpose of Data	
Comments	N/A

Data / Parameter	**w_{OM}**
Data unit	rate
Description	Weight of operating margin emissions factor
Source of data	Tool to calculate the emission factor for an electricity system
Value applied:	0.5
Justification of choice of data or description of measurement methods and procedures applied	"Tool to calculate the emission factor for an electricity system (Version 04.0)", suggests wOM = 0.5 and wBM = 0.5 for the first crediting period, except wind and solar power plants. In the second and third crediting periods wOM=0.25 and wBM=0.75

Purpose of Data	
Comments	N/A

Data / Parameter	**W_{BM}**
Data unit	**rate**
Description	Weight of built margin emissions factor
Source of data	Tool to calculate the emission factor for an electricity system
Value applied:	0.5
Justification of choice of data or description of measurement methods and procedures applied	"Tool to calculate the emission factor for an electricity system (Version 04.0)", suggests wOM = 0.5 and wBM = 0.5 for the first crediting period, except wind and solar power plants. In the second and third crediting periods wOM=0.25 and wBM=0.75
Purpose of Data	
Comments	N/A

Data / Parameter	EFgrid,CM,y
Data unit	t CO2/MWh
Description	Combined margin CO2 emission factor for the project electricity system in year y
Source of data	Tool to calculate the emission factor for an electricity system
Value applied:	Please refer to ANNEX 3
Justification of choice of data or description of measurement methods and procedures applied	The baseline emission factor is the weighted average of the Operating Margin Emission Factor and Build Margin Emission Factor. The "*Tool to calculate the emission factor for an electricity system*" (version 04.0) guideline procedures have been applied.
Purpose of Data	To calculate the Combined Margin (CM) emission factor
Comments	-

4.2 Data and Parameters Monitored

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	Project site
Description of measurement methods and procedures to be applied	Measured from topographical surveys, maps, satellite pictures, etc
Frequency of monitoring/recording	Yearly
Value applied:	875,264.111 m^2
Monitoring equipment	Topographical surveys, maps, satellite pictures
QA/QC procedures to be applied	The readings will be done during the period when the water flow is made to have the largest reservoir area
Purpose of data	
Calculation method	-
Comments	-

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	Project site.
Description of measurement methods and procedures to be applied	Supplier information on the equipment and the number of turbines will be checked on site visits
Frequency of monitoring/recording	Yearly
Value applied:	30,096,000 (15,048,000Wx2).
Monitoring equipment	N/A
QA/QC procedures to be applied	Supplier information on the related equipment and the existence of the equipment will be checked. Also, this information may be checked from the EMRA website.
Purpose of data	According to the Turbine Generator Unit Label which has been provided to the DOE, Unit Rated Power has been calculates as Label Rated capacity (16.72) * Power factor (0.90) = 15.048MWe
Calculation method	-
Comments	-

Data / Parameter	**$EG_{facility,y}$**
Data unit	**MWh/yr**
Description	Quantity of net electricity generation supplied by the project to the grid in year *y*.
Source of data	PMUM (Market Financial Settlement Center) records (Meter reading records-OSF forms of main meters cross-checked)
Description of measurement methods and procedures to be applied	PMUM records provides the exact electricity generation of the facility and the imports from the grid. The electricity meters will be controlled and maintained by the grid owner. The quantity of net electricity delivered to the grid will be cross checked with the meter reading records (OSF forms) provided to the company by TEIAS[37] The measurements will be realized according to 16-17-18 and 19 articles of Electricity Market Grid Regulation[38]
Frequency of monitoring/recording	Continuous measurement and at least monthly recording .
Value applied:	71,180 MWh/yr
Monitoring equipment	
QA/QC procedures to be applied	Cross check measurements results with records for sold electricity. The electricity meters will be subject to a regular maintenance and testing regime by the grid owner to ensure accuracy. The meter calibration process is made by an accredited party. The company is not responsible for calibration of the meters in Turkey according to the local standards[39]. The re-calibration periods are defined by national metrology institutes country by country and in Turkey this period is defined as 10 years.
Purpose of data	Calculation of Baseline emissions
Calculation method	Net electricity production figure = Electricity generation (operation base) – Electricity traction from grid
Comments	-

4.3 Monitoring Plan

The purpose of the monitoring plan is to ensure that the monitoring and calculation of emission reductions of the proposed Project within the crediting period are complete, consistent, clear and accurate.

[37] All production figures which are subject to sales to the grid are agreed with PMUM ("Market Financial Settlement Center"). These figures can be accesses from PMUM's web site by the seller. Therefore, net electricity production figures announced by PMUM will be used to calculate the emission reductions.
[38] http://www.epdk.gov.tr/documents/elektrik/mevzuat/yonetmelik/elektrik/sebeke/Elk_Ynt_Sebeke_Son.doc
[39] Periodic Calibration Article 9 - http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.6381&MevzuatIliski=0&sourceXmlSearch=

The project is operated by Peker Enerji A.S. which ensures the overall site management in accordance with Turkish Laws and technology providers' guidelines.

The monitoring will be performed in-house by the project proponent:

1.*Electrical Engineers* will undertake the specific actions required by the monitoring plan, i.e. they will measure the electricity generation, , the electricity supplied to the Turkish grid by the power plant, the electricity imports and the amount of fuel consumed, if fuel is consumed.

2.*Mechanical Engineers* will ensure that all the instrumentations and devices to perform the monitoring work properly.

3.*Accounting Manager* will be in charge of providing the electricity sales receipts to the Operations Manager of the plant.

4.*Operations Manager* will be the VER coordinator. He will be in charge of:

a) Ensuring that instrumentations and devices are available and properly suited to perform the monitoring efficiently.

b) Communicating and coordinating the monitoring tasks of all business units.

c) Developing, executing, analyzing and improving the VER Monitoring/Reporting Procedures. This includes the crosschecking and consolidation (with multiple sources whenever possible) of the data obtained from the electrical engineers and the accounting manager. He will also record this operation properly to be able to provide it to the DOE during the verification process.

d) Calculating and reporting the emission reductions, and

e) Organizing in-house seminars to inform and train the company staff about the monitoring procedures.

Please refer to Figure 5 where the site organizational chart is presented.

In order to verify the generated units of emission reductions, the VER coordinator, Operation Manager will prepare an annual Report of Vigilance of the Project, in which the following important aspects will be included:

- Year
- Net electricity supplied by the project activity to the grid (in MWh)
- Annual gross electricity generation (in MWh)
- Annual electricity consumption (in MWh)
- Calculation of the emissions reductions: ERs per year (in tCO_2e/yr) produced from the activity of the project

After the proposed Project is registered and begins its operations, the monitoring report will be submitted at the end of every year for the verification of DOE. The report will cover the monitoring of grid-connected power generation, check report, report on calculation of the emission reductions and records of monitoring instrument repair and calibration, etc.

Data will be recorded for each crediting period and maintained at least 2 years after its end. The company will establish a dedicated maintenance system to ensure the data availability for the required period.

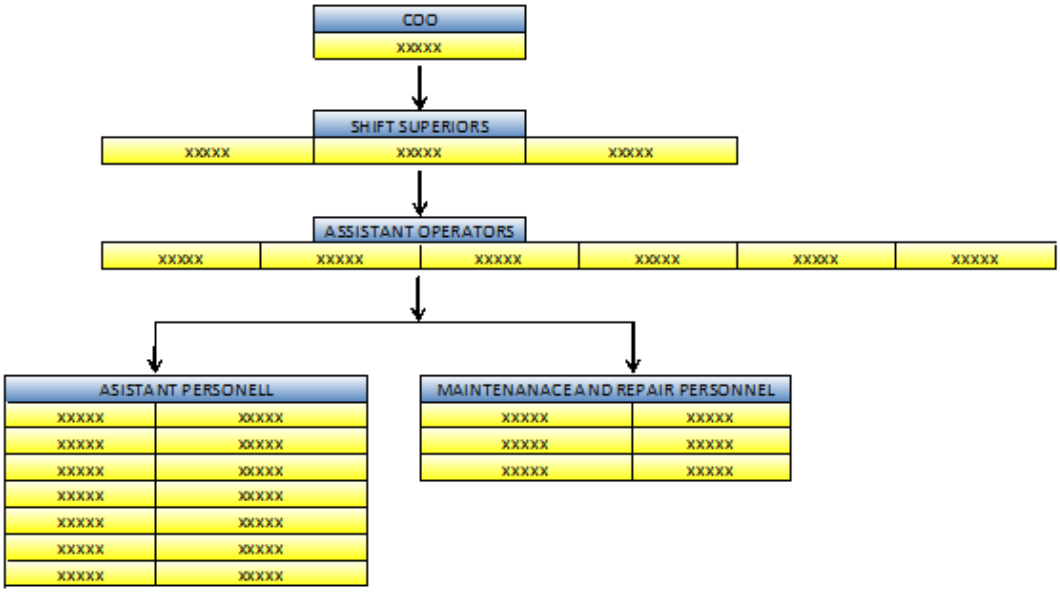


Figure 5: Site Organizational Chart

Measuring

The Electrical Engineers will obtain the readings from the meters, report them in the spreadsheet for measurement control and store the data discharged from the meters electronically.

All relevant baseline emission factors are defined ex-ante. Please see the baseline estimations - Section 3.1 - for Operating and Build Margin estimations. According to the ACM0002/Version 15.0.0 , the only parameter to be monitored during the project activity is EGfacility,y : "Quantity of net electricity supplied to the grid in year *y*"

There will be two meters attached to the power plant for measurement of the generated electricity. One of the meters is main meter and the other is control meter. The role of the second meter is to check if the main meter measures the generated electricity accurately. Technical specifications of the main and control meters are respectively follows;

Brand	SL 7000 ITRON
Date of Manufacture	2013
Accuracy	Cl.C (0.5s)
Serial Number	65006597
Nominal current	0,01-1(10) A
Nominal Voltage	3X57,7/100V

Brand	SL 7000 ITRON
Date of Manufacture	2013

Serial Number	65006598
Accuracy	Cl.C (0.5s)
Nominal current	0,01-1(10) A
Nominal Voltage	3X57,7/100V

Table 17: Technical specifications of meters[40]

The recalibration of these equipments will be done in line with the equipment requirements but re-calibration periods are defined by national metrology institutes country by country and in Turkey this period is defined as 10 years[41].If there is a measuring difference between these two meters and one of the parties (TEIAS or the company) requests for calibration of the meters, in this case, the meters will be calibrated without waiting for the periodic calibration date. (TEIAS System Usage Agreement, Art 3, B./2./b))[42].This calibration process is done by another third party under the control of TEIAS according to IEC62053-11[43],22[44],23[45], standards. The company is not responsible for calibration of the meters in Turkey according to the local standards. In all calculations, the main meter's measurements are used. The generated electricity will be measured continuously and reported in a monthly basis. The plant manager of Adiguzel HEPP will be responsible for providing the measurement records which show the monthly electricity generation of the company.

The generated electricity will be measured by TEIAS remotely by the meters attached to the facility and the electricity generations and imports are reported to the company in a monthly basis. (An excel sheet called "OSF Form – Dengeleme Birimi Sayaç Değerleri Formu" which includes the hourly electricity generations and imports is sent to the company by e-mail from TEIAS at the end of each month)

All production figures which are subject to sales to the grid are agreed with PMUM (Market Financial Reconciliation Centre). These figures can be accessed from PMUM's web site by the seller. Therefore, net electricity production figures[46] announced by PMUM will be used in emission calculation figures. These figures will also be cross checked with the production and internal electricity usage figures provided from the OSF forms which are provided to the company by TEIAS after the remote measurement of the meters.

Copies of OSF forms and PMUM records will be collected and stored in the plant. The plant manager of Adiguzel HEPP or his/her assistant (in the absence of the manager) will be responsible for providing the measurement records which show the monthly electricity generations and imports of the project.

All data collected as part of monitoring plan is indicated in Section 4.2. They will be archived electronically and be kept at least for two years after the end of the last crediting period.

5 ENVIRONMENTAL IMPACT

[40] The Meter Test Protocol, dated 24.04.2014
[41] http://www.mevzuat.adalet.gov.tr/html/21179.html
[42] www.teias.gov.tr/sistemkullanim1.doc
[43] http://webstore.iec.ch/preview/info_iec62052-11%7Bed1.0%7Den_d.pdf
[44] http://webstore.iec.ch/preview/info_iec62053-22%7Bed1.0%7Den_d.pdf
[45] http://webstore.iec.ch/preview/info_iec62053-23%7Bed1.0%7Db.pdf
[46] Net electricity production figure = Electricity generation (operation base) – Electricity traction from grid

In this section, environmental impacts of the project will be scrutinized.

According to the Turkish law, a comprehensive EIA report is required from the projects which have a 25 MW or exceeding amount of installed capacity[47]. Smaller HEPPs are subject to selection and elimination criterion. After an investigation of the project, EMRA found that the environmental precautions taken by Adiguzel were sufficient and decide 'Positive EIA'' (EIA-Not-Required) certificate for the proposed project granted by the Ministry of Environment and Forestry stating that the proposed project does not cause any environmental damage. (The letter dated on 31/01/2012)

Apart from the harmless impact of the Project to the environment due to its project size is expected to contribute to improving the environmental situation in the region and thus in the country by facilitating non-fossil based electricity usage. Therefore, it will enhance the air quality and help reduce the adverse affects on the climate. Renewable technologies for the electricity generation will be introduced and sustainable development will be promoted.

First of all, the Project is not located on restricted areas like national parks or site areas of natural and cultural value. Yet, during the construction the ecosystem will be affected temporarily. The natural flora was specified before the construction and the rehabilitation of the construction area will be realized in an effort to restore the original natural flora. Excavated soil with vegetation will continuously be kept damp in order to be reused in the restoration after the construction. Apart from the restoration of the vegetation and the desired natural landscape, measures related to erosion control will also be taken. The waterflow after the potential energy is converted to electricity will continue to be kept clean.

Before the initiation of the Project, all local public authorities like the Mayor of Amasya were informed about the Project. Apart from the local public authorities, some NGOs and mukhtars of local villages have been intreviewed and informed about the Project. The provincial directorate of environment also regularly follows the environmental impact issue and listens to the complains of the local people.

Measures to be taken by the project participant

A summary of the potential negative environmental impacts and measures to be taken by the project participant to mitigate them is presented as follows:

Waste lubricants, produced as a result of construction equipment maintenance, are temporarily stored in closed containers. All sorts of hazardous and harmful liquids and materials will be stored in the most appropriate way and will be transported to the negotiated disposal facilities.The storage, transfer and usage of the explosives such as dynamites have been under the responsibility of the project developer and in line with the regulations.[48]

Dangerous wastes like accumulators, batteries, cables, etc. will be handled in line with the regulations.[49]

Personnel's domestic liquid and solid waste in the construction and operation periods will be handled with care in line with regulations.[50] In the operation period no industrial liquid waste will

[47] Turkish Environmental Impact Assessment Regulation entered into force on 17.07.2008 and the latest revision was published in Official Gazette N°26939, dated 17.07.2008.
[48] The Official Gazette, "Regulation on the precautions to be taken by the places working with explosives" published on 24 December 1973, numbered 14752 and "Regulation on the safe transportation, storage, import, annihilation of explosives" dated 12 November 2004, numbered 25641
[49] The Official Gazette,"Regulation on waste battery and accumulator control" published on 31 August 2004, numbered 25569

be produced. The excavated materials are considered to be recycled in the construction. If there is excavation materials that cannot be recycled, it will be handled according to the relevant regulation.[51]

In order to minimize the dust emission arising during the construction phase, the project developer intends to take the following measures:

- The lorries will be covered,
- The mounds will be watered in dry weather to prevent dust,
- A speed limitation of 30 km/h on the unpaved roads will be implemented,
- The roads will be watered regularly,
- The loading procedures will be handled without blowing out.

The sources of vibration and noise will be lorries, excavators and drillers. Noise caused by the explosives will be temporary and all processes regarding the noise emissions will be handled in line with the regulation published on the Official Gazette published on 22 March 2003, numbered 25001.

During the construction and operation, no hospital/infirmary will be built. An emergency will be handled in the hospitals nearby. Therefore, no medical waste will be produced.

The project was carried out for the tree cutting and the number of trees that are cut has not been determined although, project participant paid for re-afforestation to Ministry of Environment and Forestry.

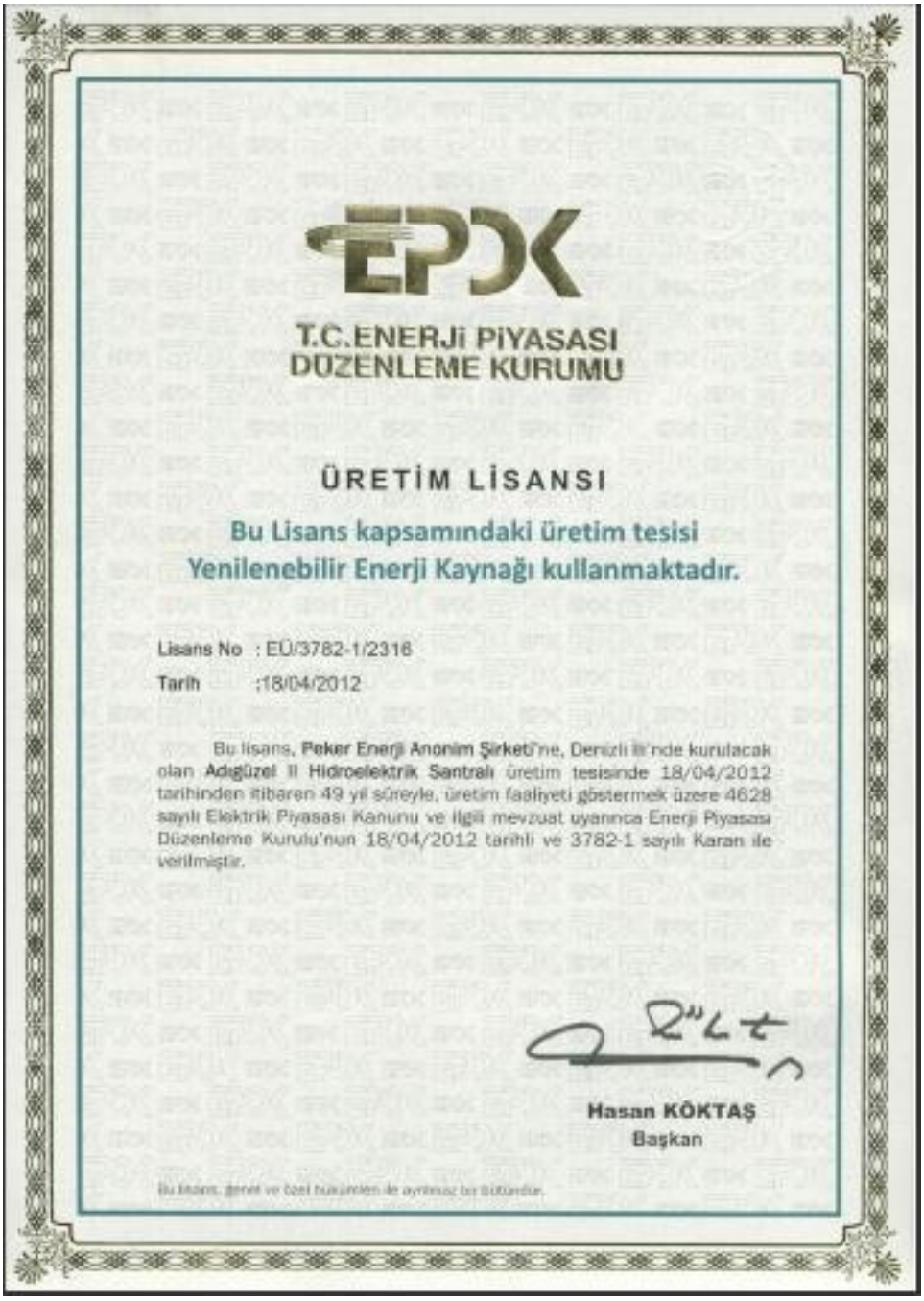
6 COMMENTS

According to the regulation declared by the Ministry of Environment and Forestry and published on the Official Gazette (dated 17th July 2008, numbered 26939), projects which an EIA is not required from are not subject to an obligation to hold Stakeholder Meetings. Therefore, a stakeholder meeting has not been planned. Nevertheless, mukhtars of local villages have been intreviewed and continuously informed about the Project for understanding the general perspective about the HEPP. For the time being, it has been experienced that mukhtars and villagers of the region are the most cooperative about the exchange of information and opinions.

ANNEX 1

The Licence for Electric Generation for Adiguzel II HEPP, which justifies the permission of EPDK (EMRA) granted to PEKER A.S. to generate energy for 49 years (The letter dated on 18/04/2012).

[50] The Official Gazette, “Regulation on liquid waste pits” published on 13.03.1971, numbered 13783 and “Regulation on solid waste control”, dated 14.03.1991, numbered 20814
[51] The Official Gazette, “Regulation on excavation waste” published on 18.03.2004, numbered 25406



EPDK

T.C.ENERJİ PİYASASI
DÜZENLEME KURUMU

ÜRETİM LİSANSI

Bu Lisans kapsamındaki üretim tesisi
Yenilenebilir Enerji Kaynağı kullanmaktadır.

Lisans No : EÜ/3782-1/2316

Tarih :18/04/2012

Bu lisans, **Peker Enerji Anonim Şirketi**'ne, Denizli İli'nde kurulacak olan **Adıgüzel II Hidroelektrik Santrali** üretim tesisinde 18/04/2012 tarihinden itibaren 49 yıl süreyle, üretim faaliyeti göstermek üzere 4628 sayılı Elektrik Piyasası Kanunu ve ilgili mevzuat uyarınca Enerji Piyasası Düzenleme Kurulu'nun 18/04/2012 tarihli ve 3782-1 sayılı Kararı ile verilmiştir.

Hasan KÖKTAŞ
Başkan

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

ANNEX 2

The ''Positive EIA'' (EIA-Not-Required) certificate for the proposed project granted by the Ministry of Environment and Forestry stating that the proposed project does not cause any environmental damage. (The letter dated on 31/01/2012)

T.C.
ÇEVRE ve ŞEHİRCİLİK BAKANLIĞI
ÇEVRESEL ETKİ DEĞERLENDİRMESİ İZİN VE DENETİM
GENEL MÜDÜRLÜĞÜ

Karar Tarihi: 31/01/2012
Karar No : 2401

ÇED OLUMLU BELGESİ

17.07.2008 tarih ve 26939 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği'nin 14. maddesi gereğince; *"Adıgüze-II Hidro Elektrik Santrali (31,01MWm / 30,09MWe) Malzeme Ocakları, Kırma-Eleme-Yıkama Tesisi ve Beton Santrali"* projesi hakkında *"Çevresel Etki Değerlendirmesi Olumlu"* kararı verilmiştir.

M.Mustafa SATILMIŞ
Bakan a.
Genel Müdür

Proje Sahibi : Peker Enerji A.Ş.
Projenin Yeri : Denizli İli, Güney İlçesi.

ANNEX 3

BASELINE INFORMATION

Details of OM Calculation

Turkey's Gross/Net Electricity Generations and Imports

	Electricity Generation (EGy) [GWh]		
	2010	**2011**	**2012**
Total Gross Electricity Generation* [GWh]	211,207.7	229,395.1	239,496,8
Total Net Electricity Generation** [GWh]	203,046.1	217,557.7	227,707,3
Net/Gross	0.961	0.948	0,951
Gross Electricity Generation from Thermal Sources*** [GWh]	155,370.1	171,169.1	174,151,0
Net Electricity Generation from Thermal Sources [GWh]	149,366.2	162,336.3	165,578,3
Imports *[GWh]	1,143.8	4,555.8	5,826,7
Net generation from thermal + Imports (Egy) [GWh]	150,510.0	166,892.1	171,405,0

Sources:

* http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/uretim%20tuketim(23-47)/30(06-2012).xls
** http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/uretim%20tuketim(23-47)/34(84-12).xls
*** http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/uretim%20tuketim(23-47)/37(06-12).xls

Fuel Consumptions

	Fuel Consumption (FCi,y) [t or m3 for natural gas]		
	2010	**2011**	**2012**
hard coal	7,419,703	10,574,434	12,258,462
lignite	56,689,392	61,507,310	55,742,463
fuel oil	891,782	531,608	564,796
diesel oil	20,354	15,047	176,379
natural gas	21,783,414	22,804,587	23,090,121
lpg	0	0	0
naphtha	13,140	0	0

Source: http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/yakıt48-53/49.xls

Net Calorific Values

	Net Calorific Values (NCVi,y) [GJ/t or GJ/m3 for natural gas]		
	2010	**2011**	**2012**
hard coal	22.3	22.8	24,3
lignite	7.1	7.3	7,0
fuel oil	40.2	41.6	41,7
diesel oil	43.1	43.2	44,7

natural gas	37.4	37.1	36,9
lpg	0.0	0.0	0,0
naphtha	33.5	0.0	0,0

Source: *http://www.teias.gov.tr/TürkiyeElektrikİstatistikleri/istatistik2012/yakıt48-53/51.xls xls*

Note 1:*The above link includes the heating values of fuels (FCi,y x NCVi,y).The heating values of fuels are given in tCal in TEIAS website. This values are converted into tJoule by using the conversion factor of 4.1868 Joule/Cal.*

Note 2:*NCVi,y values are obtained by dividing heating values to the fuel consumption values.*

CO_2 Emission Factors

	CO2 Emission Factors (EFCO2i,y) [kgCO2/TJ]		
	2010	**2011**	**2012**
hard coal	92.800	92.800	92,800
lignite	90.900	90.900	90,900
fuel oil	75.500	75.500	75,500
diesel oil	72.600	72.600	72,600
natural gas	54.300	54.300	54,300
lpg	61,600	61,600	61,600
naphtha	69,300	69,300	69,300

Source: *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Chapter 1 Introduction, Table 1.4*
http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

Built Margin Emission Factor

Company	**Fuel Type**	**Installed Capacity (MW)**	**Commissioning Date**	**Electricity Production (MWh/year)**
SODA SANAYİ A.Ş. (Mersin)	natural gas	252,20	2012	1,765,000
AFYON DGKÇ (DEDELİ DOĞALGAZ ELEKTRİK ÜR.)	natural gas	126,10	2012	945,000
ENERJİ-SA (KÖSEKÖY)	natural gas	120,00	2012	930,000
BİLECİK DOĞALGAZ KÇS. (DEDELİ DOĞALGAZ EL.)	natural gas	107,03	2012	802,088
AGE DOĞALGAZ KOM. ÇEV. SANT. (AGE DENİZLİ)	natural gas	94,00	2012	704,667

AEGSET-5-units	**5,146,755**

Note 3: *As the operation start dates of the plants that became operational in 2012 are not known, a check has been made by using the 5 units which have the largest electricity production. It is seen that even the sum of the those plants is well below AEGset>=20% "*

EFGrid,BM,y [tCO2/MWh]	**0,598**

Note 4: *The reference link for the Turkey's Total installed capacity as follows:*
http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2012/kguc(1-13)/4.xls

The given reference is same both for AEGtotal and BM calculations but the calculations are referred by its different Annexes. Furthermore Annex 1 for AEGtotal calculation and Annex 2 for BM Calculation.

Summary of Grid Emission Factor Calculation

Parameter	SI Unit	Result
EFGrid,OM,y	tCO2/MWh	0.659
EFGrid,BM,y	tCO2/MWh	0.598
EFGrid,CM,y	**tCO2/MWh**	**0.629**

For the details of the BM data, please refer to the ER sheet