



Voluntary Carbon Standard
Project Description

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Table of Contents

1	Description of Project:.....	3
2	VCS Methodology:.....	13
3	Monitoring:.....	26
4	GHG Emission Reductions:.....	35
5	Environmental Impact:.....	38
6	Stakeholders' comments:.....	39
7	Schedule:.....	40
8	Ownership:.....	41
	Annex 1: BASELINE INFORMATION.....	43

1 Description of Project:

1.1 Project title

"OTLUCA HPPs run-of-river hydro project"

1.2 Type/Category of the project

The project applies CDM EB-approved methodologies and tools in their latest version. The CDM program is a VCS approved program.

The respective sectoral scope is scope 1: "Energy Industry - Renewable/Non-renewable Sources" Installed capacity of the project is 46 MW, thus it falls into a large scale project activity.

The project is not a grouped project.

1.3 Estimated amount of emission reductions over the crediting period including project size:

With an installed capacity of **46 MW**, an expected annual electricity production of up to **224,000 MWh/year** and an estimated baseline grid emission factor of **0.5491 tCO₂/MWh**, the following reduction amounts are expected. Electricity production in year 2011 is found from by multiplying the ratio of the 37.54 MW to 46 MW by 224,000 MWh/year which is 182,803 MWh/year. Also electricity production is in $\frac{3}{4}$ of the year so generation will be 137,102 MWh/year. 37.54 MW of the Otluca project started to generate electricity since April 2011 which is stated in the [provisional acceptance certificate](#). Rest of the project will be in operation in the beginning of the 2012.

Table 1: Emission reduction volume during crediting period*

Length of crediting period	10 years
Year	Estimate of annual emission reductions in tons of CO ₂ e
2011 (from 1 April 2011 to 31 December 2011)**	75,286
2012	123,003
2013	123,003
2014	123,003
2015	123,003
2016	123,003
2017	123,003
2018	123,003
2019	123,003
2020	123,003
2021 (from 1 January 2021 to 31 March 2021)	30,751
Total estimated reductions [tCO ₂ e]	1,213,064
Annual average of estimated emission reductions [tCO ₂ e]	121,306.4

(*) *Eventual inconsistencies linked to rounding errors.*
(**) *Only Otluca 1 is in operation.*

1.4 A brief description of the project:

Otluca HPPs is a 46 MW run-of-river hydro power plant project. It consists of three sub-projects (Otluca-1, Boğuntu, Otluca-2) which are located at the upstream part of the Anamur River in Anamur district. The sub-projects are described as follows:

Otluca-1 is a medium head plant using a weir structure to divert Anamur river water into an intake structure with three de-sanding basins. From there it enters a tunnel of about 3.8 km length followed by an open canal of about 500 m length and followed again by a tunnel of about 2.2 km length until the water reaches a headpond. An intake from this pond takes it through a 507 m long penstock to the powerhouse. The combined capacity of the 3 turbines is 36.9 MW.

Boğuntu uses the water of the Boğuntu River (tributary of the Anamur River) and is a medium head structure with the same system as Otluca 1. It has one de-sanding basin, starts with 162 m long open canal and continues with a 1.5 km long headrace tunnel to a headpond. The penstock is about 94 m long and leads with a head of 67.6 m to a power plant with 3 turbines. The installed capacity is 3.3 MW.

The weir of **Otluca-2** is located only some 500 m downstream from where Otluca 1 and Boğuntu Projects feed the water back into the Anamur River. Otluca-2 diverts the water again to an intake structure and into three settlement ponds before it enters the conveyance system consisting out of 2 tunnels and 2 canals of an overall length of 1,547 m, out of which 1,137 m are tunnel. The water arrives at a headpond and feeds through a 57 m long penstock the powerhouse with 29.4 m head and 3 turbines. The combined installed capacity of 5.8 MW.

Otluca HPP is expected to start electricity production on 1st April 2011. Produced electricity is being fed into the national grid.

The project generates a substantial emission reduction by bringing carbon neutral electricity production to the Turkish grid. Overall emission reductions shall amount to **121,306.4 tCO₂e per year** on average.

The hydro project shall be registered as a voluntary emission reduction project under the Voluntary Carbon Standard, thus enabling its implementation by obtaining co-financing from carbon market proceeds.

1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:

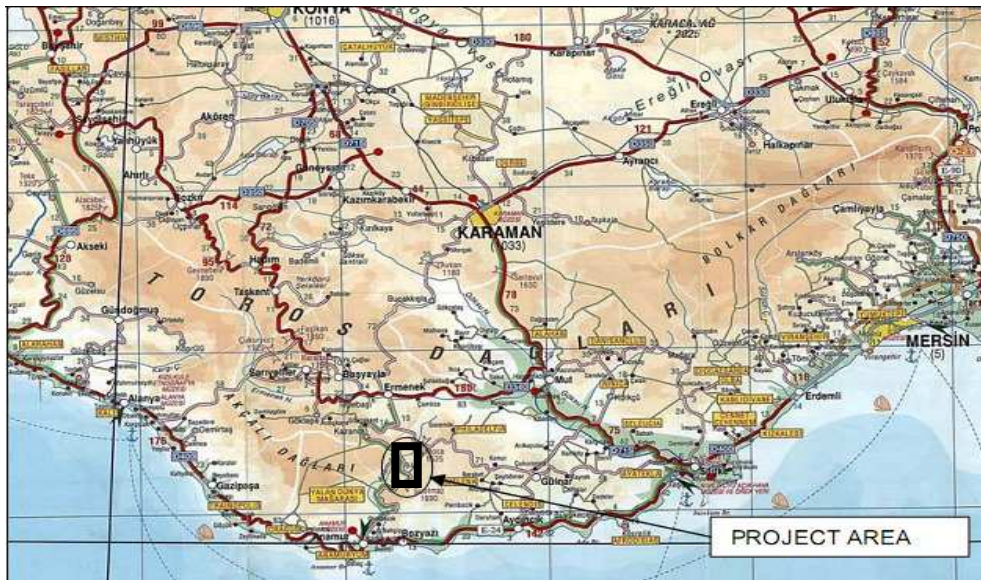
The project is located on the upstream part of Anamur River in Taşeli Plateau in southern Turkey, Anamur district, Mersin province. The geographical coordinates of the weirs and the power plants are given in Table 2 below.

Table 2: Geographical coordinates of the Weir and the Power plant

	Otluca-1 Weir	Otluca-1 HPP	Otluca-2 Weir	Otluca-2 HPP	Boğuntu Weir	Boğuntu HPP
Lat.	36° 18' 13.753" N	36° 15' 34.491" N	36° 15' 24.103" N	36° 14' 29.794" N	36° 16' 28.971" N	36° 15' 44.067" N
Long.	32° 46' 45.825" E	32° 49' 21.043" E	32° 49' 19.383" E	32° 49' 34.932" E	32° 49' 56.593" E	32° 49' 21.903" E



Map 1-1: Location of the project - national level



Map 1: Location of the project - regional, local level

1.6 Duration of the project activity/crediting period:

The project is expected to start with the initial commercial operation of the turbines on 1st April 2011.

A renewable crediting period over 10 years shall apply and will be renewed two times. Thus, the first crediting period shall begin on start date of the commercial operation of the plant and last until 31 March 2021.

1.7 Conditions prior to project initiation:

Otluca HPP project site is located on the upstream part of Anamur River in the Taşeli Plateau in southern part of Turkey (see Maps 1 and 2 above). There are no dams on the Anamur river. The project will involve three weirs(see also section 1.9 below). There were no settlements in the project site before the project. The project area is mostly forest so it was not used any purposes before the project.

The project involves the constructions of a greenfield plant, i.e. installations on the left and the right bank of Anamur River.

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

The emission reductions will be achieved by substituting electricity produced from the conventional electricity mix of the Turkish grid. The grid depends to a large degree on fossil fuels. The emission reductions will be calculated based on the Combined Margin (CM) emission factor.

1.9 Project technologies, products, services and the expected level of activity:

The 46 MW OTLUCA run-of-river HPP produces electricity for transmission into the national grid. The project is developed to generate electricity from the kinetic energy in the water of Anamur River.

The Turbine type will be Francis vertical axis for Otluca 1 and Otluca 2 and Francis horizontal axis for Boğuntu (for illustrations of the turbines, see Figure 2 below).

The generated energy of Otluca HPPs will be transmitted to Anamur switchyard which is 20 km from Otluca-1 HEPP, where energy from all three plants is connected to the transmission line. The total annual electricity production of the project activity is expected to be 224.0 GWh. Detailed technical characteristics of Otluca HPPs are given in Table 3 and Figure 1 (Single Line Diagram) below.

OTLUCA HPP SINGLE LINE DIAGRAM

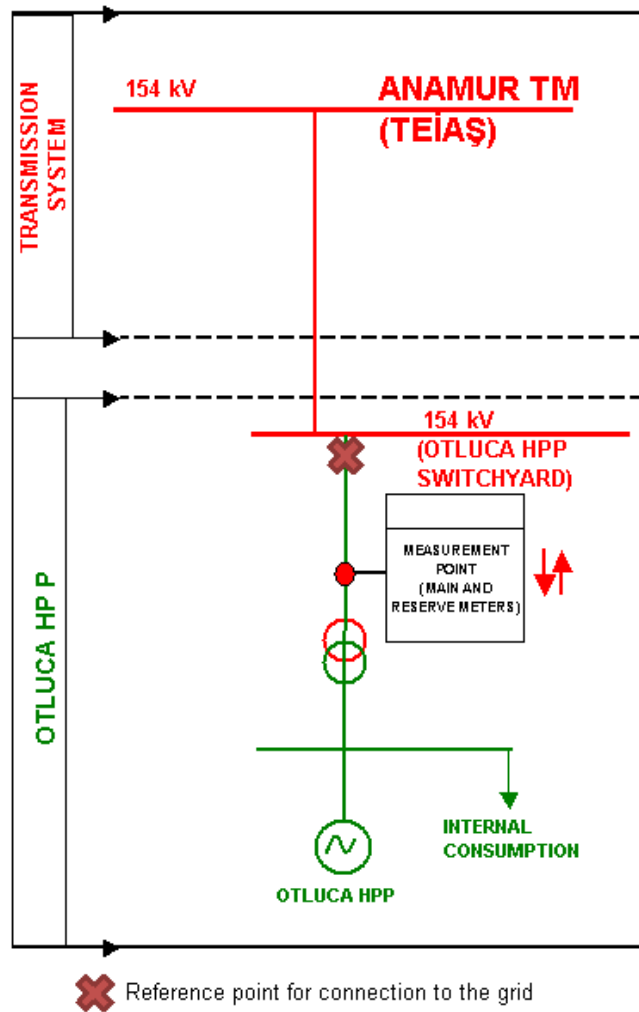


Figure 1: Single Line Diagram of OTLUCA HPPs

Table 3: Technical Characteristics of OTLUCA HPPs

Project Main Characteristics		
Project Main Characteristics	Type	Run-of-river HPP
	HPP units	3
	Total Installed Power	46 MWe
	Power Generation (for sale)	224.0 GWh/year
	Transmission Line	Type: 2x477 MCM section, line; Connection Point: Anamur Switchyard; Length: 20 km
Otluca-1		
Weir	Type	Concrete
	Elevation at crest	283.5 m
	Height from river bed	11 m
	Length	29.8 m
Conveying Tunnel I&II	Type	Standard horseshoe, right bank
	Gradient	0.00075

VCS Project Description

	Width (bed)	3.7 m
	Total length	3,896 m + 2,209 m = 6,105 m
Conveying Canal	Type	Rectangular, reinforced concrete, right bank
	Gradient	0.0006
	Width (bed)	4.5 m
	Total length	501 m
Penstock	Type	Steel, with trifurcation
	Units	1
	Diameter	2.30 m
	Total length	507 m
Power Plant	Design discharge	20 m ³ /s
	Net head	209 m
	Turbine type	Francis, vertical axis
	Units	3
	Installed power	36.9 MWe
Boğuntu		
Weir	Type	Concrete
	Elevation at crest	233.5 m
	Height from river bed	5.5 m
	Length	26 m
Conveying Canal	Type	Rectangular, reinforced concrete, left bank
	Gradient	0.00047
	Width (bed)	3 m
	Total length	161.8 m
Conveying Tunnel	Type	Standard horseshoe, left bank
	Gradient	0.0004
	Diameter	2.6 m
	Total length	1,552 m
Penstock	Type	Steel, with trifurcation
	Units	1
	Diameter	1.40 m
	Total Length	93.8 m
Power Plant	Design discharge	6 m ³ /s
	Net head	66 m
	Turbine type	Francis, horizontal axis
	Units	3
	Installed power	3.3 MWe
Otluca-2		
Weir	Type	Concrete
	Elevation at crest	159 m
	Height from river bed	2.5 m
	Length	159 m
Conveying Tunnel I&II	Type	Standard horseshoe, right bank
	Gradient	0.00081
	Width (bed)	3.9 m
	Total length	457 m + 680 m =1,137 m
Conveying Canal	Type	Rectangular, reinforced concrete, right bank
	Gradient	0.0006
	Width (bed)	5 m
	Total length	59 + 351 = 410 m
Penstock	Type	Steel, with trifurcation
	Units	1
	Diameter	3.20 m
	Total length	57 m

Power Plant	Design discharge	24 m ³ /s
	Net head	28 m
	Turbine type	Francis, vertical axis
	Units	3
	Installed power	5.8 MWe

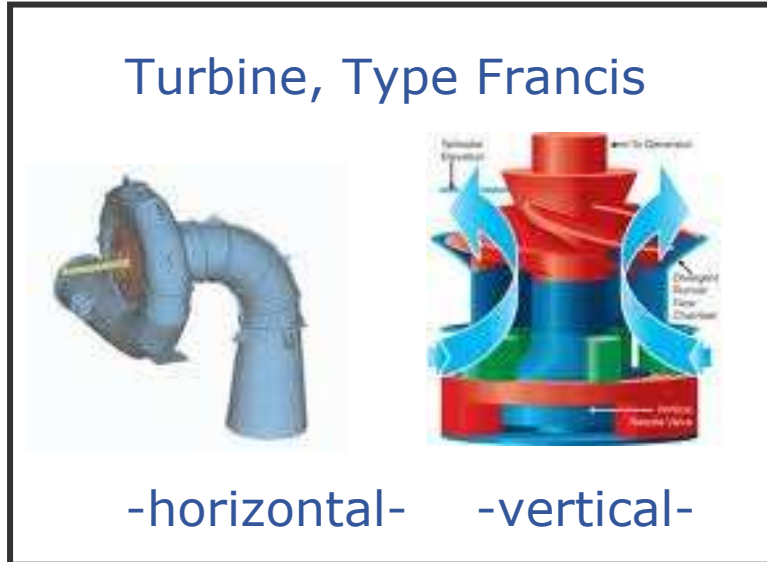


Figure 2: Illustration of Francis (vertical/horizontal) Turbine

1.10 Compliance with relevant local laws and regulations related to the project:

The project is in line with all defined laws and regulations of Turkey. This is proven by the authorizations and operation permits obtained.

Laws as relevant to the project are:

Laws as relevant to the project are (Law No. and Enactment Date):

- (1) Electricity Market Law¹ (Nr. 4628 / 03.03.2001)
- (2) Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy² (Nr. 5346 / 10.05.2005)
- (3) Energy Efficiency Law³ (Nr. 5627/ 18.04.2007)
- (4) Forest Law⁴ (Nr. 6831, 31.08.1956)
- (5) Environment Law⁵ (Nr. 2872 / 16.12.2003) - for results of the Environmental Impact Assessment please see also section 5.
- (6) Occupational Health and Safety Regulation (Nr. 25311, 09.12.2003)⁶

¹ See: <http://www.epdk.org.tr/documents/10157/351a7a0c-52a9-40d5-8e12-f8e61afe7247>

² See: <http://www.epdk.org.tr/documents/10157/4b360128-53aa-4174-8104-a6c10434ac9c>

³ See: http://www.eie.gov.tr/duyurular/EV/EV_kanunu/EnVerKanunu_Temmuz2008.pdf

⁴ See: <http://www.mevzuat.adalet.gov.tr/html/1003.html>

⁵ See: <http://www2.cevreorman.gov.tr/yasa/k/2872.doc>

⁶ See: http://www.alomaliye.com/issagligi_guvenligi_yonetmeligi.htm

The renewable Energy generation license for Otluca HPP has been issued considering Electricity Law and Law in utilization of Renewable Energy Resources for the purpose of generating electricity energy. The proposed project is also within the scope of and in compliance with Energy Efficiency Law(Article 2 of Part One). Environment Law is also satisfied and it has been confirmed by Ministry of Environment that the Otluca HPP is out of Environmental Impact Assessment Regulation. Forest Law which specifies that forest areas can be allocated by Ministry of Environment and Forestry to institutions or individuals for energy plants if the project implementation serves common good for public. As in Turkey there is no applicable local regulations to HPP constructions the list above includes national regulation only.

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

Precipitation related low-water levels might lead to diminished electricity production and thus lower emission reductions. Any possible damage in irrigation channel due to flood also may affect the electricity generation as well as GHG emission reductions. Apart from these no other risks have been identified.

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

The objective of Otluca HPPs is the creation of carbon friendly energy generation capacity via realization of a hydro-project. The baseline to the project is defined by energy generation and respective emission intensities of the already existing Turkish grid. Thus this section is not applicable.

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

Otluca HPPs has not created any form of other credits. Otluca does not obtain any public funding.

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

Otluca HPPs has not applied for crediting of any other GHG program nor has it been rejected from any other GHG program.

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

The HPP is operated and owned by **Beyobası Enerji Üretimi A.Ş (Beyobası)**. **Beyobası is also VCS project proponent and** for contact please refer to the directions given below

Table 4: Contact Data Table - Beyobası

Organization:	Beyobası Enerji Üretimi A.Ş
Street/P.O.Box:	Koza Sok.
Building:	No:22 GOP
City:	Ankara
State/Region:	N/A
Postcode/ZIP:	06700
Country:	Turkey
Personal Contact:	Mustafa Kemal GÜNGÖR
Direct FAX:	0090 0312 441 68 14
Direct tel:	0090 312 408 10 00
Personal e-mail:	akfen@akfen.com.tr; mgungor@akfen.com.tr

The project documentation at hand was defined by Beyobası in cooperation with FutureCamp Türkiye (PD consultancy).

Table 5: Contact Data of PD Consultant

Organization:	FutureCamp İklim ve Enerji Ltd.
Street/P.O.Box:	Çetin Emeç Bulvarı
Building:	Beste Apartmanı 19/18 Çankaya
City:	Ankara
State/Region:	N/A
Postcode/ZIP:	06460
Country:	Turkey
Personal Contact:	Engin Mert
Direct FAX:	0090 312 480 88 10
Direct tel:	0090 312 481 21 42
Personal e-mail:	info@futurecamp.com.tr

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information.:

Project Eligibility

Although the project cannot be staged under the JI/CDM - as Turkey is not eligible for staging such projects -, still an approved CDM methodology shall be applied. Pertaining thus to a VCS approved GHG program, the project at hand shall be eligible also under the VCS.

1.17 List of commercially sensitive information (if applicable):

/DFA/ - Documentary proof for Financial Analysis

2 VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

The United Nations approved consolidated baseline methodology applicable to this project is ACM0002 "Consolidated methodology for grid-connected electricity generation from renewable sources", Version 12.1.0. The 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).

The methodology is applicable under the following conditions:

- 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;
- In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 11 to calculate the parameter $EG_{PJ,y}$): the 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:
 - The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or
 - The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m²; or
 - The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m².

The methodology is applicable as the proposed project is a grid-connected greenfield hydropower plant project with a power density greater than 4 W/m².

ACM0002 refers to the following tools: "Tool for the demonstration and assessment of additionality", Version 05.2, and "Tool to calculate the emission factor for an electricity system, Version 02.2.0".

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The choice of methodology ACM002 is justified as the proposed project activity meets the relevant applicability criteria:

- The Hydroelectric Power Plant Project involves installation of a new 46 MW grid connected renewable electricity generation plant,
- The project results in construction of a new reservoir with a power density greater than 4 W/m² (see also 4.3).
- The project activity is the installation of a hydro power plant with a run-of-river reservoir,
- The project activity is not capacity additions, retrofits or replacements
- The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m².
- Project activities do not involve switching from fossil fuels to renewable energy sources at the site of the project activity.
- Project activity is not a biomass fired power plant.

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

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.

Greenhouse gases included in the project boundary and used in calculations of emission reductions are given in Table 6 below.

Table 6: Emission sources within the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO ₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO ₂	Yes	<i>Main emission source:</i> Fossil fuels fired for electricity generation cause CO ₂ emissions. It is included in baseline calculation.
		CH ₄	No	<i>Minor emission sources:</i> Even though there may be some CH ₄ and N ₂ O emissions during electricity generation, these emissions are negligible and not included in baseline calculation to be conservative and comply with Table 1 of the methodology (page 5).
		N ₂ O	No	
Project Activity	Emissions from construction and operation of the plant	CO ₂	No	<i>Minor emission sources:</i> As the energy density of the project activity is above 10 W/m ² (see also 4.3), project emissions in general are equal to "0" value; on this see p.7 of the methodology.
		CH ₄	No	
		N ₂ O	No	

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

The project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is that, 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.

The baseline scenario is identified as defined in ACM0002 via calculation of the combined margin calculation. For this the "Tool to calculate the emission factor for an electricity system" is applied. The calculations themselves may be found in section 4.2 of this PD.

Here for description and development of the baseline (Turkish grid emission factor) to the project activity, long-term electricity demand and supply projections for Turkey are assessed. The analysis shows that the share of fossil fuel-fired power capacity in Turkey and the related grid-emission factor are both expected to remain high.

Assessment of mid-term electricity demand and supply

Demand for electricity in Turkey is growing rapidly (annual average of 5.72% over past ten years).⁷ The Turkish Electricity Transmission Company (TEİAŞ) as responsible institution for grid reliability has prepared an electricity demand projection for the next ten years period (2009-2018). This demand projection, published in June 2009, predicts a continuation of the trend of demand growth.⁸

Table 7: Low/High Demand Projection Scenarios - figures (TWh)

Scenarios	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Low Scenario	194.0	202.7	213.9	228.2	243.5	259.8	277.2	295.5	315.0	335.8
High Scenario	194.0	202.7	215.9	232.1	249.5	268.2	288.4	309.7	332.6	357.2

⁷ See, <http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf> (page 4, Table 1)

⁸ See Link in Footnote-7 (page 12-13, Table 4 for High and Table 5 for Low Scenarios)

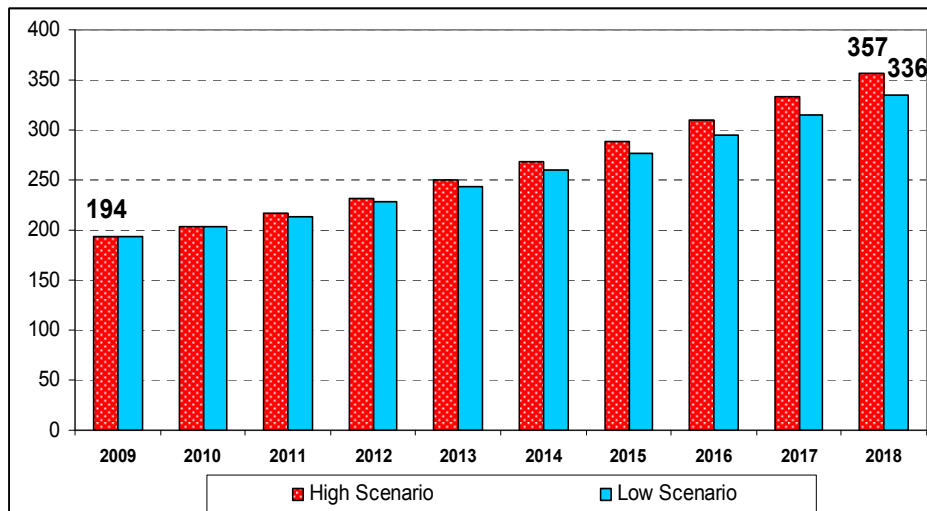


Figure 3: Low/High Demand Projection Scenarios – graphs (TWh)

In this projection, electricity supply is also forecasted, taking into account all power plants, which are operational, under construction and newly licensed. Thus the projection of electricity generation is given (table 8 below).

Table 8: Projection of Total Generation Capacity by Fuel Types⁹

Expected Generation Capacity by fuel/year	2009 (TWh)	2010 (TWh)	2011 (TWh)	2012 (TWh)	2013 (TWh)	2014 (TWh)	2015 (TWh)	2016 (TWh)	2017 (TWh)	2018 (TWh)	2018 (%)
LIGNITE	52.6	52.4	52.5	52.5	52.6	52.5	52.4	52.5	52.5	52.6	16.7%
HARDCOAL	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0%
IMPORTED COAL	12.1	12.7	14.4	19.9	28.2	31.7	32.0	32.6	32.2	32.3	10.2%
NATURAL GAS	110.3	111.9	114.6	125.9	139.0	137.9	138.6	139.2	138.4	134.5	42.7%
GEOHERMAL	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.2%
FUEL OIL	13.8	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	3.9%
DIESEL	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.4%
OTHER	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	0.5%
THERMAL TOTAL	195.4	196.0	200.4	217.3	238.8	241.1	242.0	243.3	242.1	238.3	75.7%
BIOGAS+WASTE	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.1%
HYDRO	49.7	54.8	59.7	65.9	68.8	68.7	68.7	72.6	72.6	72.6	23.0%
WIND	1.6	2.4	3.2	3.7	3.7	3.7	3.7	3.7	3.7	3.7	1.2%
TOTAL	246.9	253.5	263.6	287.3	311.6	313.9	314.8	320.0	318.8	315.0	100%

According to the 10-year projection it is clear that fossil fuels will remain the main sources for electricity generation (75.3% in 2018). Natural gas will continue to dominate the market while total imported fuel will still be at 52.9%. Hydro will account for 23.0% of the mix whereas all non-hydro renewables combined (geothermal/biogas/waste/wind) will only account for 1.5% of all electricity generation. This projection is consistent with continuing fossil fuel dependent characteristics of Turkish electricity sector, which is illustrated in Figure 4 below. The share of fossil fuels in

⁹ See, <http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf> (page 32, Table 22)

the mix has been continuously increasing since the 1970s, reaching 82.6% in 2008.

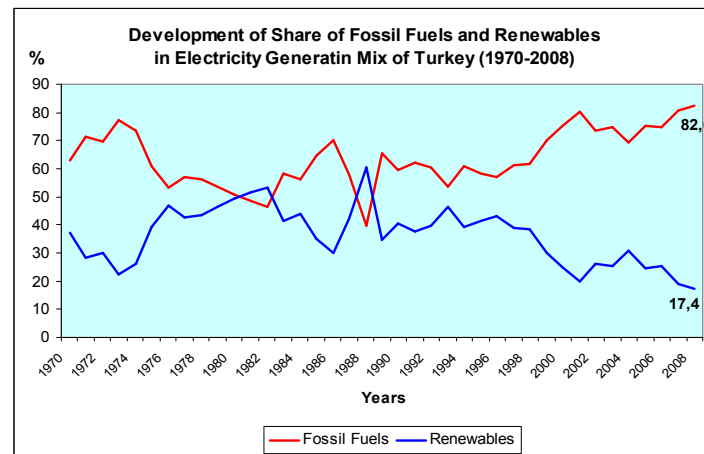


Figure 4: Fossil Fuels and Renewables in Turkish Electricity Mix (1970-2008)¹⁰

Conclusions on Baseline Development

The above given analysis of the baseline scenario (continuation of current situation) implies the following conclusions:

- Conclusion-1: High growth rate of energy demand during past 10 years is expected to continue over coming decade.
- Conclusion-2: Even if all plants (operational, under construction, licensed) are taken into account there is still a projected lack of supply from 2014 onwards.¹¹ In the face of the upcoming electricity shortage, it is clear that the most likely installation alternative would be a conventional fossil-fueled power station.
- Conclusion-3: Fossil fuels will remain dominant in the electricity generation mix, at least over the midterm period with an expected share of 75% in 2018. Renewables including hydro will hold a limited share of then 24.5%. Thus most of the new capacity will be fossil fuel based.

The combination of aforementioned trends indicates that if Otluca HPPs would not be built, power from a new grid-connected thermal plant would be the most likely scenario.

¹⁰ See TEİAŞ, <http://www.teias.gov.tr/istatistik2008/33.xls> (Renewable generation is composing of 'renewable and waste', 'hydro' and 'geothermal and wind' data)

¹¹ See, <http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf> (page 78, Table 44)

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

The additionality of the project is demonstrated and assessed according to the step-wise approach defined in the Additionality Tool in its latest version 5.2.

Step 1: Identification of technically feasible baseline scenario alternatives to the project activity

In compliance with the Additionality Tool all technically feasible options, which are realistic and credible are listed below and further discussed in the subsequent steps.

Sub-step 1a: Alternatives to the project activity

- (a) The proposed project activity undertaken without being registered as a VER project activity;
- (b) Other renewable energy scenario(s) that could also deliver electricity with comparable quality, properties;
- (c) Continuation of the current situation, i.e. Otluca hydro projects are not built

The decision in favor or against of a project investment depends on the expected revenues and risks, like for every other private investment. Investment decisions other than Otluca HPPs are independent from the question whether this HPP is built or not. Thus alternative (c) is realistic and credible.

The same generally applies to scenario (a). In fact Beyobası Enerji Üretimi A.Ş. may undertake the project activity without carbon income if the project still turns out to be financially attractive.

Scenario (b) though has to be excluded in this step, as it is not realistic. While projections of the Turkish energy market (see baseline discussion in B.4) indicate a growing need for energy investments, at the same time projections do not suggest that a renewable energy solution will be chosen. Instead figures indicate that if Otluca HPPs are not built, the same amount of energy will most likely be supplied by fossil fuel based greenfield installations. With a predicted share of 75% in 2018, fossil-based energy generation is to remain the dominant source for electricity in the Turkish grid.

Thus the only two realistic scenarios are (a) and (c) while scenario (b) is excluded.

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

Both remaining alternatives are in compliance with all mandatory applicable legal and regulatory requirements - not building a hydro power plant as well as building one (relevant laws are identified in section 1.10). Thus, none can be excluded in this step.

Step 2: Investment analysis

The investment analysis below clearly demonstrates that scenario (c), i.e. the project activity without the revenue from the sale of VERs, is not financially/economically attractive. Regarding documentation for proof of the early consideration of VER incomes, please refer to Section 7.

Sub-step 2a: Appropriate analysis method

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

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

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

Sub-step 2b: Option III: Benchmark analysis

For evaluation of the attractiveness of a specific investment, its IRR (Internal Rate of Return) shall be obtained and compared to available (benchmark) IRRs in the market.

According to the Tool, the benchmark for investment analysis can be derived from '*Estimates of the cost of financing and **required return on capital based on bankers views and private equity investors/funds***'.

As a banker view, according to Worldbank loan appraisal document¹², threshold equity IRR for hydropower investments (i.e. required returns of equity for hydro power investors) in Turkey is 15%.

Sub-step 2c: Calculation and comparison of the IRR

The IRR is calculated on the basis of expected cash flows (investment, operating costs and revenues from electricity sale), as used in the financial analysis for the feasibility assessment of the project. The parameters and values used for the IRR calculation are available to DOE during validation. A short overview on financial inputs is given in Table 9.

Table 9: Financial Inputs

Installed Power	46	MWe
Annual Electricity Generation Sold	224.0	GWh
Total Project Cost	-Confidential- (cf. 1.17)	EUR

¹² Worldbank - Project Appraisal Document on a IBRD Loan and a Proposed Loan from Clean Technology Fund to TSKB and TKB with the Guarantee of Turkey, May 2009 (http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2009/05/11/000333037_20090511030724/Rendered/PDF/468080PAD0P112101Official0Use0Only1.pdf, page 80, paragraph 29 and page 81, Table 11.5).

Operational Duration	31	<i>years</i>
Income Tax Rate	20%	%
Electricity Selling Price	55	€/MWh
Annual Operating Cost	-Confidential- (cf. 1.17)	EUR
EUR/USD Exchange Rate	1.4711	€/USD
USD/TL Exchange Rate	1.1566	USD/TL
EUR/TL Exchange Rate	1.7015	EUR/TL

Operational life time of the HPP is calculated as 31 years for the Otluca HPP by using the 'Tool to determine the remaining lifetime of equipment''¹³. In the tool it is said that lifetime for the Hydro Turbines is 150000 hours. In order to determine operational life time of the HPP firstly capacity factor of the HPP should be calculated because HPP will not be in operation for whole year. By dividing annual generation (224,000 MWh/year) to the installed capacity (46 MW), the operation time in a year will be found which is 4869.57 h/year. Since operation life time is related to the economical analysis, in the calculation of operational lifetime annual generation and installed capacity figures are taken from Generation License of the HPP. Finally dividing lifetime of the equipment (150000 hours) to the operational time per year, life time of the equipment will be found in terms of year which is 30.8. In order to be conservative operational life time of the hydro turbines will be found as 31 years. Also the operational lifetime is in line with the technical lifetime of the electromechanical equipment.

The resulting IRRs after Tax for Base Case Scenario (55 €/MWh) for 45 year periods is stated in below (Table 10):

Table 10: IRR value (after tax) for project activity

Period	IRR
45 years	9.71%

As resulting IRR for the project activity are clearly below the 15% benchmark, the project activity is unlikely to be economically attractive.

Sub-step 2d: Sensitivity analysis

While the main parameter determining the income of the project is the electricity sales price, a variation of the accordant value shall demonstrate the reliability of the IRR calculation. For Sensitivity Analysis electricity price is 55 €/MWh, which is the maximum of feed-in-tariff, is used as base case to be conservative. Also, the investment amount, annual energy yield amount and operating cost parameters are varied with +/- 10%. The worst, base and best-case results for each parameter variation are given in Table 11 below.

*Table 11: Equity IRR results according to different parameters (after tax)**

¹³ <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-10-v1.pdf>

Parameter	Power Price			Investment Cost		
Variance	-10%	0%	10%	-10%	0%	10%
IRR	8.20%	9.71%	11.24%	11.19%	9.71%	8.52%
Parameter	Energy Yield			Operating Cost		
Variance	-10%	0%	10%	-10%	0%	10%
IRR	8.20%	9.71%	11.24%	10.87%	9.71%	8.74%

(*) For other parameters than electricity price (EP), 52.50 €/MWh EP is applied.

The sensitivity analysis confirms that the proposed project activity is not likely to be economically attractive without the revenues from VERs as even the maximum IRR result for best-case scenario (11.24%) is below the 15% benchmark.

Thus the project is not the most economically and financially attractive alternative, without the revenue from the sale of emission reductions certificates (VERs).

Step 4: Common Practice Analysis

Sub-step 4a: Other activities similar to the proposed project activity

Marginalization of hydro power in the market

In general, if we examine national Turkish electricity generation data, it is conspicuous that while total installed capacity of thermal power plants has shown a rapid growth (in parallel with electricity demand growth) hydroelectric power generation has increased at a much slower rate. Thus over time the ratio of hydro-generated electricity in the overall electricity generation has decreased historically from 40.2% by 1990 to 16.8% by the end of 2008.¹⁴ . Therefore while still hydro power capacity is added to the grid, hydro power generation is only a marginal technological choice in the market.¹⁵ This is illustrated in figure 5 below.

¹⁴ <http://www.teias.gov.tr/istatistik2008/33.xls>

¹⁵ <http://www.teias.gov.tr/istatistik2008/13.xls>

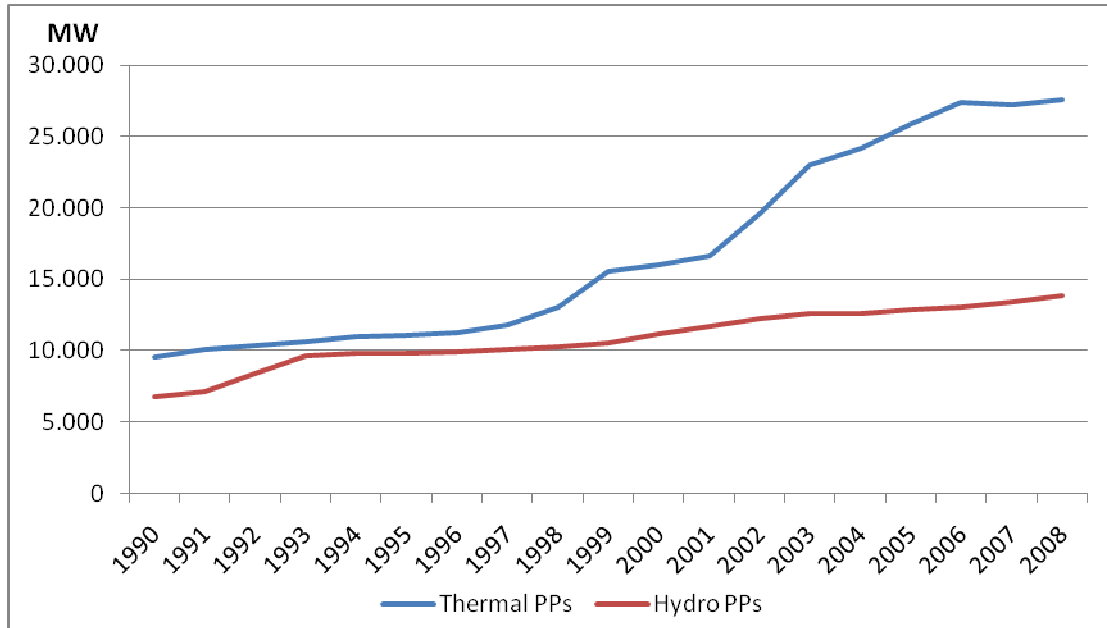


Figure 5: Annual Development of Turkey's Installed Capacity¹⁶

Exceptional plant operator/business model

Otluca HPPs is operated by Beyobası Enerji Üretimi A.Ş., a private utility. The HPP license¹⁷ is from Electricity Market Regulatory Authority (EMRA). All generated electricity will be sold on the market without any purchase guarantee.

For identification of similar projects in the market, the status/business model of the respective power plant operator has to be considered. Table 12 provides a breakdown of the market in 2008.

Table 12: Breakdown of Installed Capacity of Turkey by the end of 2008¹⁸

UTILITIES	TYPE	INSTALLED CAPACITY (MW)	TOTAL INSTALLED CAPACITY (MW)
EÜAŞ (State Power Generation Co.)	THERMAL	8,690.9	20,146.8
	HYDRO	11,455.9	
AFFILIATED PARTNERSHIP OF EÜAŞ	THERMAL	3,834.0	3,834.0
POWER PLANTS UNDER TRANSFER OF OPERATIONAL RIGHT (ToR) CONTRACT	THERMAL	620.0	650.1
	HYDRO	30.1	
MOBILE PLANTS	THERMAL	262.7	262.7
POWER PLANTS UNDER BUILT-OPERATE (BO) CONTRACT	THERMAL	6,101.8	6,101.8
POWER PLANTS UNDER BUILT-OPERATE-TRANSFER (BOT) CONTRACT	THERMAL	1,449.6	2,449.0
	WIND	17.4	
	HYDRO	982.0	

¹⁶ <http://www.teias.gov.tr/istatistik2008/13.xls>

¹⁷ Licence for Otluca HPPs is available to DOE.

¹⁸ See, <http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf> (page 16, Table 9)

GENERATION COMPANIES (IPPs)	THERMAL	3,687.3	4,839.6
	WIND	345.1	
	HYDRO	807.2	
AUTOPRODUCERS	THERMAL	2,978.5	3,533.2
	WIND	1.2	
	HYDRO	553.5	
TOTAL INSTALLED CAPACITY	THERMAL	27,624.9	41,817.2
	WIND	363.7	
	HYDRO	13,828.7	

It can be seen that in the all-over market the vast majority of electricity producers in Turkey are either state-owned companies or operating with different business models (including long-term purchase guarantees from state-owned companies):

- EÜAŞ and its affiliated companies are state owned power generation companies¹⁹;
- Mobile Plants are selling electricity to EÜAŞ;
- ToR, BO and BOTs utilities are selling electricity to TETAŞ (State Electricity Wholesale Co.) with long term purchase contracts²⁰.
- Autoproducers are private companies building utilities primarily for their own needs²¹.

Hence all those power plants not belonging to these companies cannot be considered similar to the proposed project activity. According to the business model parameter, only 1.93% of the installed capacity is potentially similar to Otluca HPP. The number is found by dividing hydro capacity under the topic of Generation companies by total capacity. Below the list of the potentially similar projects are given:

By the end of 2008, total of hydro plants belonging to generation companies is 807.2 MW and share of them in total installed capacity is only 1.93%. These independent power plants (IPPs) are listed in table 13 below:

Table 13: All hydro projects in operation belonging to IPPs by the end of 2008²²

Plant No.	Name of HPP	Plant Location	Installed Power (MW)	Average Generation (GWh/y)	Firm Generation (GWh/y)
1	BEREKET (DENİZLİ)	DENİZLİ	3.70	12	12
2	BEREKET (DALAMAN)	MUĞLA	37.50	179	179
3	BEREKET (FESLEK)	AYDIN	9.50	41	25
4	BEREKET (GÖKYAR)	MUĞLA	11.60	43	23

¹⁹ See, Website of EÜAŞ, <http://www.euas.gov.tr/>

²⁰ See, <http://www.teias.gov.tr/eng/ApkProjection/CAPACITY%20PROJECTION%202008-2017.pdf> (page 37)

²¹ See, Licence Regulation: <http://www.epdk.org.tr/english/regulations/electric/license/licensing.doc> (page 3)

²² See, <http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf> (page 93) and <http://www2.epdk.org.tr/lisans/elektrik/lisansdatabase/verilenuretim.asp> (for Location)

VCS Project Description

5	BEREKET (MENTAŞ)	MUĞLA	39.90	163	140
6	AKKÖY ENERJİ (AKKÖY I HES)	GÜMÜŞHANE	101.90	408	263
7	DAREN HES (SEYRANTEPE)	TUNCELİ	49.70	182	161
8	ALP ELEKTRİK (TINAZTEPE)	ANTALYA	7.70	29	17
9	CANSU ELEKTRİK (ARTVİN)	ARTVİN	9.20	47	31
10 ^{a)}	ÇALDERE ELEKTRİK (DALAMAN)	MUĞLA	8.70	35	25
11	DEĞİRMENÜSTÜ HES	KAHRAMANMARAŞ	25.70	69	40
12 ^{b)}	HAMZALI HES (TURKON MNG)	KIRIKKALE	16.70	117	66
13	H.G.M. ENERJİ (KEKLİCEK)	MALATYA	8.70	18	11
14	HİDRO KONTROL (YUKARI MAHOZ)	TRABZON	22.40	79	45
15	İÇ-EN ELEKTRİK (ÇALKIŞLA)	ERZİNCAN	7.70	18	11
16	KALEN ENERJİ (KALEN II)	GİRESUN	15.70	50	28
17 ^{c)}	MARAŞ ENERJİ (FIRNIS)	KAHRAMANMARAŞ	7.20	36	23
18	SARMAŞIK I HES (FETAŞ FETHİYE)	TRABZON	21.00	96	54
19	SARMAŞIK II HES (FETAŞ FETHİYE)	TRABZON	21.60	108	61
20	YEŞİL ENERJİ (TAYFUN HES)	KAHRAMANMARAŞ	0.80	5	4
21	MURGUL BAKIR	ARTVİN	4.60	8	8
22	TEMSA ELEKTRİK (GÖZEDE)	BURSA	2.40	10	6
23	EKİN ENERJİ (BAŞARAN HES)	AYDIN	0.60	5	0
24	ENERJİ-SA (BİRKAPILI)	MERSİN	48.50	171	17
25	ENERJİ-SA (AKSU-ŞAHMALLAR)	ANTALYA	14.00	45	7
26	ENERJİ-SA (SUGÖZÜ-KIZILDÜZ)	ANTALYA	15.40	55	8
27	EŞEN-II (GÖLTAŞ)	MUĞLA	43.40	170	0
28	ELTA (DODURGA)	DENİZLİ	4.10	12	12
29	İÇTAŞ YUKARI MERCAN	ERZİNCAN	14.20	44	20
30	İSKUR (SÜLEYMANLI HES)	KAHRAMANMARAŞ	4.60	18	4
31	KURTEKS Karasu Andırın Hes	KAHRAMANMARAŞ	2.40	19	19
32	MOLU ENERJİ (BAHÇELİK HES)	KAYSERİ	4.20	30	30
33	ÖZGÜR ELEK. K.MARAŞ Tahta HES	KAHRAMANMARAŞ	12.50	54	54
34	PAMUK (Toroslar)	MERSİN	23.30	112	28
35	SU ENERJİ (ÇAYGÖREN HES)	BALIKESİR	4.60	19	4
36 ^{d)}	TEKTUĞ-KARGILIK	KAHRAMANMARAŞ	23.90	83	19
37 ^{e)}	TEKTUĞ-KALEALTI HES	OSMANİYE	15.00	52	11
38	TEKTUĞ-KEBANDERESİ	ELAZIĞ	5.00	32	20
39	YAPISAN HACILAR	MALATYA	13.30	90	54
40	YPM ALTINTEPE HES	SİVAS	4.00	18	10
41	YPM BEYPINAR HES	SİVAS	3.60	18	9
42	YPM KONAK HES	SİVAS	4.00	19	10
43	BEYKÖY	ESKİŞEHİR	16.80	87	87
44	KUZGUN	ERZURUM	20.90	36	0
45	TERCAN	ERZİNCAN	15.00	51	28
46	ATAKÖY	TOKAT	5.50	8	8
47	ÇILDIR	KARS	15.40	30	20
48	İKİZDERE	RİZE	18.60	110	100
49	MERCAN	TUNCELİ	20.40	78	48
	TOTAL		807.10	3,217	1,858
	TOTAL of VER Projects		71.50	323	144
	TOTAL of Other Projects		735.60	2,894	1,714

a) VER Project, registered under VCS:

<https://vcsprojectdatabase1.apx.com/myModule/ProjectDoc/EditProjectDoc.asp?id1=363>

b) VER Project applicant to GS with no. GS633:

<https://gs1.apx.com/myModule/rpt/myrpt.asp>

c) VER Project applied to VCS:

http://www.netinform.net/KE/Wegweiser/Guide2.aspx?ID=4051&Ebene1_ID=49&Ebene2_ID=1220&mode=4

d) VER Project registered under VCS:

<https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?idl=264>

e) VER Project registered under VCS:<https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?idl=111>

Project specific cost structure

Furthermore regarding the technology it shall be highlighted that in contrast to other renewable technologies (such as wind, solar and biomass) for small hydro projects as run-of-river projects the cost share of mechanical equipment in the total investment is especially low (25%).²³ Hence, for a typical run-of-river hydro project, site specific costs (construction demands due to challenging topography) affect the economical feasibility of the project to a far larger degree.

In case of Otluca HPPs these special projects specific factors (notably canal with expensive tunnels) lead to significantly increased investment costs - thus defining project characteristics which are hard to be found in many other hydro power projects.

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

Turkey is divided to 26 different regions regarding to water potential and rivers. Otluca HPP is located in the East Mediterranean Basin²⁴. East Mediterranean Basin is in the provinces of the Karaman and Mersin. In order to be conservative all HPP's in these provinces are considered. As it can be seen at the table 13 there are 2 HPPs are in operation in Mersin by the end of 2008 which are Pamuk (23.30 MW) and Birkapılı (48.5 MW) and there is no in Karaman. Pamuk HPP has the half of the total capacity of Otluca HPP so Pamuk HPP cannot be considered similar with Otluca. Birkapılı and Otluca HPP are not similar projects when. Since Otluca HPP is construction of three different HPPs however Birkapılı HPP is one HPP constructed on a river. Otluca HPP is more complicated than Birkapılı. In addition to that Birkapılı HPP first is applied for Otoprodüktör license and then changed it to Generation license. These licenses have different procedures each other so Birkapılı HPP cannot be considered as similar project for Otluca HPP. Therefore they cannot be compared to Otluca HPP so; there is no similar project with proposed project.

Thus we can conclude that project activity is not common practice in Turkey and additional.

²³ See, <http://www.kuleuven.be/ei/Public/publications/EIWP01-02.pdf> (page 4)

²⁴ See, <http://dergiler.ankara.edu.tr/dergiler/26/920/11480.pdf> (page 8)

3 Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

As outlined in section 2.1 above the latest version of CDM EB-approved large scale "Consolidated methodology for grid-connected electricity generation from renewable sources, ACM0002, Version 12.1.0" is applied here.

This methodology was chosen as it is VCS accepted. Furthermore it is adjusted to large-scale hydropower projects like the one presented in this project description and has already been applied to several projects (also VCS projects) around the world.

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

Monitoring is carried out along ACM0002 stipulations.

Purpose of monitoring

The purpose of the monitoring is that serving the data control/logging and the consecutive calculation of baseline and project emissions and thus the calculation of achieved emission reductions. Monitored parameters are noted down in tables of section 3.3.

The below described measurement method follows Article 81 of the official regulation "Electricity Market Balancing and Settlement Regulation"²⁵.

Monitoring parameters and data origin

The only parameter for continuous monitoring is the quantity of net electricity generation (MWh) supplied by the project plant/unit to the grid in year y. The data is monitored via electricity meters. Two meters will be placed (one main and one reserve) at the power plant. These meters are sealed by TEIAS and intervention by project proponent is not possible. Meters are read by TEIAS staff monthly, a protocol is prepared and signed by both on site by technicians and TEIAS staff. This meter data is also the basis for the settlement notification of PMUM. Data are gathered electronically from the meters by TEIAS and stored in secured website of PMUM, which is accessible to project developer with a private password. For monitoring, the monthly settlement notification of PMUM shall be used as source of data. Yearly electricity generation will be calculated by summing up monthly meter reading records. Data monitored will be

²⁵ See, <http://www.epdk.org.tr/documents/10157/9fdf555f-b9d3-4114-afea-032edd0f0e9f> page 24

kept in electronic form and hard copy until the end of second year after the end of crediting period.

Calculations in monitoring and monitoring frequency

Since the meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid will be calculated by electricity supplied minus electricity withdrawn which will be taken from monthly settlement notifications.

Project related monitoring procedures begin with the start of crediting.

Data quality management

The fact that two meters are installed in a redundant manner keeps the uncertainty level of the only parameter for baseline calculation low. High data quality of this parameter is not only in the interest of the emission reduction monitoring, but paramount for the business relation between the plant operator and the electricity buyers.

According to Article 2 of the Communiqué for meters in electricity market²⁶: "The meters to be used in the electricity market shall be compliant with the standards of Turkish Standards Institute or IEC and have obtained Type and System Approval certificate from the Ministry of Trade and Industry." Therefore, Ministry of Trade and Industry (Ministry) is responsible for control and calibration of the meters. In the Provisional acceptance certificate powers of the transformers defined as 13.5 MVA since it is between 10 MVA and 100 MVA accuracy of the meter is 0.5S which is defined under the Article 11 of the Communiqué for meters in electricity market.²⁷

Paragraph b of Article 9 of the "Regulation of Metering and Testing of Metering Systems"²⁸ (Regulation) of Ministry states that: " b) Periodic tests of meters of electricity, water, coal gas, natural gas and current and voltage transformers are done every 10 years." Therefore periodic calibration of the meters will be done every 10 years.

According to Article 67 (page 20) of the same regulation, calibration shall be done in calibration stations which have been tested and approved by Ministry of Trade and Industry. Article 64 of Regulation clearly states how calibration of the meters shall be performed.

According to Article 3 of System Usage Agreement²⁹ between Beyobası Enerji Üretimi A.Ş and distribution company stipulates other than periodic tests: If a party alleges the meters are not working appropriately tests of the meters will be done in presence of both parties. If, after controls, it is seen that the meter is not working appropriately, the measurements of reserve meters are taken into account beginning from the last measurement value when both meters are reading the same (page 3, 2-c)

²⁶ See, <http://www.epdk.org.tr/english/regulations/electric/meters.doc>

²⁷ <http://www.epdk.org.tr/documents/10157/81c16fc9-7777-46d6-albf-15c5ac8795c7> page 3

²⁸ See, http://www.sanayi.gov.tr/download/osgm/olcu_aletleri_muayene_yonetmelik.zip, page 2

²⁹ See, <http://www.teias.gov.tr/sistemkullanim1.doc>, page 3, 2-b)

As above mentioned, the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures have to be established for the monitoring plan.

Roles and responsibilities

The responsibilities and management structure follows standard integrated Management System norms. Responsibilities for monitoring are defined in the monitoring plan section below (cf. 3.4). There a general responsibility structure for plant operation is given.

3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

Parameters for verification

Data / Parameter:	EG_{facility,y}
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data to be used:	The data from the Electricity Meters are the basis for the settlement notification of PMUM. Data are gathered electronically from the meters by TEIAS and stored in secured website of PMUM, which is accessible to project developer with a private password. For monitoring, the monthly settlement notification of PMUM shall be used as source of data.
Value of data applied for the purpose of calculating expected emission reductions	224,000 MWh/year (expected)
Description of measurement methods and procedures to be applied:	Two electricity meters will be placed (one main and one reserve) at the substation. These meters are sealed by distribution company and intervention by project proponent is not possible. The meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid will be calculated by electricity supplied minus electricity withdrawn which will be taken from monthly settlement notifications. . Two meters will backup each other. These meters will be chosen according to national regulations and approved and sealed by TEIAS at start up of the plant. Maintenance and calibration of the metering devices will be made by TEIAS periodically. In addition to invoices and metering devices, the electricity delivered to the grid can be cross checked through TEIAS web page (http://pmum.teias.gov.tr) using the ID and password of the project owner. All records will be kept for at least two years as requested by the applied methodology. All meters kept the data for four months in case of any breakdown. ³⁰ If any meter is found to be out of calibration, accurate energy amounts shall be detected via substitute counter group since registry values of the main counter group is the same as of the substitute group in the last measurement. ³¹

³⁰ http://www.epdk.org.tr/documents/10157/81c16fc9-7777-46d6-albf-15c5ac8795c7_article_6_page2

³¹ <http://www.teias.gov.tr/sistemkullanim1.doc> page 3

VCS Project Description

QA/QC procedures to be applied:	Monthly internal protocols consisting daily electricity generation records which will be prepared by power plant technicians and signed by power plant manager will be used for cross checking of this parameter.
Any comment:	

Furthermore parameters CAP_{PJ} and A_{PJ} (see list of parameters for validation below) shall be checked during cyclical verification.

Parameters for validation

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data to be used:	Equipment specifications that described in the equipment contracts
Value of data applied for the purpose of calculating expected emission reductions	46000000 W (46 MW)
Description of measurement methods and procedures to be applied:	Cross-checking of instrument specifications of the installed turbines/generators (MW) and the indication in the PD.
QA/QC procedures to be applied:	Yearly
Any comment:	Turbine/Generator Supply Agreement

Data / Parameter:	A_{PJ}
Data unit:	m ²
Description:	Area of the reservoir measured with topographic drawings in the surface of the water, after implementation of the project activity, when reservoir full
Source of data to be used:	Technical drawings from consultants
Value of data applied for the purpose of calculating expected emission reductions	46,463 m ²
Description of measurement methods and procedures to be applied:	Measured from one of the ways of topographical surveys / maps, satellite pictures.
QA/QC procedures to be applied:	Yearly
Any comment:	

Data / Parameter:	EF_{grid,CM,y}
Data unit:	tCO ₂ /MWh
Description:	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"
Source of data to be used:	As per "Tool to calculate the emission factor for an electricity system"
Value of data applied for the purpose of calculating expected emission reductions	0.5491 tCO₂/MWh
Description of measurement methods and procedures to be applied:	As per "Tool to calculate the emission factor for an electricity system"
QA/QC procedures to be applied:	As per "Tool to calculate the emission factor for an electricity system"
Any comment:	

VCS Project Description

Parameters used for calculation of Combined Margin

Data / Parameter:	Gross electricity generation
Data unit:	MWh
Description:	Gross Electricity supplied to the grid by relevant sources (2006-2008)
Source of data to be used:	Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Turkey's Gross Electricity Generation of Primary Energy Resources (1975-2008) TEİAŞ, see http://www.teias.gov.tr/istatistik2008/32(75-08).xls
Value of data applied for the purpose of calculating expected emission reductions	See Table A1-3.
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data / Parameter:	Net electricity generation
Data unit:	MWh
Description:	Net electricity fed into the grid. Used for the calculation of the net/gross relation (Including Import and Export figures)
Source of data to be used:	Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Electricity Generation-Consumption and Losses in Turkey (1984-2008) TEİAŞ, see http://www.teias.gov.tr/istatistik2008/30(84-08).xls
Value of data applied for the purpose of calculating expected emission reductions	See Table A1-4.
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	This data is used to find relation between the gross and net electricity delivered to the grid by fossil fuel fired power plants. (See Table A1-4). Import and Export data is used to identify total net electricity fed into the grid in the years of 2006, 2007 and 2008 (See Table A1-5). TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data / Parameter:	Sample Group for BM emission factor
Data unit:	Name of the plants, MW capacities, fuel types, annual electricity generations and dates of commissioning.
Description:	Most recent power plants which compromise 20% of total generation
Source of data to be used:	Annual Development of Fuels Consumed in Thermal Power Plants in Turkey by the Electric Utilities, TEİAŞ: For plants in 2004: http://www.teias.gov.tr/istat2004/7.xls For plants in 2005: http://www.teias.gov.tr/istatistik2005/7.xls For plants in 2006: http://www.epdk.org.tr/documents/10157/d03e6570-d4c8-461c-9e78-9cfe38f71be1 (page 76 and 77 for installed power of new plants, page 67-75 for generation amounts. For capacity additions, interpolation method is used for

VCS Project Description

	<p>generation amounts) For plants in 2007: http://www.epdk.org.tr/documents/10157/ddb52b2e-f6d4-45bc-8611-200de3607ab4 (page 121 and 122 for installed power of new plants, page 111-120 for generation amounts. For capacity additions, interpolation method is used for generation amounts) For plants in 2008: http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf (page 95 for plants and pages 82-94 for generation amounts. For capacity additions, interpolation method is used for generation amounts)</p>
Value of data applied for the purpose of calculating expected emission reductions	See Table A1-7.
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey. The latest data available during PD preparation was for 2008.

Data / Parameter:	EF_{CO₂,i,y}
Data unit:	tCO ₂ /GJ
Description:	Emission factor for fuel type i
Source of data to be used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the IPCC Guidelines on National GHG Inventories. See http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value of data applied for the purpose of calculating expected emission reductions	See Table A1-8 and Table See Table A1-13.
Description of measurement methods and procedures to be applied:	<p>No plant specific and national emission factor data is available in Turkey. So, IPCC default data is used.</p> <p>For Fuel Oil Power Plants: 'Gas/Diesel Oil' data is used for conservativeness.</p> <p>For Coal Power Plants: In the 205th page of official document given in the link below, it is stated that Çolakoğlu and İçdaş utilizes 'Taşkömürü' (Hardcoal). And at the Table-2 in page 157 of the same document, Taşkömürü is dived in two groups: Bituminous and Anthracite. Since Sub-Bituminous Coal is under Brown Coal in the same table and since Other Bituminous Coal has lower EF than Anthracite in 1.4 of IPCC Guidelines, EF for 'Other Bituminous Coal' is used. See: http://www.dpt.gov.tr/DocObjects/Icerik/4225/Enerji_Hammaddeleri_(Linyit_Taskomuru-Jeotermal)</p>
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	η_{m,y}
Data unit:	-
Description:	Average energy conversion efficiency of power unit m in year y
Source of data to be used:	Annex I the "Tool to calculate the emission factor for an electricity system"

VCS Project Description

Value of data applied for the purpose of calculating expected emission reductions	See Table A1-8.
Description of measurement methods and procedures to be applied:	<p>For Lignite power plants, default value is taken from the Annex 1 of the tool which is 39% for subcritical.</p> <p>For coal power plants, the highest efficiency rate for 'fluidized bed' technology which is 41.5%(as in the tool) for PFBS is applied as coal PPs in the sample group (Çolakoğlu (Capacity Increment) and Çan Gr I-II) are utilizing fluidized bed type technology. For reference see: http://www.mimag-samko.com.tr/akiskan_yatakli_kazanlar.pdf (last paragraph of page 6)</p> <p>For Natural Gas and Oil plants efficiencies, default value given in the tool is applied: http://cdm.unfccc.int/methodologies/Tools/EB35_repan12_Tool_grid_emission.pdf</p>
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	HV_{i,y}
Data unit:	Mass or volume unit
Description:	Heating Values of fuels consumed for electricity generation in the years of 2006, 2007 and 2008
Source of data to be used:	Heating Values Of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See: http://www.teias.gov.tr/istatistik2008/46.xls
Value of data applied for the purpose of calculating expected emission reductions	There is no national NVC data in Turkey. However, TEİAŞ announces Heating values of fuels. This data is used to calculate annual NCVs for each fuel type.
Description of measurement methods and procedures to be applied:	See Table A1-9.
QA/QC procedures to be applied:	
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data / Parameter:	FC_{i,y}
Data unit:	Mass or volume unit
Description:	Fuels consumed for electricity generation in the years of 2006, 2007 and 2008
Source of data to be used:	Annual Development of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See: http://www.teias.gov.tr/ist2007/43.xls
Value of data applied for the purpose of calculating expected emission reductions	See Table A1-10.
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data / Parameter:	NCVi,y
Data unit:	TJ/kton, TJ/million m3
Description:	Fuels consumed for electricity generation in the years of 2006, 2007 and 2008
Source of data to be used:	Calculated by using HVi,y to FCi,y as Net Calorific Values of fuel types are not directly available in Turkey. Calculation of NCVs from national HVi,y and FCi,y data, Table A1-9 and Table A1-10, is preferred to default IPCC data as these are more reliable.
Value of data applied for the purpose of calculating expected emission reductions	See Table A1-11.
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of power plants in Turkey.

3.4 Description of the monitoring plan

As described above, the relevant data that has to be monitored is the electricity supplied to the grid (EG_y) per year, the installed capacity of the hydro power plant and the area of the reservoir.

EG_y :

These data are subject to the accounting quality systems of both parties to the power purchase agreement, TEİAŞ and Beyobası Enerji Üretimi A.Ş. With this, no additional structures or processes have to be implemented to insure the availability of necessary data for monitoring.

At the end of one monitoring period, which is planned to generally last one year, the data from the monthly meter reading records by PMUM (Market Financial Settlement Centre) will be added up to the yearly net electricity generation and multiplied with the combined margin emission factor with the help of an excel spreadsheet that also contains the combined margin calculation. Thus, the complete baseline approach is always transparent and traceable.

Technicians in Otluca HPP daily reads meters and keeps record for electricity generation amount and reports to management. These records can be used for monitoring in case of any problem will arise in meters.

Cap_{PJ} and A_{PJ}

These data will be stated for monitoring yearly.

For the operating stage the responsibilities and management structure has to be defined. Names, jobs and structure will be presented with the first monitoring report.

Currently the following information on staff and responsibilities at Otluca HPPs can be seen below:

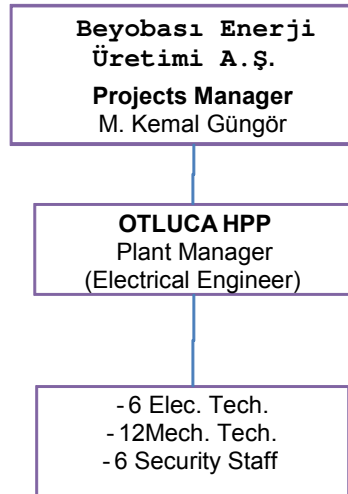


Figure 6: Organisation chart

All data monitored under the monitoring plan will be kept in electronic form and hard copy for 2 years after the end of the crediting period.

The GHG information system at Otluca HPP is in line with VCS standards. It includes definition and description of

- monitored parameters (see especially 3.3);
- how this data is obtained, recorded and compiled (see especially 3.2, 3.3);
- how it is analysed and used for quantifying and reporting GHG emissions (see especially sections 4 and 3.4 above).
- The combined margin calculation that is relevant for definition of the baseline scenario is described and analysed in Annex 1 ("Baseline information").

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

CDM approved methodology ACM0002 was chosen as methodological basis. This methodology defines well-established procedures and has already been successfully applied to many CDM and JI projects.

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

For identification of the baseline scenario ACM0002 refers to the "Tool to calculate the emission factor for an electricity system".

Calculation of the Combined Margin (CM)

A brief explanation of this methodology is given in Tool (page 2) as follows: *"This methodological tool determines the CO₂ emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). The operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project activity".*

Corresponding formulas and calculations for calculation of the CM factor are shown in Annex 1 of this PD. The origin of the applied data is shown in section 3.3 above.

Baseline emissions

As per ACM0002 baseline emissions include only CO₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. This is calculated as per formula 6:

$$BE_y = (EG_{PJ,y}) \times EF_{grid,CM,y} \quad (6)$$

Where:

BE_y	= Baseline emissions in year y (tCO ₂ /yr).
$EG_{PJ,y}$	= Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EF_{grid,CM,y}$	= Combined margin CO ₂ emission factor for grid connected power generation in year y calculated using the latest version of the .Tool to calculate the emission factor for an electricity system. (tCO ₂ /MWh)
$EG_{facility,y}$	= Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

The project activity is the installation of a new grid-connected renewable power plant, thus $EG_{PJ,y} = EG_{facility,y}$ (ACM0002 page 9, equation 7).

It follows that:

$$BE_y = EG_{facility,y} * EF_{grid,CM} = 224,000 \text{ MWh/year} * 0.5491 \text{ tCO}_2/\text{MWh} \\ = 123,003 \text{ tCO}_2/\text{year}$$

4.3 Quantifying GHG emissions and/or removals for the project:

Project emissions are calculated as follows:

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

Where:

PE_y = Project emissions in year y (tCO₂e/yr)

$PE_{FF,y}$ = project emissions from fossil fuel consumption in year y (tCO₂/yr)

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

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO₂e/yr)

$PE_{FF,y}$ is zero as there will be no fossil fuel consumption to generate electricity and $PE_{GP,y}$ is zero as the project is not a geothermal project activity.

In order to calculate project emissions from water reservoir of the plant, power density should be calculated. The power density of the project activity (PD) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (5)$$

PD = Power density of the project activity

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

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

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity when reservoir is full (m²)

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m²). For new reservoirs, this value is zero.

As the project activity is not extension of another project, Cap_{BL} and A_{BL} are zero, then

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

As in the case of Otluca HPP this density is well above the 10W/m² threshold (~930 W/m²; reservoir size: 49,463 m², installed capacity: 46 MW), emissions (CH₄ and CO₂) from the reservoir are zero (ACM0002, page 8). According to the tool (page 7), for the projects having power

density more than 10 W/m² threshold is zero. Hence, the project emission (PE_y) is zero.

Emission reductions due to project activity have to be calculated as per formula 11 of ACM0002:

$$ER_y = BE_y - PE_y \quad (11)$$

Where:

ER_y = Emission reductions in year y (tCO₂/yr).
 BE_y = Baseline emissions in year y (tCO₂/yr).
 PE_y = Project emissions in year y (tCO₂/yr).

Then:

$$ER_y = BE_y$$

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

PE_y is 0 (see 4.3 above), the emission reduction is equivalent to the determined baseline emissions. Thus emission reductions amount to **121,306.4 tCO₂/year**.

5 Environmental Impact:

According to the relevant Environmental Impact Assessment Regulation for Otluca HPPs, an Environmental Impact Assessment is not required. The official letter from Environment and Forestry Ministry confirming non-applicability of this regulation will be available to DOE during validation process.

In Turkey there are 35 Nature Preservation Area and 37 National Parks. The project is not located in any of these. Furthermore in Turkey there are 58 registered Monument of Nature and 16 registered Nature Park. None of these Monuments of Nature and Nature Parks is located in the project area.

A report from discussions with stakeholders on environmental impacts and their proper treatment will be available to the DOE at validation.

Environmental benefits

The project helps Turkey to stimulate and commercialize the use of grid connected renewable energy technologies and markets. The specific environmental benefits are:

- Reduction of GHG emissions as attributable to conventional energy production in BAU scenario;
- Creation of local employment during construction and operation of HPP;
- Reduction of other pollutants from power generation in Turkey as compared to BAU.

6 Stakeholders' comments:


Stakeholder comments have been gathered in respective stakeholder meetings. Below there are screenshots of the summary section of a public consultation report from a meeting with local stakeholders in May 2010. The full report will be available to the DoE at the validation meeting.

Summary of comments received during the local stakeholder meeting

The stakeholders in the meeting were mostly the representatives of local administrative units mainly village heads (muhtar) from surrounding villages and the villagers. All the headings were held in Turkish.

The environmental and social aspects were discussed by the stakeholders and clarifications were sought. The overall response to the project was positive.

Some points have been emphasized by the stakeholders such as the village roads near the Project regions and employment of local people for the Project. The questions regarding employment were answered by the project participant. The PP stated that during the construction process, employees will be provided from local people. However, since the single computerized system requires certain skills, much qualified people will be necessary at the operation process.



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Figure 7: Summary of the LSC-Report, Screenshot-1

The Project team ensured that all relevant national legislation will be respected and complied during the Project activities.

The meeting was concluded with no adverse reactions, comments and/or further clarifications sought. The answers provided by the Project team were accepted as satisfactory. Consequently all stakeholders agreed that the project activity will cause no significant negative impacts as far as they could assess according to their knowledge. No major concerns were raised during the entire consultation process that requiring any alterations in the project's implementation.

Figure 8: Summary of the LSC-Report, Screenshot-2

Sustainable Development effects

The project help Turkey to stimulate and commercialize the use of grid connected renewable energy technologies and markets. The specific economical, social and technological benefits are:

- Reducing Turkey's expanding energy deficit;
- Diversification of Turkish electricity generation mix and reduction of import dependency;
- Creation of local employment and income during construction and operation of HPPs (directly as well as indirectly via contracts with local providers for supply of construction material);
- Foster infrastructural investments with connected development benefits to the local rural community in the remote project area;

7 Schedule:

The following schedule shall apply:

According to Turkish regulations, to get necessary permits for further project implementation, a generation licence from Authorities is required. Hence, issuance of licence cannot be considered as 'Project Start Date' but a prerequisite to proceed for further project development activities. Starting date of construction activities is set to be investment decision date since, with this activities the project investor committed to the overall investment.

Table 14: Implementation Schedule

Date (DD-MM-YYYY)	Activity
05-07-2007	Issuance of the License
25-08-2007	Requests for Proposals from Consultants for VER Development
04-01-2008	Start of first Construction Activities
28-05-2008	Contract with Hangzhou Yatai Hydro Equipment Comp. Co. Ltd. (generators/turbines) ...
01-09-2008	Initial Agreement with a VER Consultant
27-03-2009	Financial Closure with Bank
13-04-2010	Signature with FutureCamp Türkiye for VER Development
01-08-2011	Start of operation (planned)

The implementation schedule above clearly shows that before starting of the project activity, Beyobası Enerji Üretimi A.Ş. started to analyse revenues from VER credit sales, decided to get consultancy for VER development and signed contract with a carbon consultant. However, due to problems with the initial carbon development consultant and the financial crisis this agreement is terminated. But since carbon reduction revenue is essential for implementation of this project. Beyobası Enerji later closed an agreement with FutureCamp Türkiye for carbon development.

Aforementioned schedule shows us that Beyobası started its consideration of VER income from the beginning of the project implementation. VER revenue has a decisive impact on the decision to proceed in the project development.

The project activity begins with the commissioning of the hydro plant on 1st April 2011. As starting date of the project/begin of the crediting period, 1st April 2011 is indicated. Validation of the project shall take place as soon as possible. An annual monitoring and reporting is envisaged.

The Project has an electricity generation license valid from May 5th, 2007 for a period of 48 years 6 months. The crediting period for GHG emission reductions is 10 years, and it is planned to be extended 2 more periods to a total crediting period of 30 years. Therefore it expected that the Project will continue reducing GHG emissions even after the crediting period.

The monitoring is planned to be carried out annually. Each year, an accredited DOE will verify the GHG emission reductions, which have been monitored according to the monitoring plan. The project owner will submit the relevant information and documentation for verification to this 3rd party annually.

8 Ownership:

8.1 Proof of Title:

The HPP is a project by Beyobası Enerji Üretimi A.Ş. Respective documentation regarding the ownership will be available at validation.

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

Not applicable: The project activity is neither included in an emissions trading Program nor does it take place in a jurisdiction or sector in which binding limits are established on ghg emissions.

Annex 1: BASELINE INFORMATION

PART A: Calculation of the Combined Margin (CM)

Stepwise approach of 'Tool to calculate the emission factor for an electricity system' version 02³² is used to find this combined margin (emission coefficient) as described below:

Step 1: Identify the relevant electric power system

There are 21 regional distribution regions in Turkey but no regional transmission system is defined. In Article 20 of License Regulation it is stated that '*TEİAŞ shall be in charge of all transmission activities to be performed over the existing transmission facilities and those to be constructed as well as the activities pertaining to the operation of **national transmission system** via the National Load Dispatch Center and the regional load dispatch centers connected to this center and the operation of Market Financial Reconciliation Center*³³'. As it can be understood from this phrase, only one transmission system which is national transmission system is defined and only TEİAŞ is in the charge of all transmission system related activities. Moreover, a communication with representative of TEİAŞ which indicates that: "There are not significant transmission constraints in the national grid system which is preventing dispatch of already connected power plants" is submitted to the DOE. Therefore, the national grid is used as electric power system for project activity. The national grid of Turkey is connected to the electricity systems of neighboring countries. Complying with the rules of the tool, the emission factor for imports from neighboring countries is considered 0 (zero) tCO₂/MWh for determining the OM.

There is no information about interconnected transmission capacity investments, as TEİAŞ, who operates the grid, also didn't take into account imports-exports for electricity capacity projections.³⁴ Because of that, for BM calculation transmission capacity is not considered.

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

According to Tool project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

Option II: Both grid power plants and off-grid power plants are included

³² See, <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v2.pdf>

³³ See, See, <http://www.epdk.org.tr/english/regulations/electric/license/licensing.doc> (page 21)

³⁴ See, http://www.epdk.org.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu2008_2017.pdf (page 39)

For this project **Option I** is chosen.

Step 3: Select an operating margin (OM) method

The Turkish electricity mix does not comprise nuclear energy. Also there is no obvious indication that coal is used as must run resources. Therefore, the only low cost resources in Turkey, which are considered as must-run, are Hydro, Renewables and Waste, Geothermal and Wind (according to statistics of TEİAŞ).

Table A1-1: Share of Low Cost Resource (LCR) Production 2004-2008 (Production in GWh)³⁵

	2004	2005	2006	2007	2008
Gross production	150,698.3	161,956.2	176,299.8	191,558.1	198,418.0
TOTAL LCR Production	46,338.6	39,836.3	44,618.7	36,575.6	34,498.6
Hydro	46,083.7	39,560.5	44,244.2	35,850.8	33,269.8
Renewables and Waste	104.0	122.4	154.0	213.7	219.9
Geothermal and Wind	150.9	153.4	220.5	511.1	1,008.9
Share of LCRs	30.75%	24.60%	25.31%	19.09%	17.39%
Av. of last five years	23.43%				

As average share of low cost resources for the last five years is far below 50% (23.43%), the Simple OM method is applicable to calculate the operating margin emission factor ($EF_{grid,OM,y}$)

For the Simple OM method, the emissions factor can be calculated using either of the two following data vintages:

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, or
- Ex post option: The year, in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The ex ante option is selected for Simple OM method, with the most recent data for the baseline calculation stemming from the years 2006 to 2008.

Step 4: Calculate the operating margin emission factor according to the selected method

The Simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants. The calculation of the simple OM emission factor can be based on

- data on net electricity generation a CO₂ emission factor of each power unit (Option A), or

³⁵ See, [http://www.teias.gov.tr/istatistik2008/32\(75-08\).xls](http://www.teias.gov.tr/istatistik2008/32(75-08).xls)

- data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option B).

Option B is chosen to calculate the Simple OM, as there is no power plant specific data available, renewable power generation are considered as low-cost power sources and amount of electricity supplied to the grid by these sources is known.

Where Option B is used, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants, and based on the fuel type(s) and total fuel consumption of the project electricity system, as per formula 1 of the tool:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \quad (1)$$

Where:

- EF_{grid,OMsimple,y} = Simple operating margin CO₂ emission factor in year y (tCO₂/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 (of fossil fuel type i in year y (GJ / mass or volume unit)
- EF_{CO2,i,y} = CO₂ emission factor of fossil fuel type i in year y (tCO₂/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 = three most recent years for which data is available at the time of submission of the PDD to the DOE for validation

For the calculation of the OM the consumption amount and heating values of the fuels for each sources used for the years 2006, 2007 and 2008, is taken from the TEİAŞ annual statistics, which holds data on annual fuel consumption by fuel types as well as electricity generation amounts by sources and electricity imports. All the data needed for the calculation, including the emission factors and net calorific values (NCVs), are provided in part B of this Annex. Total CO₂ emission due to electricity generation in Turkey for the years of 2006, 2007 and 2008 are given in Table A1-2.

Table A1-2: CO₂ emissions from electricity production 2006-2008 (ktCO₂)³⁶

	2006	2007	2008
CO₂-Emissions	82,562	97,649	103,352

³⁶ For detail calculation see Annex 1

Table A1-3 below presents the gross electricity production data by all the relevant energy sources. Low-cost/must run resources like hydro, wind, geothermal and biomass do not emit fossil CO₂ and thus are not taken into account in calculations.

Table A1-3: Gross electricity production by fossil energy sources 2006-2008 (GWh)

Energy Source	2006	2007	2008
Natural Gas	80,691.2	95,024.8	98,685.3
Lignite	32,432.9	38,294.7	41,858.1
Coal	14,216.6	15,136.2	15,857.5
Fuel Oil	4,232.4	6,469.6	7,208.6
Motor Oil	57.7	13.3	266.3
Naphtha	50.2	0.0	43.6
LPG	0.1	43.9	0.0
Total fossil fuels	131,681.1	154,982.5	163,919.4

Table A1-3 shows gross data, but EG_y in the above described formula means electricity delivered to the grid, i.e. net generation. Therefore following Table A1-4 shall help to derive net data by calculating the net/gross proportion on the basis of overall gross and net production numbers.

Table A1-4: Net/gross electricity production 2006-2008 (GWh)³⁷

	2006	2007	2008
Gross Production	176,299.80	191,558.13	198,418.00
Net Production	169,543.10	183,339.70	189,761.90
Relation	96.17%	95.71%	95.64%

Multiplying these overall gross/net relation percentages with the fossil fuels generation amount does in fact mean an approximation. However this is a conservative approximation as the consumption of plant auxiliaries of fossil power plants is higher than for the plants that are not included in the baseline calculation. In the end this would lead to a lower net electricity generation and therefore to a higher OM emission factor and higher emission reductions.

Table A1-5 shows the resulting net data for fossil fuel generation and adds electricity imports.

Table A1-5: Electricity supplied to the grid, relevant for OM (GWh)

	2006	2007	2008
Net El. Prod. by fossil fuels	126,634.4	148,333.3	156,768.3
Electricity Import	573.2	864.3	789.4
Electricity supplied to grid by relevant sources	127,207.6	149,197.6	157,557.7

Electricity import is added to the domestic supply in order to fulfill the Baseline Methodology requirements. Imports from connected

³⁷ For Net Production See, [http://www.teias.gov.tr/istatistik2008/30\(84-08\).xls](http://www.teias.gov.tr/istatistik2008/30(84-08).xls) (column L)

electricity systems located in other countries are weighted with an emission factor of 0 (zero) tCO₂/MWh.

The last step is to calculate $EF_{grid,OMsimple,y}$:

Table A1-6: Calculation of Weighted $EF_{grid,OMsimple,y}$ (ktCO₂/GWh)

	2006	2007	2008
CO ₂ -Emissions (ktCO ₂)	82,562	97,649	103,352
Net Electricity Supplied to Grid by relevant sources (GWh)	127,207.6	149,197.6	157,557.7
$EF_{grid,OMsimple,y}$ (ktCO ₂ /GWh)	0.6490	0.6545	0.6560
3-year Generation Weighted Average $EF_{grid,OMsimple,y}$ (ktCO ₂ /GWh)	0.6534		

Step 5: Identify the group of power units to be included in the build margin

Build Margin calculations are performed with the sample group of power units *m* consisting of either:

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

Option (b) is used to identify the sample group, as this option comprises the larger annual generation in Turkey. In 2008, gross electricity generation amount was 198,418 GWh and 20% of this is 39,683.6 GWh.

The last plant of the sample group is built in 2004 and until the end of the 2008 (which is the latest year for official statistics published for plants put in operation) there were 12 VER projects. Because of the last plant of the sample group was built 4 years ago (not more than 10 years ago), VER plants are excluded from sample group.

While identifying the sample group dismantled, revised, retrofits are not included. Only new capacity additions (power plants / units) are taken into account.

Sample group for BM emission factor is given below table. The derivation of the values presented in Table A1-7 is contained in a separate excel file which is available for validation.

Table A1-7: Sample group generation for BM emission factor calculation (GWh)

Energy Source	2004	2005	2006	2007	2008	Total
Natural Gas	8,810.4	7,068.4	3,119.1	2,552.1	2,400.0	23,950.5
Lignite	0.0	4,420.0	7,020.0	0.0	0.0	11,440.0
Coal	337.5	1,125.0	0.0	0.0	0.0	1,462.5
Fuel Oil	789.2	99.1	0.0	800.0	103.2	1,791.4
Hydro	241.8	1,028.8	482.6	1,217.0	1,629.0	4,599.2

Renewables	0.0	87.4	453.1	11.0	167.8	719.3
TOTAL	10,178.9	13,828.7	11,074.7	4,580.1	4,300.0	43,962.3

Again, the project proponents can chose between two options according to the calculation tool: calculate the BM ex-ante based on the latest available data or update the BM each year ex post. Option 1, the ex-ante approach, is again chosen.

Step 6: Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as per formula 13 of the tool:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (13)$$

Where:

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

Because of only fuel types and electricity generation data are available for the sample group, *Option B2* of Simple OM method is used to calculate emission factor. The formula corresponds to formula 3 of the tool:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \quad (3)$$

Where:

- EF_{EL,m,y} = CO₂ emission factor of power unit *m* in year *y* (tCO₂/MWh)
- EF_{CO2,m,i,y} = Average CO₂ emission factor of fuel type *i* used in power unit *m* in year *y* (tCO₂/GJ)
- η_{m,y} = Average net energy conversion efficiency of power unit *m* in year *y* (%)
- y* = Three most recent years for which data is available at the time of submission of the PDD to the DOE for validation

BM emission factor calculation and resulted BM factor is given in the Table A1-8. For BM factor calculation, since no official emission factors for different fuel types are available, lower confidence default values of IPCC Guidelines are applied. Explanation of emission factor selection for each energy sources and references are given in section 3.3 of the PDD.

Table A1-8: BM emission factor calculation as per tool equations 13/3.

Energy Source	Sample Group Total Generation (GWh)	Effective CO ₂ emission factor (tCO ₂ /TJ)	Average Efficiency (η _{m,y})	CO ₂ Emission (ktCO ₂)
Natural Gas	23,950.0	54.3	60.00%	7,802.9
Lignite	11,440.0	90.9	39%	9,599.0
Coal	1,462.5	89.5	41.50%	1,135.5
Fuel Oil	1,791.4	72.6	46.00%	1,017.8
Hydro	4,599.2	0.0	0.00%	0.0
Renewables	719.3	0.0	0.00%	0.0
Total	43,962.3			19,555.2
EF_{grid,BM,y} (tCO ₂ /MWh)	0.4448			

Step 7: Calculate the combined margin emission factor

The combined margin emission factor is calculated as per tool formula 14:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM} \quad (14)$$

Where:

- EF_{grid,BM,y} = Build margin CO₂ emission factor in year y (tCO₂/MWh)
- EF_{grid,OM,y} = Operating margin CO₂ emission factor in year y (tCO₂/MWh)
- w_{OM} = Weighting of operating margin emissions factor (%)
- w_{BM} = Weighting of build margin emissions factor (%)

According to the Tool for wind power generation project activities:

w_{OM} = 0.5 and w_{BM} = 0.5. Then:

$$EF_{grid,CM,y} = 0.6534 \text{ tCO}_2/\text{MWh} * 0.5 + 0.4448 \text{ tCO}_2/\text{MWh} * 0.5$$

$$= 0.5491 \text{ tCO}_2/\text{MWh}$$

PART B: Calculation of Total CO₂ from OM Power Plants:Table A1-9: $HV_{i,y}$ (Heating Values for Fossil Fuels for Electricity Generation (Tcal))

Energy Sources	2005	2006	2007
Hard Coal+Imported Coal	29,504	32,115	33,310
Lignite	83,932	100,320	108,227
Fuel Oil	16,769	21,434	20,607
Diesel Oil	627	517	1,328
Lpg	0	0	0
Naphta	141	118	113
Natural Gas	150,588	179,149	189,057

Table A1-10: $FC_{i,y}$ (Fuel Consumptions for Fossil Fuels for Electricity Generation (million m³ for Natural Gas and ton for others))

Energy Sources	2005	2006	2007
Hard Coal+Imported Coal	5,617,863	6,029,143	6,270,008
Lignite	50,583,810	61,223,821	66,374,120
Fuel Oil	1,746,370	2,250,686	2,173,371
Diesel Oil	61,501	50,233	131,206
LPG	33	0	0
Naphta	13,453	11,441	10,606
Natural Gas	17,034,548	20,457,793	21,607,635

1 Tcal= 4.1868 TJ

Table A1-11: $NCV_{i,y}$ (Average Net Calorific Values for Fossil Fuels for Electricity Generation; TJ/million m³ for Natural Gas and TJ/kton for others) and EF_i (Emission Factor of Fossil Fuels)

Energy Sources	NCVi 2005	NCVi 2006	NCVi 2007	EF_i
Hard Coal+Imported Coal	21.99	22.30	22.24	89.50
Lignite	6.95	6.86	6.83	90.90
Fuel Oil	40.20	39.87	39.70	72.60
Diesel Oil	42.68	43.09	42.38	72.60
LPG	0.00	0.00	0.00	61.60
Naphta	43.88	43.18	44.61	69.30
Natural Gas	37.01	36.66	36.63	54.30

Table A1-12 CO₂ Emission by each Fossil Fuels Types (ktCO₂e)

Energy Sources	2005	2006	2007
Hard Coal+Imported Coal	11,056	12,034	12,482
Lignite	31,943	38,180	41,189
Fuel Oil	5,097	6,515	6,264
Diesel Oil	191	157	404
Lpg	0	0	0
Naphta	41	34	33
Natural Gas	34,235	40,728	42,981
TOTAL	82,562	97,649	103,352

PART C: Identification of Sample GroupTable A1-13: Sample Group PPs for BM Emission Factor Calculation³⁸

Name of Power Plant	Capacity (MW)	Average Generation (GWh)	Fuel Type	Date of Operation
ANKARA D.G.(BAYMİNA) GR-I-II-III	798.0	6,500.0	N. Gas	08.01.2004
ENTEK GR-IV	31.1	255.7	N.GAS+NAPHTA	12.02.2004
ATATEKS 2 GM	5.6	45.0	N. Gas	20.02.2004
TANRIVERDİ 4 GM	4.7	38.7	N. Gas	24.03.2004
ÇOLAKOĞLUB(CAPACITY INCREMENT)	45.0	337.5	IMPORTED COAL	05.05.2004
TEKBOY TEKSTİL 1 GM	2.2	16.0	N. Gas	18.05.2004
GÜL ENERJİ GR-II	12.5	96.5	Fuel Oil	03.06.2004
KOMBASSAN KAĞIT GIDA VE TEKS	5.5	38.1	N. Gas	09.06.2004
AYEN OSTİM ENERJİ ÜRETİM	31.1	264.1	N. Gas	11.06.2004
BİS ENERJİ 2 GT	73.0	602.7	N. Gas	16.06.2004
ENERJİ-SA ADANA 1 BT	49.8	322.9	NAPHTA	23.06.2004
ŞAHİNLER ENERJİ 1 GM	3.2	22.2	N. Gas	29.06.2004
BESLER GR-2, BT (5,2+7,5)	12.7	97.7	N. Gas	07.07.2004
ÇELİK ENERJİ ÜR.ŞTİ. 2 GM	2.4	18.6	N. Gas	09.07.2004
KOMBASSAN KAĞ. MATBAA GIDA	5.5	35.7	N. Gas	24.09.2004
AYEN OSTİM ENERJİ ÜRETİM (BT)	9.9	84.0	N. Gas	01.10.2004
HABAŞ ALIĞA GRUP I-II	89.2	713.9	N. Gas	08.10.2004

³⁸ For 2004 plants; <http://www.teias.gov.tr/istat2004/7.xls>.

For 2005 plants; <http://www.teias.gov.tr/istatistik2005/7.xls>

For 2006 plants (Page 76 and 77 for 2006 Plants and 67-75 for Generation amounts); http://www.epdk.org.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu.pdf

For 2007 plants (Page 121 and 122, for 2007 Plants and 111-120 for Generation Amounts (some dates are by error typed as 2003 by TEIAS));

http://www.epdk.org.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu2008_2017.pdf

For 2008 plants (Page 95 for 2008 Plants and Pages 82-94 for Fuel Types and Generation Amounts); <http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSİYONU2009.pdf>

VCS Project Description

STANDART PROFİL 3 GM	6.7	49.2	N. Gas	22.10.2004
KARKEY-II 3+3 DGM	54.3	369.7	Fuel Oil	12.11.2004
ALTINMARKA GIDA GR I-II-III	3.6	28.8	N. Gas	17.12.2004
ERE (BİR KAPILI HES) GRUP-I	48.5	170.6	Hydro (Run of River)	11.03.2004
ELTA ELK (DODURGA) GR-I-II-III-IV	4.1	12.3	Hydro (Run of River)	26.04.2004
İSKUR TEKSTİL (SÜLEYMANLI) GR I-II	4.6	17.9	Hydro (Run of River)	28.04.2004
BEREKET EN. (Feslek Hes) Gr-1-2	9.5	41.0	Hydro (Run of River)	05.08.2004
ÇAN GR I	160.0	1,040.0	LIGNITE	15.02.2005
ÇAN GR II	160.0	1,040.0	LIGNITE	15.03.2005
ELBİSTAN-B GR I	360.0	2,340.0	LIGNITE	15.02.2005
AKBAŞLAR GR-II (Isolated)	8.8	73.0	N.GAS	24.06.2005
AKÇA ENERJİ GR-III	8.7	65.4	N.GAS+NAPHTHA	14.12.2005
AYKA TEKSTİL GR-I	5.5	40.0	N. Gas	24.09.2005
BAYDEMİRLER GR IV-V-VI	6.2	51.4	N. Gas	04.02.2005
BOSEN GR-III	50.0	350.0	N. Gas	30.12.2005
ÇUMRA ŞEKER	16.0	40.0	N.GAS+LIGNITE	01.01.2005
ETİ MAD.(BAN.ASİT)GR-I	11.5	85.0	RENEW.+WASTES	15.07.2005
EVYAP GR I-II	5.1	30.0	N. Gas	27.08.2005
GRANİSER GRANİT GR-I	5.5	42.0	N. Gas	14.11.2005
HABAŞ ALIĞA GR III	47.7	381.6	N. Gas	02.06.2005
HABAŞ ALIĞA GR IV	47.7	381.6	N. Gas	21.09.2005
HABAŞ ALIĞA GR-V	24.6	196.8	N. Gas	24.11.2005
HAYAT KAĞIT GR-I	7.5	56.0	N. Gas	27.05.2005
İÇDAŞ ÇELİK GR-I	135.0	1,080.0	IMPORTED COAL	30.11.2005
KAHRAMANMARAŞ KAĞIT GR-I	6.0	45.0	IMPORTED COAL	08.12.2005
KORUMA KLOR GR I-II-III	9.6	77.0	N. Gas	03.12.2005
KÜÇÜKÇALIK TEKSTİL GR I-II-III-IV	8.0	64.0	N. Gas	27.11.2005
MERCEDES BENZ TURK GR I-II-III-IV	8.3	68.0	N. Gas	04.02.2005
MODERN ENERJİ GR-III	8.4	62.9	N. Gas	14.06.2005
MODERN ENERJİ GR-II	6.7	50.4	N.GAS+LPG	14.06.2005
MOSB GR I-II-III-IV-V-VI-VII	84.8	434.0	N. Gas	01.03 - 01.08.2005
ORS RULMAN	12.4	99.4	N. Gas	25.08.2005
PAK GIDA (Kemalpaşa) GR-I	5.7	45.0	N. Gas	07.12.2005
TEZCAN GALVANİZ GR I-II	3.7	29.0	N. Gas	27.05.2005
YONGAPAN(KAST.ENTG) GR-II	5.2	32.7	N. Gas	25.05.2005
ZEYNEP GİYİM SAN. GR-I	1.2	9.0	N. Gas	07.07.2005
AK ENERJİ(K.paşa) GR- III	40.0	256.9	N. Gas	09.11.2005
AK ENERJİ(K.paşa) GR I-II	87.2	560.1	N. Gas	30.04.2005
ALTEK ALARKO GR I-II	60.1	420.0	N. Gas	14.10.2005
BİS ENERJİ GR VII	43.7	360.8	N. Gas	18.03.2005
CAN ENERJİ GR-I	3.9	28.0	N. Gas	25.08.2005
ÇEBİ ENERJİ BT	21.0	164.9	N. Gas	27.08.2005
ÇEBİ ENERJİ GT	43.4	340.1	N. Gas	23.08.2005
ENTEK ELK.A.Ş.KOÇ ÜNİ.GR I-II	2.3	19.0	N. Gas	07.02.2005
KAREGE GR IV-V	18.1	141.9	N. Gas	07.04.2005
KARKEY(SİLOPİ-4) GR-IV	6.2	47.2	Fuel Oil	30.06.2005
KARKEY(SİLOPİ-4) GR-V	6.8	51.9	Fuel Oil	23.12.2005
METEM ENERJİ(Hacısıramat) GR I-II	7.8	58.0	N. Gas	29.01.2005
METEM ENERJİ(Peliklik) GR I-II-III	11.7	89.0	N. Gas	29.01.2005
NOREN ENERJİ GR-I	8.7	70.0	N. Gas	24.08.2005
NUH ENERJİ-2 GR I	47.0	319.7	N. Gas	24.05.2005
ZORLU ENERJİ KAYSERİ GR-I-II-III	149.9	1,144.1	N. Gas	22.07.2005

VCS Project Description

ZORLU ENERJİ KAYSERİ GR-IV	38.6	294.9	N. Gas	26.10.2005
ZORLU ENERJİ YALOVA GR I-II	15.9	122.0	N. Gas	26.11.2005
TEKTUĞ(Kargılık) GR I-II	23.9	83.0	Hydro (Run of River)	25.04.2005
İÇTAŞ ENERJİ(Yukarı Mercan) GR I-II	14.2	44.0	Hydro (Run of River)	02.05.2005
MURATLI GR I-II	115.0	444.0	Hydro (with Dam)	03.06.2005
BEREKET EN.(DALAMAN) GR XIII-XIV-XV	7.5	35.8	Hydro (Run of River)	16.07.2005
YAMULA GRUP I-II	100.0	422.0	Hydro (with Dam)	31.07.2005
SUNJÜT(RES) GR I-II	1.2	2.4	Wind	23.04.2005
EKOTEN TEKSTİL GR-I	1.9	14	N. Gas	16.02.2006
ERAK GIYİM GR-I	1.4	10.0	N. Gas	22.02.2006
ALARKO ALTEK GR-III	21.9	173.0	Steam	23.02.2006
AYDIN ÖRME GR-I	7.5	60.0	N. Gas	25.02.2006
NUH ENERJİ-2 GR-II	26.1	180.1	Steam	02.03.2006
MARMARA ELEKTRİK (Çorlu) GR-I	8.7	63.0	N. Gas	13.04.2006
MARMARA PAMUK(Çorlu) GR-I	8.7	63.0	N. Gas	13.04.2006
ENTEK (Köseköy) GR-IV	47.6	378.2	N. Gas	14.04.2006
ELSE TEKSTİL (Çorlu) GRI-II	3.2	25.0	N. Gas	15.04.2006
SÖNMEZ ELEKTRİK (Çorlu) GRI-II	17.5	126.0	N. Gas	03.05.2006
MENDERES ELEKTRİK GR-I	8.0	56.0	Geothermal	10.05.2006
KASTAMONU ENTEGRE (Balıkesir) GR-I	7.5	54.0	N. Gas	24.05.2006
BOZ ENERJİ GR-I	8.7	70.0	N. Gas	09.06.2006
ADANA ATIK SU ARITMA TESİSİ	0.8	6.0	Biogas	09.06.2006
AMYLUM NIŞASTA (ADANA)	14.3	34.0	N. Gas	09.06.2006
ŞIKMAKAS (Çorlu) GR-I	1.6	13.0	N. Gas	22.06.2006
ELBİSTAN B GR-III	360.0	2,340.0.	Lignite	23.06.2006
ANTALYA ENERJİ GR I-II-III-IV	34.9	245.0	N. Gas	29.06.2006
HAYAT TEM. VE SAĞLIK GR I-II	15.0	108.0	N. Gas	30.06.2006
EKOLOJİK EN. (Kemerburgaz) GR-I	1.0	6.0	Waste Heat	31.07.2006
EROĞLU GIYİM (Çorlu) GR-I	1.2	9.0	N. Gas	01.08.2006
CAM İŞ ELEKTRİK (Mersin) GR-I	126.1	1,008.0.	N. Gas	13.09.2006
ELBİSTAN B GR-II	360.0	2,340.0.	Lignite	17.09.2006
YILDIZ ENT. AĞAÇ (Kocaeli) GR-I	6.2	40.0	N. Gas	21.09.2006
ÇERKEZKÖY ENERJİ GR-I	49.2	390.0	N. Gas	06.10.2006
ENTEK (Köseköy) GR-V	37.0	293.9	N. Gas	03.11.2006
ITC-KA EN. MAMAK TOP.M. GR I-II-III	4.2	30.0	Waste Heat	03.11.2006
ELBİSTAN B GR-IV	360.0	2,340.0.	Lignite	13.11.2006
ÇIRAĞAN SARAYI GR-I	1.3	11.0	N. Gas	01.12.2006
ERTÜRK ELEKTRİK Tepe RES GR-I	0.9	2.0	Wind	22.12.2006
AKMAYA (Lüleburgaz) GR-I	6.9	50.0	N. Gas	23.12.2006
BURGAZ (Lüleburgaz) GR-I	6.9	54.0	N. Gas	23.12.2006
ŞANLIURFA GR I-II	51.8	124.0	Hydro (Run of River)	01.03.2006
BEREKET ENERJİ GÖKYAR HES 3 Grup	11.6	43.3	Hydro (Run of River)	05.05.2006
MOLU EN. Zamantı Bahçelik GR I-II	4.2	16.7	Hydro (Run of River)	31.05.2006
SU ENERJİ (Balıkesir) GR I-II	4.6	20.7	Hydro (Run of River)	27.06.2006
BEREKET EN. (Mentaş Reg) GR I-II	26.6	108.7	Hydro (Run of River)	31.07.2006
EKİN (Başaran Hes) (Nazilli)	0.6	4.5	Hydro (Run of River)	11.08.2006
ERE (Sugözü rg. Kızıldüz hes) GR I-II	15.4	31.6	Hydro (Run of River)	08.09.2006
ERE (AKSU REG. Ve ŞAHMALLAR HES) GR I-II	14.0	26.7	Hydro (Run of River)	16.11.2006
TEKTUĞ (Kalealtı) GR I-II	15.0	52.0	Hydro (Run of River)	30.11.2006
BEREKET EN. (Mentaş Reg) GR III	13.3	54.4	Hydro (Run of River)	13.12.2006
HABAŞ (ALIAĞA-ADDITION)	9.1	35.3	N. Gas	02.05.2007

VCS Project Description

MODERN ENERJİ	5.2	38.0	N. Gas	2007
Acıbadem Sağlık Hiz.ve Tic.A.Ş.(Kadıköy Hast.)	0.5	4.0	N. Gas	19.06.2007
Acıbadem Sağlık Hiz.ve Tic.A.Ş.(Kozyatağı Hast.)	0.6	5.0	N. Gas	23.10.2007
Acıbadem Sağlık Hiz.ve Tic.A.Ş.(Nilüfer/BURSA)	1.3	11.0	N. Gas	28.08.2007
AKATEKS Tekstil Sanayi ve Ticaret A.Ş.	1.8	14.0	N. Gas	30.07.2007
FLOKSER TEKSTİL SAN.AŞ.(Çatalca/istanbul)	2.1	17.0	N. Gas	03.12.2007
FLOKSER TEKSTİL SAN.AŞ.(Çatalca/istanbul)	2.1	17.0	N. Gas	03.12.2007
FRİTOLAY GIDA SAN.VE TİC. AŞ.	0.5	4.0	N. Gas	23.01.2007
KIVANÇ TEKSTİL SAN.ve TİC.A.Ş.	3.9	33.0	N. Gas	20.03.2007
KİL-SAN KİL SAN.VE TİC. A.Ş	3.2	25.0	N. Gas	19.02.2007
SÜPERBOY BOYA SAN.ve Tic.Ltd.Şti.	1.0	8.0	N. Gas	05.12.2007
SWISS OTEL (Anadolu Japan Turizm A.Ş (İstanbul)	1.6	11.0	N. Gas	01.08.2007
TAV Esenboğa Yatırım Yapım ve İşletme AŞ.	3.9	33.0	N. Gas	19.09.2007
KARTONSAN	5.0	40.0	Liqued Fuel + N.Gas	2007
ESKİŞEHİR END. ENERJİ	3.5	26.8	Liqued Fuel + N.Gas	2007
İGSAŞ	2.2	15.2	Liqued Fuel + N.Gas	2007
ITC-KA Enerji Üretim Aş.(Mamak)(Addition)	1.4	11.0	Waste Heat	22.05.2007
BİS Enerji Üretim AŞ.(Bursa)(Addition)	43.0	354.8	N. Gas	30.05.2007
Aliğa Çakmaktepe Enerji A.Ş.(Aliğa/İZMİR)	34.8	278.0	N. Gas	13.09.2007
BİS Enerji Üretim AŞ.(Bursa)(Addition)	48.0	396.1	N. Gas	30.08.2007
BOSEN ENERJİ ELEKTRİK AŞ.	142.8	1,071.0	N. Gas	18.01.2007
SAYENERJİ ELEKTRİK ÜRETİM AŞ. (Kayseri/OSB)	5.9	47.0	N. Gas	03.07.2007
T ENERJİ ÜRETİM AŞ.(İSTANBUL)	1.6	13.0	N. Gas	04.04.2007
ZORLU EN.Kayseri (1 GT Addition)	7.2	55.0	N. Gas	17.01.2007
SİİRT	25.6	190.0	Fuel Oil	2007
Mardin Kızıltepe	34.1	250.0	Fuel Oil	2007
KAREN	24.3	180.0	Fuel Oil	2007
İDİL 2 (PS3 A- 2)	24.4	180.0	Fuel Oil	2007
BORÇKA HES	300.6	1,039.0	Hydro (With Dam)	27.02.2007
TEKTUĞ(Keban River)	5.0	32.0	Hydro (run of river)	08.05.2007
YPM Ener.Yat.AŞ.(Altintepe Hydro)	4.0	18.0	Hydro (run of river)	06.06.2007
YPM Ener.Yat.AŞ.(Beypınar Hydro)	3.6	18.0	Hydro (run of river)	06.06.2007
YPM Ener.Yat.AŞ.(Konak Hydro)	4.0	19.0	Hydro (run of river)	19.07.2007
KARASU HES-Andırın	2.4	19.0	Hydro (run of river)	28.11.2007
İSKUR TEKSTİL (SÜLEYMANLI HES)	4.6	18.0	Hydro (run of river)	30.12.2007
ÖZGÜR ELK.AŞ.(K.MARAŞ)(Tahta)	6.3	27.0	Hydro (run of river)	03.05.2007
ÖZGÜR ELK.AŞ.(K.MARAŞ)(Tahta)(Addition)	6.3	27.0	Hydro (run of river)	24.05.2007
MB ŞEKER NIŞASTA SAN.A.Ş. (Sultanhanı)	8.8	60.0	Natural Gas	2008
AKSA ENERJİ (Antalya)	183.8	1,290.0	Natural Gas	2008
AKSA ENERJİ (Manisa)	52.4	370.0	Natural Gas	2008
ANTALYA ENERJİ (Addition)	17.5	122.3	Natural Gas	2008
ATAÇ İNŞAAT SAN. A.S.B. (ANTALYA)	5.4	37.0	Natural Gas	2008
BAHÇIVAN GIDA (LÜLEBURGAZ)	1.2	8.0	Natural Gas	2008
CAN ENERJİ (Çorlu - Tekirdağ) (Addition)	52.4	304.2	Natural Gas	2008
FOUR SEASONS OTEL (ATİK PASHA TUR. A.Ş.)	1.2	7.0	Natural Gas	2008
FRİTOLAY GIDA SAN.VE TİC. AŞ. (Addition)	0.1	4.0	Natural Gas	2008
ITC-KA Enerji Üretim Aş.(Mamak)(Addition)	14.1	95.8	Waste	2008
KARKEY (SİLOPİ-5) (154 kV) (Addition)	14.8	103.2	Fuel Oil	2008
MELİKE TEKSTİL (GAZİANTEP)	1.6	11.0	Natural Gas	2008
MİSİS APRE TEKSTİL BOYA EN. SAN.	2.0	14.0	Natural Gas	2008

VCS Project Description

MODERN ENERJİ (LÜLEBURGAZ)	13.4	94.1	Natural Gas	2008
ORTADOĞU ENERJİ (ODA YERİ) (Eyüp/İST.)	2.8	22.0	Waste	2008
POLAT TURZ. (POLAT RENAISSANCE İST. OT.)	1.6	11.0	Natural Gas	2008
SARAYKÖY JEOTERMAL (Denizli)	6.9	50.0	Geothermal	2008
SÖNMEZ Elektrik (Addition)	8.7	67.3	Natural Gas	2008
AKKÖY ENERJİ (AKKÖY I HES)	101.9	408.0	Hydro (with Dam)	2008
ALP ELEKTRİK (TINAZTEPE) ANTALYA	7.7	29.0	Hydro (run of river)	2008
CANSU ELEKTRİK (MURGUL/ARTVİN)	9.2	47.0	Hydro (run of river)	2008
ÇALDERE ELEKT. (ÇALDERE HES) Dalaman - MUĞLA	8.7	35.0	Hydro (run of river)	2008
DAREN HES ELKT. (SEYRANTEPE BARAJI VE HES)	49.7	182.0	Hydro (With Dam)	2008
DEĞİRMENÜSTÜ EN. (KAHRAMANMARAŞ)	25.7	69.0	Hydro (With Dam)	2008
GÖZEDE HES (TEMSA ELEKTRİK) BURSA	2.4	10.0	Hydro (run of river)	2008
H.G.M ENERJİ (KEKLİCEK HES) (Yeşilyurt)	8.7	18.0	Hydro (run of river)	2008
HAMZALI HES (TURKON MNG ELEKTRİK)	16.7	117.0	Hydro (run of river)	2008
HİDRO KNT. (YUKARI MANAHOZ REG. VE HES)	22.4	79.0	Hydro (run of river)	2008
İÇ-EN ELK. (ÇALKIŞLA REGÜLATÖRÜ VE HES)	7.7	18.0	Hydro (run of river)	2008
KALEN ENERJİ (KALEN II REGÜLAT. VE HES)	15.7	50.0	Hydro (run of river)	2008
MARAŞ ENERJİ (FIRNIS REGÜLATÖRÜ VE HES)	7.2	36.0	Hydro (run of river)	2008
SARMAŞIK I HES (FETAŞ FETHİYE ENERJİ)	21.0	96.0	Hydro (run of river)	2008
SARMAŞIK II HES (FETAŞ FETHİYE ENERJİ)	21.6	108.0	Hydro (run of river)	2008
TORUL	105.6	322.0	Hydro (With Dam)	2008
YEŞİL ENERJİ ELEKTRİK (TAYFUN HES)	0.8	5.0	Hydro (run of river)	2008
TOTAL	6,718.6	43,962.3		